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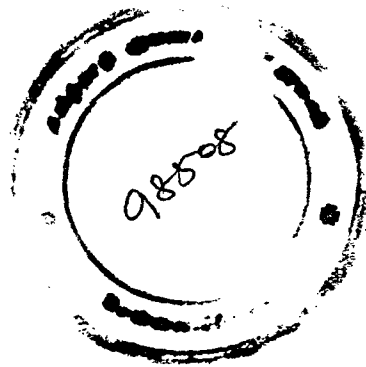
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NOTES FOR THE MONTH

THE Practical Education of Women for Rural Life is the subject of a report,* just issued, of a Sub-Committee of the Inter-Departmental Committee of the Ministry of Agriculture and Fisheries and the Board of Education. In the report, the general findings of which are now under consideration by the Departments, the Sub-Committee points out that, owing to concentration on the education of men and youths, such provision as exists for women has been made in somewhat haphazard and subsidiary fashion. It is claimed that, through her hold on the present and the rising generation, the woman can do much to promote or retard agricultural development. In particular, the absence of facilities for instruction in rural domestic economy is regarded as a serious deficiency.

Recommendations relating to the practical education of adult women include the provision of more itinerant instruction in dairying, poultry-keeping and horticulture, of instruction at residential farm institutes, and at an Institute of Rural Domestic Economy. The addition to the Ministry's grant list of a college for women, capable of providing training in agriculture, is also suggested.

The report recommends that steps should also be taken as far as possible to increase the employment of women on county educational staffs, and to improve the representation of women on educational bodies.

The outstanding feature of the report is, perhaps, the very thorough and careful examination given to the question of educating for rural life the girls who leave school at 14 years of age. The absence of further educational facilities for girls at this period is considered to constitute a grave defect. It is suggested, therefore, that organized courses (on the lines

* "The Practical Education of Women for Rural Life," being the Report of a Sub-Committee of the Inter-departmental Committee of the Ministry of Agriculture and Fisheries and the Board of Education, Published by H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price, 6d. net; post free, 7d.

of the day courses for farmers' daughters in Derbyshire), giving combined instruction in agricultural, domestic and general subjects, should be provided by county authorities; that corresponding residential courses should be arranged at Farm Institutes and at Secondary Schools in counties not possessing Farm Institutes; and that additional scholarships should be provided to enable suitable girls to take advantage of such instruction.

The final section of the report deals with the education of still younger girls in Country, Elementary, and Secondary Schools. It is pointed out that, while, in general, the curriculum is satisfactory, the instruction is not always sufficiently related to environment, with the result that girls are not interested enough in their surroundings. As compared with the town girl, the country girl is handicapped by the excessive range of age dealt with by one teacher. It is computed that 69 per cent. of girls in rural schools are eligible for instruction in housecraft and are not receiving it. It is further considered that gardening for girls requires considerable development.

It is recommended that further encouragement should be given to teachers to attend courses in rural science, economics, and housecraft, and that, in appointments to headships of rural central schools, preference should be given to teachers with country experience.

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In consequence of the public interest aroused by the experiments of Dr. S. Voronoff, of the Collège de France, as applied to live stock, the Ministry of

Dr. Voronoff's Experiments on the Improvement of Live Stock Agriculture and Fisheries and the Board of Agriculture for Scotland arranged for a delegation to visit Algeria for the purpose of examining Dr. Voronoff's experimental animals and records. Dr. F. H. A. Marshall

and Dr. A. Walton, of Cambridge, and Dr. F. A. E. Crew and Mr. William C. Miller, of Edinburgh, were good enough to undertake this task on behalf of the two departments. They visited Algeria, last November, in the company of delegates from Argentina, France, Italy, Spain and Czecho-Slovakia, witnessed the Voronoff method of gland-grafting as applied to live stock, and examined a number of animals which had been subjected to this technique, which is described in detail in an appendix to their report.* Dr. Voronoff claims two

* Report on Dr. Serge Voronoff's Experiments on the Improvement of Live Stock, published by H.M. Stationery Office, 1928, price 9d. net.

advantages from his experiments, namely: (1) that old male animals may be rejuvenated and their period of usefulness as sires extended, and (2) that the growth and development of immature male animals may be so stimulated as to produce an improved breed which can transmit these characters to the offspring.

The conclusions of the British delegates are summarized below:—

The claim of Dr. Voronoff to effect rejuvenation of the aged and decrepit male by his technique is possibly justified, but the evidence is not based on critical experiments. Data on the duration of the graft and its effect upon the animal are at present insufficient to warrant an estimate of the economic value. It is an open question whether this method can become of any considerable importance in Great Britain, where alternative methods of extending the usefulness of valuable sires are available.

Dr. Voronoff's claim to increase the body weight and wool clip of rams by operating on immature animals is supported by the figures submitted and by the sheep shown to the delegates, but the conditions under which the experiments have been conducted, the inadequacy of the data submitted, and the methods of presentation of the data, exclude any possibility of forming a critical opinion. The direct economic advantages of the operation are negligible.

The delegates recommend that the technique of Dr. Voronoff should be put to further and more critical test in this country, under conditions where scientific control can be exercised. It is understood that arrangements are already in hand for conducting such tests.

* * * * *

MARKETING reform is a question that is engaging the attention of farmers in England and Wales at the present time.

Agricultural Produce (Grading and Marking) Bill

Consignments in bulk of agricultural produce, graded and packed to recognized standards, are regularly received on the English markets from overseas. Exporters of such produce to this country have been compelled by the necessity, in many cases, of securing a market, and encouraged by the opportunity for control of quality and presentation afforded, where produce

has to be assembled at a few ports, to improve their marketing methods. The British farmer has had a ready market at his door, and although, in effect, he is himself an exporter whenever he consigns his produce to a wholesaler, there is seldom any obvious bottle-neck where his produce can be easily bulked with the produce of other English farmers, and graded. A certain quantity of home-grown produce has always been graded before sale, but the grades used have been those of one individual and may have borne no relation to those used by others.

Considerable importance attaches, therefore, to a Bill recently introduced by the Government in the House of Lords providing for the grading and marking of home-grown agricultural produce. The Bill seeks to secure that national grade standards may be prescribed by regulation and, also, a national mark, which may be used on graded produce, subject to certain conditions, or on packages of such produce. It is important to note that the Bill offers farmers an opportunity to fight their competitors with their own weapons, namely, standardized methods, but that it remains entirely optional for a farmer whether he elects to take the opportunity. The passing of the Bill—the first of its kind in this country—will provide the opportunity. It will remain with the farmer to take it or not as he wishes. Already, the agricultural industry has prepared a scheme to reform the marketing of eggs; the Bill will make this scheme effective; also the scheme which the National Farmers' Union and the Ministry of Agriculture, in collaboration, are working for fruit.

With regard to eggs, in addition to giving the Minister power to define weight and quality grades and to prescribe grade designation marks, the Bill, as it now stands, will make it illegal, after December 31, 1928, to sell or expose for sale any egg which has been subjected to any process of preservation unless the egg is marked in a manner to be prescribed. The Bill also provides for the registration of any premises used by way of trade for the cold-storage or chemical storage of eggs; and, if, and so long as, any Order-in-Council made under Section II of the Merchandise Marks Act, 1926, is in force prohibiting the sale or the exposure for sale in the United Kingdom of any imported eggs unless they bear indication of origin, makes it illegal to store eggs in any premises registered for the cold-storage or chemical storage of eggs unless the eggs and any covering in which they are contained have been marked in a manner to be prescribed.

Copies of the Bill can be obtained from His Majesty's Stationery Office, price 3d., and any who have not yet seen the scheme of egg marketing reform can obtain a copy free on application to the Ministry.

* * * * *

In the course of its Inquiry, the Royal Commission on Mining Subsidence found, in the low-lying area to the east of Doncaster, that the apprehended consequences of surface subsidence due to underground coal workings were exceptional and serious, and that the problems presented called for separate consideration. A special commission was therefore appointed to inquire into conditions in this area with regard to:—

- (1) The effect of the working of minerals on the existing system of land drainage.
- (2) The efficiency of the existing system of land drainage quite apart from the effect thereon of the working of minerals.
- (3) The best method of reconciling and co-ordinating such interests as mineral working, agriculture, building, inland navigation and transport generally, in the development of the area; and
- (4) Any related matter; and to make recommendations on them.

More than three-quarters of the area dealt with by the Commissioners lies below the 25 ft. contour. It includes the Hatfield Chase, the marsh lands of which were drained by Sir Cornelius Vermuyden, the Dutch engineer, who also carried out the vast Ouse drainage scheme in the 17th century. As a result of the flood prevention works of Vermuyden and his successors, the geography of the district has been entirely changed: rivers have been diverted, and a complicated system of artificial carrier and other drains, carefully graded in relation to land levels, now controls the waters falling on, or running through, the area. It will be readily appreciated, therefore, that any variation in the level of the land due to mining subsidence would have a very serious effect on the whole of the district, unless remedial works were executed.

The Special Commission, which has just issued its Report, examined 23 witnesses, who represented, within the area, the County and District Councils, the Drainage Authorities, the Navigation Authorities and the Land, Mineral and Colliery Proprietors. Technical evidence was also taken from geologists and mining engineers.

The Commission visited the area, inspected the more important features of the drainage system, and viewed typical

subsided areas. Certain collieries, and remedial works in connexion therewith, were also inspected.

The chief recommendation of the Commission is the establishment of a drainage court for the area, a plan which was favoured by a large majority of the witnesses. The area is defined, and the powers, composition and sources of revenue of the Court determined.

It is recommended, *inter alia*, that the Court should have direct control over the main rivers, Don (which recently overflowed its banks and flooded the countryside) and Torne; and certain other carrier drains; that it should exercise supervision over works required to remedy the consequences of subsidence, but that the works themselves should generally be carried out by the mines; that the mines should be required to accumulate funds sufficient to provide for the maintenance of remedial works after the mines have ceased to operate; and that royalty owners should pay a share of the cost of remedial works. Recommendations are also made regarding the financing of works unconnected with, or only partially connected with, subsidence.

The Commission is of opinion that numerous works of improvement are desirable on the existing drainage channels, but recommends that a decision regarding their execution should be postponed until after consideration by the Drainage Court. It considers that drainage due to subsidence can best be dealt with by the installation of pumping plants to lift the water out of subsided areas into higher levelled, carrier drains, and by the raising of river banks where necessary.

After hearing evidence regarding inland navigation in the area, the Commission expressed the opinion that the construction of a new Ship Canal would not assist in the solution of the drainage problem.

Copies of the Report (price 4s.) can be purchased through any bookseller, or direct from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2.

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PRELIMINARY returns of the 1927 sugar beet crop in England and Wales are now available, and an approximate idea of the general results can be drawn. The acreage returned on June 4, 1927, as under sugar beet showed the large increase of 96,752 acres, compared with 1926, the figures being 125,814 acres in 1926 and 222,566 acres in 1927. On the

other hand, owing to the consistently unfavourable weather, the yield per acre, and, to a less extent, the sugar content and coefficient of purity of the roots, fell much below the average of previous years. The spell of cold and dry weather during sowing-time, which retarded germination and early growth, was followed by a dull, rainy summer and autumn which prevented the proper ripening of the crop. These conditions induced the production of small, fangy roots, made the work of harvesting more difficult, and increased the tare for dirt. On January 15, 1928, the English factories estimated their total receipts of topped and washed roots at 1,448,084 tons, which, on the basis of 222,566 acres, means an average yield for the whole of England and Wales of about 6½ tons per acre, as compared with 8.6 tons in 1926, and an estimate of over 8 tons to the acre which the factories themselves made as recently as November 8, 1927.

The sugar content is estimated to have averaged 16.13 per cent. as compared with 17.33 per cent. in 1926, and the average tare for dirt is put at 20 lb. per cwt., as against 15 lb. per cwt. in 1926. Many of the factories complained of a shortage of beets, and also of losses through frosted and rotten beets which could not be worked.

The low yield, sugar content and purity of the beets are, of course, reflected in the production of sugar, which is now regarded as unlikely to exceed 185,000 tons. This figure would give an average yield of commercial sugar of 1,862 lb. per acre as compared with 2,674 lb. in 1926.

Four new factories (*i.e.* Allscott, Bardney, King's Lynn and Selby) commenced work during the last campaign. The Flynsham Experimental Factory has been enlarged to work the desiccation process on a commercial scale.

The production of dried pulp is estimated to have been about 88,000 tons, and of wet pulp 18,000 tons; about 20,000 tons of dried pulp were exported.

While the past season has been the worst for sugar beet since the passing of the Subsidy Act, it should be remembered that most farm crops suffered very badly through the weather. The factories report a steady improvement in cultivation technique which justifies the belief that, with normal conditions, the much better yield and sugar content of the roots in 1926 will not only be regained but exceeded in future seasons. The merits of the crop should certainly not be judged by new growers on the results of the 1927 season.

IN the Report on the Marketing of Pigs in England and Wales (Economic Series No. 12), emphasis was directed to the fact that, while producers' and distributors' organizations have done much to strengthen the position of their respective branches of the pig industry, they have not collaborated to build up the industry as a whole. For this reason, it was suggested in the report that the Minister of Agriculture and Fisheries should appoint a Pig Industry Committee, representative of both producers and distributors, to act as a co-ordinating body with the object of extending the pig industry generally. This proposal met with general approval, and numerous resolutions pressing for the appointment of such a Committee reached the Ministry from responsible organizations. The Minister of Agriculture and Fisheries has, therefore, now appointed a Committee, entitled the Pig Industry Council, with the following terms of reference: "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."

The Council consists partly of members nominated by the Minister, and partly of members nominated by the National Farmers' Union, the Royal Agricultural Society of England, the National Federation of Meat Traders' Associations, the Food Manufacturers' Federation, the Pig Breed Societies, and the London Central Markets Association.

The following are the members of the Council:—

The Rt. Hon. Sir Alfred Mond, Bart., M.P.
 T. Baxter, Esq.
 David Black, Esq., J.P.
 J. F. Bodinnar, Esq.
 Lord Daresbury, C.V.O.
 Viscount Folkestone
 H. German, Esq.
 John H. Glover, Esq.
 Sir Frederick Keeble, C.B.E., D.Sc., F.R.S.
 H. Martin Lewis, Esq.
 A. E. Marsh, Esq., J.P.
 H. W. G. Millman, Esq.
 Leopold Paget, Esq.
 Capt. the Hon. Godfrey Phillimore

J. B. Pitchford, Esq.
 Colonel F. S. Kennedy Shaw, C.B.E.
 Theo. A. Stephens, Esq., and
 William Wright, Esq., J.P.

The Minister has appointed the Rt. Hon. Sir Alfred Mond, Bart., M.P., to be the Chairman, and Charles Crowther, Esq., M.A., Ph.D., W. A. Stewart, Esq., M.A., B.Sc., and Professor T. B. Wood, C.B.E., F.R.S., to be Consultative Scientific Advisers to the Council.

Mr. J. B. Baber, M.C., of the Ministry of Agriculture, has been appointed Secretary of the Council, and communications should be addressed to him at 10 Whitehall Place, London, S.W.1.

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SPEAKING in his constituency at Ixworth, Bury St. Edmunds, on February 24, 1928, Mr. Guinness said that,

**The Minister
 on the
 Agricultural
 Situation**

in answer to Mr. Buxton in the House of Commons, he had already made it plain that the Government were resolved to maintain the Agricultural Wages Act. The Conservative Party had been largely responsible for the form of that Act, and it was due to them that wages were fixed by the County Committees, and not, as the Socialist Party had desired, by a central body sitting in London and ignorant of local conditions. Under the terms of the Act, no employer was allowed to pay less than the minimum rate as fixed by a County Committee on the ground that men were receiving an Old Age Pension after the age of 65. Employers were only authorized to pay less than the minimum rate in individual cases, under Section 2 of the Act, where a man was so affected by any physical injury or mental deficiency, or any infirmity due to age, or to any other cause, as to be incapable of earning the minimum wage. The receipt of an Old Age Pension was not a consideration which the Wages Committee were empowered to take into account in giving these exemptions from the standard rates which it was their duty to fix.

With the present bad agricultural prices, many farmers found it difficult to pay the minimum wage, although, in justice to them, he ought to say that they generally admitted that it was no higher than was necessary to afford a proper standard of life. It was not because of any lack of understanding of the farmers' difficulties that the Government

had decided that the system of compulsory regulation of wage rates in agriculture should be maintained. The public conscience demanded that this minimum standard should be ensured. Although they could not, therefore, reduce that part of the farmers' costs which was represented by the compulsory wage, the Government were so much impressed by the difficulties which confronted employers that they were examining the possibility of still further lightening the burdens of local taxation.

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THE proceedings instituted by the Ministry of Agriculture and Fisheries against Herbert John Charles Knight, Seed Merchant, of Bromley, Kent, for obtaining money by fraudulently describing New Zealand and Polish seed as genuine Kentish Wild White Clover, were terminated at the Kent Assizes held at Maidstone on February 20, when Mr. Justice Shearman sentenced Knight to twelve months' imprisonment in the Second Division, and ordered him to pay the costs of the prosecution. For some time the Ministry had suspected that spurious stocks of seed, described as Kentish Wild White Clover, were being distributed in this country and in Scotland, but, owing to the difficulty in obtaining sufficient evidence, the Ministry had been unable to take action. In October last, however, the Ministry obtained conclusive evidence that a quantity of seed supplied by Knight to an Essex firm of seed merchants as genuine Old Pasture Kentish Wild White Clover was, in fact, of New Zealand origin.

During the course of the investigations into this matter it was discovered that Knight had been systematically purchasing New Zealand and also Polish seed, and selling it at a very considerable profit as genuine Kentish Wild White Clover. As the evidence disclosed a serious system of fraudulent trading, charges were preferred under the Seeds Act, 1920, the Merchandise Marks Act, 1887, and the Larceny Act, 1916. The proceedings before the Magistrates at Bromley occupied six days. Knight pleaded not guilty in respect of each charge, and was committed for trial to the Kent Assizes, where, however, he pleaded guilty, with the result noted above.

The Judge, in passing sentence at the Assizes, described Knight's transactions as a very impudent fraud.

ON page 1080 of last month's (March) issue of this JOURNAL, a list was given of Marketing Demonstrations to be held by the Ministry at various agricultural shows during the coming summer. Included in the list was a demonstration of egg and poultry marketing to be given at the Leicestershire Show in June. In consequence, however, of a change in the date on which the Show will be held, the Ministry has been obliged to cancel the arrangements for this particular demonstration.

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A REPORT on the Cambridgeshire County Council's small holdings estate, which has recently been prepared by the County Land Agent, contains interesting data as to the progress of the statutory small holdings movement in that county.

The majority of the Cambridgeshire holdings are small (the average area being less than 10 acres), and unequipped, but the county estate affords valuable evidence of what the "little" man can do. Probably, one of the best examples in the county of this kind of rural development is to be found at Soham, the largest parish in the county, where the small holdings movement has come down without a break from the manorial system. The County Council, who own over 2,000 acres in this neighbourhood, have taken an active part in maintaining and expanding this movement. Their largest property is situated on reclaimed land originally known as Soham Mere, which, in the eighteenth century, was one of the largest inland meres in the eastern counties.

The Council's estate ranks third in order of area in the whole of England and Wales. The following table shows the area of the Cambridgeshire estate at various dates, and illustrates the Council's progress :—

1892	..	..	..	..	..	32 acres
1908	..	..	..	..	..	1,533 "
1914	..	..	..	..	..	10,552 "
1919	..	..	..	..	..	15,150 "
1926	..	..	..	..	..	19,388 "

The total area of the Council's estate at the present time is just under 19,000 acres. Of this area, about 17,400 acres (or over 90 per cent. of the total area) are owned by the Council.

The Council have over 2,000 individual small holding tenants; in addition, they have let land to four Small Holdings

Associations, who, in turn, have sub-let to about 250 tenants. It is interesting to note that Cambridgeshire settled more small holders than any other county under the Act of 1908. Whilst a considerable number of the smallholders are engaged in growing ordinary farm crops, the area devoted to sugar beet is increasing, and fruit and flowers are also being grown in certain areas. The stock kept consists mainly of cows and pigs. An increasing number of tenants go in for milk production, and endeavour to make use of a properly balanced ration. During the past two years, a competition for the best-managed and cultivated holdings in the county has been organized under the auspices of the National Farmers' Union, and it is satisfactory to be able to record that the Council's tenants have carried off all the prizes awarded in the small holdings section. The County Land Agent states that much credit is due to the National Farmers' Union for initiating this very useful experiment. The Council themselves propose to continue the competition in the current year, in accordance with a scheme prepared by the Small Holdings Committee.

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IN this JOURNAL for January last, p. 890, appeared an article dealing with the Imperial Agricultural Research Conference, which was held in October and November, 1927. A full Report of the Conference, containing conclusions of importance to agriculture in all parts of the Empire, has now been published.* The Conference, the first of its kind ever held in the history of the Empire, which met in London and toured Great Britain, was attended by delegates from home, from all the Dominions, and from practically all the Crown Colonies. It was organized jointly by the Ministry and by the Empire Marketing Board. In a speech to the delegates, Lord Bledisloe observed that:—

There has been no Conference of an Imperial character which has been more harmonious, more definite in its objectives, more constructive in its deliberations and decisions, or more calculated in its results not only to contribute to the ever-growing solidarity of the Empire, but materially to affect its future prosperity and happiness.

The Empire's agriculture is representative of a vast range of conditions and problems. It is practised in some of the

* Report of the Imperial Agricultural Research Conference. Published by H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price 1s. net; post free, 1s. 5d.

hottest and the coldest, some of the wettest and the driest, and some of the most fertile as well as, apparently, some of the most barren parts of the world. As Lord Balfour has pointed out, there is no problem which affects any part of the world's agriculture which does not also affect that of the British Empire. Some of the agriculture goes back to an unexampled historical past, and some of the newest and least-touched surfaces of the globe are represented. On one matter all are agreed—that one means for the improvement of Empire agriculture is the conduct of research into the many and varied problems which confront the agricultural community in all the Empire's territories.

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THE Saskatchewan Overseas Live Stock Marketing Commission was appointed early last year by the Saskatchewan Agricultural Research Foundation, to conduct an investigation into the marketing of Canadian live stock in Great Britain, and to study co-operative bacon factories in England, the Irish Free State, and Denmark. In a synopsis of a Report, presented by the Commission to the Foundation, on the results of its investigation into European methods and conditions, it is stated that, throughout the tour, the Commission had constantly before it the co-operative movement, as related to the marketing of farm produce. The conclusion arrived at by the Commission is that the marketing of live stock through co-operative associations affords a means of providing a better service to the producer at the initial point of loading. "Such a system," the Report states, "would be a powerful factor in controlling undue speculation in the product of the primary producers. This product, heretofore, has passed through too many hands in its movement from the primary producer to the export terminal. This method of marketing, therefore, is commended to the live stock producer of Saskatchewan."

Regarding the establishment of co-operative bacon factories, the Commission advises caution, and recommends that, before any action is taken, a complete survey of the position should be made. The Commission further recommends that, only on the basis of actual experience and profitable operation should the producer enter the field of processing on a large scale; that an intensive campaign should be conducted by the Provincial Government, educational bodies and breeders' marketing

associations, to the end that an approved type of hog may be forthcoming, that continuity of supply may be depended upon, and that the producer may gradually familiarize himself with the demands which will be made upon him should co-operative bacon factories materialize.

In recommending the advisability of establishing feeding stations in the proximity of central markets, the Report states "gluts on the market are frequently the result of unloading cars of live stock in unfinished condition, due to shortage of feed and other contingencies and factors beyond the control of a farmer."

Adoption of the Danish system, where breeding stock on farms is obtained direct from breeding centres, pigs from which are furnished to the testing stations for the purpose of recording type, prolificacy and, responsiveness to feeding, is urged. This system of connecting up the breeding centre with the commercial farmer through the medium of the testing stations is responsible for the development of the national type of pig in Denmark.

Relative to a recommendation urging the importation of pure bred sires of outstanding type from England and Scotland to improve beef cattle quality in Saskatchewan, the Commission suggests that the Foundation request the Provincial Government to consider means whereby this may best be accomplished.

The creation in Canada of a Department or Bureau, the special work of which would be to conduct study in marketing and other economic problems for the benefit of the agricultural industry, is urged in the Report, with the recommendation that the Provincial Government submit to the Federal Minister of Agriculture the suggestion that this Bureau be added to the activities of the Federal Department of Agriculture.

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THE South Australia Agricultural Education Act of 1927 provides that the following sums shall be paid to the University of Adelaide, out of the General Revenue of the State of South Australia, in addition to any other sums payable to the University from the same source:—

£				£			
1927-28	..	..	5,000	1932-33	..	..	11,000
1928-29	..	..	7,000	1933-34	..	..	12,000
1929-30	..	..	8,000	1934-35	..	..	13,000
1930-31	..	..	9,000	1935-36	..	..	14,000
1931-32	..	..	10,000	1936-37	..	..	15,000

These sums must be used by the Adelaide University for the extension of research in agriculture and allied subjects at the Waite Agricultural Research Institute.

The following conditions are attached to the grant of the above sums:—

- (a) The Waite Agricultural Research Institute shall conduct researches in cereal breeding, plant genetics, and plant nutrition, the improvement of pastures and pasture plants, agricultural chemistry and its application to the production of farm crops, soil management and soil classification, and shall maintain divisions of Entomology and Plant Pathology for the purpose of investigating the insect and fungus diseases of agricultural and horticultural crops, and shall undertake such other investigations as may from time to time be prescribed by the Council of the University during the currency of the Act.
- (b) The Waite Agricultural Research Institute shall, in addition to the investigational work, furnish an advisory service in Plant Pathology and Entomology to the Minister of Agriculture.
- (c) The staff of the Waite Agricultural Research Institute shall, upon such terms and conditions as are agreed upon between the Minister of Agriculture and the University, make and report to the Minister the result of any investigation in agricultural matters which he requires.
- (d) The University shall maintain a course in agricultural science, of degree standard for the training of graduates for service in the Department of Agriculture, the Education Department, the Stock and Brands department, and the Woods and Forests Department, and for service under the Irrigation and Drainage Commission.

In each of the ten years 1928-1937 the Council of the University of Adelaide may nominate to the Minister of Agriculture not more than four persons' who have taken the course in Agriculture at the University of Adelaide, and obtained the degree of Bachelor of Science at the University, to be officers of the Departments of the Public Service mentioned in paragraph (d) above. After nomination, the Government shall appoint these persons to be officers in one of the Departments at salaries of not less than £300 a year.

FOOT-AND-MOUTH DISEASE FROM ABROAD

Statement of the measures taken by the Ministry of Agriculture and Fisheries to prevent the introduction of foot-and-mouth disease ("Aftosa") from South America, and the object and result of Lord Bledisloe's recent mission.

IN 1926 a disastrous epidemic of foot-and-mouth disease occurred in Scotland which was traced to a bacon factory which had been receiving weekly consignments of fresh carcasses of pigs from Europe for conversion into bacon. Typical lesions of the disease were found in carcasses in the factory, and they were proved by inoculation experiments at the Ministry's laboratory to be in an active stage of infection. In all, carcasses showing characteristic lesions of the disease were found in consignments from three different ships.

As the proof that these European carcasses had brought disease to this country was complete, and as the importation of fresh carcasses of calves, sheep and pigs from the Continent had grown from 130,000 cwt. in 1920 to 1,199,000 cwt. in 1925, and 632,000 cwt. in 1926, during which period foot-and-mouth outbreaks had been almost continuous, it seemed clear that a most important, although possibly not the only, source of infection in this country had been discovered.

The Importation of Carcasses (Prohibition) Order of 1926 was promptly passed, which prohibited the importation of fresh carcasses of animals and their offals from Europe.

The Foot-and-Mouth Disease Research Committee was then asked to determine how long the virus of the disease remained active in the different parts of other carcasses when submitted to the trade conditions under which they are imported.

In January, 1927, the Committee reported (see Second Progress Report of the Committee) that they had slaughtered cattle and pigs in the early stages of foot-and-mouth disease, dressed their carcasses for market in the usual way, and kept some of them at the chilling temperature of 28° F. and others at the freezing temperature of 15° F. Bone marrow from the chilled carcasses was proved by inoculation to remain active for 42 days and, from the frozen carcasses, for 76 days.

The blood from either the chilled or frozen carcasses remained active for 30-40 days.

These experimental findings gave an impetus to consultations which had been taking place between the Argentine Ambassador, Dr. Richelet, his veterinary adviser, and Colonel

Dunlop Young, Chief Veterinary Officer of the City Corporation, and the Ministry's officials as to what measures could be adopted to prevent the shipment of possibly infective carcasses from South America to Britain. As it is not possible by ordinary examination to tell whether a dressed carcass is infective or not, and no test short of inoculating portions of the carcass to susceptible animals is reliable, it was concluded that any measures to prevent the shipment of infected carcasses must be applied in South America, where inspectors would have the advantage of seeing the animals when alive and immediately after they had been slaughtered.

Finally, certain conditions were agreed upon which were designed to get the disease under control in the South American countries which export meat to Britain, and to lessen the chance of infected cattle reaching the frigorificos (or packing houses), and to prevent the export to Great Britain of the carcasses of animals killed when in the infective stage of the disease, or of animals which had been in contact with them.

The Governments of Argentina, Brazil and Uruguay were asked, through the Foreign Office, to apply these conditions to the cattle trade in their respective countries so far as local conditions would permit.

Also, the three Governments were asked to allow one or more of the Ministry's Senior Veterinary Inspectors to visit their countries from time to time to collaborate with the Governments and the Officials in solving any difficulties which might arise in the local application of these conditions.

The three Governments cordially approved the proposed visit of our Inspectors, and the Argentine Government expressed the hope that, in addition to foot-and-mouth disease control work, our Inspectors would find time to be present in the quarantine station at Buenos Aires when British animals were being tested with tuberculin, and also be present at the post-mortem examination of any reactors.

In May, 1927, Mr. John Lamb Frood, Superintending Veterinary Inspector, arrived in Buenos Aires, and has since visited Uruguay and Brazil. He has been given every facility to make a complete study of the trade and disease conditions in the interiors of the three countries and in the frigorificos (packing houses), and, with the co-operation of local officials, has suggested modifications of the original conditions which make them more effective and workable under the agricultural and trade conditions of each country.

Finally, a position was reached when negotiations between the South American Governments and the Ministry were hanging fire owing to the long range at which they were conducted, and it became obvious that the presence of someone having political knowledge and authority was necessary in South America to explain to the Government and peoples of each country the British attitude towards the suggested control of the cattle trade and to create an atmosphere in which all persons interested in the trade would heartily co-operate to prevent diseased animals being shipped to Britain.

On the invitation of the Minister, Lord Bledisloe agreed to undertake a mission to visit all three countries to modify, if necessary, and finally ratify the agreements which were awaiting final adjustment and approval.

Lord Bledisloe reached Buenos Aires on January 10, 1928, and was received by the President of the Republic and the Ministers of Foreign Affairs and Agriculture, and during his ten days' stay made a comprehensive study of every phase of the cattle trade, visited estancias, inspected railway vehicles for the transport of cattle, and the methods of disinfecting them. He watched the arrival and the inspection of cattle at the frigorificos (packing houses), the examination of their carcasses by the Government Veterinary Inspectors and the wrapping of the carcasses with cloths, and the final loading and stowing of them on the ships.

Lord Bledisloe, with some considerable experience of methods adopted in other countries, reports that the hygienic conditions of frigorificos and the system of official veterinary inspection of the animals before and after death were as good as, if not better than, any other in the world.

He found, however, that, except in the frigorificos and in the corrales (or collecting yards adjoining them), there was little or no systematic attempt to control the dissemination of the disease, and he formed the strong opinion that any attempt to impose drastic regulations and penalties immediately upon countries wholly unused to such control would defeat its own object. He realized, too, that the "benignant" (or very mild) type of the disease which is consequent upon its endemic character under sub-tropical conditions has in the past rendered the pastoral community of Argentina somewhat callous about its prevalence and transmission, and that the reasonableness of an over-drastring policy at the present stage might be questioned by those estancieros least conversant with the true grounds

of Great Britain's demands, with consequent reluctance to comply with their Government's Decrees and Regulations.

On completion of this study of the conditions under which the cattle trade is conducted, Lord Bledisloe met in conference at the Ministry of Agriculture at Buenos Aires the Minister of Agriculture, the Secretary of Agriculture and the principal officials.

A Decree to give effect to the conditions suggested by the British Ministry of Agriculture had already been issued, but had not been put into effective operation. This was discussed at the Conference. Lord Bledisloe suggested some modifications which were agreed to and later embodied in a Decree, of which the following is a translation, which became law on February 1, 1928:—

Soundness of Animal Products Destined for Export.

Whereas the intention of the Government is to ensure by all the means within its power the soundness of animal products intended for export, with a view to offering greater guarantees to consuming markets,

And Whereas:

For this purpose it is necessary to reorganize veterinary control over producing establishments (estancias), ensure strict hygienic means of transport, and intensify inspection in markets and slaughter-houses,

The President of the Argentine Nation decrees:—

Article 1.—As from February 1, 1928, no animals of the bovine, ovine or porcine species shall be slaughtered in the frigorificos (freezing plants) unless they are accompanied by a veterinary certificate of soundness in accordance with the conditions prescribed in this Decree.

Article 2.—The removal of animals of the aforesaid species for the above purpose will not be permitted unless it has been previously established by veterinary inspection that the live stock on the establishments of origin (estancias) are free from all contagious diseases, that no case has been recorded within the period prescribed by regulation, and that the stock to be removed have also been examined and found healthy two days before the date fixed for the removal.

Article 3.—No animals shall be loaded into wagons or other means of transport that have not been duly cleansed and disinfected, the transporting companies being obliged to take all the necessary measures for the strict fulfilment of this requirement.

Article 4.—Persons concerned in forwarding live stock to the freezing plants must in all cases notify the Government Livestock Bureau, in sufficient time to allow for examination, as to the place of origin, its locality, means of access, loading point, date of loading, and number of head of live stock.

Article 5.—Herds from the Liniers and Tablada Markets, selling fairs, exhibitions, etc., intended for freezing plants must be subjected to a special examination in those places apart from the verification of the condition of health of the place of origin.

Article 6.—Herds brought in on foot must, in so far as origin and health are concerned, comply with the conditions laid down in the preceding Articles.

Article 7.—The procedure of inspecting animals at the freezing plants before and after slaughter will be intensified, and the herd (particular consignment) shall be isolated in the event of symptoms of foot-and-mouth disease or other contagious disease being established among the animals on foot, and when such disease is ascertained on the slaughter-ground the meat from the herd may not be exported.

Article 8.—In the event of the occurrence of cases referred to in the preceding article the yards where the animals have been lodged shall be rigorously cleansed and disinfected under the supervision and control of the Veterinary Inspector of the establishment, and such disinfection shall extend to the slaughter-grounds and other places of possible contamination.

Article 9.—Decree of July 1, 1924, regulations under law No. 11,228, is modified in the relevant portion, the process (of disinfection) not being considered as terminated until the Veterinary Inspector has recognized the healthy condition of the herd.

Article 10.—Packings, coverings and wrappings of refrigerated meat intended for export must be entirely new, the use being strictly prohibited of those that have been already used and have been in contact with animals or objects likely to transmit foot-and-mouth disease.

Article 11.—For the purpose of ensuring the control of establishments of origin, and the compliance with the other dispositions of this Decree, as also those laid down by the Law and Regulations of the Livestock Sanitary Police, the Government Livestock Bureau shall create 70 posts for Veterinary Inspectors, at a salary of 350 pesos monthly, with 250 pesos as travelling and subsistence allowance, this latter grant

being extended to the existing staff when they are called upon to carry out this duty in rural districts.

Article 12.—Apart from measures to be adopted as a result of the application of this Decree, contraventions thereof shall, when proved, be punished in accordance with the pertinent articles of Law 3,959.

Buenos Aires,

October 31, 1927.

When discussing this Decree with the Minister of Agriculture, the officials of that Department, the railway managers and the managers of the frigorificos, Lord Bledisloe advised that although it was of the utmost importance faithfully to carry out those clauses of the Decree which were designed to get disease under control within the country, the really critical clauses were Nos. 2 and 7, which, if skilfully and conscientiously administered, should prevent any infected carcasses being exported to Britain.

He also indicated that while the Decree embodied all those precautions which Great Britain deemed reasonable and necessary in the immediate future for the due protection of her agricultural community, she might ask within the next two years, in the light of experience, that its provisions should be tightened up and made more drastic.

In fairness he pointed out that all foot-and-mouth infected countries from which Britain imported animal products were not situated in South America.

The Argentine Government has decided to appoint 50-70 Veterinary Inspectors additional to its present staff, who will be employed to examine all cattle at the estancias and to license them, if healthy, to the frigorificos, and to inspect them on their arrival.

The success of the efforts of these Inspectors will depend, of course, on the co-operation of the estancieros. In fact, the success or failure of the whole campaign is largely in the hands of these producers and fatteners of cattle.

Fully realizing this, Lord Bledisloe accepted an invitation to address a largely-attended meeting of the Argentine Rural Society to which all the leading estancieros belong. After explaining the British reasons for requesting the Argentine Government to pass the Decree in its present form, Lord Bledisloe appealed to the estancieros loyally to carry out both the letter and the spirit of the Decree, not only as good

citizens of the Republic, but as a matter of honour and conscience.

This appeal was enthusiastically responded to, and the Society promised its loyal support to the Government and the officials who will administer the Decree.

Accompanied by Mr. John Frood, Lord Bledisloe visited Uruguay and Brazil on the return journey, and met the Ministers and officials of these countries.

His reception was as cordial as it had been in Argentina, and, as in that country, the conditions laid down by the British Ministry are being complied with by regulations of the Ministries of Agriculture which will later be embodied in the disease control laws, as legislative opportunities occur. The cattle trade conditions in Uruguay and Brazil are not identical with those in Argentina, owing to differences in the method of transport of animals to the frigorificos, and, in the latter case, to the tropical climate.

The critical clauses, Nos. 2 and 7, of the Argentine Decree, to the effect that no carcasses of affected animals or of animals which have been in contact with diseased animals shall be exported to Britain, are, however, being put into force in both Uruguay and Brazil.

Mr. Frood and another Inspector of the Ministry, Mr. Rodger, recently transferred from Canada, will continue to watch British interests in this matter in South America.

The Foot-and-Mouth Disease Research Committee has been asked to continue its study of the different parts of a carcass (which include by-products, hides and fleeces) by which foot-and-mouth disease may be conveyed by a carcass imported from a country in which the disease exists.

As an additional precaution Local Authorities of Britain are to be again asked to enforce vigorously the Orders which prohibit bones, broken foodstuffs or swill, and cloths in which foreign meat is wrapped, from being brought into contact with animals until they have been boiled or otherwise sterilized.

USE OF CREDIT FACILITIES BY FARMING ORGANIZATIONS

ON July 28 last, the Minister of Agriculture and Fisheries promised to inquire into the reasons why the existing credit facilities, provided by the Government, are not more largely used by the farming organizations. In this connexion, the following report to Mr. Guinness, made by the Advisory Committee on Co-operation and Credit, is self-explanatory.

To the Rt. Hon. Walter Guinness, D.S.O., M.P., Minister of Agriculture and Fisheries.

Sir,—In accordance with a promise made to Mr. Percy Hurd, M.P., in the House of Commons on July 28, we were requested by you on August 2 to report upon “the reasons why the existing credit facilities are not more largely used by the farming organizations.” We accordingly report as follows:—

1. We, the Advisory Committee on Co-operation and Credit, were appointed by the Minister of Agriculture on May 26, 1924. Our terms of reference were “to advise as to the administration of any public moneys that may be made available for the assistance of agricultural co-operation and credit.”

2. We have held 21 meetings, in the course of which we have considered applications from 22 Societies, and have advised the granting of loans totalling £44,670 to 11 Societies, all of which have been, or are in process of being, taken up.

3. For the financial year 1924-25, Parliament voted the sum of £200,000 for the purposes of the scheme. As, however, in the latter part of 1924-25, it became apparent that this sum could not usefully be expended within the year, the provision was, on the occasion of the taking of a supplementary estimate, written down to £50,000. For 1925-26, £50,000 was provided, and was similarly written down at a later date to £20,000. The subsequent provisions have been £20,000 for 1926-27 and £5,000 for the current financial year.

The effective figures of Vote and expenditure have therefore been as follows, *viz* :—

	Vote	Expenditure	Balance unspent which ceased to be effective after the end of the financial year
	£	£	£
1924-25 ..	50,000	23,120	26,880
1925-26 ..	20,000	8,550	11,450
1926-27 ..	20,000	—	20,000
1927-28 ..	5,000	10,000 (to date)	over-spent

4.—We consider that the assistance that has been given to co-operative societies by these loans has justified the scheme, but we also recognize that the results have not been commensurate with the possibilities. In the following paragraphs, we refer to some of the factors which we think have operated most strongly against the scheme.

5.—When the loan-system was inaugurated in May, 1924, farmers may possibly have regarded it as being designed to grant assistance to societies who were not in a position to obtain money elsewhere, and not as a scheme where security equal to that demanded by an ordinary commercial lender had to be provided by the society desiring to effect a loan.

6.—The scheme, however, presents certain definite advantages to societies. In the case of an advance granted by the Ministry of Agriculture, the loans are granted for fixed periods, up to 20 years, and the Ministry has power to forego interest on a loan for the first two years.* As against those two advantages, a society that is in a position to satisfy the Ministry's requirements as to security can probably go to a bank, firm, or private individual, and obtain a loan with far less formality than in the case of an application for assistance from the Ministry.

7.—The loans were intended only to assist in the development of co-operation for the marketing of produce. This is the form which has always shown least development and the greatest risks. At the present time, sales of farm produce furnish only a little more than one-third of the total turnover of agricultural co-operative societies. According to the latest figures published by the Ministry of Agriculture, the turnover of agricultural co-operative societies in England and Wales in 1923-24 was :—

193 Requisite Societies	£8,203,580†
181 Produce Marketing and Handling Societies	£4,865,998‡

It is not surprising that the total demand for loans has not been greater than that shown. Immediately after the war there were some disastrous failures of manufacturing and/or marketing societies, and other cases of liquidation or absorption. Certain societies formed under war conditions were unable to live under the conditions of peace-time trading. Even many of the requisite societies, formed previously to the

* See Appendix as to terms and conditions.

† Economic Series No. 5: Co-operative Purchase of Agricultural Requisites in England and Wales.

‡ Economic Series No. 1: Co-operative Marketing of Agricultural Produce in England and Wales.

campaign of 1919, which were well established at the end of the war, met with considerable trading and financial difficulties between 1921 and 1924. To these conditions must be added the great struggle of some of the more recently established requisite societies, and the very unfortunate failure of the Agricultural Wholesale Society. Thus, the general conditions of the agricultural co-operative movement were not such as provided an incentive to enterprise in the most difficult branch of organization and trading—the collection, treatment or manufacture, and sale of produce.

The conditions of organization, of trading and finance, of the societies operating in this branch previous to 1924 had shown, and were showing, the risks involved in this form of agricultural co-operation. In that year, and previously, there was much discussion on general marketing systems, especially with reference to the margin between wholesale and retail prices. Yet many of the better informed of agricultural co-operators, with the experience of societies in mind, felt that farmers' organizations had not sufficient knowledge of marketing technique and organization to enable them to establish successful businesses of the co-operative type. Moreover, in that year, the Ministry of Agriculture began its systematic analysis of general market organization, and of processes of marketing particular commodities. In those circumstances, many people who were, and are, interested in the possibilities of co-operation on the marketing side did not deem the time appropriate for widespread activity.

8.—We found certain of the conditions attaching to the scheme to be of an onerous nature or to be difficult of compliance. To an extent this was unavoidable, and the conditions have been modified where possible.

9.—In certain cases, the inability to borrow more than £10,000 under the scheme may have compelled societies to seek assistance elsewhere.

10.—A society registered under the Industrial and Provident Societies Acts is unable to give a valid charge on its chattels except by means of a Bill of Sale. In this respect an Industrial and Provident Society is under a disadvantage as compared with a joint stock company, which can create a debenture on its chattel property, such as movable plant and stocks.

For this reason it has been found difficult to obtain adequate security for a loan in some cases in which societies had little or none of their funds invested in freehold or leasehold properties, whereas no difficulty would have arisen if a charge

on plant or stocks could have been accepted as security for a loan.

11.—Under the conditions of the scheme, the Ministry is normally compelled to take, as security for a loan, a first charge on all fixed assets, unless special sanction is obtained from the Treasury. Our experience has shown that this is a necessary precaution, and it does not in theory prevent a society from further borrowing on a second mortgage, if the security is worth it; but it undoubtedly has the effect of making it more difficult for a society to obtain short-term credit to finance demands which may be annual or only occasional. Some societies, realizing this, have hesitated to tie up their credit for a period of years. This difficulty is related to the question of the chattel mortgage.

12.—We regret that greater use has not been made of the facilities, yet we realize that there would have been great danger both to the lender and to the borrower in the extension of these loans in support of haphazard attempts to improve the marketing system. Marketing developments in the future must be thoroughly and exhaustively considered, as to general organization, technique of treatment and presentation of goods, and as to business methods.

13.—In conclusion, we are of opinion that the provision of capital for loans should remain.

We have the honour to be,

Sir,

Your obedient Servants,

(Sgd.) GEO. M. GILLETT (Chairman),

„ F. D. ACLAND,

„ A. W. ASHBY,

„ G. W. BROOKS,

„ MERVYN T. DAVIES,

„ BASIL L. MAYHEW,

„ THOS. HOWARD RYLAND.

(Sgd.) J. B. BABER

(Secretary),

January 31, 1928.

RESERVATION BY MESSRS. M. T. DAVIES AND T. H. RYLAND
To the Rt. Hon. Walter Guinness, D.S.O., M.P.

SIR,—We have signed the foregoing Report feeling that the reasons therein assigned are contributory causes of the small demand for loans under the Credit Scheme. We think, however, that there are points in the Report upon which

stress should be laid, and we deal with these in paragraphs (a) and (b) below. There is a further point which, in our view, should be added, *viz.*, the matter dealt with in paragraph (c) below.

(a) A society which is in a position to satisfy the Ministry's requirements as to security can obtain a loan elsewhere with less formality than is involved in an application to the Ministry.

(b) If the Scheme had been designed to grant assistance to societies who were not in a position to obtain money elsewhere, and not as a Scheme where security equal to that demanded by an ordinary commercial lender had to be provided, more applications for loans would probably have been received. Obviously, however, unless the Scheme had been devised simply as a means of providing subsidies, security had to be required for moneys advanced on loan by the taxpayer to farmers' societies.

(c) This country is a food-importing country, where the effects of food importations and of the nation's industrial and financial policy upon the interests of the home producer are generally ignored, and where food distributing agencies which are firmly established must from the nature of the case be chiefly concerned with imported foodstuffs. Further, farmers, particularly in industrial areas, have their markets at their door. Such conditions must narrow the possibilities of marketing home produce on a collective basis.

Despite these limitations more has been done by organized farmers in the field of marketing than is sometimes realized. By collective bargaining, milk is dealt with to the value of not less than £40 millions annually. The success of this enterprise is reflected in the annual increase in the dairy herds that has taken place since the scheme of collective bargaining was inaugurated. The figures show a total increase since 1922 of 269,000 dairy cows, or an average increase of nearly 54,000 head per annum. Similarly, sugar beet is now dealt with by collective bargaining to the estimated value of £5 millions annually. English Hop Growers, Ltd., a society formed in 1925 to handle the marketing of the hop crop, had a turnover of £2 millions during 1926, while the co-operative wool societies, which are handling an increasing number of fleeces, had a turnover of £138,000 during the same period. In another sphere it may be noted that a Mutual Insurance Society organized by farmers for the sole benefit of farmers has a premium income in excess of £240,000.

Special circumstances apply respectively to milk, sugar beet, hops and wool; they are the outstanding examples of collective marketing effort, and, while it is not suggested that the limits of collective effort have been reached as regards those or other commodities, the factors which in varying degrees make success possible as regards milk, sugar beet, hops and wool, are not usually found in the case of other commodities.

It may be of general interest to know that farmers' co-operative societies of whose proceedings we have personal knowledge had, in 1926, a turnover of £10,863,000, and from the summary tables of the Chief Registrar of Friendly Societies, which are available, however, only up to 1925, it would appear that some £2,121,000 should be added to this figure to arrive at the total turnover of the class of society in Great Britain.

We have the honour to be,

Sir,

Your obedient Servants,

(Sgd.) MERVYN T. DAVIES,

„ THOS. HOWARD RYLAND.

January 31, 1928.

APPENDIX

MINISTRY OF AGRICULTURE AND FISHERIES

Loans to Co-operative Enterprises

Provision has been made by Parliament to enable the Ministry to make loans to 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 will be made for periods up to 20 years at 5 per cent. per annum, and will be repayable by half-yearly instalments.

The purpose for which the loans are made is definitely limited to the preparation and marketing of agricultural produce, but societies, of which the purchase of requisites is the main object, are not excluded from applying for a loan to develop, say, the marketing of their members' grain. Loans will normally be granted for the acquisition of land and buildings and the supply of plant, machinery and implements. The bulk of the remaining capital required must be provided by the members.

Each application for a loan is considered by the Ministry's Advisory Committee on Co-operation and Credit. The Committee usually invite a representative of the society to attend for the purpose of supporting the application.

The following are the terms and conditions under which loans may be made:—

1. In order that a society may be eligible for a loan, the society must be registered under the Industrial and Provident Societies Acts, and must have for its object such agricultural purpose as may be approved by the Ministry, and its capital must be subscribed mainly

by agriculturists. The share capital paid up by the subscribers must not be less than 5s. per £1 share, and the rate of interest on the paid-up share capital must be limited to 5 per cent. Where a society's rules require the payment of a higher rate of interest as a first charge on profits, such rules must be amended to limit the interest payable on share capital to a maximum of 5 per cent. during the currency of the Ministry's loan, and the amendment must be duly registered.

2. The amount of the loan from the Ministry will, normally, not exceed (a) half the total amount considered by the Ministry to be necessary for the proper equipment and working of the society, or (b) the amount of subscribed capital, whichever may be less. In exceptional cases, however, the Ministry may make loans to new societies towards the capital cost of plant and buildings to the extent of one and a-half times their paid-up share capital, provided that adequate security is available in the form of uncharged fixed assets. No loan will be granted until the Ministry is satisfied that the remaining capital required for the proper equipment and working of the society will be available. Advances to existing societies will normally be made only for the purpose of improving or extending premises and plant, but the Ministry, in its discretion, may make loans to be used for working capital, if adequate security exists, in the form of uncharged fixed assets.

3. In no case will the Ministry's loan exceed the sum of £10,000 to any one society.

4. The security required will normally be a first charge on all fixed assets and on uncalled capital.

5. A loan may be granted for a period not exceeding 20 years. Interest thereon will be charged at 5 per cent., and both interest and repayment of principal will be payable half-yearly. In certain circumstances, a loan may be made free of liability for interest for an initial period not exceeding two years; repayment of capital may be deferred for a similar period.

6. The Ministry reserves the right to require, at any time, immediate repayment of the principal of the loan and all outstanding interest, but there would be no intention to exercise this right, so long as the society was managed to the satisfaction of the Ministry. The Ministry will also have the right to inspect the work of a society, and to be represented at meetings of the committee of management of any society to which a loan is made.

7. A copy of the auditor's report and of the accounts shall be supplied annually to the Ministry as soon as they are available. The books of the society shall be open to inspection by an officer of the Ministry at any time.

LONDON, S.W. 1,

April, 1926.

Further particulars may be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

MACHINERY FOR THE HARVESTING OF SUGAR BEET

THOMPSON CLOSE,

Ministry of Agriculture and Fisheries.

IN the preliminary cultivation, seeding, and singling of sugar beet, this country has, so far as my observation extends, little, if anything, to learn from the Continent. Longer hours are worked on the Continent than in this country; labour can be more readily and cheaply obtained and better organized for the harder tasks on the farm. The actual methods employed, however, do not offer any advantage over English methods.

That this should be so is not surprising. The sugar beet is a sister crop to the mangold, a crop which has long been well established in our agricultural practice. The preliminary cultivations necessary are the same—except perhaps that the deeper rooting beet requires deeper ploughing—singling and hoeing are carried out by the same methods and with the same implements, and our farmers know how to produce a crop.

With harvesting, however, the position is different. The mangold grows well out of the ground, and can be readily pulled by hand. No great care is required in removing the tops, as there is no fear that the root will bleed or lose any of its value. The sugar beet, on the other hand, grows close into the ground, and sends down long tap roots to a depth of three feet or more, so that only in the very lightest of soils can it possibly be pulled up by hand. In almost all cases, considerable force is required to lift it, while, at the same time, it is necessary that as little damage as possible should be done to the root. As a consequence of its deep-rooting characteristic, some earth adheres to the root when it is lifted, and as much of this as possible must be removed before the roots are sent to the factory. Moreover, the tops must be removed in such a way that as little as possible of the sugar-bearing root is cut away.

The harvesting of sugar beet constitutes a comparatively new problem, therefore, to the farmers of this country—a problem which is presented to them, too, at a time when there is not available a supply of labour brought up through generations to the manual tasks involved. Even abroad, there is a fear that adequate labour will not for long be available, and that recourse must be had to machinery if the

production of sugar beet is to be maintained at its present level.

As a matter of fact, as far as I could judge, in the course of a tour which I made in October last, the greater part of the sugar beet grown in France, Belgium and Germany is lifted and topped throughout by hand. On the smaller holdings, such as are common in Northern France and Belgium, the farmer and his family do the work, while, on the larger holdings, it is done by an organized gang of workers, generally women. The lifting is done with specially made small forks or spades of various types. As much of the adhering earth as possible is shaken off as the beets are lifted. The topping of the beet when lifted is done with sharp knives, of which various forms, both straight and sickle-shaped, are used.

At the same time, beet “looseners” are also used to some extent on the Continent. The “loosener” performs the same function as our beet-lifting plough, loosening the beet in the ground so that hand-pulling is made possible. It eliminates one of the most unpleasant of the tasks involved in harvesting the beet, but it does not do away with the necessity of hand labour for actually pulling up the beet, shaking off the dirt, and topping. I was informed by more than one agriculturist abroad that, where sufficient hand labour is available, lifting entirely by hand is to be preferred. One great argument against using the “loosener” is that it disturbs the soil and makes carting difficult.

Whichever method of lifting the roots is employed, the one thing which is particularly striking in all three countries mentioned is that the work is well organized. Each member of the gang has his or her own task allotted, and they work together in a pre-arranged system. On one farm in France where the beet was lifted by hand—a farm where a beet “loosener” was available and could have been used—the roots with tops attached were thrown into heaps round the sides of hollow squares; the tops were then cut off and the roots were thrown into the middle—more of the attached earth being shaken off in the process; and, finally, the roots were covered with tops to protect them from possible frost at night. This is only one of many systems which are employed. It is quoted here in order to emphasize the fact that, in the countries where the sugar beet has been cultivated for many years, the work connected with the crop—and especially with its harvesting—is usually thoroughly organized. I am convinced that, whether the crop is harvested by existing methods, or

whether improved machinery is introduced, organization of the labour employed is essential to the economical harvesting of the crop.

In this country, comparatively little of the sugar beet grown is lifted entirely by hand, the beet being for the most part loosened in the soil by the beet-lifting plough before it is touched by hand labour. Several efficient types of beet-lifting plough are manufactured in this country, and an interesting demonstration of these implements was recently arranged by the Oxford Institute of Agricultural Engineering. I saw abroad no foreign "loosener" which I should consider to be superior to our beet-lifting ploughs.

Although the first step may thus be considered to have been taken towards the mechanization of the beet harvest, a very serious problem—and it is mainly a labour problem—still exists. While the need for hand labour, for the heavier task of digging the beet out of the ground, may be said to be eliminated by the beet-lifting plough, there yet remains the work of lifting the beet from the soil, shaking off the adhering earth, and topping it, to say nothing of collecting tops and beets into heaps suitable for carting. We have not sufficient willing hands for the work. Beet is, in consequence, left in the ground until there is grave risk of damage by frost. Our farmers are fully prepared to grow beet, and are anxious to keep it in their rotation, if only they can be sure that they will be able to harvest it. The main difficulty with them is not the cost, which is undoubtedly high, but the difficulty of obtaining labour.

Another factor in the problem is brought out in the German brochure "Englands Versorgung mit Zucker," by Dr. Kurt Henninger, in which the author points out the inadequacy of our rural housing facilities. Workers may have to be taken out daily from the towns to work in the sugar beet fields. This seems to place a limitation upon the use of town labour, even when it is otherwise suitable.

A labour problem exists, too, on the Continent, where the movement of the rural population to the towns is making it more and more difficult to obtain labour for the sugar beet harvest. The notice, issued by the German Ministry of Agriculture as to the beet-lifting machinery demonstrations held in Germany last autumn, states the position very clearly as regards that country. The following is an extract from it:—

"Our economic life has, in the past year, shown a satisfactory revival. Unemployment among industrial workers has fallen to one-fourth the figure of last year. At the same time, the provision

of labour for agriculture has again become a problem causing serious anxiety to the authorities concerned. Even at the time of the corn harvest, it was only in very rare cases that the labour offices were able to provide fully the labour required; and grave fears are expressed in many quarters as to whether adequate labour will be forthcoming for the potato and sugar beet harvests. We shall have to reckon with an intensification of these difficulties as time goes on.

"For these reasons, every endeavour towards mechanical aids in sugar beet cultivation, in which hand labour still plays the predominant part, is to be encouraged. Last year, tests, carried out by the Imperial Committee for the Elaboration of Economic Methods of Harvesting Sugar Beet, showed that there exist a number of mechanical methods which are capable of satisfactory results under average conditions. The Imperial Ministry of Food and Agriculture intends to bring to the knowledge of the agricultural industry the technical progress which has been made in recent years in this field. In this way, steps may be taken to prevent the decline of sugar beet cultivation which would be unavoidable if no solution of the labour problem were to be found."

It might, too, be held that the experiments which have been carried on for many years past with improved lifting methods and machinery in France, Belgium and Germany constituted evidence, to some extent, of an anticipated if not actual shortage of hand labour. All those countries, however, appear still to be in a position to obtain enough workers to enable them, as a rule, to dispense with the use of beet "looseners." With us the position is more serious. There is a real dearth of workers, and we may be obliged to look for an improvement in harvesting machinery, not to expand the area under sugar beet in this country, but even to maintain the area already devoted to the crop.

The introduction of the simple beet-lifting plough or "loosener" was a first step. Improvements have been made to the extent that certain types have been evolved, which not only loosen the beet in the soil, but lift the root completely out of the ground. This does not materially assist the work of harvesting, but it is an interesting development, and marks a stage in the evolution of the modern lifter. A further advance in harvesting methods is shown in what is known as the "Pommritz" method, which has been used to some extent, although with varying success, in Continental countries. By this method, the tops are first chopped off the beets by hand, while they are still in the ground, by means of special hoe-shaped implements. The beets are then lifted with an advanced type of beet plough, to which a small special harrow is attached for the purpose of knocking adhering earth off the roots.

Experiments have been going on for a number of years in

France, Belgium, Germany and Holland with machines designed to eliminate hand work on the topping and lifting of the beet, and the removal of the earth adhering to the roots. In certain cases, a single machine has been devised to perform all three functions; in others, one machine is designed to top the beets as they stand in the ground, and another to lift the roots and shake off the adhering earth. Some are one-row, others, two-row machines. An interesting survey of the machines produced in the four countries was made by a Dutch Committee appointed in 1924, but the Committee was unable to recommend any machinery. The experiments on certain machines in Germany and Belgium have, however, been continued since the date of that Committee's report. In Germany, two makes of machine were widely demonstrated throughout the country last autumn, under the auspices of the German Ministry of Agriculture. Improved topping and lifting machines have been evolved and are now manufactured by a firm in Belgium.

The German machines did the work quite well on the light soil where I saw them demonstrated. The Belgian machines seen not merely demonstrated but actually engaged on a contract for topping and lifting some 30 acres; the soil was lightish and the conditions were ideal at the time, but the work was well performed. In France, a number of the earlier models have been found to be unsatisfactory: one firm has, however, placed improved models on the market, and I have seen designs for a new combined topping and lifting machine at the works of another firm. Machines have been manufactured in Holland, Czecho-Slovakia and the United States of America: all of them have some interesting points, even if none can be described as a perfect implement for the work.

Machines both of German and Belgian manufacture have been demonstrated in this country. It cannot be said that their competence was proved in the unfavourable conditions they had to meet. It is probable that no existing machine will perform successfully in every soil under weather conditions which the English farmer has to face: and there is room for a good deal of modification in existing designs. Yet sensible progress has been made and will continue. If machinery, however, is to be used in harvesting sugar beet, particularly if two-row machines are to be employed, great care will be necessary in drilling, and in the subsequent cultivations, so that the rows of grown beet may be evenly spaced and the land kept clean. Otherwise, whatever machine is employed,

damage to the beet must result, and stoppages occur which will reduce the effectiveness of mechanical lifting.

Conclusions.—From what I have seen abroad and in this country, it is quite clear in my mind that, while the foreigner has his labour problem in connexion with the beet harvest, it is not nearly as serious as it is in this country. We have no tradition of hand work and organization at that harvest such as exists on the Continent; generally speaking, too, our labour is less closely attached to the land; and, finally, we cannot employ migrant labour as is still possible in many places abroad.

We are in no way behind the foreigner in our methods of cultivation, which are, as we have seen, practically identical with those required for the mangold, a crop which has been grown successfully for many years in this country. We are, however, faced with very great difficulties in connexion with the harvesting of the crop.

These difficulties appear to me to be first and foremost labour difficulties. The financial aspect of the matter is of secondary consideration. If we can obviate the need for hand labour for the heavy tasks, by means of machinery, we shall have taken the most important step towards the solution of our problem. Once the machinery is introduced, I have no doubt that, even if, as is possible, it is expensive at the beginning, improvements will very rapidly be made which will result in minimizing the amount of labour necessary and reducing the cost. I am glad to know that at least one prominent firm of agricultural implement manufacturers in this country is interesting itself in the problem, and is working on designs for a new machine.

The sugar beet harvest occurs at the busiest season in the farming year. The thrashing of malting barley must be carried out early if the first market is to be secured; the mangold crop must be lifted before frosts set in; and most farmers like to get their wheat drilled during October, in order that it may be well rooted before the winter starts. The introduction of machinery would for that reason be particularly welcome.

Machinery would, too, make for increased speed in harvesting the crop, and the crop could be got in before the severe weather sets in. In this connexion I have observed that the past few winters have been particularly mild and open, and this has, led to many farmers becoming careless of the risk of frost damaging their beet crops. When we again have hard winters they will need to reconsider their methods.

THE MANURING OF THE POTATO CROP

T. J. SHAW, M.C., N.D.A.,

Head of the Agricultural Department, Seale-Hayne College.

FROM a series of trials, designed to collect information on the relative amounts of potash and nitrogen that can profitably be applied to the potato crop, results have been obtained that will be of general interest. It is well known that the crop will, in favourable seasons, repay fairly heavy dressings of artificial fertilizers, but only limited information is available as to what constitutes a *balanced* dressing either with or without farmyard manure. The purpose of these trials was to discover :—

- (a) The maximum dressings of sulphate of ammonia and sulphate of potash that can effectively be applied.
- (b) The most effective combination of these two fertilizers.
- (c) The effect of an application of farmyard manure on the manurial requirements of the crop.

The layout of the trials was on modern lines, permitting of greater accuracy in the results, and of an estimate of their trustworthiness. Sulphate of ammonia and sulphate of potash were each used at four different rates : 0, 1, 2, and 3 cwt. per acre, and all possible combinations of these two fertilizers at these rates were used, making 16 treatments in all. A uniform dressing of 6 cwt. superphosphate per acre was applied throughout. This somewhat heavy dressing was necessitated, to some extent, by the condition of the land, but was also intended to ensure that there should be no chance of lack of phosphate limiting the action of the other fertilizers. There were four replicate plots of each treatment, the arrangement consisting of four randomized blocks, each block containing all 16 treatments, so that there were 64 plots in the trial in which dung was used, and the same number on that part of the field not receiving dung.

A severe drought in May and June showed in unmistakable manner one at least of the many advantages of dung to this crop. The potatoes on the dunged land made continuous growth during this period, whereas those on the undunged area remained short in the haulm, and showed no signs of growth until the rains of July. These latter never properly recovered from this initial set-back. The beneficial effect of farmyard manure was most marked and was strongly evident in the crop yields.

The results of the trials are set out in the tables opposite.

Results.—(1) In all cases, applications of sulphate of ammonia up to 2 cwt. per acre have given marked increases in yield, the

TABLE I.—POTATOES GROWN WITH DUNG
Sulphate of Ammonia per Acre

Sulphate of Potash per Acre	0 cwt.			1 cwt.			2 cwt.			3 cwt.		
	Yield per acre tons	Percent- age ware	Percent- age ware	Yield per acre tons	Percent- age ware	Percent- age ware	Yield per acre tons	Percent- age ware	Percent- age ware	Yield per acre tons	Percent- age ware	Percent- age ware
0 cwt. . .	4	16.9	38.6	6	3.5	42.6	7	7.18	52.7	7	7.5	47.9
1 cwt. . .	5	3	44.7	6	14.4	48.6	7	16.5	55.4	8	4.6	55.9
2 cwt. . .	5	11	49	6	16.2	46.1	7	7.5	50.6	7	13.7	57.9
3 cwt. . .	5	15.8	47.6	7	0	54.3	7	17	54.1	9.	0	60.2

The analysis of variance of these results by Fishers' method showed that the standard error of the mean yields was ± 7 cwt. per acre. A difference of 14 cwt. may thus be regarded as significant.

TABLE II.—POTATOES GROWN WITHOUT DUNG
Sulphate of Ammonia per Acre

Sulphate of Potash per Acre	0 cwt.			1 cwt.			2 cwt.			3 cwt.		
	Yield per acre tons	Percent- age ware	Percent- age ware	Yield per acre tons	Percent- age ware	Percent- age ware	Yield per acre tons	Percent- age ware	Percent- age ware	Yield per acre tons	Percent- age ware	Percent- age ware
0 cwt. . .	3	4	28	4	6	20.8	4	4.2	33.3	4	11	34.9
1 cwt. . .	3	16.4	32.5	5	14.8	40.3	7	9.6	41.9	6	18.3	42.3
2 cwt. . .	3	13.6	40.5	5	2	45.6	6	18	50.5	6	18	48
3 cwt. . .	4	18	37.3	5	12.8	49.8	6	10.4	46	6	17.2	50

In this case, the Standard Error of the mean yield worked out to be ± 8 cwt. per acre, so that a difference of 16 cwt. may be regarded as significant.

first cwt. being rather more effective than the second. These increases have been from 22 to 27 cwt., and sometimes more, per acre for each cwt. of sulphate of ammonia applied. Estimated in terms of "ware" or saleable potatoes, this has meant an average return of from 10 to 14 cwt. "ware" for an expenditure of 1 cwt. sulphate of ammonia. This result confirms those of the Rothamsted Experimental Station, 1925-26.

(2) There was no remunerative increase in crop yield due to the application of the third cwt. sulphate of ammonia, except in those instances where heavy dressings of potash were also applied, with dung.

(3) It would appear to be essential that, to obtain maximum returns from a dressing of 2 cwt. sulphate of ammonia, at least 1 cwt. of sulphate of potash, or its equivalent, must be given to the crop.

(4) Where dung had been applied to the crop, dressings of artificials, containing as much as 3 cwt. sulphate of potash and 3 cwt. sulphate of ammonia, have given profitable returns.

In those cases where the crop was grown without farmyard manure, no economic crop increases have been obtained from dressings containing more than 1 cwt. sulphate of potash and 2 cwt. sulphate of ammonia. This was largely due to the check the crop received in May and June, which shortened its period of growth, and so lessened its ability to draw on the supplies of nitrogen and potash applied to the crop.

(5) In all cases, an increased yield of the saleable potatoes resulted from increased applications of artificials, whether nitrogenous or potassic.

(6) The efficacy of farmyard manure has been demonstrated, its application having resulted in :—

- (a) An increased crop yield of an average of approximately 2 tons per acre.
- (b) An increased yield of saleable potatoes of approximately 10 per cent. over the crop without dung.
- (c) The effective use of larger dressings of sulphate of ammonia and sulphate of potash.

In conclusion, these results may be said to demonstrate the importance of maintaining a proper balance between the amounts of nitrogen and potash that are applied to the potato crop. The maximum result from nitrogenous dressings can be obtained only if sufficient potash is also used, and *vice versa*. They further emphasize the importance of farmyard manure, and show clearly that in these trials it was the basis of successful manuring for this crop.

SCHOLARSHIPS FOR SONS AND DAUGHTERS OF AGRICULTURAL WORKMEN AND OTHERS

RESULTS OF TRAINING

THIS scholarship scheme was established in 1922, and was one of the purposes to which the Corn Production Acts Repeal Fund was to be applied. During the six years the scheme has been in existence 731 scholarships have been awarded, namely 48 for degree courses in agriculture, four for courses in veterinary science, 62 for two-year diploma courses in agriculture, and 617 for short courses at farm institutes and similar institutions. With comparatively few exceptions, the progress made by scholars at the universities, agricultural colleges and farm institutes was distinctly good, and an impressive list of scholastic successes is published in the report of the Committee in charge of the scheme.* The following are the origins of the scholars :—

Sons and daughters of agricultural workmen	..	..	181
" " working bailiffs	..	..	46
" " smallholders	..	..	189
" " other rural workers (e.g., black-smiths, wheelwrights and harness makers)	..	..	128
Scholars who qualified on their own account as <i>bona fide</i> workers in the agricultural industry	..	..	187
			731

The broad purpose of the scheme is to enable young agricultural workers to improve their technical education, so that in later life, as farm managers, bailiffs or foremen, or as managers and manageresses of dairies, cheese factories, poultry farms, nursery gardens and so on, they may bring a trained mind to bear in the direction of the details of the industry. A few scholarships are, however, available for fully qualified candidates who aim at teaching and research posts.

The basis of the scheme is the farm institute, or junior scholarships, of which about 120 awards are offered each year. These scholarships are intended to develop the intelligence of the scholars, to widen their outlook, and to teach them something of the scientific principles underlying ordinary agricultural operations. Those who make the most of a farm institute course have an opportunity of a second year's study by means of an extended junior scholarship, and those who

* Report of the Central Scholarships Committee, 1927. Published by H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price 1s. 3d., post free 1s. 4d.

do exceptionally well can qualify for a senior scholarship and attend a two-year diploma course at an agricultural college, or, in very special cases, a three or four-year degree course.

Ten senior scholarships are available each year for diploma and degree courses, and, of these, about three per annum, for courses leading to a degree in honours, are reserved for boys and girls, educated at secondary schools, who have reached a high standard in general education. The main object of the two-year diploma course is to equip scholars for posts of responsibility in practical agriculture. In the case of women students, two-year courses in dairying and poultry keeping may lead to teaching posts, such as assistant county instructresses, but, as a rule, the qualifications gained by a two-year agricultural course are not sufficient to enable students, especially men students, to obtain positions as teachers or lecturers in agriculture; although, as will be seen later, some of the scholars who have held junior and senior (diploma) awards have managed to obtain such posts. The principal avenue of advancement for those who have attended a two-year course lies in the practical side of farming, and such scholars are advised to return to farm work when their course ceases, and to work their way up to positions in management.

An agricultural degree, preferably an honours degree, is practically essential for scholars who hope to become lecturers in agriculture, research workers and advisory officers, both at home and abroad. The number of such posts which become vacant each year is small, and the competition is keen. Men and women with agricultural degrees often have a year or two to wait before suitable employment in the ranges of agricultural teaching or research is secured, but scholars trained under this scheme, who are unable to obtain help from their parents, cannot afford to wait; and for them it is of paramount importance that they should support themselves as soon as their scholarship grants cease. For this reason, some of the scholars who have held university awards have been compelled to take up positions elsewhere than in agriculture. In this connexion it should be noted that the number of university scholarships available under the scheme has recently been considerably reduced.

At the present time, 534 scholars have completed their studies. Of these, 17 attended three or four-year degree courses, 41 attended two-year diploma courses and 476 attended farm institute courses ; 111 of those who attended farm institutes used the scholarships as stepping stones to

more advanced courses of instruction. The subsequent progress of the students who have completed their courses, so far as the Ministry has been able to obtain information, is summarized below :—

SENIOR (DEGREE) AWARDS

Entomologist at a farm institute	1
On staff of an agricultural college	1
Assistant chemist in a sugar beet factory	1
Assistant veterinary surgeon	1
Commercial post with a firm of fruit growers	1
" " mustard manufacturers	1
Gaining practical experience on a farm	1
Temporary lecturer in Biology at a women's college	1
Teaching post abroad	1
Awarded further post-graduate scholarships	2
No information	6

17

SENIOR (DIPLOMA) AWARDS

Assistant Inspector, Ministry of Agriculture and Fisheries	..	1
Assistant County Instructors	.. ..	2
Assistant County Instructresses	.. ..	2
On staff of an agricultural college	.. ..	1
Managers of farms	.. ..	3
Bailiffs of farms	.. ..	3
Managers and manageresses of dairies	.. ..	3
Manageress of poultry farm	.. ..	1
Buttermakers and cheesemakers	.. ..	4
Working at research stations	.. ..	5
Organizer under National Farmers' Union	.. ..	1
Costings Officer to a co-operative society	.. ..	1
Set up small holding on own account	.. ..	1
Working on parents' small holdings	.. ..	3
Student assistant at an agricultural college	.. ..	1
Farm assistants	.. ..	2
Agricultural labourers	.. ..	2
Continuing studies with other help		2
Police constable		1
No information		2

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JUNIOR AWARDS

Assistant County Instructors	..	..	..	..	..	2
Assistant County Instructresses	..	..	..	..	..	3
Manual Processes Instructors	..	..	..	..	..	4
Inspector for a group of dairies	..	..	..	..	..	1
Under-manager of large farm	..	..	..	..	..	1
Bailiffs	..	..	..	..	..	4
Assistant bailiffs and foremen	..	..	..	..	..	8
Head stockmen	..	..	..	..	..	6
Managers and manageresses of dairies and cheese factories	..	..	..	..	..	8
Manager of nursery garden	..	..	..	..	..	1
Manager of County Egg-Laying Trials	..	..	..	..	..	1
Manageresses of poultry farms	..	..	..	..	..	5
Farm assistants	..	..	..	..	..	12

Agricultural workmen, including cowmen, cattlemen and horsemen	67
Dairymaid to H.M. The King	1
Dairy workers, including cheesemakers and milk testers	49
Workers in horticulture	44
Engaged in poultry work	9
Working on own account :—	
As smallholders	4
As nursery gardeners	2
As poultry farmer	1
Engaged on parents' small holdings	52
Milk recorders	2
Recorders on experimental farms	2
Emigrated for agricultural work	16
Miscellaneous agricultural occupations	2
Died	1
Obtained employment other than agriculture	22
No information	27
Still seeking employment at date of inquiry	8
	365

It will be agreed that, taken as a whole, these results are most encouraging. It is noteworthy that, after so short a period as six years, three of the scholars should now be managers of farms (in one case the farms extend to over 1,000 acres); one, under-manager; seven, farm bailiffs; 14, foremen or head stockmen: that 19 should be managers or manageresses of dairies, cheese factories, nursery gardens and and poultry farms; and that a further 19 should hold positions in a teaching capacity in agriculture. The difficulties of securing suitable employment in the case of students possessing agricultural degrees are, no doubt, responsible for the comparatively poor showing in the section dealing with senior (degree) awards; but most of the scholars have not long left the universities, and it is hoped that the next inquiry will reveal a much more favourable position.

Particulars of the scholarships which are being offered this year may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1, or from the offices of County Councils. The latest date for receiving applications is April 30, 1928.

VALUE OF COUNTY EGG-LAYING TRIALS

Major H. D. DAY,

County Poultry Instructor, Notts.

THE primary value of the egg-laying trials organized by County Authorities must always be mainly educational. They greatly help the County Poultry Instructor in his work, by being a practical example, in public, of methods of poultry management which he is teaching. They enable him to keep in touch with the stock breeders of his county, and to check their home records against those of their birds kept under permanent observation. This, coupled with the information he can gather by observation when visiting their farms at all periods of the year, enables him to form an opinion as to the merits of their strain. This information is of the greatest assistance when called upon to recommend eggs, chicks, or breeding stock for different purposes.

The trials also serve as a centre to which parties from poultry societies and winter lecture centres can be taken for practical demonstrations in the summer. If a visible system of marking individual birds by the use of coloured rings, as well as numbered rings, is adopted, a lot can be taught about breed type and egg production. If the birds have been well selected, many examples of the breeder-layer type should be on view, and these should conform closely to the Poultry Club standard for the breed.

To many people, the object of a laying trial is competition. This idea should not, of course, be eliminated: it would be a pity if it were. It should, however, come second to the principle that a county laying trial is a trial for breeding stock. To attain this end, the birds entered must conform, first of all, as nearly as possible to the breed standard as laid down by the Poultry Club. If they do not, they cannot be regarded as first-class breeding stock. This conformation to breed type is practically ignored under the present rules, and all that can be done is for the County Instructor to do his best to obtain it. One still sees, however, such things as White Wyandottes the size of Leghorns; Rhode Island Reds that might be Buffs; Light Sussex very deficient in hackle markings, and so on. These can hardly be described as pure-bred breeding stock. This disregard of the Breed Standards in birds sent to laying trials has encouraged the divergence of certain utility types from these standards, just as the concentration on certain points by some fancy judges has led the exhibition type to diverge as far in other ways (*cf.* the small, laying White

Leghorn with the bulky long-legged type of exhibition White Leghorn cockerel). Some provision in the rules at county laying trials should be inserted to debar birds not up to standard from taking high awards, however well they lay.

Some details of the trials as at present carried on are criticized. The system of scoring by points in preference to cash values is objected to by many. It is said not to convey any meaning to many poultry keepers and farmers, who would appreciate cash values. As the present system of scoring is based on the average monthly price of eggs over a number of years, the points each month being varied in accordance with that price, the value of each pen's output can be obtained by using a co-efficient for converting points to money. In last year's Notts County Trial this co-efficient was 1d. to 3.41 points. By using the co-efficient from the previous year, a close approximation to the value of production can be obtained which will be the same for all; or the co-efficient can be obtained monthly by dividing the total number of points scored by the cash receipts for eggs in pence. This working out of positions on a cash value basis, however, appears to put too much emphasis on the commercial egg side. The real object of the trials, which is to discover the best breeding stock, is obscured by the commercial aspect of a cash column. Size of egg and body type are even more important for the breeder of stock than mere numbers. The tendency of all stock to deteriorate without selection can be counteracted by breeding only from birds laying larger eggs than we require of the progeny, and paying great attention to breed type. We may take it, then, that the point system used in the county trials is as good as any other yet suggested, although it is admitted that it is somewhat cumbrous.

The above remarks deal, in the main, with the local value of these trials. When we consider their national value, the first point that is obvious is that they can have but little value unless they are as uniform as possible. It is essential that this uniformity in certain directions must be absolute. In others, there may be variation within limits.

The following points require absolute uniformity:—

- (1) Number of scoring birds in each pen.
- (2) System of scoring.
- (3) Final Report to the Ministry of Agriculture.
- (4) Issue of awards.

In other points, variation could be allowed at the discretion of the Local Authority:—

- (5) Details of separate housing for each pen.
- (6) Feeding.
- (7) Monthly reports to competitors.

Dealing with these variable points first; housing should in all cases be on the small pen system, each pen of six birds (five scoring and one reserve bird) having a separate house and run. Two illustrations are given of houses which vary in detail, but fulfil all the necessary conditions. Both are double-pen houses, having a floor area of 7 ft. by 4 ft. 6 in. for each pen. They differ, however, in lighting system, position of nest boxes, and constructional work.

Feeding may be varied, but full details should be included in the annual report.

Monthly reports to competitors should vary with the local demand of the competitors and the teaching the County Instructor wishes to emphasize. The Instructor should see, however, that they contain the information he will require when compiling his final report for the Ministry.

The reason for the absolute uniformity of the trials on points 1, 2, 3 and 4, is that the whole national value of the trials depends on them. If these are uniform and there is only slight variation in the type of house used, the only important variant in management will be the feeding. If the method of feeding and foods used is definitely stated in the final report, the trials using similar methods can be grouped. From this, the effect of different feeding methods on egg production can be obtained with considerable accuracy in a few years. Similarly, by comparing the trials which fall in the same group for methods of feeding, the effect of variation of climate, soil, and position can be gauged. Many other equally important results can also be obtained which would prove of great value to the industry.

Failing uniformity, the figures obtained annually by these trials will be more or less wasted from a national point of view. Given uniformity, we have available, to-day, some 3,000 birds in 20 counties being trap-nested under official observation—a great chance for obtaining valuable information.

Taking the four points on which uniformity is essential.

(1) *Number of Birds in a Pen.*—This is necessary to avoid differences due to the higher production of small rather than large flocks, and in the calculation of averages.

(2) *System of Scoring.*—As shown above, the present system is satisfactory.

(3) *Form of Annual Report to the Ministry.*—The form of this report might vary from time to time according to the

points particularly under observation. It would require very careful preparation. A few suggested points that might be particularly studied are :—

(a) *Causes of Death*.—A list of all deaths and causes should be included.

(b) *Feeding*.

- (1) Method of feeding and times fed.
- (2) Weight of grain consumed and mixture.
- (3) Weight of mash consumed and mixture.
- (4) Cost of food per bird.
- (5) Cost of food per dozen eggs.

(c) *Egg Production*.

- (1) Monthly production of Sp., 1st, 2nd, and N.S. eggs.
- (2) Production per bird.
- (3) Value of eggs per doz. (based on actual value obtained for eggs).
- (4) Egg production, by grades, for each breed.

(d) *Broodiness*.—Figures for the length of time off lay for broodiness in each breed, and number of birds broody.

(e) *Winter Moulting*.—Figures for the length of time off lay for winter moult. Percentage of moulters that were (1) in lay, (2) not in lay on arrival at the trials.

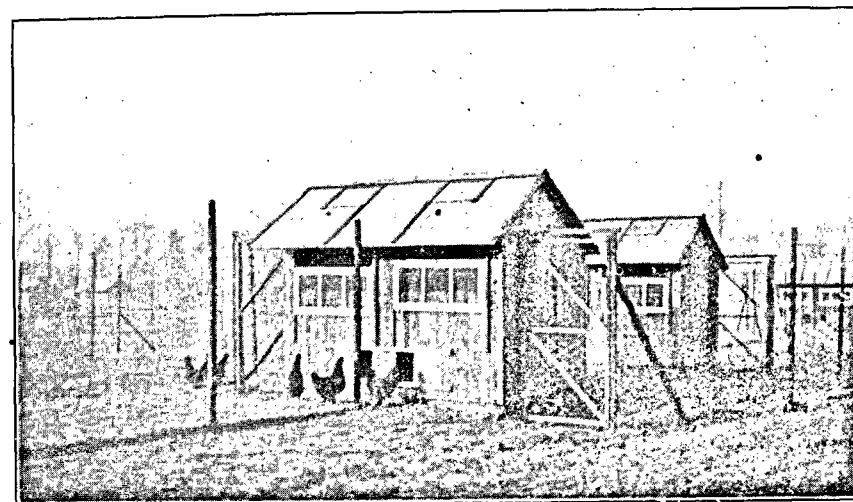
(f) *Weight of Birds* on arrival at, and dispatch from, the trials. This would indicate the laying qualities of different-sized birds in each breed.

(g) *Breed Type and Characteristics*.—Pens should be classified according to their conformation to the Poultry Club standard for the breed. Preferably, this should be done by one individual at all the trials. The pens should be judged as a whole, and not as individual birds, and put into one of three classes. Information as to the egg production in each of these classes would be useful, and the trials would tend to improve type of bird, as well as egg production.

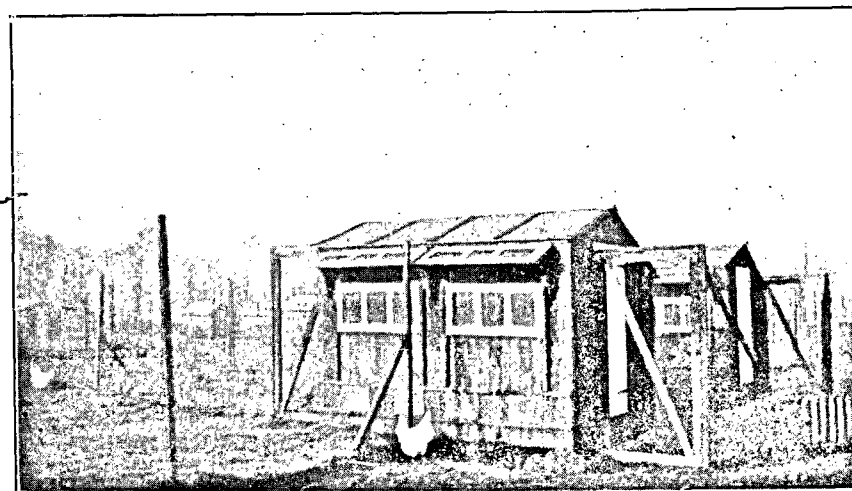
(4) *Awards*.—In addition to the prizes given by the Local Authorities, certificates to individual birds should be awarded on a uniform basis at all county trials.

An important point in getting uniformity in reports must not be overlooked. Not only must the information required be asked for, but the actual method of obtaining it must be stated. Any eggs laid by birds during the monthly period in which they die should be deducted from the total of eggs laid by all the birds during that period, and the average for the period will be obtained by dividing the total for the period, so reduced, by the number of birds alive at the end of the period. The same method must be used in all counties to arrive at the figures for the annual report.

If this uniformity can be obtained, the figures that accumulate yearly would answer many of the questions that are at present debatable. What is laying type? Can it be obtained close up to Poultry Club standards? What do we lose (or gain) by broodiness? Is wet or dry mash really better for egg produc-

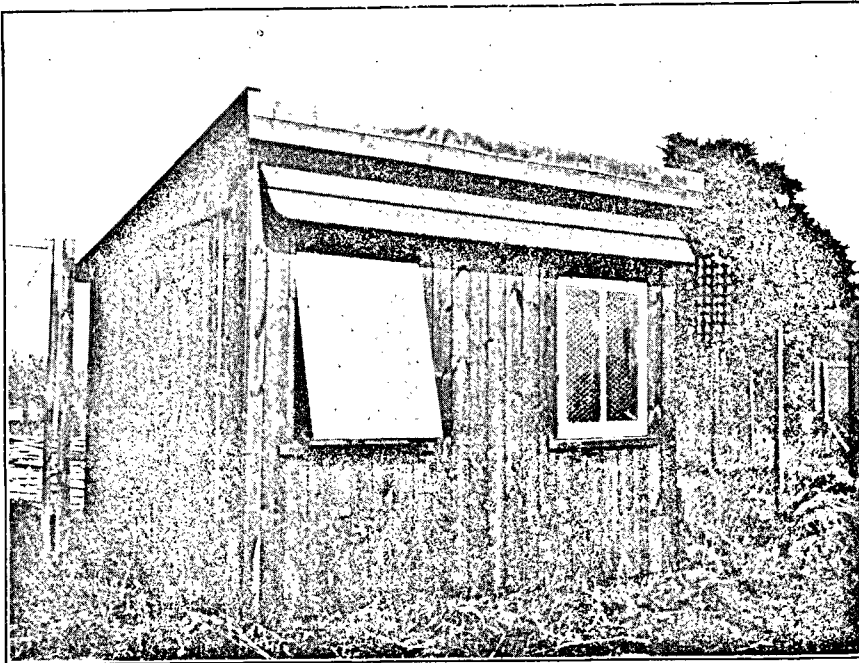


Double-pen house, Notts County Laying Trials. Each pen of six birds has half the house, with a floor area of 7 ft. by 4 ft. 6 in.



Double-pen house, Leicestershire County Laying Trials. Note variation in detail, although the floor area is the same as in house above.

THE VALUE OF COUNTY LAYING TRIALS.



The Ministry's type of house for Egg-laying Trials. 8 ft. by 6 ft., with partition in centre. To accommodate two pens of five or six birds each.

HOUSING AT COUNTY EGG-LAYING TRIALS.

tion? Does either tend to produce the winter moult? There are hundreds of such questions, and many of them could be elucidated if full advantage is taken of the system of laying trials under the County Authorities and the Ministry of Agriculture. It may be asked, why not put *all* laying trials, county and private, under one authority? The answer is that the two classes serve different purposes. The county trials are firstly educational, the others, almost entirely competitive. The educational value of the county laying trials depends, therefore, on one thing—Uniformity, but that must be not only in their rules, but also in their control. As their value depends on the reliability and official nature of the figures obtained, the Ministry of Agriculture should, therefore, be the best authority to deal with them.

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HOUSING IN COUNTY LAYING TRIALS

Major C. H. EDEN.

Ministry of Agriculture and Fisheries.

THE type of house which is illustrated and described in this note, was first put into use in the Devon County Trials, in the season of 1925-26, and has since been adopted at the Dorset, Wilts, Middlesex, and Somerset trials, except that, at the Somerset trials, a slight modification has been made in the method of window adjustment.

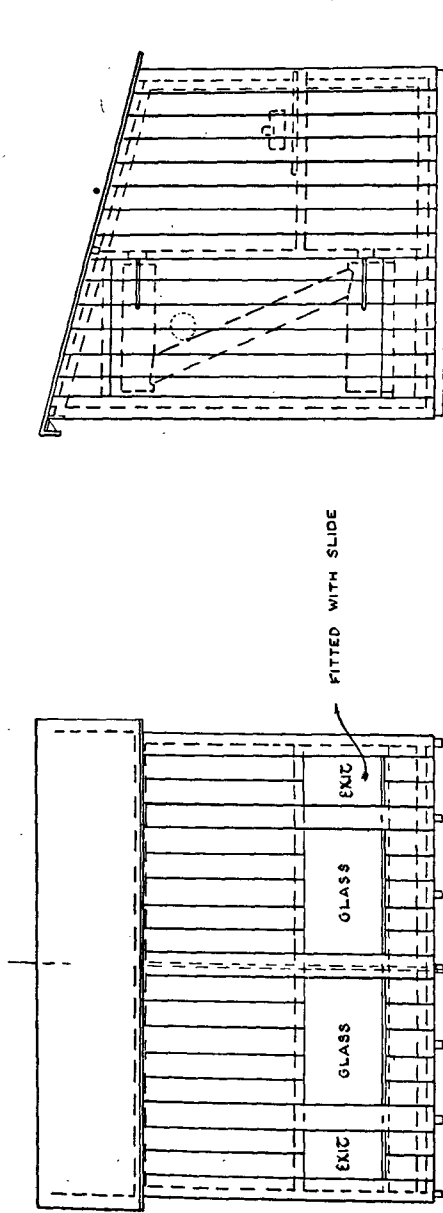
The design was considered from the point of view of health of the birds, and convenience in everyday use for the managers.

It is 6 ft. 6 in. high in front, and 5 ft. at the back, 8 ft. long and 6 ft. deep, divided in the centre so as to accommodate two pens of birds. The floor space, which is all kept clear and available for scratching exercise, gives 24 sq. ft. per pen, thus allowing 4.8 sq. ft. per bird with five birds, or 4 sq. ft. per bird with six birds, in cases where there is a reserve bird.

Ventilation is provided by a 2 in. opening at the highest point of the house, and this is protected by a 6 in. vertical board. Below this, there is another opening of 10 in., protected by a hood. The front windows are also made to open.

Ample light is provided by windows placed low down at the back. The exits for the birds are placed either in the front or back, to suit the arrangement of the pens.

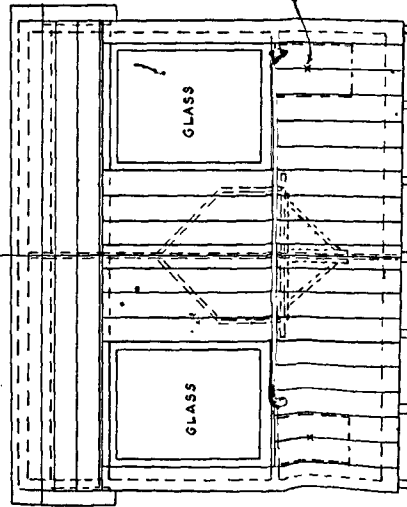
The nest boxes, (three in number), which are provided with wire netting bottoms, are placed immediately opposite the doors, and are in a very accessible position for the attendant, it being possible to release the birds without actually entering



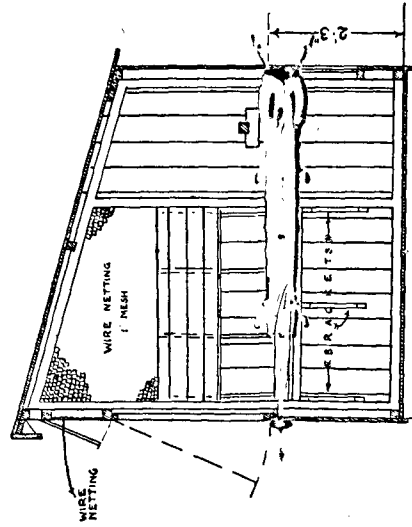
-BACK-ELEVATION-

FITTED WITH SLIDE

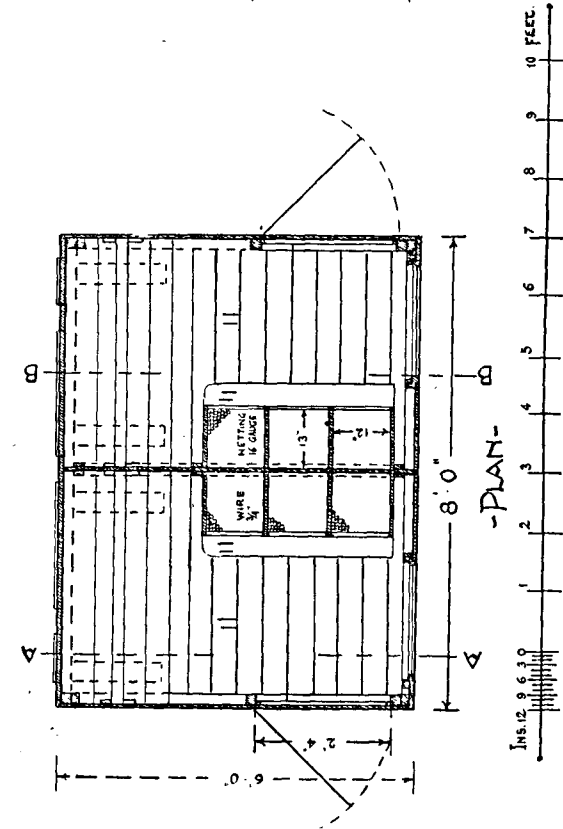
-END-ELEVATIONS-



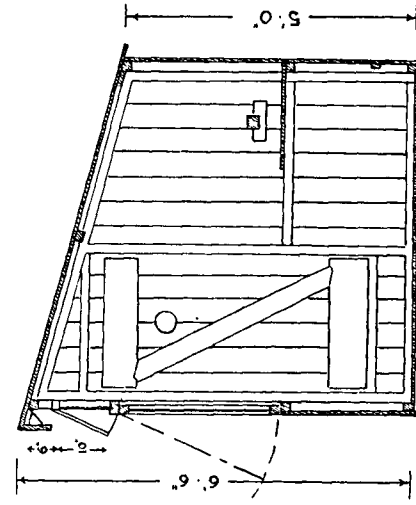
-FRONT-ELEVATION-

*ALTERNATIVE
POSITION FOR
EXITS

-SECTION-B-B-



-PLAN-



-SECTION-A-A-

Sketch drawing of Ministry's Poultry House for laying tests.

the house. Small spy-holes are cut in the doors, so that, when the houses are arranged with their backs to the alleyway, it is possible to see whether the trap nests require attention without opening the doors. This small matter saves considerable time in going the round of trap-nesting. When the houses face the alleyway, then, of course, it is possible to see the nests through the front windows.

A centre door has not been provided, as it was considered unnecessary in such a small house, and the space it would occupy is better utilized for the nest boxes. A convenient place for dry mash hoppers is on the side of the house, between the door and droppings board.

In exposed positions, it is necessary to anchor the houses to the ground. These houses have proved very satisfactory in use.

* * * * *

WEEDS OF ARABLE LAND

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THE harm done by weeds has been recognized by tillers of the soil throughout the centuries, and it may be recalled that advice on weed destruction was given by John Fitzherbert in 1523, Thomas Tusser in 1557, Thomas Hale in 1756, James Grahame in 1812, and many another old writer. Tusser's horse-hoeing husbandry, indeed, has been regarded as a main specific for weed destruction almost since he first promulgated it. The literature dealing with weeds has been scattered, but certainly not negligible. It is proposed to give here as simple an account of the weeds of arable land as may be possible. If a weed is "a plant out of place," and if it be true that agriculture is "a controversy with weeds"—as a Bishop of Newcastle is reported to have observed—and that British farmers lose millions of pounds sterling in the necessary carrying on of that controversy, then the more we know of the weeds we have to fight the better, and the more likely are we to be able to succeed in the combat.

The writer's practical interest in weeds began in a small garden as a child; it became more intense on the land when, in his 'teens, he spent many a back-aching day pulling charlock—before spraying was known—and it culminated some 20 years ago when he realized that others might wish to know more of the widely scattered literature he was collecting.

In the third week of August, 1909, 10 minutes were spent in collecting such weeds as were most easily found within an

area of perhaps little more than 100 sq. yd. in a field of standing wheat. In this small area were gathered the following 29 species:—

* <i>Convolvulus arvensis</i>	<i>Senecio vulgaris</i>
* <i>Polygonum convolvulus</i>	* <i>Galium aparine</i>
* <i>Polygonum aviculare</i>	<i>Vicia sativa</i>
* <i>Rumex</i> sp.	* <i>Matricaria inodora</i>
* <i>Tussilago farfara</i>	<i>Plantago major</i>
* <i>Mentha arvensis</i>	<i>Lychnis alba</i>
* <i>Sinapis arvensis</i>	* <i>Euphorbia exigua</i>
* <i>Sonchus arvensis</i>	* <i>Alopecurus agrestis</i>
* <i>Stellaria media</i>	* <i>Agrostis</i> sp.
<i>Papaver</i> sp.	<i>Agropyrum repens</i>
<i>Potentilla anserina</i>	<i>Poa annua</i>
* <i>Ranunculus arvensis</i>	* <i>Veronica</i> sp.
* <i>Viola</i> sp.	<i>Myosotis</i> sp.
<i>Aethusa cynapium</i>	<i>Alchemilla arvensis</i>
<i>Scandix pecten-veneris</i>	

Of these species, most are very troublesome weeds, and it is worthy of note that all those marked with an asterisk were abundant!

In another case, 13 species of weeds were found in a wheat field in which the crop was already cut; and in a field of peas was an almost overwhelming quantity of Field Bindweed (*Convolvulus arvensis*), Black Bindweed (*Polygonum convolvulus*) and Perennial Sow Thistle (*Sonchus arvensis*), besides many other weeds.

Finally, in a good garden soil, which had been well cultivated for at least three years, few weeds having been allowed to shed their seed during that time, one sq. yd. was measured off, and all seedling weeds were removed by hand, on May 17, 1909. An attempt was made to count the seedlings and separate them roughly into species, with the following result:—

	Number
Buttercup (? chiefly <i>Ranunculus repens</i>)	654
Annual Meadow Grass (<i>Poa annua</i>)	107
Dock (<i>Rumex</i> sp.)	60
Goosefoot (<i>Chenopodium album</i> ?)	26
Groundsel (<i>Senecio vulgaris</i>)	25
Shepherd's Purse (<i>Capsella bursa-pastoris</i>)	15
Annual Sow Thistle (<i>Sonchus oleraceus</i>)	14
Chickweed (<i>Stellaria media</i>)	10
Persicaria (<i>Polygonum persicaria</i>)	8
Charlock (<i>Sinapis arvensis</i>)	5
Creeping Thistle (<i>Cnicus arvensis</i>)	4
Plantain (<i>Plantago</i> sp.)	1
Clover (<i>Trifolium</i> sp.)	1
Various	120
Total	1,050

In addition to these were found two plants of shepherd's

purse near the seeding stage, two growing portions of couch rhizomes, and one small potato plant!

If any further evidence of the prevalence of weeds, and the injury they cause, were required it has been furnished in abundance on many a farm since then, and in numerous letters inviting suggestions directed to the eradication of many troublesome species.

A little consideration will make it clear that cultivated crops are harmed and profit is reduced by weeds in a variety of ways. It may enable us to understand this the more readily if we consider for a moment the functions of the different parts of a plant.

Seed.—The seed contains the germ of the new plant, to continue the life of the species, and in nature is usually the sole means of continuing the annuals and biennials.

Flower.—The flowers of plants are the organs concerned with seed production, and are specially fitted, according to circumstances, to ensure successful pollination and fertilization.

Stem.—In general the stem serves the part of support of the foliage and flowers, and in most cases is sufficiently stout to stand alone and raise these parts to secure light and warmth and air. In some cases, weak stems are specially adapted to attain the desired end, as in climbers having tendrils or hooks. The stem also distributes water and mineral food in solution to the various branches of the plant.

Leaves.—The green leaves of the more ordinary flowering plants play the part of breathing and feeding organs, for the purpose of absorbing carbon dioxide from the air, building up from it the organic structure of the plant, and returning oxygen to the air. (To some very slight extent the process may be reversed during the hours of darkness, but this is almost negligible.)

Root.—The function of the root is at least two-fold: to anchor the plant in the soil by its ramifications vertically and horizontally, and to pump up water and mineral food in solution for the use of the plant. In some cases a creeping "rootstock" or underground stem—commonly spoken of as a root—may serve perennials as a means of propagating the species. In biennials and perennials the root or rootstock stores up reserves of food to carry the plant over the winter and enable it to resume growth in spring. In certain plants, of the order to which clovers belong, small nodules on the roots contain nitrifying bacteria which enable the plant to fix the nitrogen of the air for its use.

The root system often descends deeply into the ground, far beneath the soil and into the subsoil, particularly perhaps in open sandy land and on the chalk formation. It may suffice to note, as an example, that in some 50 of the chief species of chalk down plants, Anderson found that, on the average, "the zone in which the bulk of the feeding roots occur is 4-8 in. below the surface." In some cases, however, individual species reached much greater depths, e.g., 12-20 in. (*Thymus serpyllum*), 16-27 in. (*Poterium sanguisorba*).*

The function of the different parts of the plant are of importance when one comes to consider means of eradication. The prevention of flowering and seeding is obviously desirable in combating weeds. To this end, the cutting of foliage and stem prevents growth generally—altogether in annuals, very largely in biennials, and quite usefully in the case of perennials. In perennials, the cutting of the plant induces the root or rootstock to send up fresh shoots, in a renewed endeavour to produce flowers and seed. Each time this takes place more of the food reserves are used, so that repeated cutting gradually exhausts the plant until it dies.

Both the farmer and the gardener are aware that their crops require plenty of space to enable each individual plant to grow, and this is quite plain when we observe the space allowed for a turnip, a mangold, an onion, or a potato root. The principle of space is involved in the idea of "singling" root and other crops and flowers. Two plants cannot advantageously grow on the spot of ground intended for one, and, if several charlock plants and oat plants grow together with their roots in the same cubic foot of soil, it is certain that the charlock will exert an adverse influence on the oat, and prevent it from yielding its full crop. A plantain growing on a lawn covers quite a large area with its broad flat leaves, under which grass does not grow, the removal of the weed leaving a bare patch. Under ideal conditions the whole of the cultivated area should be occupied, even if not covered, by the planted crop.

When we see a cornfield crowded with weeds, we may be quite sure that these not only take up much space, but that they also rob the cultivated crop of food, air, warmth, and moisture. A large crop of weeds needs a considerable quantity of mineral food, which can only be obtained

*Violet L. Anderson: "Flora of the Chalk Downs," *Science Progress*, No. 87, Dec., 1927, p. 444.

from the soil and from the manures applied for the sown crop. Weeds absorb soluble ingredients from the soil in considerable quantity. Analyses made at Konigsberg, and reported by Professor Stutzer and L. Seidler in 1908,* show that the amounts of nitrogen, phosphoric acid, potash, and lime which are removed are deserving of serious consideration. A number of weeds, without their roots, were collected from oatfields, the soil of which was fairly heavy and poor in humus. In the case of wild radish or white charlock, the plants had already formed many seed-pods, but the other weeds were in full bloom. The analyses indicate that the nitrogen in persicaria equalled 20 per cent. and that in the sow thistle nearly 15 per cent. of albuminoids in the dry matter. Phosphoric acid was chiefly taken up by spurrey and persicaria; potash by the sow thistle and spurrey; and lime by persicaria, yarrow, and cornflower. The following table shows the actual figures:—

PERCENTAGE CONTENTS OF DRY MATTER.

	Nitro- gen	Phos- phoric acid	Potash	Lime	Sodium	Crude ash
Sow Thistle (<i>Sonchus oleraceus</i>)	2.39	0.88	4.77	1.94	2.16	14.95
Cornflower (<i>Centaurea cyanus</i>)	2.36	0.78	1.94	3.13	1.07	8.12
Spurrey (<i>Spergula arvensis</i>)	2.36	1.08	4.21	1.52	1.91	10.12
Wild Radish (<i>Raphanus raphanistrum</i>)	1.85	0.78	1.30	1.81	0.71	5.22
Persicaria or Red-shank (<i>Polygonum persicaria</i>)	3.12	1.16	3.12	4.93	2.53	10.58
Yarrow (<i>Achillea millefolium</i>)	2.30	0.93	3.15	3.84	1.17	9.61
Average of six weeds	2.38	0.93	3.08	2.86	1.59	9.76

The figures show that weeds take from the soil food material which would have been equally available for the cultivated crop, but which is thus lost to the farmer, at least for the time being. Although the weeds may in some way be utilized, or the food they have taken be in part returned to the soil, it would be of greater benefit to the farmer if the food removed by the weeds were utilized more directly in building up larger and better grain, root, or fodder crops.

If any ordinary crop is to grow successfully, an unrestricted amount of light is requisite, green crops being unable to develop the green colouring matter, or chlorophyll, necessary for their nutrition, except in the presence of sunlight. This

* Fuhling's *Landwirtschaftliche Zeitung*, June 15, 1908, p. 429.

may be clearly seen when a patch of grass is covered with a board or a sack, the grass which grows beneath being of a sickly yellowish-white colour. Crops vary in their ability to tolerate lack of a free supply of light, but, as a general rule, the more light crops get the better. An abundant growth of weeds tends to restrict the light supply, and has therefore a bad effect on the cultivated crop. The supply of heat to the soil and crop is also restricted, and the free circulation of air is prevented. Ripening corn crops, especially, suffer in this way from a profusion of weeds, both as standing crops and when stooked to dry. Wollny found that an unweeded soil was colder to a depth of four inches than a soil kept free from weeds.

An important point is that weeds also absorb from the soil and "transpire," or pass off into the atmosphere, large quantities of moisture which would be of great service to the growing crop. For example, a maize plant has been observed to transpire, in the 15 weeks between May 22 and September 4, as much as 36 times its own weight.* A large oak tree is also stated to transpire 10 to 20 gallons of water in a day; while barley, beans, and clover were found to transpire, during five months of their growth, over 200 times their dry weight of water. Experiments conducted at the Agricultural Experiment Station of Cornell University many years ago showed that during the growth of a 60-bushel crop of maize the plants pumped from the soil, and transpired into the air through the leaves, upwards of 900 tons of water. A 25-bushel crop of wheat similarly disposed of 500 tons of water. Since weeds also transpire, it is certain that, if the ground be covered with weeds, much of the moisture which would be of value to the crop will be lost in the manner indicated. Weeds are especially harmful in this way in a hot summer, and the loss is most felt by cultivated crops on light sandy soils.

Experiments at Iowa Agricultural Experiment Station, comparing wheat and oats grown alone with the same crops grown with black mustard to represent a crop of weeds, indicated that the mustard impaired the crop, the mixture cutting down the weight of dry matter produced.

A multitude of weeds in a cultivated crop hinders proper and thorough cultivation. "Singling" of root crops, earthing up of potatoes, even ploughing, cultivating, and harrowing, are all rendered more difficult and costly by their presence.

* Fream, *Elements of Agriculture*, 8th. Ed., p. 158.

The harm frequently done by weeds in sheltering insect and fungus pests is considerable. In addition to serving as hiding places for insects, they may be intermediate host plants for both insects and fungi, and many examples might be quoted.

Some seeds are actually parasites living on the crop under cultivation, feeding on the juices elaborated by the crop for its own growth.* These parasites may do great damage, even killing extensive areas of the crop. There are two rather important parasitic weeds which occur on arable land, dodder and broom-rape, both of which attack red clover (*Trifolium pratense*).

Quite a number of weeds must be regarded as poisonous, either to man or to farm live stock, and, as such, are to be destroyed.* In other cases, although not directly harmful to stock, weeds may taint the milk, and consequently the butter made from it, of cows which have fed upon them, thus lowering the market value of the produce or rendering it distasteful for home consumption. Similarly, meat may be severely tainted.

Certain climbing and binding weeds, e.g., Bindweeds (*Convolvulus arvensis*, *C. sepium*, and *Polygonum convolvulus*), twine themselves round bush fruit-trees, cereals, and many garden crops, and when once they gain a footing are difficult to eradicate, and may do much damage. Wild vetches, cleavers, etc., may, by sheer weight, break down corn crops.

The importance of sowing clean seeds is now fairly generally recognized, and farmers, as a rule, prefer a high-class to a low-class sample. Nevertheless, sufficient care is not always exercised in the selection of agricultural seeds, and when these contain many weed seeds the crop is bound to suffer, while there is greatly increased expenditure in cleaning the crop. Further, if a crop is "dirty" the seed merchant is certain to offer only a low price, or a reduced price, for samples of grain, clover, grass, and other seeds badly infested with weed seeds, for considerable trouble and expense is involved in cleaning them. To take two examples only, wheat for milling purposes is much reduced in price if it contains many bulbils of wild onion, or much seed of corn cockle, black bindweed, or wild or cultivated tares; and clover samples containing dodder and other weed seeds are seriously

* See Miscellaneous Publications, No. 57 (*Poisonous Plants on the Farm*), 1927, obtainable from the Ministry, price 2s., 2s. 6d., and 3s. net, post free.

depreciated in value. Agricultural seeds suffer if weed seeds are present, not only because the seed merchant must expend time and money in cleaning them, but if this be not done thoroughly the farmer is faced with the introduction of new and harmful weeds on his farm.

The growth of roots and underground stems is sometimes responsible for the stoppage of drains, and may, therefore, cause considerable expenditure in correcting this trouble.

When weeds are very abundant in corn and hay crops, reaping or mowing the crop is much more difficult and prolonged, while drying or curing is also rendered troublesome. Much opportunity is thus offered for the spoiling of both grain and straw by long exposure to the weather, to say nothing of loss due to birds and animals. Where many thistles abound, pitching, loading, stacking, and thrashing are all rendered more troublesome and costly.

It is probable that no farmer needs proof that great losses are due to the infestation of crops by weeds, but various attempts have been made to determine the financial loss due to the presence of weeds among crops. In some cases the extent of the loss has proved to be greater than the farmer would anticipate. Percival, in writing of some field observations, 24 years ago, wrote: * "In many cases the moderately weeded areas carried from 40 to 50 per cent. more crop than those on which the weeds were unchecked." Wollny has placed the annual loss of crops due to weeds in Bavaria at an average of 30 per cent.† Investigations conducted in Norway by E. Korsmo‡ show that the effect of weeds on the yield and money value of crops is very serious. Hay, barley, and potatoes were each grown on duplicate plots of the same size, one being clean and the other weed-infested. The crops were carefully weighed and the yields calculated. The results may be given thus in English figures (taking 2·2 lb.=1 kilogramme and 2·48 acres=1 hectare):—

Crop	Yield per acre		Percentage loss in money value on weedy plot compared with clean plot
	Clean plot	Weedy plot	
	Cwt.	Cwt.	Per cent.
Hay	49	*13·8 23	47
Barley—			
Grain	18	6·6	46
Straw	30	*13·8 19	
Potatoes	175	90	49

* Weight of weeds included with hay and straw.

* *Jour. Bd. Agric.*, March, 1904, p. 462.

† Fr. Maier-Bode, *Die Bekämpfung der Acker-Unkräuter*.

‡ *Tidsskr. Norske Landbr.* 10 (1903), Nos. 6, pp. 247-280; 7, pp. 295-330. (Review by F. W. Wells in *U.S. Expt. Sta. Record*, 1903-4, p. 683.)

An experiment carried out in 1907 and 1908 at University College Farm, Reading, showed that, when mangolds were not weeded after plants were singled, the yield in the two years averaged $16\frac{1}{2}$ tons per acre, while on a similar plot, on which the weeds were kept down by hand weeding only, without hoeing, the yield averaged 39 tons. When kept clean by hoeing, the yield was practically the same as with hand weeding, but with two hoeings only the yield averaged $37\frac{1}{2}$ tons per acre; with one hoeing only the yield was 31 tons. Two points in this experiment stand out clearly: one hoeing only appears to have almost doubled the yield; while hand weeding, and keeping quite clean by hoeing, had about the same effect, and much more than doubled the yield, the "no weeding" and "hand weeding" comparing in yield as 100 to 240.

Losses due to profuse growth of charlock and allied species (described below) have been found in Germany to be very great. The following examples may be given, taking 2·5 acres to the hectare, 2·2 lb. to the kilogramme, and oats at 42 lb. per bushel* :—

	With Charlock bushels per acre	Without Charlock bushels per acre	Approximate loss due to Charlock per cent.
(1) Oats ..	45	67	33
(2) Oats ..	24·8	76·5	67·5

The small extent to which a cultivated crop can compete with weeds was long since demonstrated at Rothamsted,† where a plot of wheat which was allowed to shed its grain and reproduce itself in subsequent years without any kind of cultivation or help against weeds was found in the second year to produce only about half a crop, less the next year, and only two or three stunted wheat plants in the fourth season, after which the wheat disappeared entirely—a literal case of a crop being "smothered by weeds." Instances are known to every farmer in which a vigorous fight against weeds has had to be waged in order to raise a successful crop of corn or roots.

The practical farmer who is thoroughly alive to his own interests will allow no weeds to grow if he can possibly help it. The first object of a farmer, gardener, or fruit-grower who has land foul with weeds is to exterminate these as quickly as possible. Eradicating charlock in the cornfield, thistle

* Arb. d. deut. Landw. Gesell: *Ackersenf und Hederich*, Gustav Schultz, 1909.

† Sir E. J. Russell, *The Book of Rothamsted Experiments*. (Second Edition, 1917.)

cutting on both arable and pasture land, cleaning arable land of couch or twitch, removing weed seeds from a seed crop—all these absorb much time, and consequently mean considerable loss of time, energy and money. Fortunately, the persistent destroyer of weeds will find that, as time goes on, his expenditure on this score becomes less and less, until the weeds are in ordinary seasons kept down effectually in the ordinary process of good cultivation, so that when once a farm is clean it is, with due care, much less difficult to maintain it in this condition. Preventive and remedial measures, however, must be closely and faithfully followed, and no slackness or negligence allowed to creep in: "One year's seeding means seven years' weeding" is a motto which should be well graven in the minds of all cultivators of the soil.

If weeds may perchance be said to serve any useful purpose, it would doubtless lie in the fact that by their mere presence they indirectly promote good tillage, without which first-class agricultural crops cannot be raised. No sooner are the root and many other crops through the surface than the hoe of a good farmer or gardener is put to work to keep down the weeds, and this act of tillage, quite apart from the destruction of the weeds, is one of the chief means which conduce to good crops, since it leads to the production of a fine tilth, minimizes the evaporation of moisture by capillary action, and aerates and sweetens the soil. In field cultivation, hand hoeing is very materially assisted by the horse hoe; in ordinary gardening the hand hoe alone must be kept busy early and late. It was well said by a writer in *The Times* (May 25, 1907) that "many a casual gardener owes what success he has largely to the accidents of weeds. They demand the use of the hoe; and the more soils and plants are studied, the more manifest does it become that a friable, well-worked surface is the prime secret of cultivation, even in the case of many things that grow deep."

While, however, weeds act as an undoubted incentive to good cultivation, without which the best crops cannot be grown, they do so much injury in other ways that their destruction is essential. The damage done by weeds, the means of their distribution, and the general preventive and remedial measures which may be practised will be summarized in a subsequent article.

* * * * *

THE "MAT" IN GRASSLAND

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THE existence of a "mat" of fibrous roots on the surface of the soils of old pastures is common. It is generally known that this mat hinders the interaction of agents in the soil and air, whose combined activities are necessary to produce a good crop of grass. Enterprising farmers who wish to remove this obstacle to growth may plough up the old turf, put it through a rotation, and lay it down with a mixture of seeds. The crops in the rotation may be profitable, and the seeds mixture may both catch and hold well, but there is considerable expense attached to the operation, and a proportionate risk. A modified and less expensive process is to plough and seed down at once.

Other farmers, with the same object in view, but perhaps less ready to go through the course of a rotation, or to take the risk of turning their land at all, use some rejuvenating implement to cut and break the mat. They may believe that the minimum of disturbance of the old conditions necessary to obtain an improvement is the safest and most economic policy, and that there is much to be said for this view will be acknowledged by those who have seen some of the crops of trouble which have been reaped on grass and meadow land ploughed during the Great War. After a mat-breaking implement, farmers can use lime and other fertilizers, with or without a seeds mixture, and achieve success.

There are other farmers, and they are probably the majority, who are anxious to achieve the same result, but who cannot adopt either of the methods mentioned above. Their land is steep and rough; their farms and fields are small; they possess no adequate implements, and no power, horse or tractor, to use them if they were purchased. Land of this kind is found in all the hilly parts of England. Large areas of it lie in East Lancashire, North-east Cheshire, and West Yorkshire, where the soil conditions and the atmosphere aggravate the mischief. In some of these parts, the mat has been growing for years, or for centuries. Its destruction is desirable, because its presence interferes with the only kind of farming which is possible with the personal and financial conditions as they are there, and because, owing to the proximity of good markets, improvement is correspondingly profitable. The most usual method of operation, and the one

most consistent with the farmers' resources, has been the application of lime, or phosphates, or both together. The disappointing aspect of this method is generally the long delay before results are obtained. The period of the delay depends on the treatment. If there is rough, shaggy grass on the surface, as well as the mat underneath, the penetration is so much slower. Experiments show that it takes six, seven, or eight years for the lime to do its work in such conditions, and, of course, phosphates are wasted. There are few farmers ready to spend money when they have to wait so long before seeing any return from it.

In searching for the method most suitable for farmers of moderate means on small farms, and possessed of the barest facilities for cultivation, one combination of operations was tried. On a pasture on an East Lancashire farm, two acres were treated. Excessive acidity had encouraged the growth of the worst herbage. Sorrel and "soft grass" (*Holcus mollis*) flourished, or grew luxuriantly, rotted, and left bare patches. Bent occupied a good deal of space. Lime was applied in November, 1925, rock phosphate in February, 1926, and wild white clover was sown in the following April. During the spring months, when the rainfall was heavy, a Parmiter harrow was freely used. The farm is 600 feet above sea level, and the field, considering the character of the pasture, had been pretty heavily stocked. There was more than one cow to the acre carried during the summer, and one or two horses had the run of it in winter. The ugly broken patches, which the cows would not graze, considerably reduced the useful area. It was one of those fields, of which there are hundreds, more correctly described as exercise grounds for the cows than as sources of their food supply. The grass was not too long or thick, and in its soppy, wet condition the harrow scored and scratched the surface sufficiently to make, in most parts, a very shallow seed-bed for the clover. There was good growing weather at the time of sowing, and, in August, a reasonably thick growth of clover appeared. By this time, the cows had demonstrated their preference for the two acres as compared with the rest of the 20-acre field. Their close grazing, and the change in the herbage, entirely altered its appearance. On examination, in the spring of 1927, the clover roots had penetrated the mat to the depth of two inches on the average. They continued growth during the summer, and went down from one to two inches farther. The clover itself spread widely over the surface, supplanting

the bent and sorrel and making a strong fight against the "soft grass."

That is about all that has happened. There is no apparent breaking or dissolution of the mat, and it is hard to say what the ultimate effect on it will be. The farmer is comparatively indifferent about this. He is satisfied with the verdict of the cows, and with their performance, with the disappearance of the ugly pasture, and with the rapid spread of the clover. In this experiment, for a moderate expenditure he sees the prospect of a definite profit. The achievement of the clover is that, given a start in a very superficial layer of soil with a congenial mixture of lime and phosphates, it uses this foothold to push its roots through the mat. The lime and phosphates in turn may use the roots as conductors to make their way to the subsoil. Decomposition of the mat may take place through its aeration by the penetration of the roots, and probably by the action of the lime which they carry into it.

The combination of operations is simple. They may be summed up thus: (1) apply lime in autumn, (2) apply phosphates as soon as convenient, (3) harrow the old pasture without mercy in spring, (4) sow wild white clover in the best growing weather of spring or early summer, and use the harrows again. Wild white clover is a good thing and it is an aggressive thing. The second quality adds infinitely to the value of the first. In this experiment, it is its aggressiveness which makes it an effective substitute for a mechanical cultivator. It attacks the mat by sending its roots straight through it, and by spreading itself almost universally over the surface. The supply of lime and phosphates will have to be renewed, but, with proper support, there is no doubt that the clover will vanquish even the *Holcus mollis*. Experiments on the same lines, but on a larger scale, were started in 1926. The same results are following. The mat in meadows is a separate and more difficult problem.

For the guidance of any one who may think of trying the experiment, the costs of the materials for one acre at the works, as well as at the station, may be given:—

2 tons of ground limestone, cost at Buxton	14s. per ton.
5 cwt. rock phosphate, cost at Widnes	2s. 9d. per cwt.
1½ lb. wild white clover	5s. per lb.

To the East Lancashire station, about 30 miles from Buxton, the railway carriage for lime is 5s. 9d. per ton, and from Widnes, about 25 miles, 10d. per cwt. for phosphate. The

cost of the materials, therefore, at the works was £2 9s. 3d., and at the station £3 4s. 9d. per acre. The cost of cartage will vary with the distance of the fields from the station. Here, the field was less than a mile from the station, and the lime was carted by one man and horse, and applied straight from the cart in four hours. This cost may be put at 4s. 6d. If the cost of a man and horse harrowing is put at 1s. 1d. per hour, the farmer may decide the number of hours necessary. One advantage is that the harrowing need not be done in fine weather. The final cost on the East Lancashire farm was about £3 15s. 9d. per acre. The element in this sum which might be altered is the expenditure on lime. In bad cases, an additional ton might be used. Against the cost, is to be set a definite reduction in the cost of feeding stuffs.

The results obtained in 1926 have been confirmed by a larger number of experiments in 1927. These again have been so satisfactory, from the economic point of view, that a number of farmers are running the experiments for themselves this year.

* * * * *

APRIL ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),
Agricultural Organizer for Derbyshire.

April Tillages.—There is usually a considerable spell of dry weather in this month; and, with the cattle still indoors, the numbers of all kinds of live stock increased by the recent arrivals of young, and with so many branches of field work claiming attention, this is perhaps the busiest period of the whole farming year. Even when weather conditions prevent sowing and cleaning operations, there are plenty of other jobs—mixing artificial manures, repairing walls and fences, opening drain mouths (this being the time for the detection of faulty drains and stopped openings), and preparing generally for progress when the land is again ready for the teams.

The field operations of April comprise the drilling of such parts of the land intended for oats and barley as could not be sown in March; the greater part of the acreage of second-early and main crop potatoes is planted in this month, and a portion, if not the whole, of the land devoted to ox-cabbage should now be planted. Where cabbages are expected to keep well until the beginning of January, however, later plants and later planting are desirable. About the third week

in the month is a favourite time for drilling mangolds and kohlrabi, and the first batches of folding and soiling crops—vetches, rape and early turnips for July and August, and kales for autumn use—are now put into the ground. Sometimes the attempt to sow by the calendar instead of the condition and temperature of the soil leads to a poor plant of mangolds.

Grass and clover seeds are also commonly sown in April. Where the cover crop is wheat, plenty of harrowing is needed on heavy soils to prepare the surface for the seeds, but, given this and a dressing of slag at the time of sowing, wheat is a good crop in which to seed down. Early sowing is advisable for grass and clover seeds under wheat, but this is impracticable in late-sown spring corn. In response to inquiries concerning seeds mixtures for two years' ley, the following prescription is given as typical: perennial rye-grass 12 lb., cocksfoot 6 lb., late-flowering red clover 6 lb., alsike 2 lb., and white clover 1 lb. Care should be exercised to obtain a genuine late strain of the red clover, such as Montgomery or Cornish marl. Where an early bite for sheep is required, Italian rye-grass must be included in the mixture for that purpose.

Land intended for bare fallow should receive its first ploughing in April, and that assigned to sugar beet, swedes and turnips should be chain-harrowed and, if necessary, seed-harrowed to form a surface mould which checks clod formation. Too commonly, in the stress of attention to other parts of the farm, the land intended for these crops is not touched until near the time for sowing, by which stage intractable clods have baked, entailing much labour and loss of soil-moisture in their reduction.

At one time, the outlook for spring tillage operations on medium and strong soils was bad, but probably the February and March frosts will be found to have lessened the difficulties somewhat. In many cases, however, it was impossible to apply and plough-in the yard manure before the frosts occurred, and much late ploughing to cover manure and, unfortunately, to bury the frost mould, will have to be done this year. For potatoes, there is no great objection to applying the manure in the ridges at the time of planting; some growers first throw a little soil over the manure and plant or dibble the potatoes on this before splitting the ridges. Mangolds, however, often germinate badly and come away weakly when drilled on newly manured and split ridges. Wherever practicable, the ridges for mangolds should be manured and split and

allowed to settle and mellow two or three weeks at least before drilling. Just before the seed is drilled, the ridges should be superficially stirred with the chain harrows, which operation not only freshens the soil for the reception of the seed, but also removes clods and destroys weed seedlings.

April Grazing.—Under ordinary management, April is not within the grazing season for cows in the Midlands and the North of England. During the month, fattening fields are stocked with bullocks, and store dairy stock begin to run out on the pastures not reserved for the milking herd; but commonly the cows are kept indoors until May. It has hitherto been regarded as a rule of good husbandry not to turn the cows out for full grazing until the grass affords a full bite; premature grazing incurs the risk of the pasturage failing, especially in a dry summer, and in any case it is considered inadvisable to make the change from winter to summer rations while there is any possibility of having to revert to winter feeding. Doubtless also the desire not to expose the cows to risks of chill is, in some cases, another factor tending to delay the date of turning out; but, in herds where free ventilation is practised, the change from indoor to outdoor conditions is not important in respect of temperature.

During the past two years, the possibility of forcing abnormally early growth of old pasture by nitrogenous top dressing has been demonstrated—it had long been understood and practised with Italian rye-grass, in the Lothians for instance. This year, many farmers are experimenting, on a large or small scale, with the object of obtaining earlier grazing, the desirability of which has been accentuated by the shortage of good hay and the increased cost of feeding stuffs. Whether the results will fulfil expectations this year depends largely on the weather conditions of the months of March and the first half of April. This aspect of the matter seems to have been generally overlooked by advocates of the stimulative treatment; it has been assumed that the forwardness obtained in the spring of 1926 and 1927 can be expected every year. The validity of this assumption has yet to be proved; and from the snowy aspect of the land at the time of writing, the chances seem to be against very early growth this year.

The erratic nature of the British climate is well known, and, in the matter of spring temperatures, there may be more difference between the figures for the same place in different years than between, say, Cumberland and Kent in the same

year. The following figures showing the mean temperatures at Belper (Derbyshire) are of interest in this connexion :—

	50 Years Average	1926	1927
March	40·7° F.	42·9	44·2
April	45·2° F.	48·3	46·2
May	51·3° F.	49·5	51·3

In both of the years 1926 and 1927, it will be observed, the March and April temperatures were significantly above the normal for those months ; hence it is, perhaps, advisable to regard the earliness of the grazing stimulated by the top dressings as due in some measure to the favourable conditions of temperature prevailing in those particular years.

Farming Systems.—In the notes for February, the cultivation of roots for bullock feeding was criticized, not on account of the cost of producing food material in the form of roots, but on account of the low return obtainable from beef-producing cattle. Where roots can be converted into milk, however, it may be, and often is, economical to cultivate fodder roots for that purpose.

It is impossible to prescribe systems of farming suited to all conditions. Where large quantities of milk can be sold at a good price, cow-keeping may be more remunerative than crop-production ; under these conditions, the farmer keeps the maximum possible number of milk cows, subordinating crop production and rearing to the purchase of feeding stuffs and cows in milk. In its extreme form, this is urban dairying. At the other extreme, is the remote country farmer, who keeps cows and rears cattle to consume the produce of his farm, in contrast with the urban dairyman whose business is that of converting bought foods into milk.

In designing his cropping, the modern dairy farmer has to consider not only the suitability of his land for pasture, meadow and arable crops respectively, but also the capacity of his buildings and the market for milk, which is not indefinitely expansile. Where the two latter considerations limit the cattle stock to the moderate number of 20 cows and 20 head of young stock per 100 acres, three alternative apportionments of land are possible, two of which are common, while the third is possible under intensive grassland management :—

- (a) 60 acres pasture, 40 acres meadow, no arable land.
- (b) 50 " " 30 " " 20 acres arable land.
- (c) 30 " " 25 " " 45 " " "

The last is possible only under intensive manuring of the

pasture and meadow land, but it is a conservative estimate of the acreage of intensively treated grass needed to support 20 cows and 20 young cattle. It involves greater expenditure than system (a), but produces for sale or for feeding purposes, as may be most expedient, about £450 worth of roots, potatoes and corn crops in excess of the produce of the all-grass system. The additional expenditure on labour, fertilizers, etc., would not absorb anything like the whole of this surplus.

Warble Fly.—The annual loss in value of British hides due to warble holes has been responsibly estimated at £500,000.* Probably that figure might now be an under-estimate, as leather has recently become scarcer and dearer. The connexion between this loss and his own interests are not always obvious to the farmer. A few warbles in the back of a beast make little if any difference to its selling value ; warbles are a familiar affliction of cattle at this time of the year, and it is not customary to take special notice of them. The warble fly is, to the average farmer, a much more serious matter in summer when it is causing the cattle to gad, with the consequences of broken fences, reduced milk yield, and perhaps udder troubles.

The time to deal with the warble pest is in spring, while the grubs are in the backs of the cattle. Such is the life history of the insect that if these larvae are all destroyed there will be no flies to lay another batch of eggs later. There is ample evidence of the success of this method in practice, and if every cattle farmer would co-operate, the pest could in a very few years be almost completely eradicated.

There are several dressings which can be used with success on warbles which have reached the stage of puncturing the hide : iodoform one part to vaseline five parts is a good killer, and causes the dead grubs to project through the perforation. Whatever treatment is adopted, however, repetition is essential, as fresh grubs keep arriving in the backs of the cattle.

* The Ministry's Leaflet No. 21, "The Warble Fly," Revised Nov., 1927. Single copies free on application to the Ministry.

NOTES ON MANURES FOR APRIL

H. V. GARNER, M.A., B.Sc.,

Rothamsted Experimental Station.

Top Dressing.—At this time of the year, many farmers will be applying a spring, nitrogenous dressing to their winter corn, this practice being most usual in the drier and warmer districts of the Midlands and Eastern Counties, where wheat and winter oats are important crops. In the wetter districts, the risk of lodging the cereals on good land tends to restrict the use of nitrogen in this way, while spring-sown corn does best when it receives its manure before sowing. A few notes on experience gained at Rothamsted with top dressings may be of interest. Experiments have been carried out with winter oats and wheat for several seasons, and the dressings have been applied in March, April, and May, usually as sulphate of ammonia. A heavy application of 2 cwt. per acre has been compared with the more normal dressing of 1 cwt. The following is a summary of the results:—

WINTER OATS.

Year	Increase for 1 cwt. Sulphate of Ammonia		Additional Increase for the second cwt. Sulphate of Ammonia		Date of application of S.A.
	Grain Bu. per acre	Straw Cwt. per acre	Grain Bu. per acre	Straw Cwt. per acre	
1919	7.8	5.3	—	—	—
1921	—6.9	—1.0	—	—	—
1923	8.9	6.2	—	—	—
1923	8.1	7.1	9.2	9.4	April 23
1923	8.5	7.9	7.7	5.1	March 28
1923	5.4	3.7	19.1	11.0	April 23
1925	9.8	8.3	7.0	4.9	May 22
1925	14.6	7.3	5.1	3.8	March 5
1926	3.5	6.2	—1.2	3.4	May 5
1926	7.9	5.1	—	—	March 26
					March 4

WHEAT.

Year	Increase for 1 cwt. Sulphate of Ammonia		Additional Increase for the second cwt. Sulphate of Ammonia		Date of application of S.A.
	Grain Bu. per acre	Straw Cwt. per acre	Grain Bu. per acre	Straw Cwt. per acre	
1918	4.4	4.6	—	—	—
1921	0.7	3.5	—0.3	—0.1	—
1921	—0.4	1.2	—	—	March 2
1921	2.0	3.2	0.9	0.4	April 7
1922	3.7	2.9	2.6	4.6	May 2
1922	5.1	4.8	—1.3	1.0	March 18
1922	5.1	3.8	—0.3	1.8	April 20
1926	4.8	3.7	0.5	1.6	May 18

It will be noted that, with the exception of the very dry year, 1921, the 1 cwt. application was effective on both oats

and wheat, the average increase being 6.8 and 3.2 bushels per acre, respectively. The double quantity was beneficial in the case of oats, the further increase in grain being approximately the same as with the single dressing. With wheat, however, the second dressing produced no benefit. Further, in the case of both wheat and oats, dressings applied as late as the fourth week in May have been effective, and sometimes highly effective. The conditions under which this happens are not as yet clearly defined. The question of applying nitrogen late in the life of the plant has recently gained interest from the results of experiments carried out in America, where it was shown that a marked increase in the protein content of the grain of wheat resulted from nitrogenous dressings given at heading time, the gain being one of quality rather than yield. It remains to be seen whether these results will be confirmed under English conditions, and, if so, whether there will be any inducement to produce such grain.

In the ordinary way, however, farmers are recommended to apply their nitrogenous manures early rather than late, for late dressings tend to delay ripening, and this can be a real disadvantage in a catchy season. The double dressings used at Rothamsted have occasionally lodged the crop, and when this happens the gain of a few extra bushels may not compensate for the extra labour involved. In this matter the choice of stiff-strawed varieties is as important as the use of fertilizers.

On most farms, the extra yield of straw arising from nitrogenous dressings has its value either as feed or manure, and will approximately discharge the handling and application costs of the artificials. It should be borne in mind that nitrogenous manures, used alone, can operate only when the soil contains reserves of the other manurial constituents. In ordinary practice, the corn crops following roots or leys will benefit from the residues of phosphate and potash given to these crops; failing this, more complete manuring will usually be necessary.

Several manures are now available for top dressing purposes. The nitrates of soda and of lime are useful where immediate response is required. Sulphate of ammonia serves for general purposes, except on soils deficient in lime. Chloride of ammonia has been under trial in this country for some years, while compounds containing both ammonia and nitrate nitrogen are making headway in Germany. Cyanamide and

the newer substance urea are more suited to application in the seed bed than for top dressings.

Returns from Fertilizers.—In estimates of the profit arising from the use of artificial fertilizers, it is sometimes found that the difference is taken between the cost of the manure and the value of the crop increase. This is only approximately correct, for several other considerations involved are worthy of notice, although some of them are not readily expressible in figures. They operate in opposite directions. Tending to reduce the profit, as reckoned above, we may have additional costs for :—

- (1) Railway carriage on f.o.r. quotations.
- (2) Transport to the farm, if this has to be undertaken at a time when horses and men could profitably be employed elsewhere.
- (3) Mixing, bagging, transport, and distribution on the farm.
- (4) Increases on the 4-ton price where smaller quantities are ordered.

On the other hand, tending to improve the estimate, as roughly arrived at, we have the following :—

- (1) There are residual effects from phosphates and potash applied in excess of the requirements of the first crop. This happens when cereals follow well-done roots, or clover follows barley which has received phosphates; while manures applied for hay frequently increase the grazing value of the aftermath.
- (2) There is usually an increase in organic matter apart from the chief product in view. More grain is accompanied by more straw, larger roots carry more leaf, and so on. These by-products have value either for feeding, dung making, or turning under. In this connexion we may attribute an indirect residual effect to nitrogenous fertilizers, since the increased quantity of straw produced by their use increases the dung supply.
- (3) In certain cases, fertilizers produce an increase in quality and feeding value of the whole crop, as with phosphate or lime on grassland. There are two sides to this question, however, for although skilful manuring may maintain or slightly improve the quality of such crops as potatoes, barley, and sugar beet, it is well known that certain schemes of manuring can injure the quality of these crops.

Manuring of Potatoes.—Numerous experiments have shown that potatoes can be grown successfully on a light dressing of dung in conjunction with a mixture of fertilizers containing nitrogen, phosphate, and potash. A typical set of results obtained by the Irish Department of Agriculture may be quoted as an illustration of this :—

AVERAGE OF 353 EXPERIMENTS.

No Manure	4.0 tons per acre
15 tons dung	8.2
15 tons dung and complete artificials* ..	10.8

* Consisting of 4 cwt. superphosphate, 1 cwt. sulphate of ammonia, 1 cwt. of muriate of potash per acre.

With the exception of certain peaty soils, *e.g.*, the Fen district, where large amounts of superphosphate seem to be the main requirement, manuring on some plan as the above is the common practice. More recently, attention has turned to the effect of manures on the quality of the produce; and here the fact has emerged that chlorides are injurious to the quality of potatoes and, in extreme cases, the yield may also suffer. This conforms with the practice of supplying the necessary potash as sulphate or high-grade muriate, but not as low-grade salts. These last, containing a large proportion of chloride, as common salt, have often been unsatisfactory in their effect on cooking quality as compared with equivalent potash in the high-grade forms. This has been observed at Rothamsted, although the yields obtained with low-grade salts have, on the whole, been only slightly less than with the more usual forms, as the following four-year average shows :—

AVERAGE 1921-24.					Tons per acre	
					With Dung	No Dung
No Potash	..	..	..	..	8.1	4.9
Sulphate	..	..	..	..	8.7	7.9
Muriate	..	..	..	..	8.7	8.1
Low-grade salts	..	..	..	..	8.2	7.5

In the last few seasons, a beginning has been made at Rothamsted to test the effect of varying the proportions of the constituents in fertilizer mixtures for potatoes. Sulphate of ammonia and sulphate of potash have been used at different rates in presence of a constant dressing of dung and superphosphate. The results obtained in 1925 and 1926 were as follows :—

INCREASES OVER SUPERPHOSPHATE (1925); DUNG AND SUPERPHOSPHATE (1926): TONS PER ACRE.

	No Potash		2 cwt. Sulphate of Potash		4 cwt. Sulphate of Potash	
	1925	1926	1925	1926	1925	1926
No nitrogen ..	0	0	1.7 (31)	0.2 (3)	2.4 (44)	0 (0)
2 cwt. sul. amm. ..	-0.3 (-5)	1.6 (20)	3.7 (67)	2.5 (32)	5.0 (91)	2.6 (33)
4 cwt. sul. amm. ..	0.9 (16)	1.7 (22)	4.7 (86)	3.8 (49)	5.5 (100)	4.5 (58)

Note.—All plots received 3 cwt. superphosphate per acre, with dung in addition in 1926. These treatments yielded 5.5 tons in 1925 and 7.8 tons in 1926. The figures in brackets are the percentage increases on these basal yields.

It will be noted that the increases, produced by the different combinations, varied from nothing to 5.5 tons per acre, or double the original crop. The season 1925, and the absence of dung, favoured the action of potash, which was effective with all rates of nitrogenous manuring, and even in the absence of sulphate of ammonia. Nitrogen, on the other hand, gave little result unless used with potash, when it gave good increases, especially for the first 2 cwt. of sulphate of ammonia. The following year, 1926, nitrogen was most effective. Two hundredweight of sulphate of ammonia increased the crop by 1.6 tons (20 per cent.) in the absence of potash, while potash without nitrogen was useless. At a level of 2 cwt. of sulphate of ammonia, only 2 cwt. of sulphate of potash were required for full yields, but, where 4 cwt. of sulphate of ammonia were used, the higher rate of potash was required. In both years, the combination of 4 cwt. each of sulphate of ammonia and potash gave the highest yield. In 1926, potash could be spared from this combination better than nitrogen; in 1925, the reverse was the case. On the whole, heavier dressings than are commonly given have come out quite well in these experiments. The indications are that the use of the above two fertilizers in about equal proportions is justified. Two hundredweight of each did not suffice for maximum crops in either of the two seasons; on the other hand, 4 cwt. of each is too heavy a dressing to be recommended for general purposes without further trial, especially where farmyard manure is employed.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending March 14				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	12 10	11 15	11 0	11 0	14 2
" " lime (N. 13%) ..	7 0f	7 0f	7 0f	7 0f	17 6
Nitro-chalk (N. 10%) ..	7 0f	7 0f	7 0f	7 0f	14 0
Compound white nitrates of lime and ammonia B.A.S.F. (N.15½%)	11 19g	11 3h	..	..	..
Sulphate of ammonia :—					
Neutral (N. 20.6%) ..	10 13*	10 13*	10 13*	10 13*	10 4
Calcium cyanamide (N. 19%) ..	9 0†	9 0†	9 0†	9 0†	9 6
Kainit (Pot. 14%) ..	3 7	2 17	3 0	3 1	4 4
Potash salts (Pot. 30%) ..	5 2	..	..	4 19	3 4
" (Pot. 20%) ..	3 17	3 5	3 10	3 10	3 6
Muriate of potash (Pot. 50.53½%)	9 10	9 0	9 9	10 0	3 9
Sulphate " (Pot. 48.51½%)	11 10	11 0	11 14	12 2	4 9
Basic Slag (T.P. 34%) ..	3 6§	2 12§	2 12§	..	..
" (T.P. 32%) ..	3 3§	2 10§	2 10§	..	..
" (T.P. 30%) ..	3 1§	2 7§	2 7§	2 15e	1 10
" (T.P. 24%) ..	2 7§	1 18§	1 19§	..	..
Ground rock phosphate (T.P. 58%)					
Very fine grade ¶	2 15	..	..	2 10d	0 10
Fine grade||	2 10	2 10	..	2 7d	0 10
Superphosphate (S.P. 35%) ..	3 0	..	3 4	3 0	1 9
" (S.P. 33%) ..	..	..	3 2	..	..
" (S.P. 30%) ..	2 15	2 12	2 18	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 12	8 2	..
Steamed bone flour (N. ½%, T.P. 60.65%)	5 17†	6 2†	6 5	5 15	..
Burnt Lump Lime ..	1 9	1 12a	1 16b	2 1§	..
Ground Lime ..	1 18	2 1a	2 6b	1 15§	..
" Limestone ..	..	..	1 10b	..	..
" Chalk ..	..	1 9	..	1 5§	..

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. 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.

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

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

§ Prices for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of town mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

|| Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

a Delivered to Hull. b Delivered to Liverpool area.

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

e F.o.r. Northern rails; 3s. 6d. per ton extra on Southern rails.

f Delivered in 6-ton lots at purchaser's nearest railway station.

g F.o.r. Gloucester. h F.o.r. Goole.

NOTES ON FEEDING STUFFS FOR APRIL

H. E. WOODMAN, M.A., Ph.D., D.Sc.,

School of Agriculture, Cambridge.

Wild White Clover.—Wild white clover (*Trifolium repens*) occupies a unique position among the herbage plants of the farm, since it not only affords a nutritious, succulent and protein-rich feed to grazing animals, but also, by its power of utilizing atmospheric nitrogen, leads to an enrichment, in respect of nitrogen, of the soil underlying the pasture. The clover herbage is consumed by the grazing animal, and the protein constituent, which has been elaborated cheaply at the expense of the nitrogen of the air, is, in part, transformed into products like meat and milk within the body of the animal, and, in part, finds its way into the soil in the excreta of the animal.

It is scarcely surprising, then, that the farmer has come to regard the production of a good plant of wild white clover as the essence of efficient grassland management. The method by which this end could be achieved was brought prominently to the notice of agriculturists by the classical researches of Somerville, Middleton, Gilchrist and others, at Cockle Park, into the effect of basic slag in stimulating the growth of wild white clover. By manurial treatment along these lines, many a pasture of poor stock-carrying capacity was transformed into grassland of the first quality. Indeed, cases were not unknown where farmers suffered from excessive production, the clover growing so profusely under such treatment as to crowd out the grasses. Grassland fertilizing became substantially a question of the periodic application of basic slag, with occasional applications of kainit. The provision of the necessary nitrogenous fertilizer was largely left to the activities of wild white clover, and to the incorporation in the soil of the nitrogenous components of the excreta of cake-fed animals.

This was essentially sound philosophy at the time. Indeed, it is questionable whether we have ever learnt to make sufficient use of the natural fertilizing agencies which are resident in the soil itself. To quote Professor Armstrong: "When we think of the way in which nitrogen and hydrogen are converted into ammonia in the root nodules of leguminous plants, apparently by a minute organism leading an imprisoned, airless life, when we contrast this with the great array of pumps, compression vessels and many other mechanical appliances used in the factory to the same end, we may

indeed hang down our heads in very shame at our ignorance of all that is fundamental in the minute operations of nature. To pour such material, so made, as fertilizer on the soil, when the humble bacterium, by which it is populated, can do the work on the spot, if only properly encouraged, may some day come to be regarded as soil sacrilege."*

It is now becoming increasingly manifest that the use of basic slag is not the only means at the farmer's disposal for enriching his pastures with wild white clover. The same purpose can be achieved by the simple method of keeping the herbage short by efficient grazing; or, alternatively, where heavy stocking is not feasible, by keeping the herbage in check by an occasional resort to the mowing machine. One of the most striking results of a pasture experiment at Cambridge, during 1925, was the extraordinary manner in which wild white clover flourished and spread in the pasture plot under a system of frequent cutting. Members of farmers' parties, who inspected the plot during the summer, expressed astonishment that such a result had been produced by systematic cutting and not by slugging.

A similar effect was witnessed, on a much wider scale, in the Cambridge district during the season of 1927. A droughty May led to an early shortage of grass, with the consequence that pastures were much more tightly grazed than usual. The result of this closer grazing became very apparent during late June and early July, when the pastures in the district were seen to be covered with carpets of flowering clover. The appearance of the pastures at this date was so unusual as to be commented on by the most casual observer.

The marked stimulation of wild white clover appears to constitute, therefore, a consequence of keeping a pasture closely grazed. The effect, however, may not always be so strikingly apparent in the same season. In the 1926, Cambridge, investigation, when a plot on a second pasture was submitted to precisely the same treatment as had been employed on the 1925 plot, the effect on clover development, although quite noticeable, was not nearly so outstanding. This less striking effect was attributed to the competition of creeping bent, which displayed very considerable growth, and appeared thereby to react adversely on the productivity of the other species in the sward. At the conclusion of the experiment in autumn, the pasture plot, as well as the rest of the field (on

* H. E. Armstrong, *The Art and Principles of Chemistry*; E. Benn, Ltd., 1927.

which the aftermath following hay-making had not been grazed very efficiently) received a dressing of basic slag at the rate of 10 cwt. to the acre.

The plot was kept under observation during the season of the following year. During the spring of 1927, it was noted that wild white clover was beginning to display signs of vigorous growth and activity. This continued to such an extent, that, when July arrived, it would have been possible to have marked out the old experimental plot with the greatest accuracy by simply following the sharply defined border of the flowering carpet of clover which covered the area of investigation of the previous year. This picturesque result was clearly a belated effect of the systematic cutting of the plot during 1926. Outside the line of clover flower, on the part of the field which had not been included in the 1926 experiment, but which had, nevertheless, also been dressed with basic slag during the autumn, it was a matter of some difficulty to discover even individual plants of clover.

The reader will be able to draw his own conclusions as to the relative influences of slagging and of close-grazing on the spreading of wild white clover in a pasture. Certainly, the results of these experiments lend point to an oft-repeated assertion of the writer: "The best accompaniment to slagging is close-grazing."

Under conditions of intensive grazing, therefore, wild white clover is likely to figure very prominently in many types of pasture. The question naturally arises as to how far it will be desirable to encourage the growth of this species, since over-stimulation may result in a tendency to crowd out the grasses. To the credit side of wild white clover may be set the following considerations:—

- (1) Its power of utilizing atmospheric nitrogen.
- (2) Its capacity for enduring droughty conditions.
- (3) Its ability to reduce the evaporation of moisture from pasture soils during dry summers, in consequence of the manner in which a single plant is able to spread closely over a wide area.
- (4) Its richness in protein and lime.

On the other hand, due weight must be given to the following facts:—

- (1) The palatability of wild white clover appears to diminish when the plant has grown beyond the young stages. During the summer of 1927, the writer was struck by

the observation that, on a certain Cambridge pasture, large patches of well-grown white clover were being left absolutely untouched by dairy animals, the latter grazing carefully round such patches in their efforts to secure the grasses, for which they appeared to have a decided preference. The question of the palatability of wild white clover, in relation to maturity, is a problem which should repay detailed investigation.

- (2) Recent research at Cambridge and Aberystwyth has brought to light the fact that the grasses themselves, if cut or grazed in the young condition, are almost as rich as the clovers in respect of protein. Moreover, such young grass, although not so rich as wild white clover in respect of lime, contains a satisfactory amount of this important mineral constituent. It would therefore appear permissible to conclude that, where the practice of close grazing is being followed, the cardinal feature of good grassland management should not consist in paying particular attention to the stimulation of wild white clover, but in so treating the pasture as to bring about (1) a denser growth of the grasses, (2) a more *uniform* rate of growth of grass over the whole season, and (3) a more abundant growth during the earliest and the latest stages of the grazing year.

The well-managed pasture provides the farmer with the cheapest method for converting inorganic nitrogen into digestible protein. In advocating the use of nitrogenous fertilizers for increasing the productivity of pastures, the writer is simply giving practical expression to the conclusions arrived at in respect of the richness of young pasture grass in digestible protein. In these days of more intensive agriculture, the view is not so generally held as heretofore that the question of nitrogen supply in pasture soils can safely be left to the activities of wild white clover and the effects of the excreta of cake-fed animals. The results obtained in the numerous investigations carried out in various parts of the country are leading to the belief that nitrogen, no less than potash and phosphate, should be applied to pastures in the form of quickly available artificial fertilizers. It is claimed that the periodic dressing of the pasture with nitrogenous fertilizer during the season leads, not only to a more vigorous and a denser growth of herbage during summer and autumn, but also to an extension of the season over which the pasture will carry grazing animals.

DESCRIPTION	Price per qr.		Price per ton		Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.				s. d.	d.	%
Wheat, British ..	—	—	10 2	0 13	9 9	72	2 8	1-43	9-6	
Barley, British feeding ..	—	—	9 15	0 10	9 5	71	2 7	1-38	6-2	
" Canadian No. 3 Western ..	40 6	400	11 7	0 10	10 17	71	3 1	1-65	6-2	
" Danubian ..	39 3	"	11 0*	0 10	10 10	71	3 0	1-61	6-2	
" Karachi ..	38 9	"	10 17	0 10	10 7	71	2 11	1-56	6-2	
" Persian ..	37 3	"	10 8	0 10	9 18	71	2 9	1-47	6-2	
Oats, English, white ..	—	—	10 17	0 11	10 6	60	3 5	1-83	7-6	
" black and grey ..	—	—	10 13	0 11	10 2	60	3 4	1-78	7-6	
" Scotch, white ..	—	—	11 10	0 11	10 19	60	3 8	1-96	7-6	
" Canadian No. 2 Western ..	36 3	320	12 13*	0 11	12 2	60	4 0	2-14	7-6	
" feed ..	27 0	"	9 8§	0 11	8 17	60	2 11	1-56	7-6	
" Argentine ..	29 3	"	10 5	0 11	9 14	60	3 3	1-74	7-6	
Maize, Argentine ..	44 6	480	10 8	0 11	9 17	81	2 5	1-29	6-8	
Beans, English, winter ..	—	—	9 7†	1 6	8 1	66	2 5	1-29	20	
Peas, English, blue ..	—	—	15 15†	1 3	14 12	69	4 3	2-28	18	
Dari, Egyptian ..	—	—	10 0†	0 13	9 7	74	2 6	1-34	7-2	
" Palestine ..	—	—	11 5	0 13	10 12	74	2 10	1-52	7-2	
Millers' offals—										
Bran, British ..	—	—	8 5	1 3	7 2	42	3 5	1-83	10	
" broad ..	—	—	9 12	1 3	8 9	42	4 0	2-14	10	
Middlings, fine, imported ..	—	—	10 10	0 18	9 12	69	2 9	1-47	12	
" coarse, British ..	—	—	8 5	0 18	7 7	58	2 6	1-34	11	
Pollards, imported ..	—	—	8 2	1 3	6 19	60	2 4	1-25	11	
Meal, barley ..	—	—	12 5	0 10	11 15	71	3 4	1-78	6-2	
" maize ..	—	—	10 12	0 11	10 1	81	2 6	1-34	6-8	
" S. African ..	—	—	9 15	0 11	9 4	81	2 3	1-20	6-8	
" germ ..	—	—	10 5	0 16	9 9	85	2 3	1-20	10	
" gluten feed ..	—	—	10 10	1 1	9 9	76	2 6	1-34	19	
" locust bean ..	—	—	9 0	0 8	8 12	71	2 5	1-29	3-6	
" bean ..	—	—	12 15	1 6	11 9	66	3 6	1-87	20	
" fish ..	—	—	21 10	3 10	17 0	53	6 5	3-44	48	
Maize, cooked flaked ..	—	—	12 15	0 11	12 4	85	2 10	1-52	8-6	
Linseed—										
" cake, English 12% oil ..	—	—	13 0	1 11	11 9	74	3 1	1-65	25	
" " " 10% " ..	—	—	12 10	1 11	10 19	74	3 0	1-61	25	
" " " 9% " ..	—	—	12 5	1 11	10 14	74	2 11	1-56	25	
Soya bean ..	—	—	11 0	2 4	8 16	69	2 7	1-38	36	
Cottonseed cake English—										
" Egyptian 5½% " ..	—	—	8 7	1 10	6 17	42	3 3	1-74	17	
" Egyptian, 5½% " ..	—	—	8 2	1 10	6 12	42	3 2	1-70	17	
Decorticated cottonseed meal, 7% oil ..	—	—	12 5§	2 5	10 0	74	2 8	1-43	35	
Ground-nut cake, 7% oil ..	—	—	9 17*	1 7	8 10	57	3 0	1-61	27	
Decorticated ground-nut cake, 7% oil ..	—	—	13 5*	2 5	11 0	73	3 0	1-61	41	
Palm kernel cake, 6% oil ..	—	—	10 2*	0 19	9 3	75	2 5	1-29	17	
" " meal, 6% oil ..	—	—	10 12*	0 19	9 13	75	2 7	1-38	17	
Feeding treacle ..	—	—	9 0†	1 0	8 0	71	2 3	1-20	17	
Brewers' grains, Dried ale ..	—	—	6 0	0 9	5 1	51	2 0	1-07	2-7	
" " " porter ..	—	—	8 15	1 0	7 15	49	3 2	1-70	13	
" " " wet ale ..	—	—	8 5	1 0	7 5	49	3 0	1-61	13	
" " " porter ..	—	—	1 15	0 7	1 8	15	1 10	0-98	4-8	
Malt culms ..	—	—	1 0	0 7	0 13	15	0 10	0-45	4-8	
	—	—	8 15§	1 9	7 6	43	3 4	1-78	16	

* 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 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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. 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 1-29d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 11d.; P₂O₅, 3s. 10d.; K₂O, 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 follows:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported) ..	71	6-2	10 18
Maize ..	81	6-8	10 8
Decorticated ground nut cake ..	73	41-0	13 5
" cotton cake ..	71	34-0	11 5

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

The cost per unit starch equivalent works out at 2-81 shillings, and per unit protein equivalent, 1-40 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, 1927, 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	10 16
Oats ..	60	7-6	8 19
Barley ..	71	6-2	10 8
Potatoes ..	18	0-6	2 11
Swedes ..	7	0-7	1 1
Mangolds ..	7	0-4	1 0
Beans ..	66	20-0	10 13
Good meadow hay ..	31	4-6	4 14
Good oat straw ..	17	0-9	2 9
Good clover hay ..	32	7-0	5 0
Vetch and oat silage ..	13	1-6	1 19
Barley straw ..	19	0-7	2 14
Wheat straw ..	11	0-1	1 11
Bean straw ..	19	1-7	2 16

MISCELLANEOUS NOTES

A BRIEF note on the Great Britain Section of the Empire Marketing Board Stand at the British Industries Fair was given in this JOURNAL last month (p. 1170). The Fair this year was a record in every respect. Large numbers of visitors, both from home and overseas,

showed great interest in the exhibits of home produce, and it is satisfactory to record that several commodities were the subjects of promising inquiries—overseas inquiries for seed potatoes, fleeces, and tomato seed may be mentioned in particular. Illuminated photographs of British breeds of live stock proved attractive, and inquiries about purchasing stock for export were received from visitors from Spain, Italy, and the Far East. Many agents were interested in the display of canned and bottled fruits, in some cases with a view to export to the Far East and to Germany. Photographs of the stand are reproduced herewith (Fig. 1 and 2).

The Ideal Home Exhibition attracted large crowds, and it was gratifying to notice the increasing interest shown in home produce, largely due to the new features introduced on this occasion. Fruit, in its various forms, was treated as one unit. In the centre was a large map of England and Wales, which had been specially designed for the Ministry; on this, the main fruit-producing districts were indicated by small coloured lights, while two panels at the top of the map contained the names of the principal English fruits. On each side was a small diorama, depicting orchard trees on the one hand, and a small fruit plantation on the other. The actual produce on each side of the map was arranged according to variety: for example, a basket of raspberries (artificial) was surrounded by bottled and tinned raspberries and raspberry jam. The whole of this section was lit up in series; thus, when the word "raspberries" appeared at the top of the map, the bulbs in the raspberry-growing districts on the map and the small fruit diorama were also lit, and hidden lights illuminated the raspberry products group. This system was repeated for each of the fruits in turn. (The photograph reproduced herewith, Fig. 3, was given a long exposure, and thus shows all fruits illuminated in the one picture.) A crowd continuously watched this apparatus, which, besides being instructive, undoubtedly focussed attention on the English fruit industry, emphasizing the message conveyed on a card—"English fruit is always obtainable—when fresh fruit is out of season,

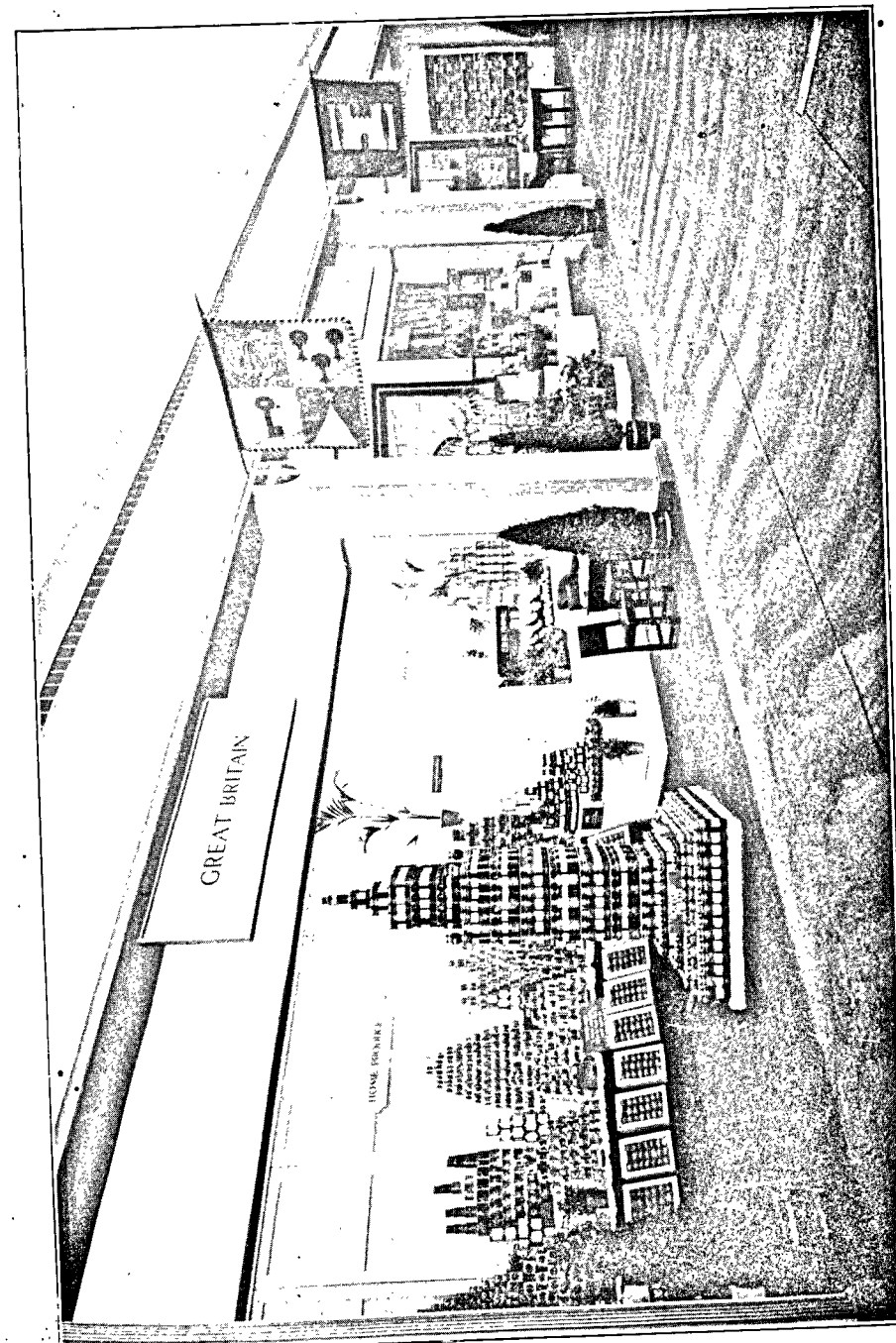


FIG. 1.—The British Industries Fair, 1928, at White City, London. General view of Home Produce Display.

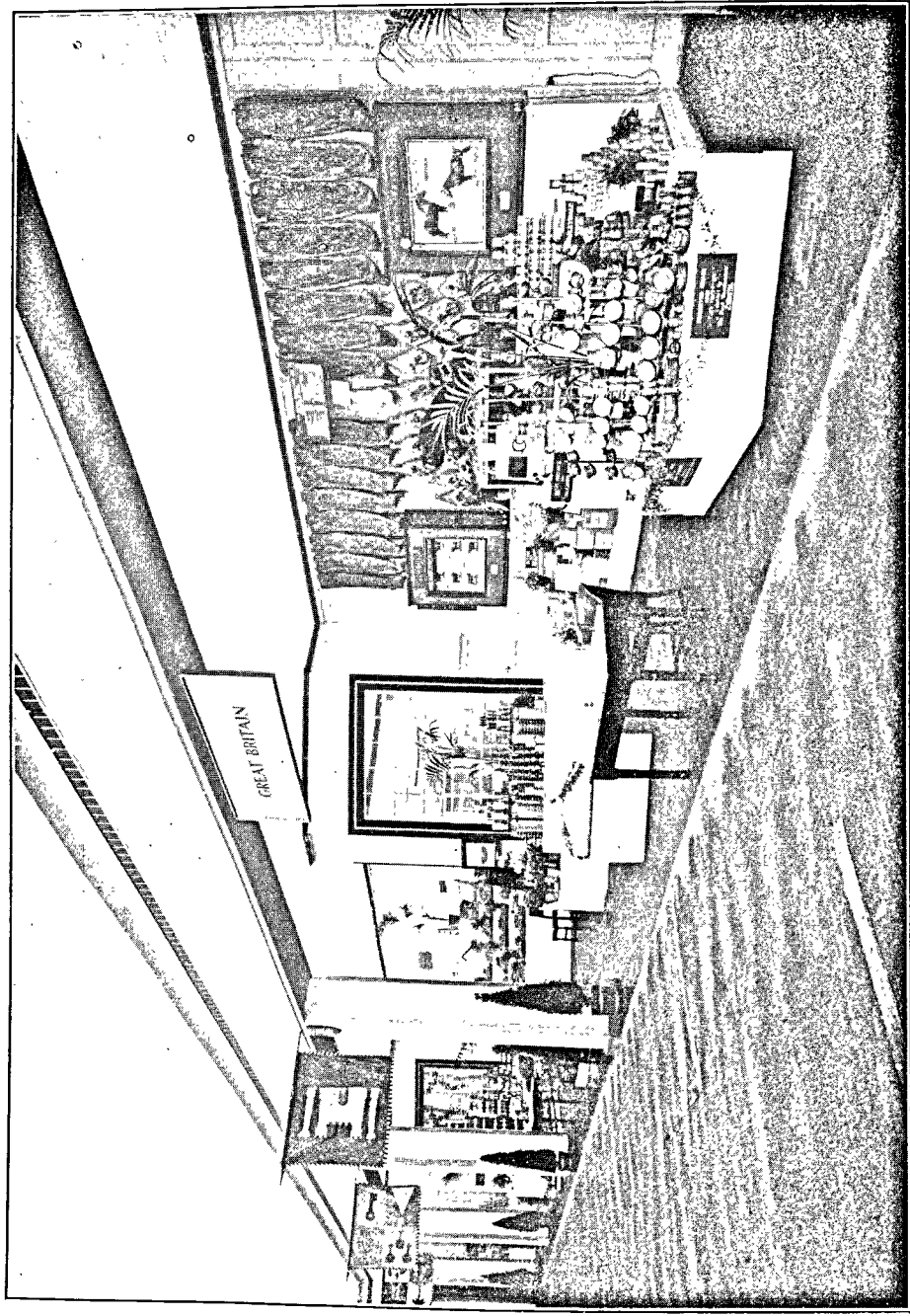


FIG. 2.—The British Industries Fair, 1928, at White City, London. General view of Home Produce Display.

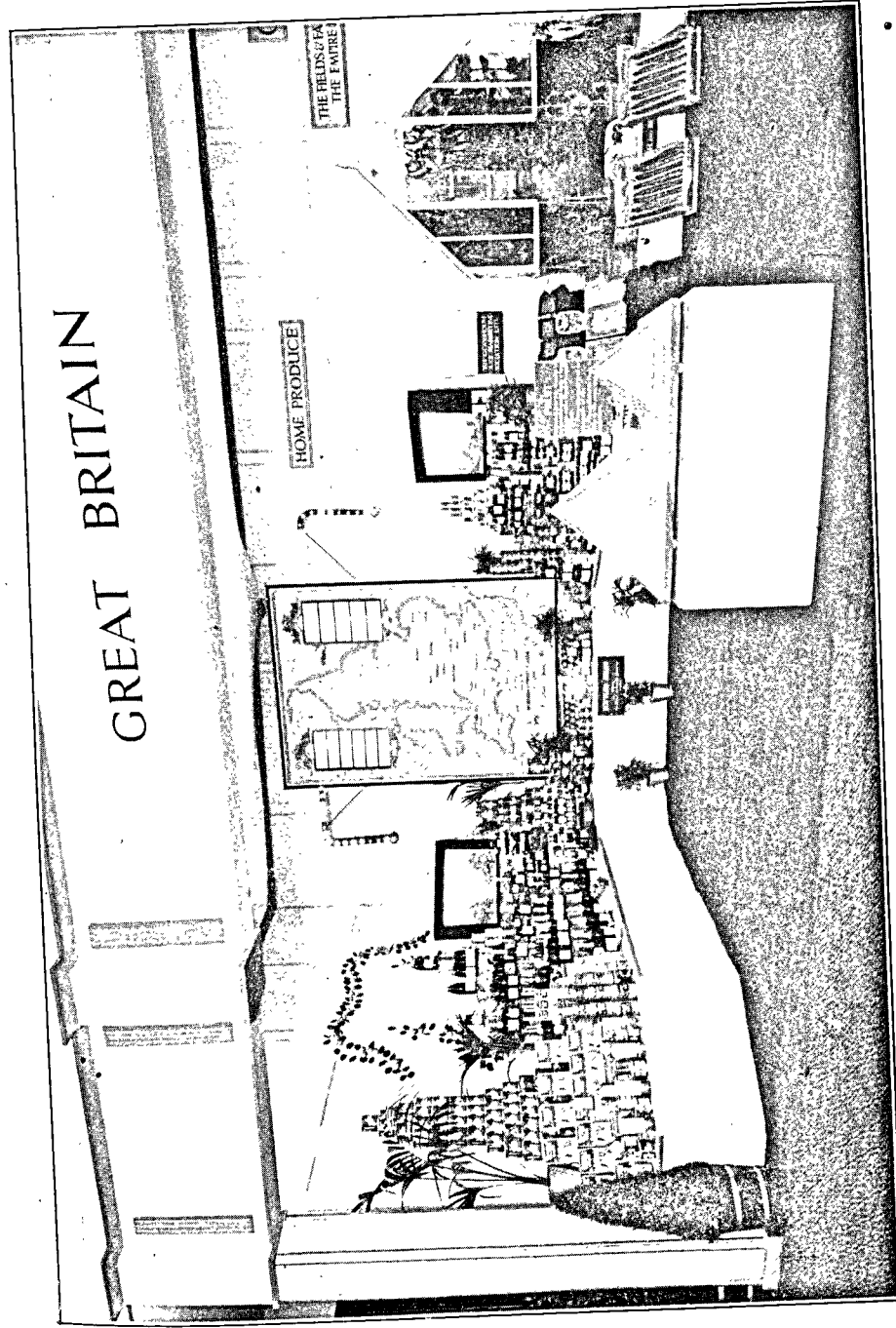


FIG. 3.—The Ideal Home Exhibition, 1928, at Olympia, London. Display of Home-Produced Fruit.

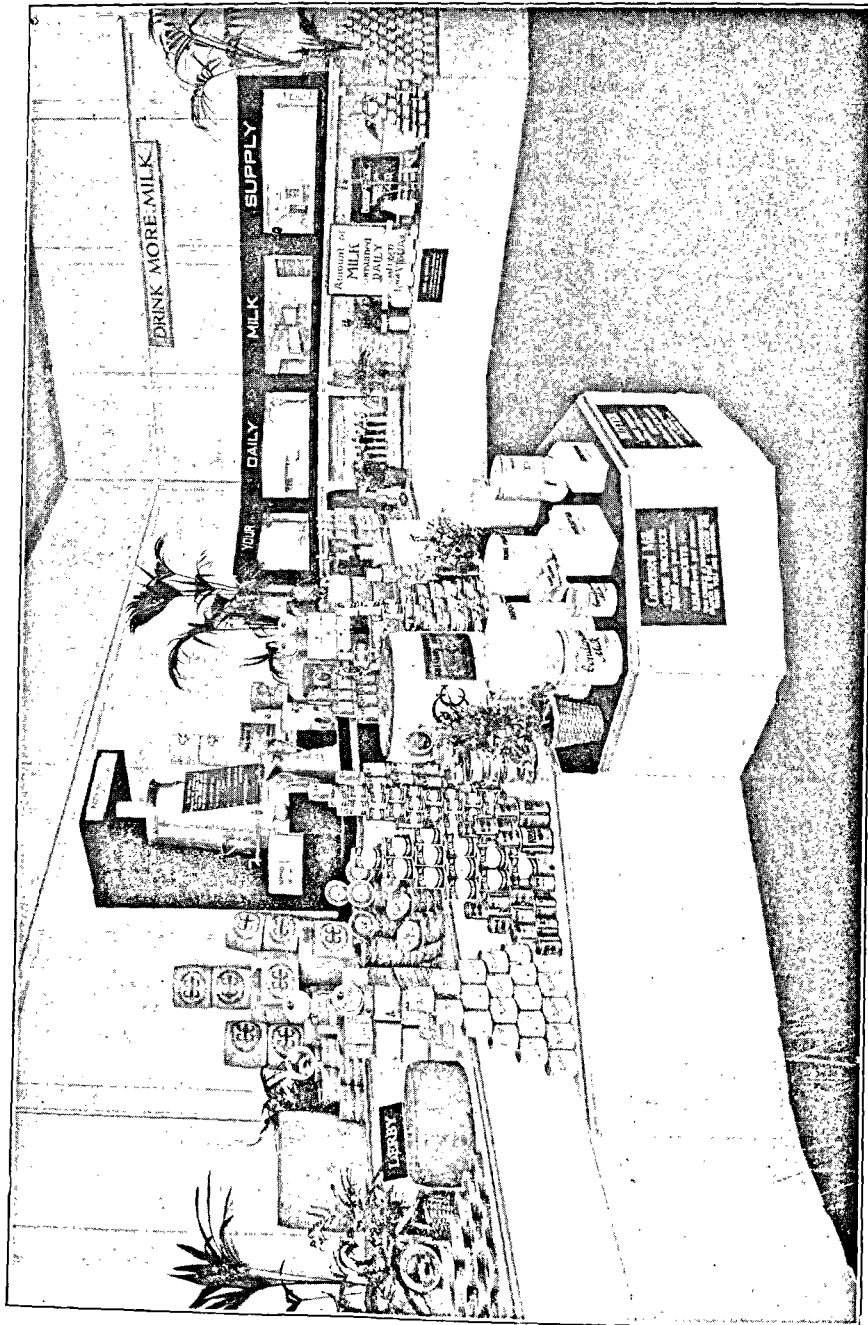


FIG. 4.—The Ideal Home Exhibition, 1928, at Olympia, London. Display of Home Dairy Produce.

try canned and bottled fruit." The amount of fruit imported into Great Britain in six months is equal in bulk to the Great Pyramid of Ghizeh, while home-produced fruit is only one-quarter of this; this striking comparison was presented by illuminated models.

Hot-house produce, comprising cucumbers, beans, mushrooms and seakale, looked very tempting, and was staged round a model glass-house made in perspective.

In addition to an excellent display of eggs by the Wiltshire Egg Producers, the Cheltenham Fruit Market supplied an exhibit of eggs, graded in accordance with the suggested national standards, and this proved of great interest.

In the centre of the stand was a plinth, on the top of which was a stuffed pig, and below this were two sides and two hams. At one end of the plinth was a side of bacon marked with ribbons to illustrate the various joints into which bacon is normally cut. At the other end was a selection of hams cured by various firms. The fourth side of the plinth was fitted with glass shelves, holding a comprehensive display of meats in jars and tins. A bundle, 2 ft. 6 in. high, of (dummy) £100 notes provided a striking illustration of the amount of money which goes out of this country every week for pig products. A card explained this, and exhorted visitors to "Buy home produce and keep some of this money in the country."

The centre of the dairy exhibit was a graphic illustration of the disposal of milk in this country, the total production of milk being illustrated by a stream flowing into a churn; taps round the churn showed the proportion of milk which is consumed fresh, and as cheese, butter, condensed milk and other manufactured products. In addition to groups of Cheddar and Cheshire cheese supplied by the two newly formed Federations, many other types of English cheese were shown. Several brands of condensed and dried milk, butter, cream and milk foods were also exhibited. Models showing, by their relative size, the proportion of home dairy produce to imports, brought home to Londoners the extent to which they are dependent on imported supplies; suitably worded cards exhorted them to buy home produce where available. A set of four dioramas, illustrating the organization necessary to supply London with its milk, was also shown for the first time here. This formed the centre-piece for a small section devoted to the "Drink More Milk" campaign.

The keynote of the whole display was the message on a board in the centre of the stand: "The fields and farms of

home are none the less a part of Empire because they are near and familiar." The display is believed to have done much to impress this message forcibly on the minds of the thousands who saw it.

The electrical apparatus and other novel features mentioned above have been specially made for the Ministry, and will be used at future exhibitions as circumstances permit. The National Farmers' Union and other national organizations collaborated with the Ministry in providing the produce exhibited.

* * * * *

CLEAN Milk Competitions have been held in most counties in England and Wales during the past four years, and the total number of milk producers competing

Medals for has shown a steady annual increase.
Clean Milk Several interested bodies and private persons have helped in furthering the

aims of the competitions by providing trophies of various descriptions to be awarded to the leading competitors.

Prominent among these donors have been the National Milk Publicity Council and the British Dairy Farmers' Association, both of whom have freely offered gold, silver, and bronze medals. Hitherto, there has been no co-operation between these two organizations in respect of these awards, with the result that, in some cases, both were giving medals in one and the same competition. Now, however, as the result of a conference between the National Milk Publicity Council, the British Dairy Farmers' Association, and the Ministry of Agriculture and Fisheries, a definite scheme of awards has been mutually agreed upon, the National Milk Publicity Council agreeing to offer medals to be won in approved County Competitions, while the British Dairy Farmers' Association will provide super awards in the form of a gold medal to the leading competitor in each of the advisory provinces, as arranged by the Ministry.

The scheme applies to Clean Milk Competitions held during 1928* and subsequent years, and sets out the following conditions:—

- (1) A competitor, to be eligible for a medal, must obtain at least 66½ per cent. of the maximum marks in a County Clean Milk Competition approved by the Ministry of Agriculture and Fisheries.

*It should be understood that the scheme will not affect any commitment in respect of medal awards which either body may have made prior to the acceptance of the agreement.

(2) Gold medals will be awarded only in connexion with County Clean Milk Competitions of at least six months' duration.

(3) Subject to the provisions (1) and (2), the National Milk Publicity Council are prepared to award medals as follows (and organizers of competitions wishing to avail themselves of this offer should communicate with the Council, 33 Gordon Square, London, W.C. 1):—

Competitions with a Total Entry of 20 or more Herds.—Where the competition is arranged in one class only, a gold medal to the competitor scoring the highest number of marks, a silver medal to the second, and a bronze medal to the third. Where the competition is arranged in more than one class, a silver medal to the best competitor, and a bronze medal to the second best in each class; in addition, a gold medal to the highest scorer in the whole competition.

Competitions with a Total Entry of less than 20 Herds, or of a Duration of less than Six Months.—The highest scorer will be awarded a silver medal, and the second highest a bronze medal; if the competition is arranged in more than one class these medals will be awarded for each class.

(4) Subject to the provisions (1) and (2), the British Dairy Farmers' Association offer as an award of higher distinction a series of *provincial trophies*. These trophies—one gold medal for each of the twelve Advisory Dairying Provinces recognized by the Ministry of Agriculture and Fisheries—will be offered annually to the competitor securing the highest number of marks in any of the approved County Competitions held within his province that year. Certificates will be awarded to the regular employees of the recipients of such gold medals.

(5) Counties will submit their returns to the Secretary of the Conference Committee for their province, who will be asked to arrange for the classification of the results of county competitions held that year, and to submit to the British Dairy Farmers' Association the classified results. The British Dairy Farmers' Association, before making an award, will consult the Ministry of Agriculture and Fisheries as to the eligibility of the competitions included in each classification.

(6) The British Dairy Farmers' Association will cease to award silver and bronze medals in connexion with County Clean Milk Competitions.

It should be noted that this scheme does not interfere with awards by the British Dairy Farmers' Association in connexion with the annual Inter-County Clean Milk Competition.

* * * * *

THE general level of the prices of agricultural produce during February was two points lower than in the previous month, at 43 per cent. above the base

The Agricultural years 1911-13, and two points below the
Index Number figure recorded in February, 1927. Prices of live stock, both fat and store, were

slightly higher than in January, but most other commodities were a little cheaper.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :—

Month	Percentage Increase compared with the Average of the corresponding month in 1911-13					
	1923	1924	1925	1926	1927	1928
January	67	60	71	58	49	45
February	63	61	69	53	45	43
March	59	57	66	49	43	—
April	54	53	59	52	43	—
May	54	57	57	50	42	—
June	49	56	53	48	41	—
July	50	53	49	48	42	—
August	52	57	54	49	42	—
September	52	61	55	55	43	—
October	50	66	53	48	40	—
November	51	66	54	48	37	—
December	55	65	54	46	38	—

Grain.—Wheat at an average of 9s. 7d. and barley at 10s. 10d. per cwt. were reduced by 3d. and 4d. per cwt. respectively, and the corresponding index numbers were five and six points lower at 29 and 34 per cent. above pre-war. A further rise in the price of oats of 7d. per cwt. brought this cereal to 42 per cent. dearer than in 1911-13, as compared with 16 per cent. in February of last year and 27 per cent. in February, 1926.

Live Stock.—Fat and store cattle advanced in price, the former realizing 32 per cent. more than in 1911-13 as against 28 per cent. in January, while the index number for the latter was one point higher at 25 per cent. above pre-war. Dairy cattle were appreciably dearer, and the index number rose by three points to 29 per cent. above the base years. There was an increase in the price of fat sheep of $\frac{1}{4}$ d. per lb. estimated dressed carcass weight, but as there was a greater increase in the corresponding period of the base years the index figure fell by seven points to 56 per cent. above pre-war. This cause also accounted for a fall in the index figures for pork pigs and store pigs to 42 and 41 per cent. above 1911-13, but the increases in the prices of store sheep and bacon pigs were sufficient to raise the relative index numbers by two and four points to 44 and 38 per cent. respectively above pre-war.

Dairy and Poultry Produce.—Butter was practically unaltered in price during February, and at 47 per cent. above 1911-13 was rather dearer than a year ago, when it averaged 40 per cent. Cheese at 59 per cent. above pre-war was two points lower on the month, but was considerably above the

level of 36 per cent. recorded in February, 1927. There was no alteration in the price of milk, and the index figure remained unchanged at 66 per cent. above pre-war. A sharp reduction of about 8d. per dozen in egg prices led to a fall of 44 points in the index number, and at 33 per cent. above the base years eggs were appreciably cheaper than in February, 1927 and 1926, when the index figures stood at 62 and 72 per cent. respectively above pre-war.

Other Commodities.—Potato prices were slightly lower on average during the month, and this, combined with a higher base price, caused the index number to fall three points to 71 per cent. above 1911-13, while a reduction of about 4s. per ton in the price of hay brought the index figure from 18 to 12 per cent. dearer than pre-war. Vegetables were a little cheaper than in January at 107 per cent. above the base years. Wool prices rose a little, and at 62 per cent. above pre-war this commodity is now considerably dearer than a year ago.

Index numbers of different commodities during recent months and in February, 1926 and 1927, are shown below :—

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

Commodity	1926	1927		1928	
	Feb.	Feb.	Nov.	Dec.	Jan. Feb.
Wheat	60	60	34	34	34 29
Barley	19	37	45	35	40 34
Oats	27	16	30	31	39 42
Fat cattle	47	30	19	16	28 32
Fat sheep	50	44	40	44	63 56
Bacon pigs	89	63	18	20	34 38
Pork pigs	89	75	29	33	44 42
Dairy cows	40	26	28	28	26 29
Store cattle	37	30	13	13	24 25
Store sheep	53	48	35	35	42 44
Store pigs	121	125	44	41	47 41
Eggs	72	62	47	41	77 33
Poultry	50	39	46	37	38 39
Milk	74	62	59	66	66 66
Butter	47	40	47	47	47 47
Cheese	78	36	55	55	61 59
Potatoes	49	94	76	75	74 71
Hay	4	—2*	19	20	18 12
Wool	45	32	46	50	58 62

* Decrease.

THE New Zealand Orchard Tax Act, 1927, came into force on January 1 this year. It repeals the previous Orchard Tax

The New Zealand Orchard Tax Act, 1927

Acts of 1916 and 1921, also Section 23 (3) of the Fruit Control Act, 1924. Like the previous Acts, this measure, which applies only to commercial orchards, with 120 fruit trees or over, has been enacted by the Legislature, at the request of the New Zealand fruit-growers, the object being to raise funds for promoting the interests of the Dominion fruit-growing industry, and especially the development of the export trade to Great Britain. Fruit in this connexion is defined as including apples, pears, quinces, oranges, lemons, peaches, nectarines, apricots, plums and cherries, and any other kind which the Governor-General may, by notice in the Government *Gazette*, declare to come within the provisions of the Measure. Under the Act, the occupier of every orchard pays a general orchard tax at the rate of one shilling per acre or part of an acre comprised in his orchard, two or more separate areas of land, used by one occupier for fruit-growing, being accounted as one orchard. The minimum tax under this head is five shillings per year.

This general tax on commercial orchards was common to the two previous Measures, but the present Act differs from them in instituting an additional special tax to be imposed only in fruit-growing districts which, by public notice of the Minister of Agriculture, are declared to be affected by fireblight. In such declared districts, the Minister, by notice in the *Gazette*, may prescribe an additional tax, not exceeding five shillings for every acre or part of an acre comprised in an occupier's orchard. The purpose of this additional impost is to provide funds for the control and suppression of fireblight, the moneys being expended by Fireblight Committees set up in the respective declared districts, the appointment of these committees being prescribed by regulations made by the Governor-General under Order-in-Council.

The taxes under these two heads must be paid by March 1 in each year, and tax not paid within 21 days is subject to a penalty addition of 10 per cent. Unpaid taxes are recoverable as a debt due to the Crown.

All moneys received by way of these taxes are paid into the Consolidated Fund, to the credit of a deposit account. The expenses of collection and administration are apportioned by the Minister of Agriculture, as between the amount received for general tax and that received for the special fireblight tax,

and are deducted from the total proceeds in each case. The residue of the general tax, without further deduction, is paid over to the New Zealand Fruit-growers' Federation, Ltd.—a co-operative association of fruit-growers—to be expended by that body in furthering the interests of the fruit-growing industry. In like manner, the residue of the special fireblight tax is paid over to the Fireblight Committees to be expended in their respective districts in connexion with the control of fireblight, including payment in respect of the cutting-down or destruction of hawthorn hedges.

By Order-in-Council, the Governor-General may make regulations prescribing the purposes for which the moneys paid over to the Fruit-growers' Federation and to the Fireblight Committees may be expended; also the forms of account to be kept by these bodies and the returns they must furnish. He may, also, make regulations prescribing the methods of settling disputes as to the area of an orchard, or the amount of tax to be paid, or on any other matters which he deems necessary for the effective administration of the Act.

* * * * *

EXCELLENT progress has been made in the investigations being carried on at the Midland Agricultural and Dairy College, into diseases of celery plants. The

Investigation into Celery Diseases

investigators have found it possible to secure good control of Leaf Spot (or Blight) in the field by spraying with Bordeaux mixture (see the Ministry's Leaflet No. 238). Spraying is now carried out regularly by all growers in the district, and this practice is responsible, in a large measure, for the exceptionally good crops which were obtained last season. Attention has been paid to the possibility of disinfecting seed, to enable the raising of healthy crops, without the necessity for spraying in the field, but experiments have proved that, while disinfection may check Blight to some extent in the early stages of the growth of the plants, it cannot be recommended as a means of effecting complete control of the disease. An interesting and instructive trial of the different varieties of celery in cultivation throughout the country was conducted at the College in 1927, and arrangements are being made to extend this trial next season. A report of the work in progress was published recently as Bulletin No. 14 of the College at Sutton Bonington, Loughborough, and should be studied by those interested in celery growing.

**Travelling
Research
Fellowships**

ON the recommendation of the Advisory Committee on Agricultural Science, the following grants have been awarded :—

(i) £75 to Mr. N. Bisset, University College, Cardiff, for a visit of two months to the Pasteur Institute, Paris, to study epidemiology in domestic animals.

(ii) £100 to Mr. H. G. Thornton, Rothamsted Experimental Station, for a visit to Continental countries in connexion with his work in bacteriology and the growth of lucerne.

(iii) £40 each to Professor E. S. Salmon and Dr. W. Goodwin, of the South Eastern Agricultural College, Wye, for a visit to Germany to study Downy Mildew of hops.

(iv) £250 to Mr. A. D. McEwen, Royal Veterinary College, for a visit to the United States to study American work on contagious abortion in cattle.

(v) £80 to Dr. A. D. Imms, of Rothamsted Experimental Station, for a visit to the United States and Canada to attend the International Entomological Conference and to visit centres of entomological research.

* * * * *

THE Ministry of Agriculture and Fisheries invites applications for research scholarships in agricultural and veterinary science. The scholarships are tenable for three years from October 1, 1928, and are of the value of £200 per annum; extra allowances may be made for travelling and subsistence for periods spent abroad. The number 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, 1928, 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.

* * * * *

THE Ministry of Agriculture and Fisheries 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, 1928. 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.

**Special Research
Grants**

ACCORDING to returns rendered to the Ministry by the beet sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during February, 1928, together with the quantity produced during the corresponding month in 1927, was :—

**Production of
Home-Grown
Beet Sugar**

	cwt.
February, 1928	18,466
February, 1927	102,453

The total quantities of sugar produced during the two manufacturing campaigns to the end of February, were :—

	cwt.
1927/8	3,804,744
1926/7	3,069,757
* * * * *	*

THE Ministry has arranged for a special short course of instruction in rabbit management for County Poultry Instructors, to be held at the National Institute of Poultry Husbandry, Harper Adams Agricultural College, Newport, Salop, from April 16 to 21, inclusive.

The course will include lectures and demonstrations in all sections of work connected with the management of rabbits for the economic production of fur, wool and meat, and will be specially designed to meet the requirements of Instructors, many of whom find an increasing demand for information on this subject owing to the development, during the last few years, of rabbit breeding for furs and Angora wool.

* * * * *

THE Ministry has decided to continue the scheme, inaugurated five years ago, under which smallholders and cottagers who keep milch goats are enabled to obtain the services of first-class stud goats for breeding purposes at a maximum fee of 5s. During the season

just concluded, 113 stud goats were registered at 105 centres as compared with 104 at 99 centres during the previous season.

The scheme is again being administered by the British Goat Society, and no stud goat can be accepted which has not been entered or is not considered eligible for entry in the Society's Herd Book. Applicants, however, need not necessarily be members of the Society. Applications for the registration of stud goats under the scheme must be made, not later than June 1, direct to the Honorary Secretary of the Society, at 10 Lloyd's Avenue, E.C.3, who will be pleased to furnish full particulars and application forms.

APPOINTMENTS

THE Ministry feels that it may be of considerable assistance to farmers and others to know to whom they may apply in their own county for guidance on the various technical matters connected with their work on which they may be glad of advice. It is accordingly proposed to publish in this JOURNAL a list of the principal officers of the county agricultural education staffs, and farm institutes; also agricultural colleges and university agricultural departments; and a list of the principal workers at research institutes, etc. Thereafter, changes in these staffs will be notified from time to time as they occur; and various other appointments of interest to farmers may be similarly recorded.

A list of the staffs employed by certain English county authorities is given below; the remainder of the English county staffs and those in Wales will be published next month.

Principal Members of Teaching Staffs Employed by County Agricultural Education Authorities in England and Wales.

* Wholly employed by the County Council but only partially on agricultural education work.

ENGLAND

Bedfordshire

Instructress in Poultry-keeping .. Miss D. THOMPSON, N.D.P.

Berkshire

Agricultural Organizer .. G. S. BEDFORD, N.D.A., P.A.S.I.
 Assistant Instructor in Agriculture .. R. S. SULLIVAN, N.D.A., N.D.D.,
 B.D.F.D.
 Instructor in Horticulture .. A. E. BARNES
 Instructor in Bee-keeping .. B. COMYNS BERKELEY
 Instructress in Dairying .. Miss J. MATTHEWS, N.D.D.
 Instructor in Poultry-keeping .. T. M. PHETHEAN, N.D.P.

Buckinghamshire

Agricultural Organizer .. J. PORTER, B.Sc., N.D.A., N.D.D.
 Horticultural Superintendent .. P. MANN, F.R.H.S.*
 Instructor in Poultry-keeping .. E. STEVENS, F.B.S.A.
 Instructor in Dairying .. W. H. THOMAS

Cambridgeshire

Agricultural Organizer .. J. C. LESLIE, M.A., B.Sc.
 Agricultural Adviser .. R. SAYCE, B.Sc., N.D.A.
 Instructor in Horticulture .. A. T. PASKETT, F.R.H.S.*
 Instructor in Poultry-keeping .. H. ROBINSON, M.C.

Cheshire

Agricultural Organizer and Principal of the School of Agriculture .. W. B. MERCER, M.C., B.Sc.,
 N.D.A.
 Lecturer in Agriculture and Vice-Principal .. W. A. C. CARR, M.C., N.D.A.

Lecturer in Agricultural Biology.. F. W. HANKINSON, M.Sc.
 Lecturer in Agricultural Chemistry .. J. FEATHERSTONE, M.Sc.
 Horticultural Superintendent .. W. E. SHEWELL-COOPER, C.D.H.
 Assistant Instructor in Horticulture .. A. E. B. LANGMAN, C.D.H.,
 R. E. LOUCH, N.D.D.
 Lecturer in Poultry-keeping .. R. E. LOUCH, N.D.D.
 Chief Instructress in Dairying .. Miss N. BENNION, N.D.D.
 Assistant Instructress in Dairying .. Miss E. M. BLACKBURN, N.D.D.
 Peripatetic Instructress in Dairying .. Miss M. BLACK

Cornwall

Agricultural Organizer .. A. GREGG, B.Sc., N.D.A.
 Lecturers in Agriculture and Agricultural Chemistry .. B. JENKINS, B.Sc.
 W. WILLIAMS, M.Sc.
 R. H. SMITH, B.Sc.
 Horticultural Superintendent .. H. W. ABBISS, D.C.M., M.M.,
 N.D.H.
 Assistant Lecturer in Horticulture .. W. J. MOYSE, N.D.A.
 Chief Instructress in Dairying .. Miss A. J. W. NICHOLAS, M.B.E.
 Miss G. LYNE, N.D.D.
 Assistant Instructresses in Dairying .. Miss M. F. GRIFFITHS, N.D.D.,
 B.D.F.D.
 Instructor in Poultry-keeping .. C. H. TOY

Cumberland and Westmorland

(Joint Staff)

Principal of Farm School and County Agricultural Organizer.. J. H. FAULDER, B.Sc., N.D.D.
 Vice-Principal .. A. MANN, B.Sc.
 Instructor in Agriculture .. W. W. BALLARDIE, B.Sc.*
 Horticultural Organizer .. D. S. ANDERSON*
 Poultry Assistant .. Miss M. HEWITSON
 Itinerant Instructress in Dairying .. Miss F. COWARD
 Instructress in Dairying .. Miss D. MORRISON, N.D.D.

Derbyshire

Agricultural Organizer .. J. R. BOND, M.B.E., M.Sc.,
 N.D.A.*
 District Agricultural Lecturers .. G. H. BATES, B.Sc.
 A. L. STICKLAND, N.D.A.,
 N.D.D., B.D.F.D.
 Instructor in Veterinary Hygiene .. A. LEVIE, F.R.C.V.S., D.V.S.M.,
 F.R.S.E.
 Horticultural Instructor .. W. H. TUCK, N.D.H.

Devonshire

Agricultural Organizer .. C. D. ROSS, B.Sc.
 F. C. HAROLD, A.I.C.
 District Lecturers in Agriculture.. R. P. HAWKINS, B.Sc., N.D.A.
 D. C. BOWER, N.D.A., N.D.D.
 N. J. SHARROCK, N.D.A., N.D.D.
 Horticultural Superintendent .. D. MANNING
 Woman Horticultural Superintendent .. Miss E. M. GUNNELL, N.D.H.*
 Instructress in Dairying .. Miss E. BRAY
 Assistant Instructress in Dairying .. Miss F. M. CRAWTER, N.D.D.
 Instructor in Poultry-keeping .. E. RUSSELL
 Assistant Instructor in Poultry-keeping .. W. HEALE

Dorsetshire

Agricultural Organizer ..	T. R. FERRIS, M.Sc., N.D.D.*
Instructor in Agriculture ..	J. A. ROBOTHAM, B.Sc., N.D.A., N.D.D.
Instructor in Horticulture ..	T. P. P. MCPHAIL, F.R.H.S.
Instructresses in Dairying ..	{ Miss H. BALCH, N.D.D.
Instructor in Poultry-keeping ..	{ Miss E. BUCKNELL, N.D.D.*
	A. TURNER

Durham

Agricultural Organizer ..	J. WALKER, M.A., B.Sc.
Instructor in Horticulture ..	W. S. SHARP, F.R.H.S.
Assistant Instructor in Horticulture ..	L. BUSS
Instructor in Poultry-keeping ..	G. M. ROBERTSON
Instructress in Dairying ..	Miss M. H. STEWART, N.D.D.

Essex

Principal of East Anglian Institute of Agriculture and County Agricultural Organizer ..	D. B. JOHNSTONE-WALLACE, M.Sc., N.D.D.
Senior Lecturer in Agriculture ..	A. HAY, N.D.A., N.D.D., C.D.A.
Lecturer in Agriculture ..	D. J. EWING, B.Sc.
Assistant Lecturer in Agriculture and Crop Recorder ..	E. N. HERINGTON.
Lecturer in Agricultural Biology ..	R. ROBSON, M.Sc., F.Z.S.
Assistant Lecturer in Agricultural Biology ..	J. BRYCE, B.Sc.
Assistant Lecturer in Agricultural Biology and Bee-keeping ..	Miss E. W. JAMESON, N.D.H.
Lecturer in Agricultural Chemistry and Analyst ..	F. KNOWLES
Assistant Lecturers in Agricultural Chemistry ..	{ F. W. F. HENDRY, B.Sc., A.I.C.
Lecturer in Horticulture ..	{ J. E. WATKIN, Ph.D., B.Sc.
Instructor in Commercial Horticulture ..	{ C. WAKELY, F.R.H.S.*
Assistant Lecturer ..	R. HART, N.D.A., N.D.D.
Instructress in Dairying ..	H. FRASER, N.D.H.*
Assistant Instructress in Dairying ..	Miss M. I. FLETCHER, N.D.D.
Instructor in Poultry-keeping ..	Miss M. WOODS, N.D.D., B.D.F.D.
	F. BOWERS

Gloucestershire

Agricultural Organizer ..	G. H. HOLLINGWORTH
Instructor in Agriculture ..	C. COMELY
Instructor in Horticulture ..	J. COOMBS
Instructress in Dairying ..	Miss A. COLNETT, N.D.D.
Instructor in Poultry-keeping ..	L. G. PRICE
Assistant Instructor in Poultry-keeping ..	E. A. KING

Hampshire

County Agricultural Organizer ..	L. G. TROUP, B.Sc.
Principal of Farm Institute ..	J. M. TEMPLETON, B.Sc.
Lecturer in Agriculture and Warden ..	T. H. ROSE, B.Sc., Ph.D., N.D.A.
Instructor in Horticulture ..	C. J. GLEED, N.D.H., F.R.H.S.

Assistant Instructor in Horticulture ..	A. P. KING
Instructor in Bee-keeping ..	H. P. YOUNG
Instructor in Dairy Husbandry ..	E. A. G. WIGGINS, N.D.A., N.D.D.
Instructress in Dairying ..	Miss G. BOWDEN, N.D.D., B.D.F.D.

Travelling Dairy School Instructress ..	Miss E. M. GIFFORD
Assistant Instructress ..	Miss F. DINGLE
Instructor in Poultry-keeping ..	A. W. GRIMES
Instructor in Farm Book-keeping ..	B. R. LOVELL.
Travelling Farriery School Instructor ..	W. HOUSE, R.S.S.

Herefordshire

Agricultural Organizer ..	J. L. EVANS, B.Sc.
Instructor in Horticulture ..	A. J. MANNING
Instructress in Dairying and Poultry-keeping ..	Miss B. WALL, N.D.D., B.D.F.D.

Hertfordshire

Principal of Agricultural Institute and County Agricultural Organizer ..	J. HUNTER-SMITH, B.Sc., N.D.A., N.D.D.
Vice-Principal and Instructor in Horticulture ..	C. E. HUDSON, N.D.H., F.R.H.S.
Lecturer in Agriculture ..	R. H. WILLIAMS, B.Sc.
Lecturer in Agriculture and Farm Costings ..	J. W. REID, N.D.A.
Agricultural Chemist ..	H. W. GARDNER, B.A.
Assistant Instructor in Horticulture ..	E. R. SALTMARSH, N.D.H.
Instructress in Dairying ..	Miss D. M. PEACOCK, N.D.D.
Instructor in Poultry-keeping ..	D. W. FERGUSON, N.D.P.
Instructor in Book-keeping ..	A. DEAN*

Huntingdonshire

Horticultural Adviser ..	F. TUNNINGTON*
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Isle of Ely

Horticultural Superintendent ..	W. G. KENT, N.D.H., F.R.H.S.
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Isle of Wight

Instructor in Horticulture ..	C. MARTIN, F.R.H.S.
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Isles of Scilly

Horticultural Adviser ..	G. W. GIBSON, F.L.S.
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Kent

Agricultural Organizer ..	G. H. GARRARD, N.D.A.
Assistant Agriculturist ..	T. W. McDUGALL PORTER, M.C., N.D.A.
Horticultural Superintendent ..	W. P. WRIGHT, F.R.H.S.*
Assistant Horticulturist ..	H. C. ELSDON, N.D.H.*
Instructor in Commercial Horticulture ..	N. B. BAGENAL, B.A.
Instructor in Poultry-keeping ..	W. R. SNELL

Lancashire

Principal of Hutton Farm School	J. J. GREEN, B.Sc.
Assistant Lecturers in Agriculture	{ C. P. MAY, M.A. V. LIVERSAGE, M.Sc., B.Sc.
Lecturer in Botany and Dairy Bacteriology	H. EDMUNDS, B.Sc.
Instructress at Dairy School	Miss J. STUBBS, N.D.D.
Assistant Instructress Dairy School	Miss M. K. PAYNE, N.D.D.
Instructor in Cheesemaking (Itinerant)	R. RICHARDSON, N.D.A.
Lecturer in Poultry-keeping	C. H. DOBBIN
Assistant Instructresses in Poultry-keeping	{ Miss K. H. ARTHUR Miss M. L. SINCLAIR
Horticultural Superintendent	A. G. SOWMAN
Instructors in Horticulture	{ N. J. MACPHERSON W. L. STEER

Leicestershire

Agricultural Organizer	T. HACKING, LL.B., B.Sc.*
Instructor in Horticulture	T. G. BULLOCK, F.R.H.S.*
Instructress in Dairying	Miss E. PRATT-SADDINGTON
Instructor in Poultry-keeping	H. T. ATKINSON, N.D.P.

Lincolnshire (Holland)

Principal of Kirton Agricultural Institute, Agricultural Organizer and Horticultural Superintendent	J. C. WALLACE, M.C.
Agricultural Biologist	W. F. CHEAL, D.I.C., N.D.A.
Agricultural Chemist	M. N. NICHOLSON, B.Sc., A.I.C.
Agricultural Entomologist	E. E. EDWARDS, M.Sc., B.Sc.
Assistant Lecturer in Agriculture	J. K. THOMPSON, N.D.A.
Instructor in Poultry-keeping	G. H. REED

Lincolnshire (Kesteven)

Agricultural Organizer	F. WAKERLEY, M.Sc., F.H.A.S.
Instructress in Dairying and Poultry-keeping	Miss R. JACKSON, N.D.D.

Lincolnshire (Lindsey)

Agricultural Organizer	J. A. McMILLAN, B.Sc.
Instructor in Agriculture	A. MCGIBBON, B.Sc., N.D.A., N.D.D.
Horticultural Organizer	A. G. MURRAY, F.L.S.*
Instructor in Poultry-keeping	A. TYLER

Middlesex

Horticultural Superintendent	J. LAWSON
Instructor in Horticulture	G. W. PYMAN*
Instructor in Dairying and Poultry-keeping	E. REA
Assistant Instructor in Dairying and Poultry-keeping	J. WORTHINGTON

Norfolk

Instructor in Horticulture and Bee-keeping	H. GOUDE, N.D.H.*
Assistant Instructor in Horticulture	C. SAVIDGE*

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on February 21 and March 12, at 7 Whitehall Place, S.W. 1, Mr. W. B. Yates, C.B.E., presiding on each occasion.

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 continuing from March 26, 1928, until March 25, 1929, the minimum and overtime rates of wages for male workers, and minimum rates of wages for female workers at present in force in their area. The minimum rate in the case of male workers of 21 years of age and over is 32s. 6d. per week of 52 hours from April 22 to October 6, and 50 hours from October 7 to April 21, 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.

Durham.—An Order continuing from May 14, 1928, until May 13, 1929, 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 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, where the rate is 6d. per hour. The overtime rate for all classes of male workers other than casual workers is 10d. per hour on Sunday and after twelve 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 eight hours, with overtime at 4d. per hour.

Hampshire and Isle of Wight.—An Order varying as from March 26 the minimum and overtime rates of wages for male workers, and minimum rates of wages for female workers. The minimum rate in the case of male workers of 21 years of age and over is 30s. 6d. per week of 51 hours in summer and 48 hours in winter, with overtime at 8d. per hour, except in the case of overtime employment of carters, cowmen, shepherds or milkers on the ordinary routine work of such workers, when the overtime rate is 7½d. per hour. Certain variations have been made in the minimum rates of wages for male workers under 19 years of age. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

Kent.—An Order continuing from March 2, 1928, until March 1, 1929, the minimum and overtime rates of wages at present in force for male and female workers. The minimum rate in the case of horsemen, stockmen and shepherds of 21 years of age and over is 33s. per week of 52 hours, with, in addition, 8d. per hour for all employment on customary duties in excess of 52 hours, but not exceeding 60 hours in any week, and overtime at 9d. per hour for customary duties, and 9d. per hour on weekdays and 10d. per hour on Sundays for other work. In the case of other male workers of 21 years of age and over the minimum rate is 32s. 6d. per week of 52 hours in summer and 48 hours in winter, with overtime at 9d. per hour on weekdays and 10d. 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 6½d. per hour on weekdays and 7d. per hour on Sundays.

Leicester and Rutland.—An Order varying as from March 19 the minimum and overtime rates of wages for male and female workers. The minimum rates in the case of male workers of 21 years of age and over are 34s. per week of 54 hours in Leicestershire and 32s. 6d. per week of 54 hours in summer and 50 hours in winter in Rutland (instead of 54 hours all the year round as at present), overtime being payable in each case 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 8d. per hour for Sunday work.

Lincolnshire (Kesteven and Lindsey).—An Order continuing from March 5, 1928, until March 3, 1929, the minimum and overtime rates of wages for male workers and the minimum rates of wages for female workers at present in force.

The minimum rates in the case of male workers of 21 years of age and over are: For waggoners, 39s. per week of 52 hours in summer and 48 hours in winter, with such additional hours not exceeding a total of 61 per week during the period from October 15 to May 13, and 58 per week during the remainder of the year required for the performance of customary duties; for shepherds, 37s. per week of 52 hours in summer and 48 hours in winter, with such additional hours not exceeding a total of 55 per week in summer and 56 per week in winter as may be required for the performance of customary duties, and, in addition, in respect of the lambing season, a sum of £3 10s. for flocks of from 50 to 100 sheep, and £1 in respect of every additional 100 sheep; for stockmen, 38s. per week of 52 hours in summer and 48 hours in winter, and such additional hours not exceeding a total of 56 per week in summer and 58 per week in winter as may be required for the performance of customary duties; and in the case of other male workers 32s. per week of 48 hours in winter and 52 hours in summer. The overtime rates in the case of 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 for female workers of 17 years of age and over is 5½d. per hour for all time worked.

Middlesex.—An Order continuing from March 1, 1928, until February 28, 1929, the operation of the minimum and overtime rates of wages for male and female workers. The minimum rates of wages

for 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, 8½d. per hour, and for other workers 34s. 4½d. per week of 50 hours in summer and 33s. per week of 48 hours in winter. Overtime is payable in the case of all classes of male workers of 21 years of age and over at 10½d. per hour. The minimum rates in the case of female workers of 18 years of age and over are: For stockwomen, 30s. per week of 60 hours; for carters, 28s. per week of 56 hours; for casual workers, 6d. per hour, and for other workers 25s. per week of 50 hours in summer and 24s. per week of 48 hours in winter, overtime being payable in the case of all female workers of 18 years of age and over at 7½d. per hour. The Order also extends the operation of the overtime rates to all employment on Bank Holidays.

Monmouth.—An Order fixing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers to come into force on March 16, 1928, and to continue in operation until March 15, 1929. The minimum rate in the case of male workers of 21 years of age and over is 32s. per week of 52 hours in summer and 50 hours in winter (instead of per week of 50 hours in summer and 48 hours in winter as at present), with overtime at 9½d. per hour on weekdays and 11½d. per hour on Sundays. 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 for male and female workers to come into force on March 6, 1928, and to continue in force until March 2, 1929. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 53 hours in summer (instead of 50 hours as at present) 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 4½d. per hour, with overtime at 5½d. per hour.

Glamorgan.—An Order fixing minimum and overtime rates of wages for male and female workers to come into force on March 2, 1928, and to continue in force until March 1, 1929. The minimum rate in the case of male workers of 21 years of age and over employed as stockmen, cattlemen, cowmen, horsemen, shepherds and bailiffs is 38s. per week of 60 hours (instead of 40s. as at present), with overtime at 11d. per hour. In the case of other male workers of 21 years of age and over the minimum rate is 34s. (instead of 36s. as at present) 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.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending March 15, legal proceedings were instituted against seven employers for failure to pay minimum and overtime 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 concerned
		£	s.	d.	£	s.	d.	£	s.	d.	
Notts ..	Southwell ..			*	—			18	14	11	4
Salop ..	Cleobury Mortimer ..	1	0	0	—			15	13	8	2
Rutland ..	Oakham ..	25	0	0	5	0	0	118	0	0	6
Warwick ..	Coleshill ..	1	0	0	1	2	6	10	0	0	1
Somerset ..	Axbridge ..	0	10	0	—			18	8	0	2
Wilts ..	Wootton Bassett ..	1	0	0	1	0	0	20	0	0	1
		5	0	0	—			16	0	0	1
		£33	10	0	£7	2	6	£216	16	7	17

* Dismissed under Probation of Offenders Act.

In regard to the proceedings taken at Coleshill, the wages of one of the workers concerned had been reduced, on the worker becoming entitled to a contributory old-age pension on January 2 last, by the amount of his pension plus the 9d. special contribution which employers are required to pay in respect of male workers of 65 years of age and over. The Court ordered the full arrears of wages to be paid to this worker.

* * * * *

Foot-and-Mouth Disease.—Since the report in the last month's issue of this JOURNAL, 10 outbreaks of foot-and-mouth disease have been confirmed in Great Britain. These outbreaks were in the following counties: Lancashire, 2; Cheshire, 2; Yorks (West Riding), 1; Derby, 1; Glamorgan, 1; Warwick, 1; Stafford, 1; and Lincoln (Lindsey), 1. The outbreaks in Glamorgan, Lancashire, Cheshire, Yorks (West Riding), and Derby were confirmed in hitherto "clean" districts. The other outbreaks were in already existing "infected" areas.

The number of outbreaks confirmed since January 1 last is 85, involving 12 counties and the slaughter of 2,454 cattle, 3,387 sheep, 1,342 pigs and 5 goats.

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Leaflets Issued by the Ministry.—Since the date of the list given in the November (1927) number of this JOURNAL, p. 779, the following leaflets have been issued:—

New:—

No. 203. Sugar Beet Growing.

No. 206. Hoary Pepperwort.

Re-written:—

No. 245. Crown Gall.

No. 285. Bacon Curing on the Farm.

No. 296. Potato Growing in Allotments and Small Gardens.

No. 302. The Silver-Leaf Disease of Fruit Trees.

No. 347. Profitable Pears for Market.

No. 395. Adult Bee Diseases.

Revised:—

No. 21. The Warble Fly.

No. 35. The Celery Fly.

No. 86. Brown Rot of Apples.

No. 89. Fluke or Liver Rot in Sheep.

No. 114. The Scientific Principles of Feeding Poultry.

No. 131. Apple and Pear Scab.

No. 173. Potato Growing.

No. 204. Apple Mildew.

- No. 322. Winter Pruning Bush and Half-Standard Apple Trees.
- No. 330. Apple Aphides.
- No. 346. Gooseberries.
- No. 377. "Reversion" in Black Currants.
- No. 400. List of Publications.

Amended:—

- No. 12. Gooseberry Sawfly.
- No. 25. Chafer Beetles.
- No. 128. Advice to Beginners in Bee-Keeping.
- No. 196. Small Holdings, Cottage Holdings, and Allotments.
- No. 234. A Die-back Disease of Gooseberries.
- No. 277. Tuberculosis in Farm Stock.
- No. 320. The Manuring of Vegetable Crops.
- No. 328. The Smuts of Barley and Oats.
- No. 331. Home and Farm Canning of English Fruits.
- No. 349. Methods of Obtaining Strong Colonies of Bees for Wintering.
- No. 364. Coccidiosis in Rabbits and Poultry.

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Agricultural and Cattle Show, Gijon, Spain.—The organization known as "the official and international" Asturian Sample Fair of Gijon have arranged to hold a grand Agricultural and Cattle Show in connexion with the Fifth Sample Fair, which is to be held at Gijon from August 1 to 25 next. This will be under the patronage of the Spanish Government, which invites the participation of British Exhibitors. Detailed information can be obtained from the Secretary-General, Seria de Nustras Asturiana, Gijon, Spain.

* * * * *

Importation of Nursery Stock into South Africa.—The Ministry has received a copy of a Proclamation issued by the Governor-General of the Union of South Africa prohibiting the importation into the Union of rooted stocks for budding or grafting. The Government retains the power to introduce stocks considered to be of exceptional or special value, and may issue permits for the introduction of such stocks by private individuals under certain conditions. The prohibition does not come into operation until October 1, 1931, but early notice is given in order that exporters may be aware of the position in good time to make their growing and trade arrangements.

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NOTICES OF BOOKS

Seed Production and Marketing. By Joseph F. Cox and George E. Starr. Pp. xviii + 450. (New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd., 1927. 20s. net.)

Having regard to the fact that seeds are of great importance to agriculture and horticulture, and that so much capital is sunk in their production and marketing, it is remarkable how little has been published on the subject. There are no reliable data as to the quantity of seeds which are sown annually in this country, and no statistics are collected regarding the quantity which is home-produced. We know, however, from the Trade Returns, that, apart from the home-produced seed sown in this country, we have a considerable export trade, amounting in 1927 to nearly 360,000 cwt, of a value of over £890,000. Further, the net imports in the same year amounted to over 300,000 cwt., of a value approaching a million sterling. An industry of this magnitude surely justifies more attention than is paid to it by those competent to write on what is, of course, a highly technical and intricate

subject. It is, therefore, of interest to note the issue of a book on seeds, which, although written by American authors and relating primarily to American conditions, contains much that is of interest in this country. Dealing, as it does, with the production and marketing of most of the important farm and garden crop seeds, the details given for each kind of seed are necessarily confined to essentials. These details are, however, informative, and bear the stamp of practical experience. Chapters are devoted to clovers, grasses, seed potatoes, field peas and beans, and to a large number of vegetable and garden seeds. In addition to cultural instructions, information is given as regards the history, adaptation, uses, and varieties of each kind of crop, and of the insects and other pests from which they suffer.

The importance of using seeds with a high vitality and free from injurious weed seeds has long been recognized. Considerable attention, however, is now being devoted to what is of even greater importance—the use of stocks and strains adapted to environmental conditions and special market demands. In this country the broad principle is recognized that home-grown seeds, when available, are in most cases likely to give more satisfactory crops than would be obtained from foreign-grown seeds. There is nevertheless a great need for more knowledge as to the performances peculiar to individual stocks and strains of the same kind of seed under varying conditions of soil and situation.

In a country such as the United States, where the variations in soil and climate are considerably greater than in the British Isles, the question of adaptability is of even more importance. Regulations have been made which prohibit the importation into the U.S.A. of red clover or alfalfa (lucerne) seed unless it is coloured in such a manner or to such an extent as may be prescribed. Red clover seed coming from Italy and lucerne seed from Turkestan and South Africa has to be stained red to the extent of at least 10 per cent. of the seed in each container—signifying that the seed is not adaptable for agricultural conditions in the United States of America. Seeds coming from countries whose products have been found adaptable to American conditions have to be stained green, or in the case of seed grown in Canada, iridescent violet. Much useful work is also done in the United States by "Crop Improvement Associations," "Seed Growers' Associations" and "Experiment Stations," in making available to the farmer certified seed of proved adaptability. Associations of this nature have been established in practically all States where extensive experiment station plant breeding work is being conducted. In addition to the crop improvement associations there are in many States organizations of growers of seeds of special crops. Amongst these are included associations of growers of certified seed of Grimm alfalfa, cotton, Ladino Clover, soya bean and seed potatoes. In Canada, the Canadian Seed Growers' Association is active in all agricultural districts. These Associations require in most cases an inspection of the growing crop and also of the seed after it has been thrashed; and the bags containing approved or "certified" seed are sealed by an official of the inspection service.

The methods adopted by these Associations are fully described in the volume under review, and merit the consideration of commercial seed growers and distributors in this country.

The co-operative distribution by farm bureau seed services and other co-operative agencies, complementary to the work of certain of the crop improvement associations, has resulted, to give one instance, in a considerable extension in the use of adapted alfalfa seed from the producing areas to the Corn Belt and the Northern States. These services are also said to have considerably increased the use of clover seed of known origin, and of adapted varieties of other crops—such as

growing wheat, oats and barley. A scheme for the verification of seed, which would be available to the general trade and to co-operative services, is now being considered by the U.S. Department of Agriculture.

The special qualifications required of the seed grower the good seed grower belongs to a highly intelligent and engaged in the production of a high-quality produce. The field offers opportunity for application of the best of skill, will and intelligence and the most highly developed sense of recompense, both financially and in the satisfaction of service to civilization."

Owing to the peculiarities of our climate and other difficulties, seed-growing in this country does not allow the same scope as in more favoured climates. It is considerably more difficult to do in this country. The above remarks might well be pondered over by many of our farmers who are struggling to make ends meet, and who have the qualifications and facilities for embarking on this special and remunerative line of production.

Principles of Soil Fertility. By Selman A. Waksman. Pp. 897. (London: Baillière Tindall & Cox. 1927. Price, 45s.)

Only within comparatively recent times, has it been realized that there is an important biological branch to research upon soils. The early investigators concentrated on the chemical aspects of soil fertility, and reaped a rich harvest of reward, culminating in the development of the fertilizer industry: but, not until the late 'sixties and early 'seventies of last century, when bacteriology made great advances, was it recognized that all decomposition and purification was largely due to the activities of micro-organisms. From this, it was deduced that decomposition in the soil was effected by similar agencies, and, in 1877, Schloesing and Muntz experimentally showed that, in sewage beds, ammonia was converted into nitrate, not by a chemical process, but by a biological one. Warrington, working at Rothamsted, proved that this conversion was brought about by the action of two species of bacteria, and, in 1880, Winogradsky isolated the organisms in pure cultures. This date may be termed the beginning of the biological epoch in agricultural research.

Naturally, the earlier work was confined to the bacterial population of the soil, and, in text-books published round about 1910, nitrification, nitrogen fixation and denitrification were the main topics of discussion. Since that date, the subject has gradually assumed a broader aspect, and it has been realized that, not only bacteria, but also protozoa, algae and fungi are playing a part in the various soil reactions.

The publication therefore of Waksman's voluminous treatise of more than 800 pages is of particular interest and importance. The present condition of soil microbiology is well shown under three main divisions, the first two dealing with the occurrence, isolation, identification and cultivation of soil micro-organisms, the chemical activities of which are considered in the third division. The treatment is very complete, since, in the first part, not only are there chapters on the fungi, algae and protozoa of the soil, but also a brief résumé of our knowledge concerning the worms, arachnids, myriapods, insects and molluscs. As might be surmised, the chapters are a little uneven, those dealing with the bacteria and fungi being of a higher level than the rest; the author is at his best when dealing with the chemical aspects of the soil organisms. A very complete bibliography, containing over 2,500 references, adds to the value of the book; and all workers in soil science must feel a debt of gratitude to the author for the production of a book at once complete and authoritative.

Sugar Beet and Beet Sugar. By R. N. Dowling. With a foreword by Sir Daniel Hall. Pp. x + 277. (London: Ernest Benn Limited, 1928. Price 15s.)

Mr. Dowling's book, which should be in the hands of all interested in the home beet sugar industry, meets a long-felt want in supplying, in a comprehensive and easily understandable form, the accumulated knowledge and experience on sugar beet cultivation, which has previously only been available in numerous pamphlets and brochures or in text books not available to the ordinary reader.

Opening with a brief history of the growth and progress of the industry in this country, it takes the reader through every stage of the cultivation of the crop to the final production of white sugar. The production and breeding of the seed, the botanical structure of the beet plant, and the effect of soil and climate upon its growth and sugar are described in detail. There are excellent chapters on manures and manuring, and on cultivation methods, which embody Mr. Dowling's considerable experience of the subject in this country and on the Continent. Considerable attention is devoted to the various makes of implements and labour-saving machinery designed for dealing with this crop, and which have special significance in a country of high labour costs.

Attention is also rightly drawn to the value of the residual products, such as leaves and tops, pulp and molasses, and also to the diseases which may add to the grower's troubles if he is not on guard against them. Finally, the book briefly describes the process of sugar manufacture in a way that can easily be grasped by those unversed in factory technique.

The book makes its appearance at a very opportune time, when the industry is at the transition stage from the period of high subsidy to the second period when the subsidy falls to 13s. per cwt. of sugar. If growers are to continue to make satisfactory profits now that the price paid per ton of beet has fallen to 46s. for roots of 15½ per cent. sugar content, they must concentrate on securing higher yields per acre, and endeavour to reduce their costs. It will be seen from tables published in the book, that the yield in this country is still much below the average secured in Western Europe and the United States.

As Sir Daniel Hall emphasizes in the preface, the three main aspects of the problem facing the British grower are "the substitution of machine work for manual labour, the effective handling of the labourers upon the farm, to work as a team, at the right things at the right moment, and the training of the individual labourer to become an efficient workman." It is believed that a careful study of this book, particularly of the series of costings, and of the yields resulting from manurial trials, will be of assistance to the grower towards a solution of these difficulties.

It may not be amiss to draw attention here to one or two inaccuracies which will doubtless be corrected in the next edition. On p. 179, the present excise duty on sugar is stated to be 9s. 8½d. per cwt., and and on p. 185, 9s. 9d. This figure should be 7s. 4½d. in both instances. On p. 185 it is further stated that the present fiscal advantage enjoyed by the home and Empire producer over foreign sugar is 1s. 11d. per cwt.; the amount is, in fact, 4s. 3½d.

SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

- Partnership Farming. *Christopher Turnor.* (Scottish Jour. Agric., x, 4 (October, 1927), pp. 377-382.) [63.191.]
- Agricultural Economics in Europe. *A. Hobson.* (Jour. Farm Econ., ix, 4 (October, 1927), pp. 421-432.) [338.1 (4).]
- The Publication of Index Numbers of Agricultural Products and Costs of Production for England and Wales. (Int. Rev. Agric., 1927, No. 9, pp. E279-281.) [311; 338.58.]
- Agriculture and National Education. *C. G. T. Morison.* (Presidential Address to Section M—Agriculture—at the British Association Meeting at Leeds, 1927.) (Advancement of Science, 1927, 14 pp.) [37 (42).]
- Agricultural Research in the British Empire: VI, Agricultural Research in the Colonies and Dependencies. *J. S. Thomson.* (Scottish Jour. Agric., x, 4 (October, 1927), pp. 382-387.) [37.]
- Agricultural Research in the British Empire: VII, The Research Grants of the Empire Marketing Board. *Rt. Hon. W. G. A. Ormsby-Gore.* (Scottish Jour. Agric., x, 4 (October, 1927), pp. 388-394.) [37.]
- The Trench or Pit Silo. Report contributed by North of Scotland College of Agriculture. (Scottish Jour. Agric., x, 4 (October, 1927), pp. 446-448.) [694.]
- "Edelmist" (a new method for making farmyard manure). *A. Cunningham.* (Scottish Jour. Agric., x, 4 (October, 1927), pp. 434-439.) [63.163.]
- The Utilization of Carbohydrates by Honey-bees. *E. F. Phillips.* (pp. 385-428.)
- The Utilization of Carbohydrates as Food by Honey-bee Larvæ. *L. M. Bertholf.* (pp. 429-452.) (Jour. Agric. Res. 35, 5 (September 1, 1927). [63.81.]

Field Crops

- Yield Studies in Oats: II, The Relationship Between the Characteristics of a Seed Sample; Its Germination and Field Establishment; and the Early Growth of the Subsequent Plants. *M. A. H. Tincker and M. G. Jones.* (Ann. App. Biol. xiv, 4 (November, 1927), pp. 400-421.) [63.314.]
- Nitrates and Wheat Yields after Certain Crops. *P. E. Karraker.* (Soil Sci., xxiv, 4 (October, 1927), pp. 247-258.) [63.191; 63.311.]
- The Composition of Swedes. *A. Lauder.* (Scottish Jour. Agric., x, 4 (October, 1927), pp. 428-433.) [63.332; 63.60433.]
- Crop Improvement in Canada. *G. H. Clark.* (Scottish Jour. Agric., x, 4 (October, 1927), pp. 404-408.) [63.3; 63.1951.]

Sugar Beet and Beet Sugar

- Distribution of Sugar in Different Shaped Species of Beets. (Int. Rev. Agric., 1927, No. 9, pp. T526-529.) [63.3433.]
- The Dessication (De Vecchis) Process of Beet Sugar Manufacture. *C. Scott Garrett.* (Chemistry and Industry, 46, 44 (November 4, 1927), pp. 1014-1021.) [664.1.]
- Plant for the Drying of Cossettes in the De Vecchis Process of Beet Sugar Manufacture. *G. W. Riley.* (Chemistry and Industry, 46, 45 (November 11, 1927), pp. 1036-1042, and 46, 46 (November 18, 1927), pp. 1080-1084.) [664.1.]

Diseases and Pests of Plants and Remedies

- Note on the Occurrence of *Pythium proliferum*, de Bary, on the

- Roots of the Strawberry. *C. W. Wardlaw*. (Ann. Bot., xli, 164 (October, 1927), pp. 817-818.) [63.24.]
- La Mouche des Cerises (*Rhagoletis Cerasi*). Etat Actuel de la Question. *J. Verguin*. (Annales des Epiphyties, xiii, 1 (January-February, 1927), pp. 31-42.) [63.27.]
- Sulphur Treatment of Soil and the Control of Wart Disease of Potatoes in Pot Experiments. *E. M. Crowther, M. D. Glynnne, and W. A. Roach*. (Ann. App. Biol., xiv, 4 (November, 1927), pp. 422-427.) [63.24.]
- Early Manifestations of Potato Blight (*Phytophthora infestans*). *N. L. Alcock and A. E. S. McIntosh*. (Ann. App. Biol., xiv, 4 (November, 1927), pp. 440-441 + 1 pl.) [63.24.]
- A Study of Lead Arsenate and Lime Spray Mixtures. *P. A. Van der Meulen and E. R. Van Leeuwen*. (Jour. Agric. Res., 35, 4 (August 15, 1927) pp. 313-321.) [63.295.]
- Carbolineum Washes for Winter Spraying. (Bull. Bureau of Bio-Technology, Nos. 15 and 16 (1926-7), pp. 185-195.) [63.295.]

Live Stock and Feeding

- Polled and Horned Cattle. *R. C. M. Auld*. (Jour. Heredity, 18, 7 (July, 1927), pp. 309-321.) [63.60; 63.62.]
- The Nutritive and Manurial Values of Sugar Beet Tops. *H. E. Woodman and J. W. Bee*. (Jour. Agric. Sci., xvii, 4 (October, 1927), pp. 477-488.) [63.60432; 63.165.]

Dairying

- Open-Air Dairying. *A. J. Hosier*. (Jour. Farmers' Club, 1927, Pt. 6 (November), pp. 103-121.) [63.711.]
- Sugar in Milk. *J. F. Tocher*. (Scottish Jour. Agric., x, 4 (October, 1927), pp. 408-415.) [63.712.]
- The Influence of Separation and Pasteurization on the Size and Distribution of the Fat Globules in Milk and Cream. *Dorothy A. Beckett*. (Econ. Proc. Roy. Dublin Soc., Vol. II, No. 20 (November, 1927), pp. 303-317 + 1 pl.) [543.2; 63.712; 63.717.]
- The Variations in Milk Yields Caused by Season of the Year, Service, Age, and Dry Period, and their Elimination. Part II. Service. *H. G. Sanders*. (Jour. Agric. Sci., xvii, 4 (October, 1927.), pp. 502-523.) [63.711.]

Poultry

- The Palatability of Certain Seeds to Chicks. *H. F. Newbigin and R. G. Linton*. (Scottish Jour. Agric., x, 4 (October, 1927), pp. 422-428.) [63.651: 043.]
- Hybrid Vigor in Poultry. *D. C. Warren*. (Poultry Sci., vii, 1 (October-November, 1927), pp. 1-8.) [63.651.]
- The Vitamin A and Vitamin D Content of Cod-Liver Meal. *E. M. Cruickshank, E. B. Hart, and J. G. Halpin*. (Poultry Sci., vii, 1 (October-November, 1927), pp. 9-16.) [63.60432; 63.651: 043.]

Meat

- The Trend of Consumers' Requirements for Joints of Meat and How Farmers Can Supply Them. *S. Pulham*. (Jour. Farmers' Club, 1927, Part 7, (December), pp. 125-138.) [63.75.]
- Variations in Carcass Type for Pork and Bacon. *H. R. Davidson*. (Scottish Jour. Agric., x, 4 (October, 1927), pp. 394-403 + 4 pl.) [63.64; 63.752.]

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NOTES FOR THE MONTH

THE export of British pedigree stock is a valuable part of the trade of this country, but this trade has been seriously interfered with since 1922 by outbreaks of foot-and-mouth-disease occurring in Great Britain, in consequence of which importing countries—including the British Dominions—have placed embargoes upon British live stock in order to protect themselves against the possible risk of infection. It was therefore desirable to find some means, if possible, whereby the Dominions could continue to receive British live stock without incurring such a risk, and thus to preserve this valuable trade from interruption by sporadic outbreaks of foot-and-mouth disease in Great Britain. With this object in view, a Quarantine Station has been established at East India Dock, London, out of funds provided by the Empire Marketing Board, for the detention and isolation, for a period of 14 days before shipment, of pedigree stock intended for export to those British Dominions and Colonies who are prepared to accept such animals after they have passed through the station.

The admission of animals into the station and their detention thereat, under the supervision of the Veterinary Department of the Ministry of Agriculture and Fisheries, are governed by the Quarantine Stations (Regulation) Order of 1928, made by the Minister on March 30, 1928.

The principle underlying the establishment of the station is, that if animals, officially certified to be healthy, and to have come from disease-free districts in Great Britain, successfully pass through a period of 14 days' quarantine, under conditions of strict isolation, with official veterinary supervision, and are shipped with a certificate to that effect from a responsible veterinary officer of the Ministry of Agriculture, the importing Dominion or Colony can with reasonable confidence admit such animals without risk of infection.

The Quarantine Station at East India Dock was formally opened on April 4, 1928, by the Right Hon. L. S. Amery, M.P.,

Secretary of State for the Dominions and Colonies. The station, which is now ready to receive animals, will be administered by the Royal Agricultural Society of England, 16 Bedford Square, London, W.C.1, to whom all applications for the admission of animals to the station should be addressed.

It is understood that animals, which have passed through the station, will be accepted by the Union of South Africa (with the Mandated Territory of South West Africa), Northern and Southern Rhodesia, and Kenya Colony. It is hoped that the Governments of the other Dominions, who have been informed of the facilities afforded by the Quarantine Station, will also agree to remove their existing embargoes on British live stock subject to the animals passing through the Quarantine Station.

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THE latest Report to be issued in the Ministry's Economic Series is the Report on the Pork and Bacon Trades in England and Wales (Economic Series No. 17).

Report on the Pork and Bacon Trades in England and Wales* Together with the Report on the Marketing of Pigs (Economic Series No. 12), to which it is, in a sense, a sequel, it provides a detailed survey of the pig industry in all its ramifications, and offers suggestions as to possible lines of improvement. The Report, which is well illustrated, is divided into five main sections dealing with the pork, bacon, ham, lard and offal trades respectively, and, as in other commodity marketing reports in the series, a thorough analysis is made of the functions involved and of the agencies employed at each stage of the marketing process.

At the present time, the greatest problem confronting the pork and bacon trades in this country is, undoubtedly, a raw-material problem. So far as the pork trade is concerned, it is true that the deficiency in supplies caused by the embargo on fresh meat from the Continent is being rapidly made up, but it is also true, judging from reports from distributors throughout the country, that producers frequently obtain unremunerative prices owing to the excessive fatness and general unsuitability of supplies marketed. It is held that no progress is possible unless it is recognized that the demand of the consumer must be studied and his preferences for lean meat, small joints and a higher standard of quality, adequately catered for. Considerable attention is, therefore, devoted to

*Ministry of Agriculture and Fisheries, Economic Series No. 17, obtainable from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2, price 6d. net, 9½d. post free.

this subject in the Report, and, as it is in the producers' interests that there should be an adequate recognition of quality, it is suggested that pigs should be graded on the basis of carcass quality as well as by weight. For this purpose, a quality specification for "prime" pork carcasses is put forward for consideration. It is, however, recognized in the Report that the difficulties inherent in grading meat are very great and that the notion is, as yet, unfamiliar in this country.

Thanks to the embargo, the fresh pork trade is at present sheltered from the direct competition of imports, but the position is different in regard to bacon; in fact, the output of home-produced bacon forms less than one-fourth of the total consumption in this country. The fundamental importance of the raw material problem is, however, apparent from the fact that the numbers of pigs received by English curers are seldom sufficient to run the factories at full capacity, while their quality often leaves much to be desired. This latter handicap is attributed primarily to four factors:—

- (i) the exact requirements of the bacon market are little understood by producers;
- (ii) curers do not, in all cases, reward superior merit with better prices;
- (iii) many breeders and feeders aim at both pork and bacon markets and at neither in particular;
- (iv) the present marketing system fails to ensure that pigs reach the outlets for which they are suited.

As regards the first point, the marked discrepancy between the sides of bacon winning the Whitley Cup Bacon Competition at the London Dairy Show, 1927, and commercial sides selected by the wholesale provision exchanges, is cited in the Report, and the suggestion is made that, in order to qualify for award, exhibits in Wiltshire-Side classes should, in the future, be required to conform to certain suggested standards of weight and measurement, and that a uniform scale of points should be adopted. In view of the importance of the subject, a full and interesting account of the relation between external conformation and that of the carcass and the side of bacon is given in the Report, and certain common carcass defects are noted. The adoption by the curers of a bacon carcass specification along the lines of the suggested pork grade, to form the basis upon which producers could be paid for their supplies according to quality, is also suggested. This is the

second of the above points. The third and fourth points call for the organization of co-operative live-pig marketing societies on the lines of that operating under the auspices of the Eastern Counties Farmers' Co-operative Association.

In regard to the sale of bacon to the distributive trade, it appears that home produce is at a disadvantage compared with imported supplies, owing to the lack of a uniform grading system. In this connexion, an authority on retail distribution is reported to have said that "English bacon is so poorly graded in comparison with Continental produce that it is a little difficult to do justice to our home-produced article." While it is recognized that this is largely the result of the irregularity in the quality and quantity of supplies of raw material, there is an obvious case for moving as early as possible in the direction of a uniform grading policy, and certain proposals with this end in view are put forward for consideration.

The remaining sections of the Report deal briefly with the business aspects and possibilities of the trades in hams and lard; a short account is also given of the offals and by-products trades, in which emphasis is laid on the importance of continuously investigating all forms of waste elimination.

In conclusion, it may be said that the aim of the present Report and of the Report on the Marketing of Pigs, is not only to give a complete picture of the industry as it actually exists, but also to bring out and emphasize the common interest of producers, curers and distributors in its welfare and development. The completion of the survey coincides with the appointment of the Pig Industry Council, which will afford an opportunity for continuous and constructive co-operation between the various interests concerned; in the last resort, it is on co-operation between producers, curers and distributors in carrying out a marketing policy for home-produced supplies that the future progress of the pig industry will depend.

All who are interested in the production and marketing of pigs and in the processing, transportation, conservation, and distribution of pig products will be well advised to obtain an early copy of this Report on the pork and bacon trades which, with the aid of the grant recently made to the Ministry by the Empire Marketing Board, is issued at the nominal price of 6d. in order to bring it within reach of all.

THE third annual Report of Proceedings under the Agricultural Wages Act, which has now been issued, surveys briefly the work of the Agricultural Wages Board and the Agricultural Wages Committees in England and Wales during the 12 months ended September 30, 1927. It also records the action taken by the Ministry to secure the observance of the minimum rates, and the action taken by Agricultural Wages Committees in dealing with applications for permits to exempt infirm and disabled workers from the operation of the minimum wage provisions. The Report also discusses the state of employment and the demand for labour in agriculture, and one of its sections deals with the results of an inquiry into the conditions of employment of women workers in agriculture. The minimum rates of wages fixed by the Wage Authorities are given in the appendices.

Copies of the Report are obtainable from H.M. Stationery Office, Adastral House, Kingsway, or through any bookseller, price 1s. 6d. net.

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Sennybridge.—At the invitation of the Brecon and Radnor Farmers' Union, a practical demonstration of the Ministry's Egg Marketing Scheme was given at Sennybridge on April 4. Supplies of hen and duck eggs were bought from local producers at a figure based on the current local price per dozen. Hen eggs were purchased per lb. net weight or by graded weight, and duck eggs per dozen. The weight of the eggs was well above the 2 oz. average, upon which the price was based. The eggs were candled, graded, and packed during the day, many of the sellers watching their own supplies pass through the process. Approximately 700 dozen hen and 40 dozen duck eggs were received and dealt with in a few hours.

A large number of people attended the demonstration and showed a keen interest in the proceedings. The practical nature of the demonstration made a lively appeal, and it certainly can be regarded as a successful illustration of the working of the Egg Marketing Scheme.

Tewkesbury.—A demonstration, covering Pigs and Pig Products, will be given by the Ministry at Pyke House Experimental Pig Farm, Tewkesbury, on May 1.

THE Ministry of Agriculture and Fisheries invites applications for agricultural scholarships from students who propose to take up posts as agricultural organizers, **Agricultural teachers** or lecturers in agriculture, &c. The **Scholarships** are tenable for two years from October 1, 1928, 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, 1928, 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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THE Pig Recording Scheme organized by the Animal Nutrition Research Institute, Cambridge, in conjunction with the St. Edmundsbury Co-operative Bacon **East Anglian** Factory, Ltd., Elmswell, has now been in **Pig Recording** operation for several months. At present, the **Scheme** pig breeders who are having their herds recorded fall into four areas, centring roughly 20 miles round—Norwich, Bury St. Edmund's, Cambridge, and Colchester.

Any farmers in these areas who are already acquainted with the outline of the Scheme, and who wish to take advantage of the pig-recording facilities offered, are invited to communicate with the Organizer, Pig Recording Scheme, Bacon Factory, Elmswell, Suffolk, as the latter is still in a position to consider recording further herds in the above districts. Unfortunately, it will not be possible, for the present, to extend the Scheme which, for this year, embraces only East Anglia, but any farmers interested in the subject are invited to write to the Organizer.

THE ECONOMIC POSITION OF AGRICULTURE*

Sir A. DANIEL HALL, K.C.B., LL.D., F.R.S.

THAT British farmers are going through a period of depression has been made patent by debates in Parliament and discussions in the Press. How serious the farmers' difficulties are is always difficult to estimate, and the public is sometimes inclined to discount such tales as the professional patter of a class that has to pay rent; yet those who have means of judging do not doubt that the situation to-day is fully as bad as it was in the late 'eighties and the early 'nineties of the last century. It is not a question of greater or less profits; the ordinary farmer dealing with the land as he has been accustomed to do cannot make his produce pay for his expenditure.

This state of things is not confined to Britain, it is almost world-wide. The United States farmers are as hard hit as our own; from Germany and most of the Dominions come the same complaints; even in France, where the farmers have been specially favoured by legislation, complaints are beginning to arise. The World Economic Conference which met last May in Geneva fully recognized the world-wide character of the depression in agriculture. The representatives of the agriculture of the various countries who there met somewhat remarkably came to an agreement, not only on the existence of the depression, but on its causes. Of course, the immediate cause is low prices, or as the Conference put it, "the disequilibrium which has arisen between the prices of agricultural products and those of manufactured products." The low prices are obvious enough, the index numbers for grain and meat demonstrate them in relation to other commodities; but the members of the Conference were also in agreement that these low prices resulted not from an excess of production since the war, but from the reduced purchasing power of much of the industrial population, itself suffering from economic distress. With 10,000,000 unemployed in Europe unable to exercise their normal demand for food and other raw materials produced by the farmer, it is inevitable that there should be relative over-production of agricultural wares and that competition should force down prices to an unremunerative level. The conclusion of the Conference was that the agricultural situation was bound up with and must wait upon the general

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industrial and commercial situation, and that prices would remain low until trade and manufactures were encouraged to start up again by the growth of public confidence and the removal of the new tariffs, which since the war had done so much to strangle the international exchange of commodities. It is necessary to examine the basis for these conclusions carefully, for they bear upon many of the proposals for the relief of farmers in this and other countries.

First of all comes the question of over-production. Is the excess of agricultural produce that forces down the world prices a real excess above what we may call the normal demand, or is it an excess generated only by an impaired demand, which might at once disappear if the industrial population began to exert its usual consuming capacity? It is not a very easy question to answer. Clearly we have no measure of the normal consuming capacity of the population; the best we can do is to take as a datum line the years just before the war and compare the subsequent growth of population with the increase of production. Even that question admits only of approximate answers, so imperfect are the statistical data and so much have changes of frontier and area rendered impossible the checks one can generally apply to recurring estimates. Anyone who has had to work upon the world's agricultural statistics available can only feel distrustful about his conclusions, and yet it is of the first importance that the figures should be sound if the world's affairs are to be run on lines of reason and not left to take their chance.

Between the years 1913 and 1926 the world population is estimated to have increased by 6 per cent., from 1,786,000,000 to 1,895,000,000. But the largest items in this figure are massed in Asia, in India and China, countries which, agriculturally speaking, are so nearly self-sufficing that they may be left out of account. A better picture is obtained of the factors influencing the international market if Asia and tropical Africa are omitted, as contributing little in the way of supplies and exerting no great demand upon the international reservoir of food upon which Europe draws. Of course, Java exports sugar in quantity and India sometimes exports wheat; *per contra*, the demand for wheat from Japan and China has been a new feature since the war, but none the less the general proposition is true that Asia barely grows enough to feed her own vast population and is yet too poor to buy from outside. If we confine our consideration to Europe, the Americas, Mediterranean, and South Africa and Australasia, we find an

estimated increase of population between 1913 and 1926 of about 50,000,000, or $7\frac{1}{2}$ per cent.

Now it has been calculated that, amongst white peoples with a western standard of living, present-day farming uses about one hectare of land in providing the food and other agricultural produce required by one unit of the population. There is nothing necessary about this figure, which is obviously dependent upon the standard of farming and the standard of living; it happens to be the current average of figures, which may vary from about three-quarters of a hectare for Denmark to nearly two hectares for Spain. It fits, moreover, very well with the increase of population during the latter part of the nineteenth century that was made possible by the settlement of the Americas, Australia, etc. The increase in area of cultivated land in the countries under consideration between 1913 and 1926 is estimated at 36,000,000 hectares. This figure, imperfect as it may be, would go to show that the growth of cultivated land has not kept pace with the needs of the white population, and that such over-production of foodstuffs as there may be is not of the character of the over-production of 50 years ago, when settlement in the Americas was proceeding with such rapid strides.

Turning to the statistics of production, the documents submitted to the Conference show an actual decline in the output of wheat when the five years 1921-25 are compared with the pre-war years 1909-13. Possibly these figures present too unfavourable a picture, because they do not take account of the rapid recovery of wheat-growing in Soviet Russia since 1921. If 1926 figures are compared with those for 1913 the wheat acreage appears to have increased from 109,000,000 to 119,000,000 hectares and the output from 1,029,000,000 to 1,139,000,000 quintals, by more than 10 per cent. Even if these estimates could be accepted, still the increase in wheat acreage has been purchased to some extent at the expense of rye and other bread corn. Taking the sum of the four chief bread corns—wheat, rye, barley and maize—from all countries except Asia and tropical Africa, the increase of area is only about 4 per cent., of the production about 5 per cent. There has also been some increase in cattle; from all sources one may estimate very approximately an increase in meat and milk products of about 8 per cent.

The net result of these and other inquiries is the conclusion that within the period since the outbreak of war the increased production of food has not kept pace with the increase of popu-

lation, but has, indeed, fallen definitely behind it, if pre-war consumption is taken as the standard. If, then, the world market is overstocked as the low and falling prices would indicate, this must result not from positive over-production but from a weakened demand, from the fact that large sections of the peoples are not able to exercise their pre-war demand for food, but by reason of poverty are living at a lower level of consumption.

In this question of low prices one factor must, however, be mentioned, though it is not reported upon by the Conference, probably because no general agreement could be reached. The break in agricultural prices began in 1921: it followed immediately upon the deflation measures which were initiated by Japan in 1920 and adopted by this country and the United States in 1921. Since that time State after State has followed a similar policy of checking the inflation that had prevailed and returning to a currency based upon a gold standard. It is maintained that agricultural distress has in every case followed deflation, that it has been deferred in those countries which were late to return to the gold standard, that it has been relieved where a subsequent mild inflation has succeeded to the initial check. Whether deflation is the cause of low prices, or only a detonator which lets loose economic forces that are causal, cannot be here considered, but the dominating effect of currency upon prices cannot be ignored and is ominous for the future of the farmer, if, as predicted, we are entering upon a period of declining production of gold.

The conclusion, however, that the low prices are due to a weakened demand and not to great surpluses of production still does not explain what the Conference called the "disequilibrium" between the prices of agricultural and manufactured produce. That arises from the nature of agricultural production. Farming in all countries and at all times is something of a gamble against the seasons. The farmer takes a course which experience has proved to be justified on the average, and he pursues that course with little regard to temporary fluctuations of yield and price. The manufacturer determines his production by the orders and inquiries he receives; he can rapidly reduce output to meet a decline in demand. Temporary over-production there may be through competition to secure a share in a shrinking market, but in every way the output of the industries is more quickly controlled than that of agriculture can be. Indeed, to a large extent the output of agriculture cannot be controlled at all. The greater part of the

farming of the world is done by peasants or family farmers, who have only one routine for the farm and no alternative occupation. They may vary the cropping a little in accordance with prices, but in the main they must continue on the accustomed paths whatever the prices, because for them the farm is primarily a living rather than a business. They sell only their surplus, and if it sells badly there is but so much the less to spend upon clothes and the other necessities they must buy. Bad times affect the production of a peasant community but slowly; eventually the younger generation declines to carry on so unremunerative a calling, and this sort of decline in the agricultural population becomes dangerous unless it is accompanied by some increase of efficiency on the land that remains in cultivation.

The inflexibility of farming is, then, the main cause why prices do not recover; another contributing factor is the weakness of farmers all over the world as economic units for sale. To some extent this is mitigated by union into co-operative societies, the only possible protection of the peasant against exploitation, but even co-operative societies cannot maintain prices in the clash of the open international market. The price of bacon pigs was (December, 1927) below the cost of the grain required to produce them on the most exact scientific basis with no margin for waste. Pig-feeding must, therefore, be a loss both to the co-operative Danish farmer and the individualist Englishman, as, again, it is to the United States farmer, whose home price has to come down to a parity with the price he can get for the surplus he has to export. The trade in manufactured articles is in fewer and bigger hands and it is therefore easier to form cartels and arrangements whereby competition, national and international, is not allowed to depress prices below the cost of production.

With this general view of the position of world agriculture in mind we may proceed to consider the special British case. The feature which distinguishes British farming is that it has long ceased to consist of peasant holdings or one-man businesses. Excluding the land held in parcels of less than 5 acres, two-thirds of the cultivated land in England and Wales is held in farms of 100 acres and upwards. Typical British farming is a small capitalist enterprise worked by paid labour. There are roughly four times as many labourers as farmers. The density of employment in England and Wales is approximately two and a-half permanent and half a casual labourer per 100 acres, and one might say that the representative English farmer is

employing five or six men. Farms again are mostly rented, though the high prices of the war and post-war years did induce such sales that some 25 per cent. of the land is now owned by the occupiers. Still, the rental system is general, and it has always given the British farmer an advantage in that the major portion of the very high capital required in agriculture has been carried by the landowner at a low rate of interest. It is estimated that the average value of the farmed land (sale price, not initial cost nor cost of reinstatement) amounts to £31 per acre, the landowners' capital; while tenants have invested from £12 to £15 an acre of their own capital. Gross rents are estimated at 5 per cent. on the capital; the average net return to the landowner may be in the order of 3 per cent. on the sale value of his land.

Since the British farmer is engaged upon a business in which he is endeavouring to obtain returns for capital that may in part be borrowed, and has payments to make for rent and labour as well as the normal expenditure on seeds, fertilizers and the like, he is in a far worse position to meet falling prices than is the peasant. Labour, rent and interest do not shrink in bad times, but have still to be met out of the greatly narrowed margin between receipts and raw materials.

A study of the index numbers defines more exactly this general statement. Taking average prices in 1911-13 as the basis (100), in October, 1927, agricultural produce stood at 140. At the same time general commodities were 160, but wages were 176 as compared with pre-war rates. Even that figure does not set out the full rise in labour costs, for if the hour rate is compared, labour is just twice as dear as it was before the war. Labour is the biggest item in the farmer's expenditure, from one-quarter to one-third of the total outgoings on an average mixed farm. This, then, in brief is the source of the British farmer's troubles; compared with 1913, labour costs have been doubled, other commodities have increased in cost 60 per cent., while his produce is only realizing 40 per cent. above the old returns.

Of course, 140 is only a weighted average index number for all kinds of agricultural produce; grain and pigs are below that figure, milk and wool above, fruit and vegetables have remained nearly 100 per cent. above pre-war figures. Hence it follows that nearly everywhere there are some farmers doing well because, owing to accidents of land or market or personal skill, they have been able to base a large part of their business upon articles commanding a more or less sheltered market.

These markets are, however, limited, and the main fact stands that the British farmer is hard put to it to carry on his ordinary business because of the disproportion that has arisen between costs of labour and prices of produce.

What remedies are open to the agricultural community? It is significant that the agricultural representatives at the Geneva Conference (collectively at any rate) did not recommend either tariffs or subsidies. They could hardly demand tariffs when the Conference at large was denouncing tariffs as the chief cause of the stagnation in international trade, from which arises the industrial poverty that reacts on the farmer as a lessened demand. The Conference could only advise the farmer to improve his co-operative organization for marketing and obtaining credit, and also to improve his technical skill; for better prices he must await the industrial revival. As far as co-operation for marketing is concerned the advice cannot be pressed too strongly upon the British farmer; such action is necessary if he is to secure his continuance as a free agent, so powerful are becoming the commercial organizations that handle imported produce. But co-operation on any big scale involves a tedious and difficult struggle with the existing well-established trading organizations, and for a long time the motive power keeping farmers within the organization will have to be faith and loyalty to the idea of co-operation, not immediate profit. Nor, indeed, is there a big profit to be diverted into the farmers' pockets. One is amazed at the discrepancies between the price the farmer receives for milk or meat and the price the urban consumer pays, but the stretch between the producers' and the wholesale market price is only a small portion of the total difference, and yet is the only part which the farmer could cut at by combination. The stretch between wholesaler and consumer may be excessive or may be only a reasonable return to the retailer in existing social conditions, but it is not the farmer's affair, and he could only secure a share of it by becoming a retailer himself. Whatever the prospects of co-operation in Great Britain, it cannot be expected to convert the current low prices into remunerative ones or to make up for the increased costs of labour.

Nor can the case be met by simply aiming at higher production on existing lines. Without entering into the controversy about the applicability of the law of diminishing returns to farming, and admitting that the "high" farmer is often successful where his neighbours are just dragging along, it may be recalled that the farming community as a whole met

the similar crisis of low prices 40 years ago by cheapening farming, producing less, and laying away land to grass. It is, in fact, falling back upon the same remedy to-day. The intensive farming that is to pay involves a degree of skill and economic intelligence that is not at the command of every farmer. If things go on as they are, with prices continuing at their low level, or even falling, and no new stimulus takes effect, the greater part of English farming land will go to some form of ranching, either grazing or the cheap wide-scale corn-growing which characterizes our competitors in the new countries. Denmark and Holland grow more bushels of wheat per acre than we do, yet they are not the competitors who make wheat cheap, but Canada, Argentina and Australia, where the average yield per acre is less than half the English yield.

Side by side with low-grade cheap production from English land there will be on the good land highly skilled intensive farming for special articles commanding a more or less luxury market. There need be no doubt about the ability of British farmers wherever the returns are such as keep the good men in the business. The potato growing of the Lothians or Lincolnshire, the fruit growing of Kent, the milk production of some of our best dairy farmers, are examples of enlightened scientific management such as can nowhere be excelled. It is the common run of stock and corn farming that has fallen into the hands of men who follow a narrow routine, sufficient in its day, but which can only survive under present conditions by the exercise of the utmost parsimony and at the cost of a steady deterioration of the land. There are still men who can make good ordinary farming answer—witness the farmers of the Lothians outside the potato area and of the Border counties of Scotland—but, speaking generally, ordinary land does not attract management of that quality for the sort of price it is able to promise in return.

Is there any policy which affords hope for British farming other than those measures of direct assistance by protection or subsidy which seem to be denied by all political parties? Farmers themselves chiefly direct attention to wages. They are seized of the change that has so rapidly occurred in the relation of wages to prices and they maintain that this disproportion has been brought about by the Wages Board. The usual argument in the Eastern Counties is that a sack of wheat ($2\frac{1}{2}$ cwt.) should pay a week's wage, whereas to-day the sack of wheat is worth only 23s. while the week's wage is 30s. But there is no causal or even traditional parity between the sack

of wheat and the weekly wage; the two did approximate in the early years of the century up to the outbreak of war, but, if we go back to the palmy days of farming in the 'sixties of the last century, the sack of wheat was the equivalent of two weeks' wage, and in the latter years of the eighteenth century, when so much of our farming system took shape, the sack of wheat would pay three or four weeks' wage. British farming for over a century has constantly been readjusting itself to a rise in the cost of labour as compared with the price of its products.

To turn to the actual situation, the average rate of wage of agricultural labourers in England and Wales is returned at 31s. 8d. per week. The rate is better than before the war, to judge by the cost-of-living index, but it is a lower rate of pay for full time than prevails in any other large-scale industry. The action of the Wages Boards in fixing rates of 30s. a week for purely agricultural counties like Norfolk may have for the time being created an artificial wage level, but it has saved the industry from the certain loss of its men. Farmers might have forced wages down to 25s. or even to 21s., in parity with prices, and for a time the majority of the labourers would have had to accept. But the active men would at once have exhausted every contrivance to get away from the land. Even as it is, no new employment comes into a country district, whether road-making or any other construction work, mining or building, without immediately drawing away the agricultural labourers who are not tied by the necessity of keeping their cottages. The new beet sugar factories have to advertise that they will not engage men from the land, otherwise they would bring to a standstill their supply of beet. If there came a revival of industry and a call for men the land would soon be swept clear of its able-bodied workers.

Thus the farmers' contention that the Government has ruined agriculture by setting up Wages Boards to fix rates beyond the capacity of the industry ignores the graver issue that even the Wages Board rates are below the general level of wages. No industry can expect to live on a basis of paying its men substantially worse wages than can be obtained elsewhere. As it is, inertia—the difficulty of making a fresh start—is keeping the labourer on the land as it keeps the farmer, though neither are getting out of it the living their fellows enjoy. Little by little the able ones carry their labour and their capital elsewhere, and those who fall out are not replaced. An industry does not die suddenly or sensationally, and there is

something particularly tenacious about the men of the land that keeps them hanging on.

But without any speculation about the future, it must be accepted as a fact that the agricultural problems cannot be solved by lower wages; if farming is to remain a permanent feature of the national economy it will have to provide as good a return as any other industry for both labour and capital. This means that current systems of farming have got to be reorganized on a basis of dear wages instead of cheap wages on which they were originally founded. This is the working problem before farmers, a personal actual problem for each man that is independent of all questions of State policy or State assistance for agriculture. It may be agreed that farming as generally practised does not pay to-day, but, without condemning that farming as "bad," it is yet susceptible of change and of adaptation to the relationship now prevailing between wages and prices.

There are two lines of reform to be followed. The one concerns the farmer as manager of his business and particularly as the organizer of labour. He needs to review all the operations of the farm, asking himself at each stage how labour can be economized. The greater introduction of machinery is fundamental, which means more than anything else a study of how the given machine may be made to work. Most agricultural machines have begun by being tried and discarded, because the poor tool could not sit up and tell its user how it was being maltreated. Tractors upon the farm are perhaps in this position to-day; the farmer has tried them, but has gone back to horses, except on the larger farms for emergency work. Yet one man with a tractor will do six times as much ploughing as a man with a pair of horses, not so fine work perhaps, but still adequate, and there must be something more to be made of this saving of labour than is yet being realized in general practice. Of course, the mere use of a machine is not necessarily an economy; there must be a certain magnitude about the operation before the saving in labour pays for the machine, and here the professors of agriculture in the country might help the progressive farmers by working out experimentally the economic data for the use of the newer implements. But, without going into details, the economical employment of labour is a problem of the first importance to the British farmer, which he will mainly have to solve himself, aided by the instructors and investigators who are now available for the development of agriculture. It has three aspects: the elimi-

nation of crops and operations which have become too costly, however good in themselves; the substitution of machine for hand work, and, lastly, the hunting down of sources of waste of labour on each particular farm.

The second step in this same process of reducing labour costs depends upon a widespread and considered attempt to make the labour employed more effective. It may be agreed that the agricultural labourer is often a very skilled operative, who exercises far more technical skill and personal responsibility than the industrial workers earning twice or thrice his wages. But it is generally deplored that these skilled craftsmen are dying out and that the standard of workmanship has deteriorated greatly within the last generation, especially in southern England. It is sometimes said that farmers have relaxed their personal interest in the land of late years and have not given enough attention to the details of work. Anyone who has watched the effect that entering into a milk recording competition or a clean milk competition has upon the cowmen in charge of a dairy herd, the keenness and care that is generated by the posting up at regular intervals of the results obtained by each man with his cows, especially if there is a little bonus attached to performance, will soon be convinced of the value of the master's "interest" in the work of his men. Particularly, too, it has been nobody's business to see that the boys as they come on the farm are really taught their job.

Without blaming anybody, it may be agreed that the standard of work upon the farm is lower than it need be. Recently investigations have been made upon farms of the kind that have for long been worked out in factories; *i.e.*, measurements of the comparative efficiency of different workers engaged upon the same task, followed by trials of the effect of teaching the right stroke to the non-efficient or of supplying some trifling means of easing or quickening the operation. The results are very promising; it is clear that the effectiveness of the agricultural labourer can be considerably increased, and at the same time his fatigue diminished, by some sympathetic study of the actual mechanical operations he is called upon to perform. It is within sight that the agricultural labourer can be taught to "earn," economically speaking, his present or even a higher rate of wages. There is a special need in farming that master and labourer should come together. Farming is unlike most industries in that it allows of little gang supervision or checking of the output upon a standardized job. Masters are very dependent upon the honesty and good will

with which their labourers work. There is an opportunity at the present time for both an individual and an organized movement among farmers to ensure better work upon the farms. After all, the function of a farmer is leadership, and without being critical of farmers, it may be fairly said that they are not giving their men enough of a lead at present.

Of course, reforms of the kind indicated will at first be accompanied by the employment of fewer men upon the land. Later, the improved methods may make intensification profitable, and with it an increased employment of men upon a given acreage. But density of employment upon the land is not of itself to be desired. The more backward the community the greater is the proportion of its workers engaged in growing the food it consumes, as in India, where it is estimated that some 70 per cent. of the population is engaged upon the land, or in some parts of China, where over 90 per cent. are so employed. The food so produced is not for export, but is being wholly consumed within the community, which is the poorer in that but a small portion of the labour is available for the production of other forms of wealth like clothing, housing, etc.

In considering the technical methods by which farming may be improved, I have put in the forefront this question of the efficiency of labour. It is true that there is scope for the greater utilization of scientific discovery, but great as are the advances that may thus be promised, they are all secondary to, and even dependent upon, the economic necessity of the more efficient utilization of labour. One sees all too many farms where well-meaning and well-read people are trying out the results obtained by the experimental stations and making them of no avail, because three men are being employed where two should be enough. In farming, management must come first, yet it seems easier to acquire a knowledge of the scientific side of farming than of the art of management. There are, indeed, elements of large promise on the scientific side of farming. It has already been mentioned that the index number for agricultural produce generally to-day as compared with 1913 stands at 140, while labour is 200. There is, however, one item in the farmers' raw materials which is actually cheaper to-day than in 1913; the two chief elements of fertilizers, ammonia and phosphoric acid, are little more than three-quarters of their pre-war cost. It therefore follows that increases of crop purchased by the use of fertilizers are likely to be profitable, since these increases involve little or no

addition to the labour costs. With the introduction on a vast working scale here and elsewhere of the processes for bringing atmospheric nitrogen into combination as ammonia, nitrates and urea, and the enormous cheapening that has already been effected in this all-important element of plant nutrition, we can certainly count on production at a higher level of yield still remaining profitable. On arable land a judicious use of the cheapened fertilizers may just determine the possibility of keeping them under cultivation; on grassland the generous use of nitrogen promises sensibly to reduce the cake bill which is the chief item in the cost of milk. As with all advances due to science, the appropriate technique has to be worked out on the economic side before the advantages can be realized. But, remembering how between 1840 and 1860 the productivity of British land was raised from 20 to 30 bushels of wheat per acre by the introduction of artificial fertilizers, we cannot but see the possibility of a similar advance in this new development of the fertilizer supply.

Such are the opportunities of righting itself from within, without either legislative assistance or social change (the value or possibility of which it is not my purpose to discuss), which are before British agriculture to-day. It is at least arguable that they alone would be sufficient to provide reasonable returns to the farmers, with the maintenance or even some increase of the agricultural output. But to seize these opportunities and utilize them throughout the industry involves a confidence in the future that is lacking.

Prices are still falling, and though falling prices may weed out the weak they do not encourage enterprise and development. The agricultural statistics show that in fact farmers are shortening sail—laying land to grass, reducing expenditure and letting labour drift away—in order to meet the situation. (The Census returns show a reduction in the number of agricultural workers in England and Wales from 678,000 in 1911 to 615,000 in 1921. Since that date the figures collected by the Ministry of Agriculture on a different basis are 685, 625, 644, 639, 654, 650, for the years 1921-27.) A revival of the industry, induced by a vigorous search for new methods such as have been discussed above, will only happen under the stimulus of better prices, when farming again becomes attractive to men of enterprise and capital. According to the Geneva Conference, agriculture must wait for a revival of industry before these better prices occur. Meantime, however, it is clear that agriculture is losing ground in the western world,

that even in the peasant farming countries men are being attracted away from the land by the higher returns to be obtained in industries. Population is still increasing, the failure of food production to keep pace tends to be cumulative, and many observers see signs in sudden minor scarcities among agricultural products that the equilibrium between supply and actual demand may be easily disturbed and the present apparent surplus as quickly converted into an apparent dearth. Prices are at the mercy of very small margins, plus or minus, and once an upward movement starts all the material facts favour a rapid speculative rise.

However, prophecy in such matters has been too often falsified; all one can note with certainty is that food production is not keeping pace with population, and that agriculture is becoming a less and less attractive occupation as industrialism advances. It is vain to hope that in future, even in the more backward countries, a peasant population can be maintained which will be content to work at less than ordinary rates in order to feed the world. Indeed, it is further questionable whether peasant farming methods can produce food for a much greater population than at present exists. But the alternative method of large-scale organized production upon which British farming tentatively entered two centuries ago, under which agriculture has to compete with other industries for both men and capital, is at present being undersold by peasant production to the undoing of both systems of farming. Our capitalist farming will only resume its progress—progress upon which depends the intensification of production necessary to the support of the world's growing population—when food scarcity gives rise to a stimulus of better prices.

THE SCOTTISH MILK AGENCY, LTD. A PRODUCERS' PIONEER MARKETING ENTERPRISE

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THE Scottish Milk Agency, Ltd., was registered under the Industrial and Provident Societies Acts, 1893-1913, on October 13, 1927, and commenced operations on November 1, 1927, in the Glasgow and Clyde Valley area of Scotland. The headquarters of this new and distinctive producers' marketing organization are in Glasgow, and consist, at present, of office quarters where the management conducts its business; it owns no depots or factories, but a considerable number of co-operative creameries are among its members.*

In form its rules bear a close resemblance to those of other co-operative enterprises already established among farmers, but its methods of organization, its relation to the markets which it serves, and its size, mark it out as a pioneer enterprise without parallel in Britain, with the exception of the English Hop Growers Ltd. A few of the chief points in its registered rules may be briefly mentioned.

The objects of the Agency are to carry on business as buyers and sellers of milk and milk products, to secure a market for the milk produced by its members, and to make provision for the disposal of supplies that are surplus to the requirements of the liquid milk market. The membership consists of such societies, associations, companies and individual milk producers as sign the membership contract specified for the time being; every producer of milk shall hold at least one share of the value of £1, payable in full on allotment, and Corporations, other than the Scottish Agricultural Organization Society, shall hold at least one share in the Agency for every producer of milk sending supplies to them. A member's share interest cannot, of course, exceed £200 in nominal value. Until the Annual General Meeting in December, 1928, the management is by a Joint Provisional Committee of 12, together with a neutral chairman; six members are appointed by the National Farmers' Union of Scotland and six by such of the farmers' co-operative dairy associations as are members of the Agency; after that date the Committee shall consist of 12 members, six of whom will represent farmers' co-operative dairy associations and six the individual members. The

* The Agency has since purchased the Kyle Creamery Co. of Edinburgh; the plant thus acquired will bring the Agency into the field of milk distribution.

neutral chairman will be elected annually by the committee of management. In voting, each individual member has one vote, and each corporation member shall be deemed to be a number of members equal to the number of producers of milk supplying the corporation.

It may be noted that the signing of the membership contract is essential before anyone may be admitted to membership; its terms are printed as part of the registered rules of the Agency. Further, it is clear that the promoters of the enterprise have steered a careful and balanced course in dealing with the interests of individual producers and of members of co-operative creameries already established in the area; in particular, the introduction of the neutral chairman seems designed to prevent any deadlock in voting on the management committee where these two important interests might clash.

The Launching of the Enterprise.—It is not possible to describe at length the causes which gave rise to this effort to create a selling agency for milk producers, nor to follow, step by step, the stages in the promotion of so considerable an organization, but the following features of the situation may be noted.

There had been in the years 1925-26-27 considerable disappointment among milk producers with the results of collective bargaining in the Glasgow area. This was not only a question of the fall of prices; there was a growing view among milk producers that the standard rates embodied in the bargain did not exert a ruling influence upon prices, and that large quantities of milk were being sold at lower prices than those fixed. Further, there was the influence of milk which was deemed surplus to fluid requirements and which was believed to obscure the real price position, while there was also the difficult relationship of near and distant milk producers to the Glasgow market. Since the Glasgow Milk Price Agreement had been among the most highly developed forms of collective bargaining found in Britain,* it was obvious that if the producers desired a closer control over the supply and sale of their output, they would require to attempt some more elaborate form of undertaking than the price settlement by bargain, and attention was drawn to the possibilities of the large-scale central selling agency; this did not alter the need

* See *The Fluid Milk Market*, Economic Series No. 16, pp. 73 and 137. H.M. Stationery Office, Adastral House, W.C. 2, price 6d. net, post free, 9d.

for a price bargain negotiated annually with distributors in the area, but it was felt that an agency would add that element of unity of action in selling which would ensure to producers that when prices were negotiated they would be a reality, and that when surplus appeared it would not be used to depress the market unduly.

Considerable propaganda work was done throughout the area during the winter of 1926-27 by representatives of the Scottish National Farmers' Union and the Secretary and Organizers of the Scottish Agricultural Organization Society, and by March 10, 1927, the Farmers' Union had decided to proceed with the project after consideration of the reports of those who had taken part in the meetings in the different districts concerned; the next step was further conference with the representatives of the creameries, so that the interests of different classes of milk producers might be merged in a suitable scheme.

An explanatory memorandum, giving the actual outline of the proposed organization, and dealing with management, membership contracts, prices, finance, and the pooling arrangements, was issued on June 2, and formed the basis upon which producers were personally canvassed and asked to sign contracts binding them to send their supplies to the Agency for the three years 1927-28, 1928-29, 1929-30. It was definitely stated therein that the Agency would not be proceeded with unless it had guaranteed supplies equal to 60 per cent. of the estimated requirements of Glasgow and the Clyde Valley, as ascertained by the Committee. By August and September it became clear that the required percentage of support would be secured, and the last stage in the effort was entered upon, namely, the negotiations with distributors for a collective price settlement for 1927-28, and for the recognition of the Agency as the producers' channel for disposal of supplies.

On September 5 a meeting of distributive trade organizations which had, in former years, taken a leading part in negotiating the Glasgow Price Settlement, decided to refuse to recognize the new marketing society. These bodies were the Glasgow Wholesale Milk Dealers' Association, the Glasgow and District Dairymen's Association, and the Glasgow Co-operative Societies. This began a period of friction between certain distributors and the Agency, but on October 31 an agreement was signed between the Glasgow and District Dairymen's Association and the Scottish Milk Agency regulating sales contracts and prices for the year 1927-28.

The Agency has now been trading for just over two months and it has prepared accounts for November, 1927; it takes, roughly, from two to three weeks to settle up the accounts of the previous month. Statistical material of a precise character is naturally lacking as yet, and only figures illustrative of the general position can be quoted. It is stated that the individual producer-members number over 1,200, and that 14 creameries, with a membership of over 600, have joined the Agency; further, it appears that in the first month of operation the total amount of milk sold amounted to $1\frac{1}{2}$ million gallons, or, roughly, 50,000 gallons per day in a month which has always been reckoned one of low output. It is not yet possible to say what cow population this represents, as the figures have still to be checked, nor is information available as to what proportion this amount bears to the total supply of Glasgow and district, but it is estimated to be equal to 70 per cent. of the total.

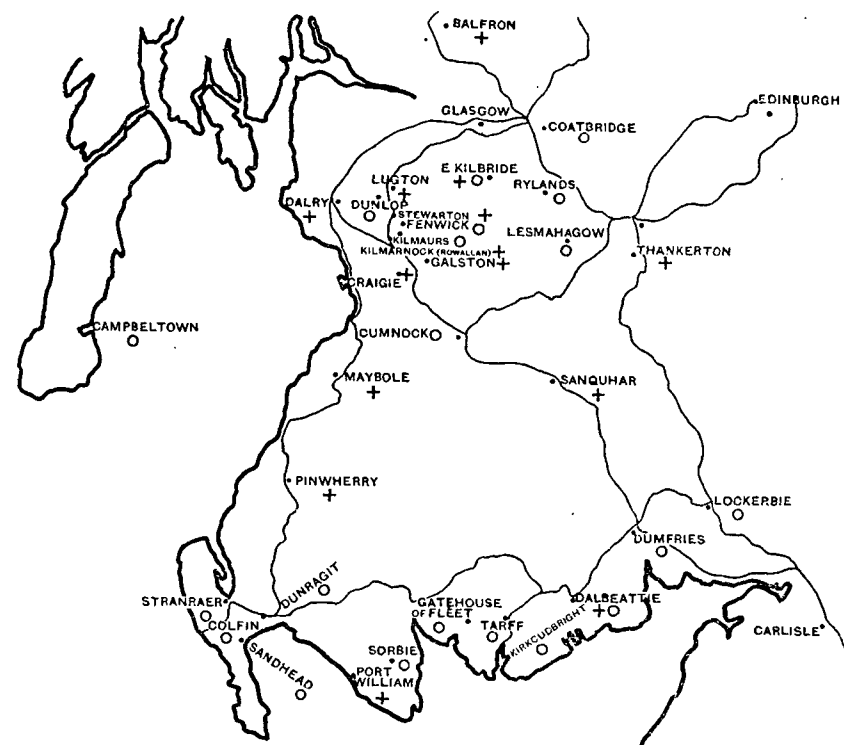
If the accompanying sketch of the region be examined, it can be seen that the milk field may be divided into two distinct Sections. The "In" Section, which extends to, say, 50 miles from Glasgow, consists of the large majority of the individual producers, together with 11 of the co-operative creameries; it lies close to the great consuming centres, Glasgow (population 1,034,000),* Greenock (81,000), Hamilton (38,600), Kilmarnock (35,900), Paisley (84,800), Rutherglen (24,700), Airdrie (25,000), Coatbridge (43,909), Motherwell and Wishaw; in the four counties of Lanark, Renfrew, Ayr and Dumbarton, the population amounts to over $2\frac{1}{4}$ million. The "Out" Section lies on the Stranraer-Dumfries-Lockerbie line and, apart from manufacturing, mainly serves other markets than Glasgow†; it is, however, a factor in supplies which cannot be left out of account in considering the position in the Clyde Valley.

The Organization.—The description of the method of organization may be most easily approached by taking the four chief matters involved:—

- the membership contract between the farmer and the Agency;
- the milk supply contract between individual sellers and buyers;
- price levels and the collective price agreement between the Agency and the dairymen;

* 1921 Census.

† Cf. *The Fluid Milk Market*, Economic Series No. 16, p. 12.



+ Indicates Creamery in the Glasgow Milk Agency o Indicates Creamery not in the Glasgow Milk Agency

SKETCH MAP OF THE GLASGOW MILK REGION.

Distances from Glasgow to

Lughton	14 to 15 miles
Kilmarnock	25 "
East Kilbride	12 "
Thankerton	34 "
Maybole	51 "
Stranraer	101 "
Dumfries	83 "
Distance from Stranraer to Carlisle	106 "

.. (d) the financial arrangements and "pooling" scheme of the Agency.

These questions are dealt with individually below.

The Membership Contract.—For the three years beginning November 1, 1927, the members are bound to sell through the Agency all milk which would normally be sold in liquid form, and, further, no liquid milk can be sold by a member without the written sanction of the Agency. This, in effect, makes the Agency the sole channel through which the producer can dispose of his liquid milk; he may, of course, use milk for domestic purposes, for feeding, or for conversion on the farm.

The amount of milk which members have for sale each month has to be stated, and is to be based on the average daily quantities sold, month by month, for the past three years, it being expressly stated in the memorandum that milk for which the members were paid surplus price under the Glasgow Conference Agreement shall not be included in estimating these standard figures. The quantities so calculated have to be entered on the contract form, and it is understood that a 10 per cent. variation, up or down, is permitted; but it is also stipulated that a supply in excess of, or falling short of, these limits shall be subject to such deduction as the Committee of Management may decide, and in all cases of abnormal variation as between the highest and lowest months, a producer may be required to accept a price lower than the basic level for a proportion of his supplies. It may be explained that, under the previous Glasgow price agreements, all quantities supplied in excess of 20 per cent. over the monthly average of November, December, January and February, were paid for at manufacturing prices, which, per gallon, were based upon certain quotations per lb. for colonial cheese, less 2d. This declaration of quantities is, therefore, meant to become a basis for smoothing out supply, and it would appear to amount to an indirect control of output, since a member must apply to the Agency for sanction to increase or decrease his supplies beyond the limits indicated in his membership contract.

In return for undertaking these two obligations towards the Agency, the member is guaranteed payment of all accounts for the sale of milk registered by the Agency. The buyer of the farmer's milk pays the Agency, which in turn remits the amount due to the producer, less a fixed deduction per gallon. If any portion or the whole of a farmer's supply be unsold, the Agency is to compensate him so that he may receive the basic price, less the fixed deduction, provided that the quantity is within the limits mentioned. The significance of the term "basic" price will be indicated, but broadly it means the price ruling at any particular time for milk of an agreed standard of quality, delivered under certain specified conditions as to quantities and times.

The ordinary member may, therefore, look to the Agency to secure for him a market for his normal output of liquid milk, provided it is not unreasonably variable, and for this he will be guaranteed the price agreed for the area, less the fixed deduction necessary to cover the operating and compensating transactions of the Agency.

A matter of interest is that no statement is made in the contract regarding the liability of members in case of their violating its terms, as is common in the membership contracts of similar types of organization in the United States; reliance will therefore be placed upon the ordinary form of legal procedure, a claim for damages, as compared with the pre-arranged amounts of liquidated damages commonly embodied in the relevant clauses of the American contracts. The position of the milk agency is, however, relatively strong in a case of this kind, as it controls the payment of accounts, and if it had any substantial ground to suspect a member of selling milk elsewhere without sanction, it could at least stop his cheque for such milk as it controlled, and the farmer would be in the awkward position of suing an agency with which he was said to have broken his contract. No doubt, at the present time of the enthusiastic launching of a new enterprise, cases of broken membership contracts are likely to be a rarity, but experience in the U.S.A. and elsewhere shows that it is a mistake to treat leniently or to palliate any definite infringement of the main points embodied in such agreements.

A few remaining points bearing upon the membership contract may be mentioned. Producer-retailers may join the Agency on special terms; they are to pay an agreed contribution to the funds which is not expected to exceed 5s. per cow per annum, and any surplus milk which they cannot sell through temporary causes, such as holidays, will be taken over by the Agency at a manufacturing price. Support has already been forthcoming from this group of milk producers, but it is not clear what gain is likely to accrue to them from membership beyond that mentioned, unless their recognition by the Agency is to strengthen their local position against competition.

The position of farmers' co-operative creameries is defined by a clause which binds them to accept all unsold milk from the Agency at a manufacturing price to be fixed by the Management Committee, and, further, it is stated that, in the case of milk supplied by the creameries, the deduction per gallon for the working of the Agency shall be half the amount levied on the supplies of individual members. This latter arrangement has been made because the creameries already perform many services for their members in their depots, and because the use of their plant represents a key position for the Agency in dealing with surplus.

Producers of graded milk also occupy a special position. The Agency enters into no contract with individual members

to guarantee them a differential price, but it is understood that a working arrangement has been entered into whereby the associations of producers of graded milk pay a lump sum membership subscription, in return for which the Agency offers its services in marketing their output and in putting producers in touch with new customers; there is, however, nothing binding involved.

All persons signing the membership contract are asked to give, for the assistance of the Committee, any special particulars regarding the saleability of their output; for example, if it is a grade milk; if it is cooled; if the producer has special facilities for early delivery of morning milk. Since these points affect prices, the presence of special features of this kind constitutes a claim for a price above the standard.

Milk Supply Contract.—The Agency has drawn up a standard form of contract between farmers and buyers of milk which is to be read and used along with the annual price agreement with the Glasgow and District Dairymen's Association. The terms of contract are that the purchaser agrees to buy the whole of the milk produced on the farm in question—except such as is needed for domestic purposes, employees, and stock purposes—for a period of 12 months from November 1; a special clause is inserted to cover the case of farmers who only sell milk in winter or who withdraw from the liquid milk market during certain months. The seller has to state a definite number of gallons for each month as his supply, and is allowed 10 per cent. variation either way. The prices agreed upon for the year 1927-28 are stated: 1s. 3d. per gallon for every month except May, June, and July, when 11d. is the rate. Accounts are to be rendered by the seller, monthly, and the buyer is to pay the Agency by the 15th day of the succeeding month; in certain cases, weekly or fortnightly payments of accounts may be required.

It is at once noticeable that, while registration of all individual contracts with the Agency is compulsory, the contract is still drawn up between individual producers and their customers, and not, as might have been thought, between producer and Agency and then between Agency and buyer. In actual fact, therefore, there remains a double initiative open to the producer: (a) he may find his own market and then register his contract, or (b) he may ask the Agency to find a market for him and it may arrange a contract on his behalf. In both cases, the milk of a producer never loses its identity. The reasons given for this course of action are that it was by

far the clearest and easiest way of inaugurating the scheme, and that it involved no sacrifice of essentials; it fell in with long-established relationships between certain producers and certain customers; and it allowed a recognition of the usual channels of supply; it was, therefore, easy to start and, further, it allowed the Agency to remain free at the beginning from all those problems relating to equipment and plant, such as churns and reception and testing depots, which are inseparably connected with a physical, as distinct from a financial and organizing, pool. Again, it leaves all questions of buyer's complaints to be dealt with as at present, since the buyer is perfectly acquainted with the identity of the supply he is receiving; it leaves the ownership of the milk always clear, and the dairyman conducts his tests as at present. On the other hand, there are naturally certain drawbacks in what is known as a "paper" pool: the actual milk never goes to the organization; it has no check itself on quality and must accept some alternative test, namely, the dairyman's; it is more difficult to deal with large numbers of small supplies going to different dairymen, each preserving its own label, than it would be for the Agency to draw all its members' milk into its own plants, test and treat it, and then sell it under a guarantee. Further, if the Agency took physical control of its supply, it would hold complete marketing initiative, whereas at present it has to recognize the member's action in finding his own market. It may be, of course, that the Agency, as it finds its feet and faces its difficulties, will take more and more actual handling on to its shoulders, especially as in some business dealings, such as export of milk to other areas, it is difficult to see how the Agency could tolerate competition from its own members.

Prices.—The 1927-28 price agreement was signed by the Glasgow and District Dairymen's Association, but not by the Glasgow Wholesale Dealers' Association nor by the Glasgow Co-operative Societies. In many respects it resembles the old collective agreements of this region—it definitely states a producer's price, a wholesale price and a retail price, and it links them together.* The range is:—

	Producer (per gal.) s. d.	Wholesale (per gal.) s. d.	Retail (per gal.) s. d.
All months except May, June,			
July	1 3	1 6½	2 0
May, June, July	11	1 2½	1 8

* See Economic Series No. 16, p. 137.

A Joint Committee of four members of the Agency and four dairymen's representatives has been set up to deal with the working of the settlement.

The prices stated are basic prices and are for milk of an agreed standard, which in some respects may be higher than the minimum legal limits. Differentials may be added or subtracted from this base, which is for milk delivered at the buyer's railway station, or an equivalent service. The differentials mentioned, apart from deductions in respect of short or excess supplies, are :—

- (a) An added 1d. per gallon for certain milk delivered to the dairyman's premises before 6.30 a.m.
- (b) A deduction of 1d. to 1½d. per gallon in cases where the purchaser lifts the milk within 30 miles of Glasgow.
- (c) Special rates for brine-cooled, pasteurized and accommodation milk to be settled by the Joint Committee.
- (d) It is also stated that the Agency, in selling its members' milk, will have regard to special quality such as butter-fat content.

More important, however, than the actual price level, from the standpoint of the position of the Agency, is the basis of mutually exclusive trading laid down in clause 7. "All members of the Dairymen's Association," it runs, "who purchase milk from members of the Agency, undertake to purchase their *whole* requirements of milk from members of the Agency in terms of this Agreement." This is only subject to exception where a dairyman could show that he had before entered into binding contracts, *bona fide*, with parties who are not members of the Agency. The Agency gives an undertaking that its members will not, without the consent of the Joint Committee, sell to any distributor in Glasgow who does not agree to purchase his whole supplies from members of the Agency. It need hardly be pointed out that this is a critical part of the Agreement; it is a protection to the Agency against being used as a cat's-paw in dealings where distributors might attempt to buy only from the Agency such supplies as were necessary to cover fluctuations in their sales. The Distributors' Association does not, of course, guarantee that its members will buy from the Agency, nor does the Agency guarantee that its members will sell only to members of the Dairymen's Association, but each is to use its good offices to assist the other.

There is little doubt that this conception of creating tied dairymen, who have the first right to Agency supplies and who provide a guaranteed market, has greatly assisted the floating of the enterprise, and is a powerful lever in negotiation so long as the Agency can control a substantial portion of

available supplies. It is a matter of interest to see how far it will lead to a clean division between Agency and non-Agency distributors.

Financial Arrangements and "Pooling" Scheme.—The last and, in some ways, the most distinctive feature of the Agency is the compensation scheme to deal with milk not sold in the fluid market. Since distributors must now pay full liquid price for all their milk, it is clear that they will arrange to buy short by contract and then come to the Agency for accommodation supplies when needed. To cover this cost of carrying unsold milk, and working expenses, and to create the necessary reserve funds, members are bound by their contract to submit to a deduction per gallon. There is, of course, no basis upon which this can be closely calculated except experience, but in the first year the amount to be deducted is understood to be 1d. per gallon for individual members and ½d. per gallon for milk which comes through creameries. This deduction applies to all milk normally sold in liquid form; it is not clear whether the same size of deduction would apply if a member sent in milk surplus to his quota to be manufactured by the Agency. The amount of the deduction will ultimately depend upon the amount of milk sold, the basic price for liquid milk, and the prices for milk for manufacture. On a basis of 50,000 gallons per day, however, it is obvious that very considerable sums will be accumulated in the "short" months at the rate of, say, £150 per day. Apart from working expenses and the 5 per cent. rate of interest upon share capital, this accumulation represents the source of the compensation, reserve and development funds. Let it be supposed that the Agency has been left with milk unsold for which it has guaranteed its member the basic price. The Agency then instructs its member to dispatch the milk to the nearest available creamery-member; the latter is bound by its contract within practical limits to accept the milk at a manufacturing price to be fixed by the Committee; the compensation fund makes up the difference between the two prices.

Two matters of business importance evidently arise in this connexion: first, there is the practical question of getting unsold milk to a creamery which is ready to manufacture and which has sufficient capacity to deal with the quantity sent; it may easily happen that the most convenient depot is already busy, but the Agency has a considerable number of creameries upon which it can call. In certain cases, churns have to be provided for transport, and it may be necessary to supplement

the equipment at some depots to increase the capacity for cheese-making.

The second question is the position of the creameries with regard to the manufacturing price for milk and the sale of the milk products. So far, of course, as a creamery is the seller of a standard quantity of milk in the liquid market through the Agency, it must be compensated for unsold margins in exactly the same way as the private member. The manufacturing price is to be fixed by the management committee of the Agency, and it is understood that the index will be a price per gallon corresponding to the price of Scottish cheese per lb., less a deduction for estimated cost of manufacture. Creameries accepting milk at these rates will have freedom to convert it as they choose and the profit will be their own, but they cannot sell it as liquid milk without the consent of the Agency. If a creamery loses money on a transaction with the Agency, it can state its case for a grant or allowance towards loss from the compensation fund.

This method is designed to spread the burden of surplus milk, as defined above, over the whole market and to control its use; it is the belief of those who launched the enterprise that this work can be done more cheaply by the Agency, and that it can use the surplus more profitably than the dairy trade.

It will be some considerable time before any appreciation can be made of the work of this organization, as it has to pass through a complete season before its preliminary measurements can be taken and its value to producers assessed. The new movement, initiated at the right season of short supplies, has, however, got under weigh quite efficiently without throwing marketing out of gear, and it will have gained a certain momentum before it has to spell out its more difficult problems in the spring and summer seasons. Its organizers have shown great energy and sagacity in carrying producers with them by contracts which are binding and in gaining recognition by distributors. The organization will not necessarily remain long in its present form, as it is only feeling its way by experience to the most convenient adjustment of working methods. It may, for example, find it expedient to do away with members' initiative in sale, and it may be necessary to re-define the position of the creameries in the system. Again, the regulation of the standard quantity of milk for sale by members may require revision later. There is, however, nothing in these things which should cause a crisis if the

organization can do its main work of selling milk profitably for its members at a standard price, and of preventing excess supplies from unduly influencing the market.

There are, in addition, other constructive efforts which will proceed from the work of the Agency; its manager has already begun to give special attention to the possibilities of regular export to other areas, such as Lancashire, and it is understood that encouragement will be given to all methods of improving the quality of the output of members, such as clean milk competitions. A further subject of direct interest to the Agency will be milk publicity and all means designed to increase and stimulate consumption.

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AZALEA CULTURE IN BELGIUM

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Azalea indica was introduced into Europe about the beginning of the nineteenth century, the first supplies coming from China and Japan. In England, the first crosses were made by Anderson, of the Chelsea Botanic Gardens, in 1810, and, in France, Loisleur-Deslongchamps effected crosses in 1815. The first azaleas appeared in Belgium in 1819 at the exhibition of the Agricultural and Botanical Society, and the culture developed gradually until, by 1839, Van Houtte's listed 93 varieties. From 1845 until 1895, azalea culture made great strides, the best modern standard varieties being obtained by hybridizers in several countries; and such names as Knight, Perry and Ivery in England, Mardner, Leibig, Schulz and Rose in Germany, and Verschaffelt, Vervaene, Van der Cruyssen, Van Houtte and De Kneef in Belgium, are associated with this progress.² At the present time in Belgium, many hybridizers are especially interested in the development of the azalea, and Haerens of Somerghen, Steyaert of Langerbrugge and Schaepens of Saffelaere have produced some new varieties showing extraordinary quality in the form, size and colour of the flowers.

The Ghent growers recognize two distinct types of azalea; the *indica* type, characterized by fairly large flowers, single or double, and with a small pale green calyx (Fig. 1b); and the *amoena* type, which has flowers only about half the size of *indica*, single, but appearing double owing to the development of the calyx, which is coloured and petaloid, and has attained a

size practically equal to that of the corolla (Fig. 1a). The *amoena* type is particularly free flowering; the plants are grown as small bushes on their own roots, and known in Belgium as "struikjes" and in England as "baby" azaleas. Hybrids have been obtained by crossing these two types with varieties of hardy deciduous species such as *A. pontica*, *A. mollis* and *A. sinensis*, but so far no varieties of special note have been produced.

The Belgian commercial grower is principally concerned with *A. indica*, and it is to this type in particular that the following account refers.

Description and Uses.—These azaleas are essentially glasshouse plants; they are evergreen, and the range of colours now obtained varies from white, through pale pink, rose, red, scarlet, brick red, and bluish red to violet. The flowers may be self-coloured or present pleasing variegations. Both single and double-flowered varieties are grown, and two distinct groups of varieties are cultivated: collection or exhibition varieties, and varieties for general commercial use. The leaf characters of the varieties are fairly distinct and furnish a valuable means of identification in the nurseries, where very few plants are seen in flower, and the growers are so familiar with these characters that very few labels are used. Identification by means of the leaf characters cannot, however, be used for the different sports of any one variety.

Azaleas are used as pot plants for winter gardens, glasshouses, conservatories, rooms and hotels, and are occasionally used as cut flowers. Varieties used for cutting are generally those having medium-sized flowers, and the plants are not severely pruned, but encouraged to grow long shoots. Azaleas in flower may be obtained from the beginning of December until well into May.

Culture.—Amateur and commercial cultivation of azaleas in Belgium has reached a high standard of excellence, probably because the soil and climate are generally suitable, and the Belgian growers have acquired great skill in growing glasshouse plants.

The azalea is perennial, and will flower year after year for upwards of thirty years, provided suitable conditions are maintained.

Under usual cultural practice, the plants are allowed to flower only in alternate years, and this system allows for the operations of repotting and pruning and ensures an abundance of

flowers of good quality and evenness in the flowering years. For amateur culture the plants after flowering are set out of doors in specially prepared beds for three or four months. In the autumn they are potted up and taken into light, well-ventilated greenhouses, where they remain for the winter. In February they are disbudded and pruned if the shoots are too long, and in April they are taken out of doors again and the pots half buried in ashes. They remain in full sunlight until the autumn, when they are put in the greenhouse again. In spring, gentle heat is applied and fairly rapid growth and free flowering takes place. This cycle may be repeated many times.

Commercial Culture.—For commercial culture, systems of wholesale propagation are adopted and a good stock of plants is accumulated. These are taken through cultural cycles similar to that described above and are marketed in the winter before flowering, so that when the plants reach their destination flowers are obtained by gentle heat or forcing, according to the requirements of the trade.

A very light, well-drained, sandy soil with complete absence of chalk or lime is necessary for successful azalea culture, and the growth of the weed Sheep's Sorrel (*Rumex acetosella*) is taken as a useful indicator of soil likely to prove satisfactory. An abundant supply of water is essential, and although rain water is considered best, well water is quite satisfactory, as also is river water, provided it does not contain refuse from chemical factories, waste chemical matter from dye works, or similar impurities.

Beds 4 ft. to 5 ft. wide are laid out side by side, with paths about 18 in. wide between. The edges of the beds are made with boards, tiles or concrete, the last being favoured by progressive growers. A certain amount of soil may be excavated so that the beds are 4 in., 8 in., or 12 in. deep, according to the size of the root and earth mass (the "ball") of the plants to be set. The bottoms of the beds are dug over one spit deep each winter, but no manure is applied, the digging being solely to promote thorough aeration. In spring, the beds are filled with leaf soil; that of oak and beech is preferred, but that of birch and chestnut may be used, although it is considered of second quality. The leaves are raked up in the woods every five or six years and placed on the beds just as collected. Owing to the difficulty of obtaining sufficient quantities of the desired type of leaf soil, pine needles are now being used to increase the bulk of leaf soil, but the results are not considered to equal those obtained where pure leaf soil is used. A certain number of anemones

and other woodland plants may be introduced with the leaf soil, hence, during the summer, several weeding are necessary to keep the beds free from both these and other weeds.

Winter Cultural Treatment.—In the autumn, the azaleas are planted out in the greenhouses on stages, or on the floor, in the leaf soil brought from the outdoor beds. Very large airy houses are now preferred, and a range of the type, shown in Fig. 2, measures about 50 yards long and 50 to 60 yards wide. The houses are generally fitted with hot water systems or hot air flues for heating, although stoves are occasionally found in small nurseries. During the winter, the temperature is maintained between 38° and 42° F., but provided the plants are dormant—there being no young shoots and the buds not breaking—no harm is done if the temperature occasionally falls a little lower. As a rule, the fires are used only when it is freezing outside. The heat in the houses is conserved by means of reed mats which are unrolled in the evenings and rolled up again in the mornings. The houses are aired whenever the temperature is above 32° F.

When the main stock of plants is set out in beds on the floor, large specimens are kept in pots or tubs elevated above the ordinary stock on stout stakes, and very young plants are planted out on light stages with wooden sides and bottoms of slate or asbestos; these stages are suspended from the roof by metal supports. The three types of plants are shown in Fig. 3.

Very little water is given during the winter, but towards the end of February one watering is given every seven to ten days.

Summer Cultural Treatment.—In spring, between April 15 and May 15, the azaleas are removed from the greenhouses and set in the beds out of doors. When planted out early, care is taken to protect the young shoots which have started developing and are susceptible to injury by late frosts. For this purpose, iron frames are fixed over the beds and the reed mats used on the glasshouses are placed over the frames at night. These mats are also used in the daytime to protect the plants from cold, drying winds, and from very powerful sunshine. In the case of severe late frosts after the plants are set out in the spring, glowing coals in suitable receptacles are placed between the beds and covered with wet hay to cause the formation of a dense cloud of smoke over the plants.

Young plants, one and two years old, are planted out in new soil, but for older plants a little of the previous year's

decomposed leaf soil may be added. For very large plants only a little fresh soil is placed round the ball.

A few plants for early forcing and for sale in the autumn may be kept in pots during the summer. This procedure avoids leaf dropping and retardation of plant development which may result from the disturbance of the roots when they are taken from the summer beds.

During the summer, abundant watering is necessary, and about two gallons per square yard of bed is given in the evenings. Various systems of overhead mechanical watering are in use in large nurseries.

The plants remain out all through the summer, receiving necessary pinching out and pruning to retain their general shape. About the beginning of September lifting starts again, and by the middle of October the plants are all removed to the greenhouses. In the case of early frosts, matting is again provided, for frost must not touch the budded and saleable plants, which are now ready for export.

Manuring.—The only manuring which has been found suitable for azaleas is the application of malt culms. Trial applications of chemical manures have invariably proved unsatisfactory, possibly through some detrimental influence to the mycorrhiza on the azalea roots. A trace of sulphate of ammonia, however, applied to forced plants has in some cases been known to improve the size and colour of the flowers, but malt culms are considered the most satisfactory dressing. Some growers apply the malt culms as a top dressing, and others prefer to work them into the soil just before the plants are set out in the out-door beds. Occasionally the amount is divided, half the bulk being worked into the beds and the rest used as a top dressing. Lack of malt culms during and immediately following the war has been thought responsible for the poor vitality of certain varieties, very noticeable for the first few years after the cessation of hostilities.

Pruning : Forms and Shapes.—Azaleas were formerly grown in very regular forms, chiefly umbrella shapes on tall or short stems, tall pyramid or fan shapes, or as tiny bushes branching directly from the ground level. Pruning and pinching must be done according to the shape required. No severe, regular forms are now adopted in Belgium; the growers prefer a loose, more or less irregular, but artistic bush, on a short stalk about 5 in. high for grafted plants, or direct from the soil in the case of plants on their own roots.

The general pruning is performed in winter, from October to February. In this operation the long shoots are shortened to a shapely level, the medium ones have their flower buds removed, and the small branches and the inside branches are removed (Fig. 4). If by planting time or during the summer odd shoots develop rapidly, they are pinched back, but this pinching is never continued after the middle of June, or a dearth of flower buds would result. Where plants are grown for export to France a special frame of stout wire or light iron is placed round the plants and the branches are tied down to this in order to give a pleasing lateral spread to the bushes, a form which is preferred in the French markets.

Propagation.—*By Seeds.*—This is done only to obtain new varieties after crossing two distinct ones in the hope that some of the progeny will combine the desirable characters of both parents. Most of the novelties are secured in this way. In order to obtain fertile seeds, artificial pollination is carried out. The seeds are sown in January in pans of well-decomposed leaf soil mixed with a little sand and kept at a temperature of about 55° F. When the seedlings are big enough they are pricked off and later planted out in the beds. They flower first when about 18 months old. Sports often occur in a number of varieties and some novelties are thus obtained; many of the varieties with picotee edged flowers have been obtained in this manner. When sports are noticed, they are carefully marked and propagated by grafting on ordinary stocks.

By Cuttings.—Although some varieties are propagated by means of cuttings to obtain small plants on their own roots, propagation by cuttings is chiefly used for the raising of stocks. Two species are used for stocks: *Azalea concinna*, a strong grower with great vigour, which is imparted to the graft, but unfortunately rather susceptible to disease; and *A. phoenicea*, which, although much less vigorous, is more resistant to disease, and, in consequence, is used for plants which are to be long-lived as, for example, collection and exhibition varieties.

Cuttings are taken, from October to March, from young plants one to two years old. They are rather soft and about 2 in. long; and, before insertion into the soil, they are plunged into a nicotine bath. Cuttings are raised in small pans, in pots, or, more generally, close together on a stage in soil composed largely of one-year-old leaf soil and sand. The cuttings are spaced about $\frac{1}{2}$ in. apart and inserted about 1 in. in the soil, and are set in such a way that when the lights or sheets of glass are

placed over them to prevent excessive evaporation their leaves touch the glass. The temperature is maintained at from 55° to 60° F., and no air is given for eight to ten days. After 12 to 15 days, air is given for a few hours in the evening, and a light watering is given if the soil is dry. After about seven or eight weeks, the root development is so strong that lights may be entirely dispensed with, and when the plants are sufficiently hardened off they are set out in 3 in. pots (sixties). The strongest cuttings may be grafted in May and the more backward ones in June. Stocks which are intended for tall plants (18 in. to 2 ft. high) remain in the same pots for some time. If cuttings are taken to form plants on their own roots, the tips are pinched out about 3 in. high after the young plants are rooted, while cuttings for stocks are never pinched out, but allowed to run on a single stem until grafting time, when they are from 5 in. to 6 in. high.

By Grafting.—Grafts are taken from plants one to two years old and are $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. long, only the tips of leafy shoots being taken. The method which is used in Belgium is the "*demi-fente en tête*" (Fig. 5). The stock is cut back to a height of about 4 in.; it is then half cleft about $\frac{1}{2}$ in. long to a depth at the top equal to half the thickness of the stock and running out at the base. A strong, well-developed leaf, known as the "*appel-sève*," or sap-drawer, is left at the tip of the stock. The graft is cut into a wedge of about $\frac{1}{2}$ in. long, *i.e.*, the same length as the cleft, the bark being retained on the base. The edge of the wedge is inserted into the cleft and bound in position with cotton thread, once above the leaf-stalk of the "*appel-sève*" and from four to six times below. The grafted plants are placed in a greenhouse, slightly inclined with the graft uppermost, the tips of the leaves touching the glass as for cuttings. Grafting is usually carried out from May to September, but azaleas may be grafted at any time of the year. When done early, artificial light is necessary, and, when done late in summer, shading and abundant moisture must be furnished. The frames are kept closed for three weeks unless it is too hot and damp, when a little air is given. After six to seven weeks the union is complete and the lights are removed. The head of the graft is then pinched back to four or five leaves. The young plants are set out in beds in the open the same year and pinched back once or twice before winter, when they are taken back into the glass-houses. The routine treatment previously described is carried out, and the plants are saleable at three years old.

Varieties.—Although a long list might be made of the varieties of azaleas grown commercially in Belgium, the following are

the varieties most commonly met with, most in demand and most highly recommended:—

“Albert and Elizabeth”: a beautiful sport of the old *Vervaeana*; it has fine, double, white flowers with picotee edge of salmon pink, and can be easily forced. It obtained considerable success in the Ghent Floraries of 1923 and is in great demand in France; it was also given an Award of Merit by the Royal Horticultural Society (England) in 1926.²

“Madam Van der Cruyssen”: a mid-season flowerer, with flowers of a deep rose with darker markings on the upper petal. The colour is excellent both in artificial light and by daylight, and flowering is even and regular over the bushes.

“Empereur du Bresil”: a late variety with double flowers of rose-pink striped with white.

“Pax”: a new variety with double, white flowers and pleasing green foliage. It is extra early and can easily be forced into flower by Christmas.

“Madam Pétrick”: the most popular and most widely cultivated azalea in Belgium, grown as standards and bushes. It is double, of a pleasing rose-pink, and much appreciated in winter. It is a very early flowerer, producing large quantities of buds which open evenly and easily. Several good sports have been produced from this variety, including “Madam Pétrick superba,” with pink and white flowers, and “Madam Pétrick alba,” a good white.

“Niobe”: a fine double flowered white.

“Vervaeana”: an early flowering variety with large double, rose-pink flowers with a white margin to the petals. It has produced many sports, including “Blushing Bride,” “Salmon Pink,” “V. superba,” and “President Oswald de Kerchove.” The last is an early half-double, with flesh-coloured flowers having a white margin.

“Docteur Bergmann”: has double, pinkish-red flowers. It is very early and in great demand.

“Tempérance”: has double, lilac-coloured flowers.

“Triumph”: a very new variety raised by Haerens, bearing large, bluish-red flowers with beautifully waved margins. The variety is very vigorous and full of promise.

“Hexe”: a variety of the *amoena* type, with rather small flowers of a pleasing red colour and a distinctly beautiful shape. This variety is much grown on its own roots and sold in the form of “baby” azaleas.

“Marie Louise”: this resembles the foregoing in many ways, but its flowers are striped white and rose.

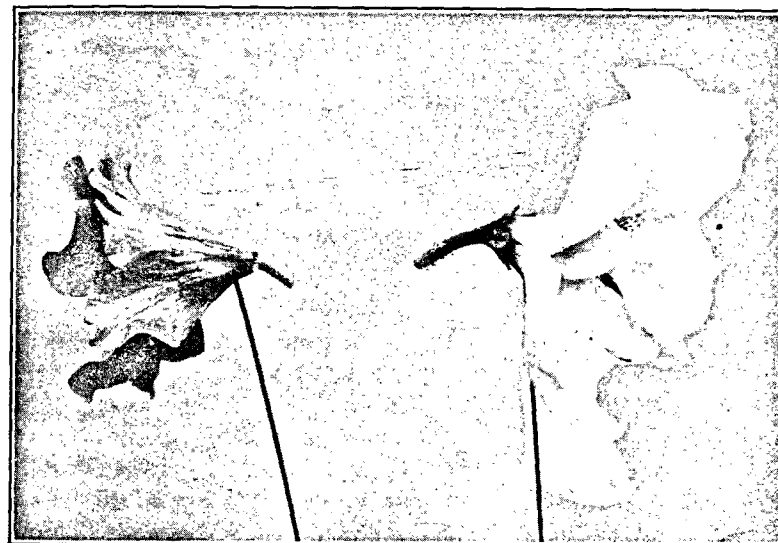


FIG. 1.—Types of Belgian azalea.
(a) The *amoena* type; (b) The *indica* type.

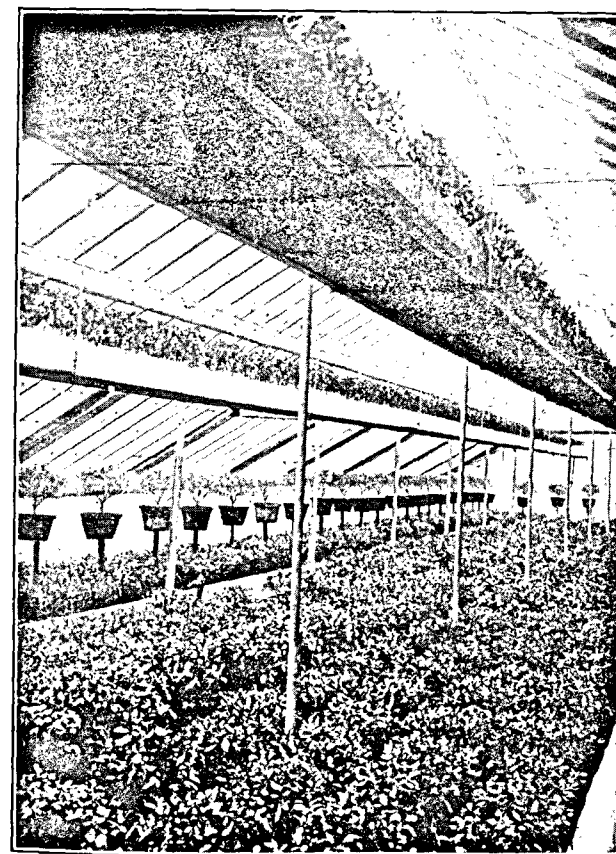


FIG. 3.—Showing three types of winter cultural treatment.
To face page 144.

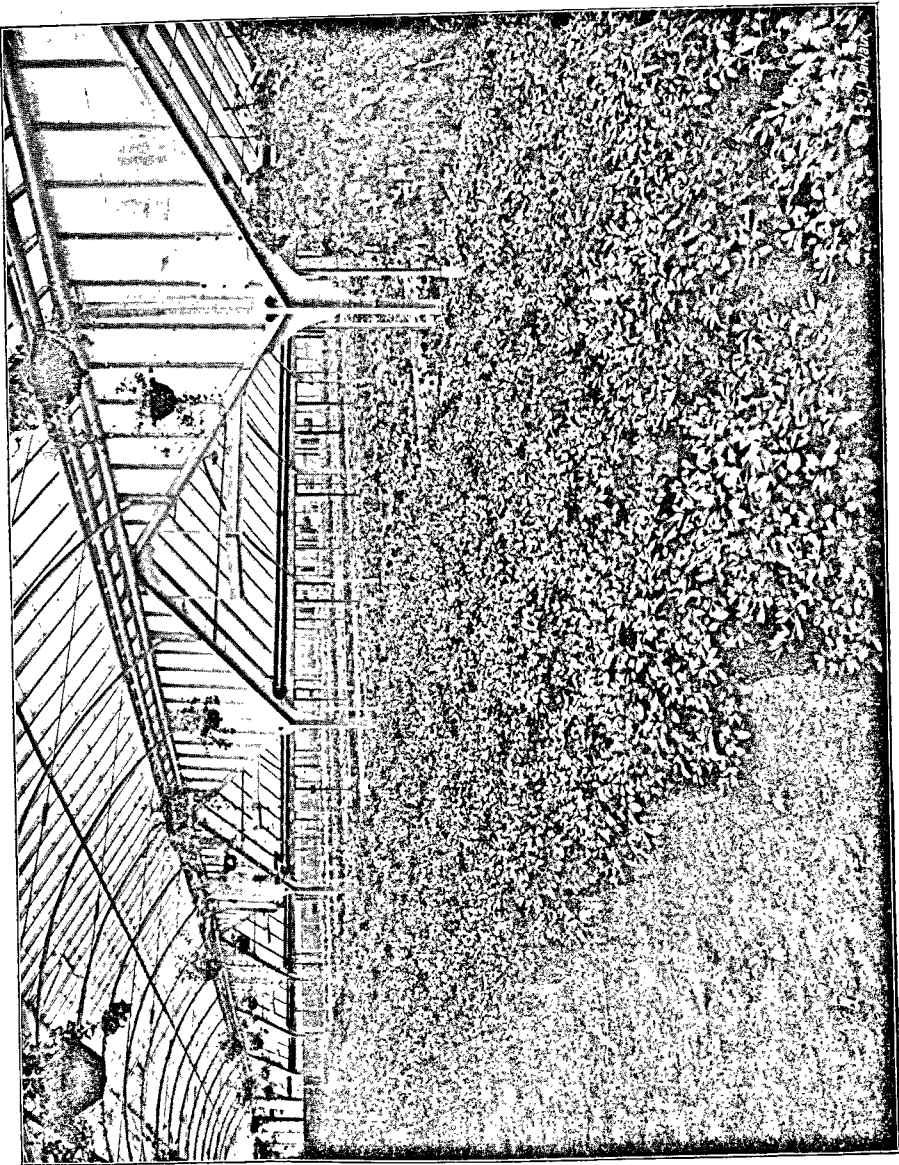


FIG. 2.—Showing type of large glasshouse for winter culture of azaleas.

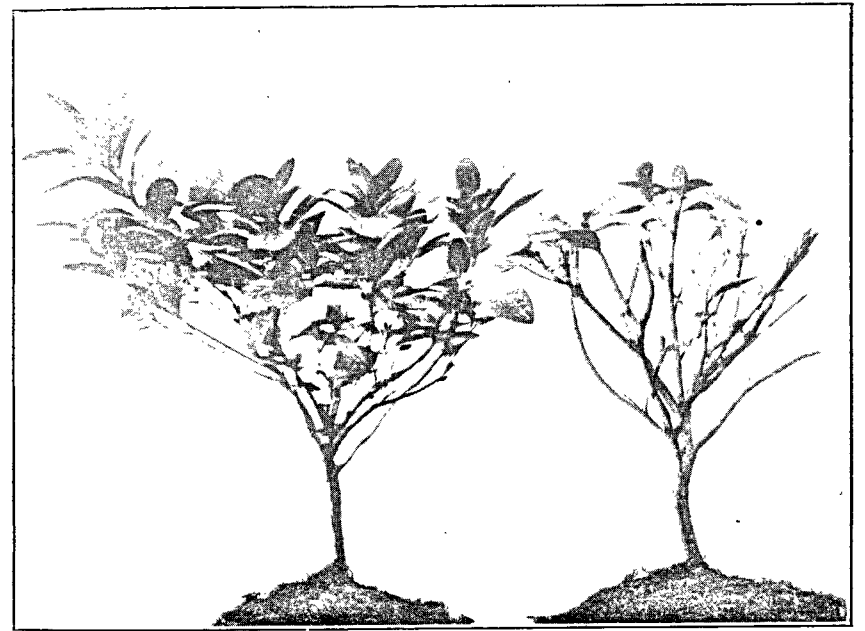


FIG. 4.—Azalea plants before and after pruning.



FIG. 5.—Showing (right to left) (a) stock; (b) stock cut back to receive graft; graft cut to insert; (c) graft in position; (d) young plant after grafting and ready to plant out of doors.

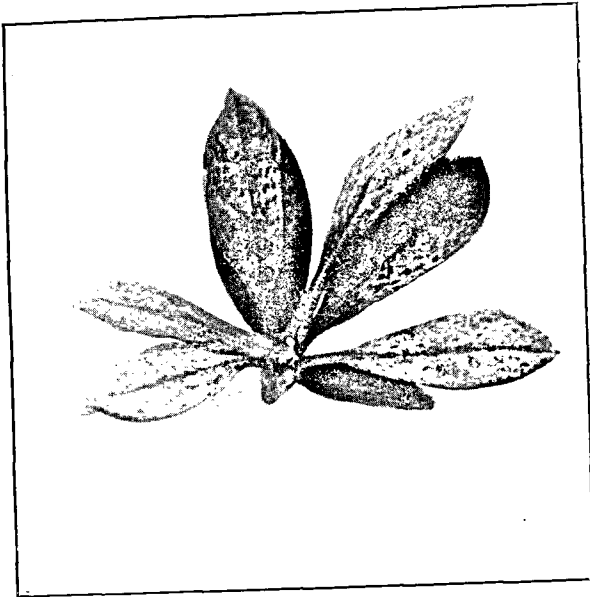


FIG. 6.—Azalea leaves showing result of thrip attack.

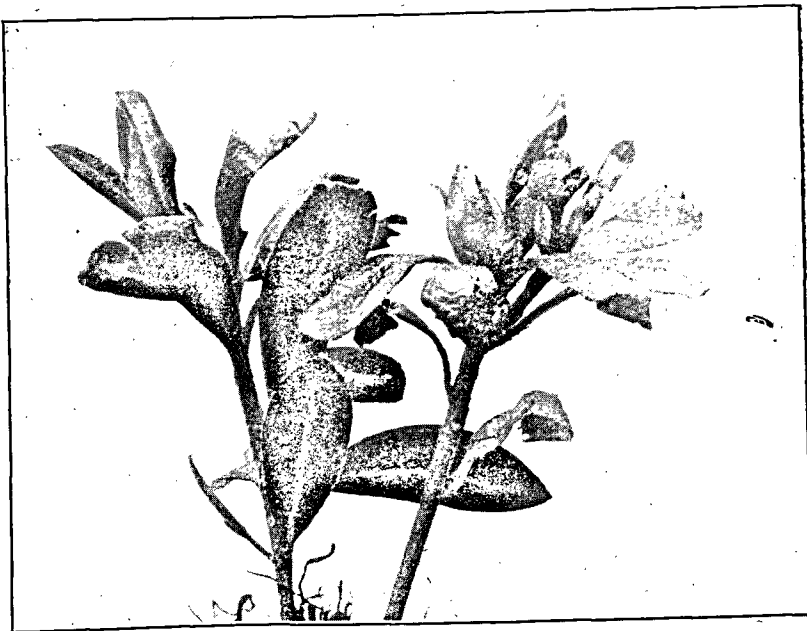


FIG. 7.—Azalea shoots infected by the leaf miner, *Gracillaria azaleella*.

Fungus Diseases.—Stem Canker.—This widespread malady takes the form of a dry rot, which develops in the stem just above the ground level. The tissue beneath the bark becomes blackened and the stem becomes rather loose in the root mass, owing, possibly, to the decomposition of some of the smaller roots. Specimens examined by the Imperial Bureau of Mycology yielded a fungus belonging to the genus *Ramularia* (as defined by Wollenweber). General observations in Belgium indicate that the plants worked on *A. concinna* stocks are more susceptible to the disease than those worked on *A. phoenicea* stocks. Too deep planting and overwatering in summer, and wide ranges of temperature or fluctuating temperatures during the growing period, are thought to encourage the trouble. Up to the present, no control treatment has been found satisfactory, and each year vast numbers of plants are lost and many others are rendered unsuitable for export.

Septoria azaleae, Vogl.—This fungus develops on the leaves of some varieties, particularly on the well-known and popular variety, “Madam Pétrick,” where it was so widespread for a year or two after the war that it was known for a time as the “Pétrick disease.” In autumn, the attacked leaves show brown patches of dead tissue, more or less circular in outline. When infected plants are forced, extensive leaf-dropping occurs and the flowers scarcely open; or, in the case of “Madam Pétrick,” when they do open, instead of the red flowers characteristic of this variety, small, dirty-white or sickly light-red flowers are produced. Many other varieties are attacked, but do not suffer to the same extent as does “Madam Pétrick.” This disease has recently attracted attention in Germany.³ Preventive measures include the use of clean stock, grafts taken from healthy plants, and spraying during the summer with lime-sulphur.⁴

Exobasidium Vaccinii (Fuckel) Woron.—The characteristic hypertrophy caused by this parasite appears on the leaves in February and continues to appear until May. Leaves, flowers and tips of young shoots are completely deformed, and certain varieties, notably “Niobe,” “Deutsche Perle” and “Professor Wolters” are particularly susceptible to attack. The infected parts are cut out and burnt periodically from the time of the first appearance of the disease. Weak solutions of Bordeaux mixture are used by some growers, who claim to have secured good results. Where much pine needle soil is used the disease seems to be more prevalent.

Insect Pests.—Thrips (*Heliothrips haemorrhoidalis*, Bché).—These insects appear on the plants when the conditions are

dry, or in winter on plants placed near the hot water pipes. The pest is most serious in poorly ventilated houses, and often causes injury to plants kept too long in the houses. Young plants on the suspended beds are also frequently attacked. All stages of the pest may be present, and, where the insects have been feeding, the leaves become mottled and discoloured by the characteristic excrement (Fig. 6). As a general preventive measure, the plants are dipped, in winter after pruning, in a mixture of soap, flowers of sulphur, chalk and nicotine, with water as a diluent. Grafts are generally dipped in nicotine soap wash or in a suspension of pyrethrum before use.

White Fly (*Trialeurodes vaporariorum*).—This pest appears in spring when the plants are indoors, chiefly on the varieties which have hairy leaves. Periodic fumigation with smouldering tobacco refuse is said to keep the pest in check.

Surface Larvae.—The caterpillars of a Noctuid moth sometimes cause injury to the young leaves and shoots in the early spring. Hand picking the caterpillars is resorted to as soon as they begin to appear in February.

Azalea Tortrix (? *Acalla schalleriana*, Linn.)—The larvae of Tortrix species spin the young leaves about the buds and feed inside the shelter thus formed, causing much damage to the young flower buds. Hand picking the attacked portions and spraying with arsenate of lead are the control measures usually adopted.

Azalea Leaf Miner (*Gracillaria azaleella*, Brants.)—The small larvae of this moth are by far the most serious pest of azaleas in Belgium, and are responsible for considerable annual losses to the commercial growers. The pest appears chiefly in July and August, and causes extensive leaf injury while the plants are out of doors. When the plants are taken indoors in the autumn, larvae and pupae are taken in on the infested shoots, and these continue their development, so that in the warmer houses, where mixed cultures occur, adults, larvae and pupae may be taken in February, and, in the normal cool cultures, adults can be taken in November and December, and larvae in various stages from January onwards. Hodson has recently described the life history of the species, as studied from material imported from Belgium.⁵ The young larvae cause small brown, elongated blisters, usually starting near a vein. When about one-third grown, the larvae leave these blisters, pass to other leaves, fasten down the edges and feed under the shelter on the leaf tissue. The upper epidermis

turns brown and the presence of such leaves disfigures the plants (Fig. 7). Attacked bushes are to some extent defoliated, and this, together with the blistering and browning of the tips, reduces their market value. Most varieties of *Azalea indita* are attacked, and "Hexe" of the *amoena* type is particularly susceptible. Persistent spraying with arsenate of lead is carried out both out of doors and under glass, but, owing to the habits of the larvae, this does not afford a satisfactory means of control. Experiments with various insecticides are now being carried out by the Belgian Phytopathological Service.

In conclusion, the writer takes this opportunity of expressing his sincere thanks to Dr. Van Orshoven, Director of Horticulture for the Belgian Ministry of Agriculture, and Dr. D. Van Hove, Chief of the Phytopathological Service, for their assistance in various ways during his visits to Belgium, and to the latter for supplying information concerning the pests and diseases of azaleas. Thanks must also be expressed to Mons. O. F. Wuyts, also of the Phytopathological Service, for kindly explaining and demonstrating the methods of propagation.

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WEEDS OF ARABLE LAND—II*

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Damage Done by Weeds.—The most serious objections to weeds may be summarized as follows :—

- (1) They absorb from the soil, moisture and plant food which would otherwise go to nourish and increase the crop which is being grown.
- (2) They "crowd" the crop and shade it from sunlight, which is essential for healthy growth. The growth of the plants is thus hampered during early life, especially in the case of crops which mature slowly. Weeds also prevent free circulation of air amongst the crop plants, thus retarding ripening and drying, particularly in the case of corn crops.
- (3) Weeds, especially such climbing kinds as bindweed and cleavers, hamper harvesting of corn crops, both as regards cutting and drying.
- (4) Weeds interfere with, and render more expensive, proper and thorough cultivation, and the "singling" of root crops.

*See this JOURNAL for April, p. 50 for the first article. These articles will embody material from certain leaflets issued by the Ministry.

- (5) Weeds may harbour, or favour the development of, insect and fungus pests.
- (6) The value of samples of cereals is reduced by the presence of cockle, garlic, cleavers and wild vetch; the value of most farm seeds is lowered by the presence of the seeds of weeds; and the market value of hay and other farm produce is similarly reduced by the presence of certain weeds or their seeds.
- (7) Some weeds—*e.g.*, garlic—taint the milk of cows which eat them, whilst others—*e.g.*, meadow saffron and water hemlock—are poisonous to stock generally.
- (8) Other weeds (dodder, broomrape, yellow rattle) are parasitic or semi-parasitic, and obtain their food by direct robbery of the crops they infest.
- (9) The underground stems and roots of weeds may cause the stoppage of drains.

All farmers will admit that it is impossible to obtain the best returns from the land when weeds are allowed to grow unchecked, but many do not appear to realize the full extent of the loss for which weeds are responsible. It was estimated before the War that about 16½ million pounds sterling per annum were lost by farmers in Great Britain in growing (and getting rid of) weeds. Owing to the higher cost of labour, seeds, etc., this figure must undoubtedly be now much increased. The loss is certainly much greater than it need be, because, in many cases, the best methods of prevention and eradication are not systematically practised.

Weeds as Indicators of Soil Condition.—Plants have developed in such a way that they have come to favour certain conditions of soil and climate. Our wild plants vary much in their requirements—so much so that some species which flourish in one situation would scarcely survive in another. The chalk downs, for example, are usually alkaline, whereas peat moors are sour or acid. Sandy soils are very permeable to water, and are liable to dry out and “burn” rapidly in hot weather, while clay soils are retentive of moisture, though if not properly drained they may become stagnant and sour. The natural flora of the different soil formations varies as widely as the soils, but good, fertile, well-drained loams containing an adequate supply, but not a superabundance, of lime, may be expected to sustain in moderate luxuriance many weeds which are “natural” to a given soil formation. Nevertheless, many weeds tend to disappear when a very chalky, very peaty, very sandy or very clayey soil is put through a course of treatment directed to improve it agriculturally. Many species of plants, of course, can tolerate widely differing soil conditions, though it is well known that some can scarcely exist in the presence of plenty of lime, while others are at their best on the chalk; some are moisture-loving and only thrive on

heavy land which is naturally retentive of water, or is waterlogged, while others are most successful in maintaining a vigorous existence on open and sandy soils. In practice there may be some variation in the course of years in the plants which are found on a given soil. For example, an application of lime may result in the practical disappearance of spurrey, but leaching by rain carrying carbon dioxide may reduce the lime to such an extent that the soil may again carry the weed in plenty. The point here, then, would be to maintain the lime content of the soil by repeated applications at desirable intervals. Reduction in the lime content of the upper layers of soil may occur even in soils overlying chalk. On Farthing Down, Coulsdon, Surrey, the total carbonate content of the upper 3 in. of soil is stated* to be less than 0.02 per cent., whereas at a depth of 9 in. 82 per cent. of the dry weight of the soil consists of carbonates. This excessive reduction of lime may, in some cases, be counteracted to a small extent by plants themselves bringing up lime from below, and by the action of earthworms in bringing lime to the surface in castings. The facts, however, emphasize the need for keeping close watch on the lime needs of farm land. The loss of nitrates, phosphates and potash by leaching similarly need special notice.

It may perhaps be suggested that, in general, weeds afford a very fair indication of the character of the soil on which they grow, and to some extent the state of fertility or otherwise of the land. For example, it is well known that mosses, horsetail, rushes, sedges, silver-weed and other plants chiefly grow upon wet undrained land. Quaking grass, oxeye daisy, Yorkshire fog, sterile brome and other plants indicate poor soils. Stinging nettles, certain thistles, buttercups, coltsfoot and others usually occur on good land. It may perhaps be said as a general rule that the weeds referred to below indicate the type of soil under which they are grouped:—

<i>Damp Soils</i>	<i>Poor Soils</i>	<i>Good or Loamy Soils</i>
Rushes	Quaking Grass	Buttercups
Certain Sedges	Yorkshire Fog	Certain Thistles
Horsetails	Sterile Brome Grass	Coltsfoot
Silver-weed	Oxeye Daisy	Stinging Nettles
Tussock Grass	(Absence of Clover)	Groundsel
Certain Mosses	Dyer's Green-weed	Goosefoot or Fat Hen
Cowslips	Sheep's Sorrel	Cleavers
Butter-bur	Rest Harrow	Dandelion
Knot-Grass	Spurrey	Chickweed
Lady's Smock	Ragwort	Sow Thistle
Meadow Sweet		
Ragged Robin		

* Violet L. Anderson, *Science Progress*, January, 1928, p. 448.

<i>Calcareous Soils</i>	<i>Soils in need of Lime</i>	<i>Heavy Land</i>
Burnet	Bracken	Coltsfoot
Chicory	Spurrey	Couch
Viper's Bugloss	Sheep's Sorrel	Horsetails
Stemless Thistle	Corn Marigold	Creeping Buttercup
Bladder Campion	Cornflower	Dandelion
Wild Thyme	Field Bindweed	Silver-weed
	Oxeye Daisy	

It is, however, not to be taken for granted that a soil is poor merely because certain of the weeds included in the above list are plentiful; the list given is not arbitrary, but general and suggestive. The character of the land is not only indicated in some sense by the weeds which are present, but largely also by the extent to which they appear and their manner of growth. Large, strong thistles, for example, and large elegant buttercups and cowslips only grow on good land—on poor land such plants will generally be much smaller or stunted in growth.

How Weeds are Distributed.—We may usefully regard weeds as divisible into three classes, Annuals, Biennials and Perennials, and an understanding as to what these mean and the principles they involve will be of use in enabling us the more successfully to combat weeds.

Annuals are plants which grow from seed which is, in general, produced the year before, and they attain maturity, produce flowers and seeds, and die the same season. Among annual weeds may be mentioned poppies, charlock, corn cockle, spurrey, groundsel, clover dodder, cleavers. Some plants, such as chickweed and groundsel, which are capable of producing several generations in one season, are frequently termed "ephemerals."

Biennials include all plants which grow from seed and complete their life cycle in two seasons. The first year they spend in establishing themselves in the soil, and in the second year produce flowers and seeds and then die. In any season, therefore, will be found plants of one year's and of two years' growth, the former being immature, while the latter at the right period will flower and seed. Examples of biennial weeds are marsh thistle, burdock, hemlock and foxglove.

Perennials are those plants which live and continue to produce flowers and seeds for a number of years in succession; they grow from seed, and may be propagated and spread by means of their rootstock and other organs. Examples are couch grass, coltsfoot, ox-eye daisy, creeping buttercup,

creeping thistle, knapweed, yarrow, bindweed and stinging nettles.

Before the suppression of weeds can be intelligently taken in hand, it is essential to have a clear conception of the manner in which weeds obtain access to the farm, and the methods by which they are spread broadcast amongst cultivated crops. The means of distribution of the three classes of weeds are very varied, but amongst the commoner ways may be mentioned:—

- (a) *Distribution by Natural Seeding and by the Wind.*—In the ordinary course of events, weeds produce seeds at their normal seasons, such seeds being naturally distributed over a narrow or wide area according to certain botanical characters of the plant. Many seed-vessels are so constructed that on ripening they split and throw out their seed with considerable force, projecting it to a distance from the parent plant. In addition to the transport of seeds by the wind, may be mentioned the conveyance by rivers, streams, heavy rains, and floods which often wash seeds away from the parent plants and carry them long distances. Many seeds, like those of the poppy, are so small that they are readily blown considerable distances from the parent plant. Some seeds, such as those of the thistle, groundsel, etc., are rendered buoyant by flight-organs or parachute-like arrangements of fluffy hairs attached to the fruits, and are easily carried about in a light breeze. In other cases, as hogweed, dock, etc., flattened, wing-like projections occur which serve the same purpose.
- (b) *Distribution by means of Farmyard Manure.*—Screenings from thrashing and winnowing machines, and sweepings from barns and hay-lofts, often find their way to the manure heap, while manure from cattle fed on inferior hay is also likely to contain weed-seeds. Many seeds of weeds may be uninjured by the heat of fermentation, and will in due course pass on to the fields. Some seeds may even germinate better after lying in the manure heap, or after passing through the stomach of an animal. Well-rotted farmyard manure will contain fewer germinable weed seeds than fresh manure, and is, therefore, less liable to introduce weeds.
- (c) *Distribution by the Use of Impure Seed* is a potent means of introducing weeds to a farm. Either through carelessness or inadvertence weed seeds are introduced into fields at the time these are seeded for a crop. Some samples of agricultural seeds contain large numbers of weed seeds; these are thus sown with the good seed, after which, in many cases, "the tares and the wheat" must grow together until the harvest. Although such distribution of weeds is doubtless generally due to carelessness, it is also perhaps frequently to be attributed—despite the extension of present-day knowledge—to ignorance on the part of those chiefly concerned. Seedsmen worthy of the name supply good clean seed, but too many imperfectly cleaned lots of seeds are used, particularly in the case of seed, purchased direct from another farm. Anyone found supplying samples of seed below the permissible minima of purity and germinating capacity should be avoided. The presence of 1 per cent. of

	No. of flowers to each plant	No. of seeds to each flower*	Total seeds for a single plant
Common Groundsel (<i>Senecio vulgaris</i>)	30	10	300 a
" " "	—	—	20,000 c
" " "	130	—	6,500 d
Corn Cockle (<i>Agrostemma githago</i>) ..	10	40	400 a
" " "	7	—	2,590 d
Sow Thistle (<i>Sonchus arvensis</i>) ..	—	—	3,000 b
" " "	190	—	19,000 d
" " "	—	—	8,169 e
Fool's Parsley (<i>Aethusa cynapium</i>) ..	300	2	600 a
" " "	—	—	6,000 c
Wild Carrot (<i>Daucus carota</i>) ..	600	2	1,200 a
" " "	—	—	4,000-110,000 b
Poppy (<i>Papaver rhæas</i>) ..	100	—	50,000 d
" (<i>P. dubium</i>) ..	—	—	60,000 c
Charlock (<i>Sinapis arvensis</i>) ..	400	—	4,000 d
" " "	—	—	1,192 e
Dandelion (<i>Taraxacum officinale</i>) ..	27	200	5,400
" " "	—	—	3,153 e
Oxeye Daisy (<i>Chrysanthemum leucanthemum</i>) ..	—	—	1,300-26,000 b
" " "	—	—	1,300-4,000 e
Scentless Mayweed (<i>Matricaria inodora</i>) ..	—	—	310,000 b'
" " "	—	—	34,478 e
Broom rape ..	—	Several hundreds	Many thousands f
Dodder ..	—	4	Very large numbers
Narrow-leaved Plantain (<i>Plantago lanceolata</i>) ..	—	—	2,500-15,000 b
Bindweed (<i>Convolvulus arvensis</i>) ..	—	—	600 c
Cleavers (<i>Galium aparine</i>) ..	—	—	1,100 c
Chickweed (<i>Stellaria media</i>) ..	50	—	500 d
Coltsfoot (<i>Tussilago farfara</i>) ..	—	—	5,000 c
Corn Marigold (<i>Chrysanthemum. segetum</i>) ..	—	—	13,500 c
Burdock (<i>Arcium lappa</i>) ..	—	—	24,520 c
Shepherd's Purse (<i>Capsella bursa-pastoris</i>) ..	—	—	4,500 c
Goosefoot, Fat Hen (<i>Chenopodium album</i>) ..	—	—	3,123 e

In the case of Composites (such as *Senecis*, *Sonchus*, etc.) the capitulum or flower head is intended.

a Morton's *Cyclopædia of Agriculture*, 1856, vol. ii, p. 1116.

b H. Dorph-Petersen, Director, Danish Seed Control Station. See *Landsmandsblade*, No. 47, 1906; also *Mitt. der Deut. Land-Gesell.*, December 12, 1906, p. 474.

c Maier-Bode, *Die Bekämpfung der Acker-Unkräuter*, 1908.

d Dr. Fr. Nobbe, *Handbuch der Samenkunde*, 1876.

e E. Korsmo, *Kampen mod Ugræsset*, 1906.

f P. Sorauer, *Pflanzenkrankheiten*.

dock seed in a mixture of grass and clover seed means ten or more dock seeds per square yard all over the field, wherever such a sample is sown at the ordinary rate for leys.

- (d) *Broken Pieces of Roots or Rhizomes*.—Some weeds—e.g., creeping thistle, couch, field bindweed, onion couch—are spread by means of broken portions of the rootstock, which may be carried from field to field or farm to farm in a variety of ways.
- (e) *Farm Machinery and Implements*.—Machines such as self-binders and travelling thrashing machines are often responsible for the wide distribution of weed seeds which are carried on the machines and also in the mud picked up by the wheels.
- (f) *The Fruits and Seeds of Certain Weeds*—e.g., burdock, corn buttercup, wild carrot and cleavers—are covered with hooks by which they fasten on to the wool and hairs of animals or the clothes of human beings, and may thus be carried considerable distances.
- (g) *Birds and Animals*.—Birds frequently carry succulent fruits and seeds to favourite positions in order to eat them at leisure, and in various ways leave or lose them. Squirrels, mice and other seed- or fruit-eating animals also aid in the distribution of plants in a similar manner. Many weed seeds are eaten by animals and birds and ejected with their germinating capacity unharmed; in this way they may be spread over a wide area.

Number of Weed Seeds Produced.—In view of what has been said about the manner in which weeds are spread, it is of interest to record the number of seeds produced by a single flower or plant of various weeds. The table on p. 152 shows at a glance that many weeds produce a prodigious number of seeds, affording a striking example of the harm a single plant may do. One need no longer wonder at the rapid increase and distribution of weeds when no care is taken to keep them within bounds. The number of seeds largely depends on the size of the plants examined. The different figures given for the same plant are the result of separate investigation by different authors.

A good example of the manner in which seeds may be spread was that of a large site at the end of the Strand, in London, which was for many years unoccupied by buildings. It was found during the summer of 1907, by a botanical representative of *The Graphic*,* that no fewer than 55 species of plants had become established since the old buildings had been removed some years previously. These may have been brought by the wind, or by birds, or introduced with rubbish, the contents of window-boxes and horses' nose-bags.

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* *Journal of Horticulture*, August 8, 1907.

EGG MARKETING REFORM: THE APPROVED SCHEME *

A SCHEME to give a better service of home-produced eggs to distributors in the large consuming centres, and to help home produce to capture ground held by imports, has been adopted by the Poultry Advisory Committee of the Ministry of Agriculture and Fisheries. This Committee includes representatives of the National Farmers' Union, the National Poultry Council, and of organizations of distributors and others concerned.

The scheme involves legislation, action by the Minister pursuant thereto, and action by the industry. The Minister has accepted the Committee's recommendations, and a Bill, entitled the Agricultural Produce (Grading and Marking) Bill, which will give effect to the main features of the scheme, is now before Parliament.

1. Grading.—Grades for hen and duck eggs are to be named and defined by the Minister by regulation. Grading will be optional, but it will be a breach of warranty if any eggs are sold under the grade names and fail to conform to the specifications laid down.

For hen eggs,† the specifications will be as follows:—

<i>Specials</i>	..	<i>First Quality</i> eggs weighing 17 lb. or more per 120. No 12 eggs to weigh less than 26½ oz.
<i>Standards</i>	..	<i>First Quality</i> eggs weighing 15½ lb. per 120. No 12 eggs to weigh less than 24 oz.
<i>Mediums</i>	..	<i>First Quality</i> eggs weighing 14 lb. per 120. No 12 eggs to weigh less than 21½ oz.
<i>Smalls</i>	..	Ungraded <i>First Quality</i> eggs weighing less than 21½ oz. per dozen.

N.B.—Definition of *First Quality*.—Eggs of which the shell is clean and sound, the yolk translucent or faintly, but not clearly, visible, the white translucent and firm, and the air space does not exceed ¼ in. in depth.

These standard grades have been arrived at with due regard to trade demand, to the character of home produce and to the competition of imported supplies. Eggs ungraded as to weight may, if desired, be sold as *First Quality*, provided they conform to the definition given above.

2. The National Mark.—The Bill authorizes the Minister to prescribe a national mark for use as a label on packages of home-produced eggs. National marks are common on Dominion and foreign produce of various kinds on the English market, and the trade is accustomed to them. Their use is only

* Ministry of Agriculture and Fisheries, Marketing Leaflet No. 6.

† Grades for duck eggs will be announced later.

authorized on goods that reach a prescribed standard of quality. A national mark on home produce will in the same way provide an outward and visible sign of guaranteed origin and reliability; it will give the distributive trades in the large centres of population a token which will engender confidence, and confidence begets business.

The idea of a national mark is thus bound up with the needs of the wholesale market. It also arises from the necessity of devising some means of accelerating the adoption of a standardization policy for home produce, having regard to the competition of imported eggs, of which nearly 3,000 million annually change hands in the large consuming centres of this country. The best accelerator is to create a demand for standardized English produce, and the best way of doing this is to market such produce under a badge, a national mark, which will be a popular guarantee to buyers, easy to see, easy to understand, with a goodwill value based both on national sentiment and on trade efficiency. Further, if, as is the intention, the same national design is used on packages of English fruit as on English eggs, and, later, on English poultry and so on, then standardized English products will advertise one another, and a snowball demand will be created for the best quality produce of our own farms and orchards.

Like grading itself, the use of the national mark will be wholly voluntary, but, obviously, a mark which will, in time, come to mean so much for English agriculture must, from the start, be carefully safeguarded against misuse. In order to give confidence to buyers, only those persons and organizations will be authorized to use it who are in a position to conform to certain conditions calculated to ensure *efficiency* and who are ready to submit to a voluntary control for that purpose. Thus it will be necessary that the national mark label should show not only the grade of the contents of any package to which it may be applied, but also the registered number of the packer, so that complaints in regard to produce marketed under the national mark can be followed up. The ultimate penalty for carelessness will be withdrawal of the right to use the mark. A National Mark Committee will be appointed by the Minister to control the use of the mark, to confer the right to use it, and to withdraw the right when necessary. This Committee will be advised by Committees representative of the various commodity interests.

3. Qualifications for Use of the National Mark.—As explained above, it is essential that the national mark should be a

guarantee of trade efficiency. It is proposed, therefore, that no person or organization shall be allowed to use the national mark unless :—

- (a) The minimum quantity of produce dealt with weekly by the said person or organization is 30 cases of hen eggs, each containing 360 eggs, except during the months of October, November and December, when the number of cases shall not be less than 10 weekly, exclusive of duck eggs.
- (b) The premises used are clean and dry, and provided with suitable and adequate accommodation and equipment.
- (c) The person or organization concerned undertakes to :—
 - (i) candle all eggs *singly* before a strong artificial light within 48 hours of despatch ;
 - (ii) grade all eggs by size according to national weight and quality grades ;
 - (iii) pack hen and duck eggs separately, only one grade of eggs to be packed in a case ;
 - (iv) pack in new, non-returnable packages exclusively—i.e., 30-dozen cases with woodwool packing or 30-dozen cubicle cases with fillers and flats, the types to be those recommended in Marketing Leaflet No. 5 or any type that may be approved. (In exceptional cases, packers may be allowed to use returnables. This concession will only be given for a period of 12 months, subject to renewal for a further period not exceeding four years in all. The concession will also be conditional on the cases being marked on the sides with the packer's name and address and the case number, the type of case being approved, the national mark being renewed on each consignment of eggs, the cases being maintained in good repair, and they and the fittings or packing materials being clean, dry and odourless) ;
 - (v) allow the premises concerned to be inspected at any reasonable time by duly authorized persons ;
 - (vi) become a member of any area association that may be formed (*see later*).

4. Explanations.—The reasons for conditions (a), (c), (i) and (c) (iv) are given below. The other conditions are self-explanatory.

(a) *The quantity qualification.*—Considerable developments have taken place in the technique of preparing eggs for market. Candling is a highly-skilled operation which requires much experience ; grading and packing call for skilful and practised handling if they are to be done rapidly and well ; finally, special equipment is required. There must, therefore, be a sufficient volume of business to enable expert operators to be employed. Volume is also necessary to ensure economical transportation. Further, since imported eggs are marketed in large, standardized consignments which are easy to handle and easy to sell, units operating under the national mark must be in a position to offer standardized supplies continuously and in commercial quantities. The trade has a right to expect

business efficiency from users of the national mark, and business efficiency includes ability to meet all reasonable demands for all grades at all times and at short notice. The quantity qualification represents the smallest unit that can be contemplated for this service.

(c) (i) *Single-candling.*—Eggs must be candled singly if a high standard of quality is to be guaranteed, and the minor blemishes, *e.g.*, small blood spots, as well as the more serious defects, are to be eliminated. For this purpose, each egg should be rotated sharply during candling, and receive the undivided attention of the operator. Mass-candling is not sufficient. With practice, single-candling is very rapid.

(c) (iv) *Non-returnable cases.*—The use of the returnable package has long been a serious handicap to home produce in competition with imported supplies. The adoption of new, clean, non-returnable packages will lift the trade in home-produced eggs on to a higher plane, and is an essential part of the movement to give a better service of home-produced supplies to distributors in the towns and cities. Retailers' organizations have already resolved to make some recognition in price for eggs supplied in non-returnables (*see Marketing Leaflet No. 5*). If account is taken of the higher initial cost of returnables, of the multiplication necessary, of the cost of repairs, of the higher transport cost due to greater weight, of the work involved in keeping trace of the boxes, of the charges paid, directly or indirectly, by the sender for their return, and of the cost of collecting the empties from a railway station, the increased cost of non-returnables is more apparent than real. The practice of selling the case with the eggs will certainly, in the long run, be to the advantage of the packer and to the industry generally. Non-returnables are now obtainable in England at the same price as in Northern Ireland, where their use in the wholesale egg trade is compulsory.

Provision has been made in the scheme for the use of returnables when the circumstances are exceptional as, for example, when packers already have large supplies of returnables in stock.

5. Preliminary Organization.—Briefly, the objective is to ensure that, at least in the "exporting" areas of England and Wales where production exceeds local requirements, supplies will so far as practicable be marketed through egg-packing stations where they can be assembled and handled efficiently in bulk and transferred promptly and economically to the centres of demand. Egg-packing stations have already

been established in many parts of the country by individuals and firms and, in a few cases, by producers' co-operative societies.* Where the work is being done efficiently, it is not proposed that new stations should be set up in opposition; on the contrary, it is desired to secure the interest and support of established businesses in order not to disturb the course of trade or the customary relations between sellers and buyers. But, although a nucleus of efficient stations exists, the establishment of others is important. One point for consideration in this connexion is the possibility of encouraging farmers' societies to open up egg-packing stations on approved lines. Another possibility is that of inducing the larger egg auctioneers to pool, grade and pack to standards all supplies sent in before offering them under the hammer. The Roermond Auction in Holland has an egg turnover of 100 millions a year on these lines. In all cases it would be an advantage if the producer were paid for ungraded supplies on the basis of the grading-out results of his own consignment; failing this, the disposal of ungraded eggs by weight is an alternative that should be considered.

The procedure for the registration of approved egg-packing stations qualified to use the national mark has been agreed as follows :—

- (a) County Branches N.F.U., in conjunction with local poultry societies and any other local interests, to prepare a roll of "accredited country packers" and to give each a registered number. The intention to prepare such a roll to be advertised locally and applications for enrolment invited.
- (b) Existing co-operative depots and any that may be formed in future, also large-scale producers, to be eligible for enrolment as well as trade buyers, but no person or organization to be enrolled unless qualified to use the national mark by reason of turnover and condition of premises (*see 3 (a) and (b) above*) and of the undertaking regarding technique (*see 3 (c) above*).
- (c) Each County Branch N.F.U. to give due publicity to the names on its roll; so far as practicable producers who customarily sell their eggs wholesale to give voluntary support to the scheme by dealing with "accredited packers."
- (d) Each County Branch N.F.U., whether directly or as may be arranged later, to recommend the names on its roll to the National Mark Committee, which would grant directly to each packer so accredited the right to use the mark so long as he observes the undertakings given to the County Branch on accrediting. The County Branch to be informed of any case in which the right to use the mark is subsequently withdrawn by the Committee.

* The egg-packing station of the Gloucester Fruit and Vegetable Marketing Society at Cheltenham is an example of a co-operative station working on sound lines.

- (e) The National Mark Committee to take corresponding steps to prepare a roll of "accredited town packers," i.e., wholesale buyers or salesmen who operate in large consuming centres, who receive supplies from all directions and cannot, therefore, be brought into gear with county arrangements based on one area of supply. The National Mark Committee to grant the right to use the mark to accredited town packers, subject to the observance of the same conditions as those laid down for country packers, including (3 (c) (vi)) above where applicable, a further condition to be that packers undertake to join any central federation of packers that may be formed—*see later*. Admission to and removals from this roll to be given such publicity as may be necessary.

6. Future Development.—Accredited packers in any district will have a common interest in safeguarding the reputation of supplies marketed from that district, just as all accredited packers will be concerned to maintain the reputation of home-produced eggs generally.

(a) *Area Organization.*—As soon as a sufficient number of packers, co-operative and non-co-operative, are at work in any one area, say, an administrative county, it would be an advantage if they formed themselves into an *area association*, which would be non-trading. The National Mark Committee would then transfer the right to authorize the use of the national mark to such area associations.

An area association would :—

- (i) register an area mark for use on eggs or on packages, e.g., a Cornish mark, a Somerset mark, a Lincolnshire mark, a Lancashire mark, and an Anglesey mark, and so on;
- (ii) delegate to its individual packer-members the right to use both the area mark and the national mark, so long as the conditions are observed, and inform the County Branch N.F.U. of any case in which the right is withdrawn;
- (iii) if thought desirable, undertake advertisement and other propaganda in favour of its area mark in order to popularize, say, Cornish eggs, Somerset eggs, Lincolnshire eggs, Lancashire eggs, Anglesey eggs, etc., in the markets normally served;
- (iv) organize its own local inspection service in order to supervise the quality and packing of members' supplies and safeguard local reputation.

(b) *Central Federation.*—To complete the chain of organization the various area associations of accredited packers, co-operative and non-co-operative, would eventually form a *central federation of egg packers*, which would also be non-trading. Accredited town packers would then enrol direct with this central body. The central federation would :—

- (i) either register its own national mark or carry on with the Minister's mark. In the latter case, the National Mark Committee would deal with the central federation only;
- (ii) delegate to area associations and to accredited town packers the right to use the national mark, subject to observance of the

conditions laid down; the area associations would be responsible for delegating the right to use the national mark to their individual members as before;

- (iii) undertake national advertisement and propaganda in favour of all home-produced eggs marketed under the scheme;
- (iv) organize its own inspection service in order to safeguard the goodwill of the national mark and to ensure national standardization.

7. Marking of Preserved and Cold-Stored Eggs.—Grading is voluntary and so is the use of the national mark. The Bill now before Parliament contains, however, two *compulsory* provisions which were recommended by the Poultry Advisory Committee. These are, *in effect*, as follows:—

- (a) As and from January 1, 1929, eggs that have been preserved by processes such as lime-water, water glass or oil, should be marked at the time of sale in such way as the Minister may prescribe.
- (b) If and when an Order has been made prohibiting the sale of imported eggs unless they bear an indication of origin, all eggs which are cold-stored or gas-stored shall be marked in such manner as the Minister may prescribe in order to indicate the fact to purchasers.

The reason for requiring that eggs preserved by lime-water, water-glass, oil, etc., shall be marked before sale, is the fact that eggs which have been so preserved cannot always be detected without expert examination.

In regard to cold-stored and gas-stored eggs, it is a well-known fact that eggs which have been so stored in this country are often bought by the public in the belief that they are fresh. Although eggs when properly stored may be of fine quality, it is only right that, like the "pickled" egg, the stored egg should stand on its own merits. The producer of new-laid eggs should be protected from unfair competition, particularly at a time of year when production costs are high. The housewife should also have an opportunity of knowing what she is buying.

There is one other reason for the compulsory marking of "pickled" and stored eggs, namely, that if, in the near future, an Order is made requiring the marking of imported eggs with an indication of the country of origin, it will be essential to remove any risk of the reputation of home-produced eggs being injured by preserved eggs of various kinds masquerading as the new-laid article.

8. Conclusion.—Home-produced eggs, properly handled, are superior in quality to any supplies from abroad and the conditions of production in this country are favourable for the maintenance of superiority. The scheme outlined above will enable business to be done in home produce on wholesale lines which will secure for it the same *commercial* advantages as are, at present,

enjoyed by imported supplies. It will provide a means and an inducement for increasing the output of the home egg industry, and it will enable the industry to face the position that will arise if the imported egg is marked with an indication of the country of origin.

It is proposed that the national mark part of the scheme should come into operation early in 1929, the date to be announced later. Meanwhile, the industry must prepare, and there is no time to be lost.

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THE CONTROL OF AMERICAN GOOSEBERRY MILDEW: TRIALS WITH SULPHUR IN THE BRISTOL PROVINCE

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Two previous papers, by the writer, in this series have already appeared in this JOURNAL* containing data based on actual field trials with spray fluids other than the commonly advocated lime-sulphur, which does not always give complete satisfaction. Through the kindness of Mr. Frank May, of Cheltenham, the writer has been very fortunate in obtaining the use of an exceptionally suitable gooseberry plantation for three years in succession.

Experiments in 1925.—In the first trials (1925) the following spray fluids were tested:—

- A. Ammonium polysulphide and soft soap.
- B. A Proprietary soda-sulphur compound and soft soap.
- C. Washing soda and soft soap.
- B. Burgundy mixture.

The spray fluids (A), (B) and (C) are of the type known as "hitting" sprays, *i.e.*, fluids which act mainly by killing the fungus on direct contact. These fluids do not form a protective covering on the surface of the leaves for any appreciable length of time, and need to be renewed, in accordance with weather conditions, to give an efficient control.

Burgundy mixture, on the other hand, is an example of a fungicide the efficacy of which is mainly dependent on its property of forming a toxic film, which remains on the surface of the twigs and foliage for a considerable time; and for this reason it must be applied before the fungus becomes established on the bush. In the 1925 trials, the Burgundy mixture was not applied until June 5, by which time the mildew had already appeared, and a very poor control resulted.

* Vol. XXXIII, 1926/27, June, 1926, p. 265, and Feb., 1927, p. 1017.

The "hitting" sprays, on the other hand, which were applied first on April 28 and again on June 5, gave a very satisfactory control, the weight of mildewed berries being reduced from 44 to 4 per cent. The spray (C), washing soda and soft soap, was tested because, if efficient, it would be a valuable and convenient fluid for use on certain varieties which are damaged by the sulphur-containing sprays. Further, it is readily made up by small growers and private gardeners, the ingredients being common household commodities.

Experiments in 1926.—In the 1926 experiments it was decided to test Burgundy mixture under more favourable conditions; also to determine the relative efficacy of a single and a double application of ammonium polysulphide. In this trial, the first application of all fluids was made on April 22, immediately after the setting of the flowers and before any mildew was visible. The second application of ammonium polysulphide was made on May 18. It was found that, whereas the single application of Burgundy mixture reduced the mildew from 40 to 4 per cent., a single application of ammonium polysulphide reduced it only to 16 per cent., thus demonstrating the value of the Burgundy type of spray fluid when only one application is possible. To obtain an equivalent result with ammonium polysulphide and soap, it was necessary to spray a second time.

The 1926 experiments are considered to have demonstrated satisfactorily the value of Burgundy mixture on certain varieties where one application only is possible. Burgundy mixture does, however, in some cases cause scorching of the foliage and is somewhat troublesome to prepare. It was decided, therefore, to concentrate the 1927 investigations on certain other methods of control which have been suggested, *viz.*, spraying with "colloidal" sulphur and powdering with various forms of finely divided sulphur. These methods were tested against the standard ammonium polysulphide treatment.

Experiments in 1927.—One series of trials (A) was carried out by the writer at Cheltenham, and another series (B) by Mr. H. T. Horsfield at Knowle Hill, Evesham, in collaboration with the writer.

Series A.—The plots consisted of well-grown Whinham's Industry bushes in series of double rows, each series being 25 ft. apart and containing 48 bushes. Two series were sprayed with "colloidal" sulphur and one series with ammonium polysulphide once only. One series was dusted with flowers of sulphur, twice. The control plot consisted of the eight

control bushes in each series, forming a strip running through the centre of the plot.

The following materials were used :—

A. Ammonium polysulphide and soft soap.

Ammonium polysulphide	..	..	..	..	1/2 gal.
Soft soap	..	..	..	..	5 lb.
Water, to make up to	..	..	..	..	100 gal.

B. Colloidal sulphur (liquid) and soft soap.

Colloidal sulphur	..	..	..	..	5 lb.
Soft soap	..	..	..	..	5 lb.
Water, to make up to	..	..	..	..	100 gal.

C. Flowers of sulphur.

By flowers of sulphur is meant finely divided sulphur prepared by the sublimation method.

The first application of all three materials was made on April 27, and a further application of flowers of sulphur was made on May 26.

At the time of the first application of the flowers of sulphur, no efficient dusting apparatus was available. The following method of application, suggested to the writer by Mr. H. T. Horsfield, was therefore used. A handful of sulphur was thrown violently on the ground at the base of each bush, causing a cloud of the powder to rise and envelop the bush. Though somewhat wasteful of material this method was found to be effective, and can be recommended for use by growers who do not wish to purchase special apparatus. The second application was made by means of a dusting machine.

Results.—The fruit was picked on July 4 and 5, sorted into clean and mildewed berries, and weighed, as in the previous trials.

The following table gives the weight of clean and mildewed berries from each plot.

TABLE I, 1927. SERIES A.

Fungicide	No. of times applied	Dates of application	Crop weight in lb.		Percentage weight of mildewed berries
			Clean	Mildewed	
Ammonium polysulphide	Once	April 27	153	33	17.6
Colloidal sulphur	Once	April 27	448	51	10.2
Flowers of sulphur	Twice	April 27 May 26	210	13	5.8
Control	..	No treatment	23	52	69.0

It will be seen, from the very heavy infestation of the control plot, that the conditions were very favourable to the disease. Two applications of flowers of sulphur reduced the amount of

mildew from 69 to 5·8 per cent. This, in the circumstances, can be considered a good commercial control. The ammonium polysulphide applied once gave a reduction to only 17·6 per cent. of mildewed berries, whereas when applied twice a reduction to 10·2 per cent. was effected. This result once again emphasizes the fact that a "hitting" spray of this type must be applied more than once, when the weather and the conditions prevailing after the first application are such as to favour the development of the mildew.

Series B.—In this trial the following materials were used :—

- A. *Proprietary soda-sulphur* 2 gal.
 Soft soap 5 lb.
 Water to make 100 gal.
 B. *Colloidal sulphur* 4 lb.
 Soft soap 5 lb.
 Water to make 100 gal.
 C. *Flowers of sulphur (sublimed)*.
 D. *Ground sulphur*.
 E. *Green sulphur*.

By ground sulphur is meant sulphur that is brought to as fine a state of division as possible by mechanical grinding and perhaps, subsequent grading. The green sulphur was a sample of the ordinary commercial dust-like product sold under that name.

Two applications of each fungicide were given, the first on April 13 and the second on May 16. The crop was picked green and treated as in the previous trial. The following table gives the weight of clean and mildewed berries from each plot.

TABLE II, 1927. SERIES B.

Fungicide	Dates of application	Crop weight in lb.		Percentage weight of mildewed berries
		Clean	Mildewed	
Colloidal sulphur ..	April 13 } May 10 }	225	15·5	6·7
Proprietary soda-sulphur ..	do.	333	23·0	6·4
Flowers of sulphur ..	do.	124	4·0	3·1
Ground sulphur ..	do.	193	2·0	1·0
Green sulphur ..	do.	151	2·5	1·6
Control ..	No treatment	96	115·0	54·5

It will be seen, from the above figures, that excellent control was obtained by the three forms of powdered sulphur. Under the conditions of this experiment the differences between the three figures 3·1 per cent., 1 per cent. and 1·6 per cent. are not considered to be significant. It appears that any one of the three forms will effectively control the mildew.

Promising results were obtained by the application of the colloidal sulphur. This spray fluid appears to act as a

"protective" spray rather than a "hitting" spray. It remains on the foliage for a considerable time, and, in this experiment, no signs of any scorching were observed. In these experiments the actual weight of sulphur applied to each bush by the "colloidal sulphur" spray fluid was less than the weight applied in the form of powdered sulphur. This fact must be borne in mind when comparing the results.

For comparative purposes the results obtained in the 1925 and 1926 experiments are given in the following tables :—

TABLE III.

Spray fluid used	No. of times applied	1925 Dates of application	Crop weight in lb.		Percentage weight of mildewed berries
			Clean	Mildewed	
Ammonium polysulphide and soft soap	Twice	April 28 June 5	90	4	4·2
Soda-sulphur compound and soft soap	Twice	April 28 June 5	132	3	2·2
Washing soda and soft soap ..	Twice	April 28 June 5	92	4	4·1
Burgundy mixture	Once	June 5	94	27	22·3
Control	No treatment		36	28	43·7
1926 A					
Ammonium polysulphide and soft soap	Once	April 22	456	84	15·5
Do.	Twice	April 22 May 18	502	30	5·6
Burgundy mixture	Once	April 22	482	22	4·3
Control	No treatment		143	95	39·9
1926 B					
Ammonium polysulphide and soft soap	Twice	April 22 May 18	169	33	16·3
Proprietary soda-sulphur and soft soap	Twice	April 22 May 18	122	20	14·0
Soda and soap ..	Twice	April 22 May 18	95	41	30·1
Control	No treatment		66	98	53·7

Conclusions.—The results of these experiments, carried out in the Bristol Advisory Province over three years, emphasize the need for early spraying, and the necessity of the grower distinguishing between the various types of suitable fungicidal materia's at his disposal.

Early application of the material is of prime importance, and it should not be deferred beyond the time of setting of the flowers. This holds particularly for the Burgundy type of spray fluid. In the West of England, the mildew frequently appears before the opening of the flowers, and the "pre-blossom" stage* is considered the best time for the first spraying or powdering. When once the mildew has appeared, a "hitting" spray, containing soap, is advised, and this should be applied at least twice.

It should be borne in mind that procedure depends, to a great extent, on the type of spray fluid used. It cannot be too strongly emphasized that the grower should be quite clear as to the method of action of the spray fluids which he intends to use. The various types of spray fluids used in these experiments can be graded according to the time in which they remain effective. At one end of the scale we have the purely "hitting" type, such as soda and soap; this in all probability ceases to be effective after the first shower of rain. At the other extreme may be placed Burgundy mixture, which has little effect as a "hitting" spray, yet resists the action of the weather for prolonged periods and so maintains a protective action throughout most of the season. The fungicidal action probably lasts at least until the time that the picking of the non-dessert fruit has taken place.

Of the polysulphide spray fluids, lime-sulphur is frequently recommended as a sovereign remedy for American Gooseberry Mildew. It has, however, certain disadvantages, the chief of these being its liability to cause scorching and to leave a film or deposit of solid matter on the fruit. Ammonium polysulphide, on the other hand, has the advantage that, besides being an efficient fungicide, it permits the use of soap as a spreader and leaves no visible deposit on the berries. With the "hitting" type of spray, the "wetting" power conferred by the addition of soap is of supreme importance. Growers must be warned, however, that lead arsenate, which

* An illustration of the "pre-blossom" stage was given (Fig. 14) in "The Correct Time for Application of Spray Fluids," by H. R. Briton-Jones and Mr. A. H. Lees. This JOURNAL, December, 1927.

can be mixed with lime-sulphur, cannot be incorporated with ammonium polysulphide or with sprays containing soap.

The advantages of a powder of established fungicidal value over a wet spray are numerous. Various forms of powdered sulphur have been tried from time to time by growers in this province, but no comparison of their merits with those of the standard spray fluids had hitherto been made. The results arising from the 1927 trials given above, although obtained from a single year's experiments only, indicate the value of the powder treatments. All the forms of powdered sulphur used in this particular trial gave a better degree of control than was obtained with the spray fluids.

It is not justifiable to compare the results obtained by powdering in 1927 with those from spraying in previous years. There are factors which cannot be standardized in an experiment of this sort over a period of years, such as the amount of infective material present and the weather conditions after the fungicide has been applied. For example, the efficacy of powdered sulphur may, perhaps, be enhanced if the application is followed by a period of hot sunshine. The effect of rain on the soap and soda spray fluid, mentioned above, may be quoted in this connexion. For these reasons it will be evident that a means of control applicable under all conditions is difficult to formulate. The investigations recorded above have, however, shown that satisfactory control of the American Gooseberry Mildew can be attained by the application of fungicides.*

* * * * *

MAY ON THE FARM

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Seasonal Notes.—While May is occasionally a wet month, its average record is one of comparatively low rainfall. Last year, it will be remembered, this was the only month of the 12 that was appreciably dry; and the effect of drought and frosty nights at this period was clearly visible in the poor growth of the hay and corn crops, and in the weak plant of mangolds and sugar beet.

Ordinarily May is a month in which the countryside passes rapidly through the change from spring to summer conditions.

* Readers of this JOURNAL who are interested in the control of American Gooseberry Mildew may be referred also to experimental work on the problem carried out by Messrs. A. E. Muskett and E. Turner in Northern Ireland, the results of which are published in the *Journal of the Ministry of Northern Ireland*, Vol. I, 1927, pp. 45-67. —[ED. M. A. AND F. JOURNAL.]

The hedgerows, now in full leaf, come into blossom; the latest of the trees—oak, ash and beech—put out their foliage; the earlier fields of corn and “seeds” make growth deep enough to wave before the wind; and the pastures—often yellow with buttercups—are fully stocked with cows as well as sheep and store cattle. In May the farmer’s interests are almost entirely transferred from the homestead to the fields; and before the end of the month he begins to weigh up the prospects of his corn and grass crops, to consider the success of his braird of beet and potatoes, and to observe the progress of his cattle since they came out to grass.

Green Crops.—Where arable land is cultivated, the chief occupation of men and teams during May is the preparation and sowing of fields with green crops—mangolds, kohl rabi, sugar beet, potatoes, ox-cabbages, kales and swedes. The order here given is approximately that in which the different crops are put into the ground; but, in the case of potatoes, the date of planting depends on the variety and on whether the setts have been sprouted.

For mangolds and sugar beet, the preparatory tillages will have been carried out and probably the greater part of the area sown during April. Questions concerning sowing and the treatment of the land after sowing will, however, be uppermost at this date. The common advice to drill the seed of these crops only half an inch deep has always been difficult to carry out, and it is interesting to note that well-conducted experiments recently carried out in Germany have shown that the ideal depth in free-working soils is about $1\frac{1}{2}$ in., and in heavier soils with a tendency to become crusted, about 1 in. These depths correspond to what successful root growers commonly adopt in this country; but, to ensure the best results, it is necessary to avoid very heavy rolling of the seed bed and to drill plenty of seed.

Thick sowing undoubtedly favours germination of the seeds of mangolds and sugar beet, as may be inferred from the common experience that the seedlings often come through in clumps alternating with blank spaces. As a means of ensuring a full plant, some growers find it sound economy to drill as much as 30 lb. of beet seed per acre, purchasing seed additional to the standard quantity—about half that—supplied by the factory.

An important advantage of sowing at a fair depth is that it allows of a surface working of the soil about five days after drilling, which lightens the tilth, destroys weeds, and, in the

case of a crust having formed, facilitates the appearance of the seedlings above ground. The most progressive Continental growers make regular use of special light harrows at this stage, drawing them diagonally across the rows, which are drilled on the flat. A second harrowing, likewise in a diagonal direction, is given when the plants are about $1\frac{1}{2}$ in. high, an implement with wider-spaced teeth being used.

In the preparation of the seed bed for the other May-sown crops, weed extraction may be as important a part of the process as the production of a fine, deep but moist tilth. Weeds are not difficult to extract from light soils, and little need here be said on the matter, except to mention that the side delivery rake may be successfully utilized where the presence of stones does not interfere. On heavier land, however, each case may require separate treatment. Clod formation and drying of the weeds on bare-fallowing lines may be necessary in some cases.

Where clod formation can be avoided, there are better prospects of securing a satisfactory braird and of averting destruction by insect pests that prey on the seedlings. To this end certain guiding principles are useful, the first of which—the formation of the early surface mulch—was mentioned in the April notes and on several previous occasions. The next is that of working downwards, securing the requisite depth of tilth by successive operations of increasing penetration; and the third is to break the lumps of soil before they have become hardened. The disc harrow is invaluable for use on fairly clean land, but probably the Norwegian, or rotary, harrow is the best tool for use where there is twitch or couch to consider. We are not well equipped for deeper stirring of the soil. The modern cultivator with curved tines is very apt to lift unweathered under-soil to the surface, where, on drying, it forms harsh knots and clods. A straight-tined implement is comparatively free from this defect and is certainly preferable for tilth-forming purposes, although not so good at combing out weeds. The work of the cultivator may be improved, however, by attaching behind the implement a suitable “rubber,” which breaks down any lumps of soil that may be lifted up, before they have become baked. For this purpose a wooden baulk of about 4 in. square section is suitable.

Clover Failures.—Red clover is one of the most fastidious of crops, and its liability to failure has become proverbial. Farmers speak of land as being “clover sick” when, in spite of every endeavour which their knowledge may prompt, the

land in question produces only a thin stand or there is a failure of the red clover component in the "seeds" year. Two of the causes of clover sickness—eelworm and the stem-rot fungus—have been closely studied, and are described in the Ministry's Leaflets Nos. 46 and 271 respectively. Except that eelworm may destroy clover seedlings in a wet spring, these two parasites are mainly concerned with the destruction, after corn harvest, of what promised to be a fair plant of clover.

The "take" of red clover is often poor, or the proportion of this plant in the hay is less than desirable, from a number of causes other than the above two forms of "sickness." Slugs and snails are often injurious to clover seedlings on damp land; and recently it has been observed that springtails, minute insects which also cause "strange neck" or "black leg" in mangold seedlings, often occur in enormous numbers on red clover and undoubtedly contribute to the causes of thin plant. Other causes of thin braird are unfavourable physical conditions of the seed bed—a harsh, unkind tilth, insufficient covering of fine soil; and either very wet or very dry weather immediately after sowing, may entail a heavy mortality of clover seedlings. Heavy shading by rank growth of either the nurse crop or weeds will also cause a thin take, while headland conditions are on the other hand generally favourable to the clover seedlings.

The presence or absence of pests and the soil and weather conditions during the seedling stage do not, however, explain all the causes of poor and good takes of red clover. Last summer and in 1926 very remarkable demonstrations of another factor were to be seen at the Norfolk Agricultural Station: where sulphate of ammonia had been applied without phosphate and potash to the nurse-crop, barley, very little clover grew in the succeeding hay crop; potash and to a less extent phosphates, on the other hand, had a very beneficial influence on the proportion of clover, and, when applied along with sulphate of ammonia, mitigated the depressing effect of the latter. At Aberystwyth basic slag applied before seeding was found to increase the seedling establishment of red clover by 40 to 50 per cent., thus expressing in figures a fact abundantly proved by field experience. The depressing effect of excessive seedings of Italian rye-grass has been previously mentioned.

Live Stock.—This year there is certainly a feeling of optimism as regards live stock matters. The reason for this attitude lies chiefly in the steady recovery in the values of fat cattle and sheep since December 1st. The price of stores has tended

to rise with that of the fat animals, but there has been sufficient lag to inspire hope of a profit on feeding speculations this year. Wool is also in good demand. Milk prices are governed largely by the prices fixed last September; but, partly owing to the advance in the price of cheese and the slightly improved market for butter, prices above those represented by the autumn contract figures are being realized for milk that is not bound by an autumn agreement. The standard liquid milk price for May is 12d. per gallon; but large quantities have been sold to be delivered into creameries at 7½d. net, and it cannot be said that producers who will realize only this price are sharing in the above-mentioned feelings of optimism. As regards horses, the prices made at recent sales of geldings point to an improvement in the demand for town purposes; and the effect of the rapid reduction in the number of foals bred, which set in about 1922-23, is now beginning to be felt. Last year only 40,200 foals were bred as compared with 84,000 in 1922 and an average of 114,000 in the years 1904-13; and consideration of the first figures in relation to the number of horses employed on farms alone (746,000) suggests the possibility of an acute shortage in a few years' time.

Milk Production.—There is no doubt as to the possibility of maintaining a higher level of output from indoor feeding than from pasturage in the case of very deep milkers. Even in entire herds, where the feeding has been intensive, the change from stall to outdoor feeding may be accompanied by a temporary fall in milk yield, the depression being probably due to the animals having to perform the work of gathering their food and having less time for rest and rumination. In ordinary circumstances, however, cows do rise appreciably in milk yield after they have been out at pasture for about a week and have become accustomed to the grass diet. Many good dairy farmers dissent from the suggestion that any increase in their milk output per cow at the commencement of the grazing season indicates inefficient winter rationing; but they would agree that a general rise of about half a gallon per cow per day on a two gallons basis may give cause for reflection.

There is statistical evidence in favour of the statement that the mixed milk of the herd is commonly lower in quality in the early part of the summer than later in the season or during the winter. That the nature of the herbage at this time of the year is partly responsible is generally agreed; but, in herds where a large proportion of the cows calve in

purposes for many years. Nitro-chalk, a new product of the Billingham factory, has something in common with the above, since half its nitrogen occurs as nitrate and the remainder is in the ammoniacal form. The nitrogen in this fertilizer is provided by ammonium nitrate, a substance which has been used for fertilizer purposes on the Continent for some time. It is a high-grade material containing 35 per cent of nitrogen, and is better used in mixture than alone. In nitro-chalk it is mixed with very finely divided carbonate of lime. As sold for use on the farm, the mixture contains 10 per cent. of nitrogen, of which 5 per cent. occurs as nitrate and 5 per cent. as ammonia; there is also present 66 per cent. of chalk. Although primarily a nitrogenous manure, the contained chalk, which amounts to about 150 lb. per acre when a normal dressing of nitro-chalk is given, should have value in preserving the lime supply of the soil, particularly when the land is poor in lime without being seriously sour. It is not claimed that the use of nitro-chalk will meet the case when soils are in need of considerable amounts of lime. One would expect the nitrogen of the new fertilizer to have a value similar to that of the more common nitrates and ammonium salts, but its exact performance remains to be determined by the results of accumulated trials. Nitro-chalk is suitable for top-dressing purposes and has the advantage that if a really wet spell of weather sets in after application, one-half at least of the nitrogen will be retained for the use of the plant; on the other hand, should conditions be favourable there is a supply of nitrogen immediately available for rapid growth. Compared with other nitrogenous fertilizers, 2 cwt. of the new substance contain the same amount of nitrogen as 1 cwt. of sulphate of ammonia, or $1\frac{1}{2}$ cwt. provide the same weight of nitrogen as 1 cwt. of nitrate of soda. It could be given a trial on sugar beet, mangolds and other root crops this spring, particularly on soils on which the chalk is likely to be beneficial.

High-Grade Fertilizers.—There is a tendency nowadays towards more concentrated fertilizer materials and compounds. This is so to a noticeable extent in England and to a marked degree in the United States and in Germany. The main purpose of this is the reduction of handling and bagging costs at the factory, transport charges to the consumer, and handling costs on the farm. When fertilizers are intended for use in distant regions or places difficult of access these considerations become increasingly important. The problem is to supply compounds containing nitrogen, phosphorus, and potassium in a form

available to plants with as little ballast, *i.e.*, material of small or no fertilizing value, as possible. At the same time the products must be easily stored, handled, and, above all, in good enough condition to be evenly applied by a manure drill. It is noteworthy in this connexion that the exact application of small quantities of material per acre is not an easy matter, and, where light dressings of plant food are customary, the use of highly concentrated fertilizer will require special care in this respect.

If we confine our attention to water-soluble substances of the highest grades in common use at present, such as 16 per cent. superphosphate, 50 per cent. muriate of potash and 21 per cent. sulphate of ammonia, the mixtures which these materials will yield, presuming that no drier were used, would contain approximately 24 units of plant food. Thus, two parts superphosphate with one part each of the other constituents would yield roughly 8 per cent. of soluble phosphoric acid, 5 per cent. of nitrogen, and 12 per cent. of potash, making 25 units in all. Above this figure it would not be easy to go if a more or less conventional balance of the mixture were to be maintained. More commonly, insoluble phosphate to the extent of about 2 per cent. phosphoric acid would be included which would have the effect of slightly depressing the above percentages of soluble nutrients.

Recently more concentrated ingredients have become available. Among nitrogenous materials we now have urea with 46 per cent. of nitrogen, and ammonium nitrate with 35 per cent., both from atmospheric sources. Processes for preparing phosphoric acid from mineral phosphates without the use of sulphuric acid are operating, the final product being diammonium phosphate with 54 per cent. of phosphoric acid and 21 per cent. of nitrogen. It is also possible to bring the potash of potash salts into combination with nitric or phosphoric acid, thus obtaining compounds that contain very high percentages of plant food. From these and other starting points, a range of complete fertilizers of high analysis can be manufactured. Substances of this kind are coming into use on the Continent and in America, and some of them will no doubt soon be on trial here. As an example, the composition of three grades of nitrophoska, compound fertilizers now being manufactured in Germany, may be given:—

Grade	Nitrogen per cent.	Phosphoric acid per cent.	Potash per cent.	Total units
1	17	12.7	21.1	50.8
2	14.7	11	25.8	51.5
3	15.6	32	16	63.6

The grades high in potash are in use in Germany, while the third type with a high content of phosphoric acid is exported to the United States. Other grades to suit varying conditions are being turned out, but all are high in total nutrients.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending April 11					Cost per unit at London
	Bristol	Hull	L'pool	London		
	£ s.	£ s.	£ s.	£ s.	s. d.	
Nitrate of soda (N. 15½%) ..	11 17	11 15	10 17	10 17	14 0	
" " lime (N. 13%) ..	..	..	..	11 7	17 6	
Nitro-chalk (N. 10%) ..	7 0f	7 0f	7 0f	7 0f	14 0	
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%)	11 19g	11 3h	..	..	..	
Sulphate of ammonia :—						
Neutral (N. 20·6%) ..	10 13*	10 13*	10 13*	10 13*	10 4	
Calcium cyanamide (N. 19%) ..	9 0†	9 0†	9 0†	9 0†	9 6	
Kainit (Pot. 14%) ..	3 7	2 17	2 18	3 1	4 4	
Potash salts (Pot. 30%) ..	5 2	..	..	4 19	3 4	
" (Pot. 20%) ..	3 17	3 5	3 10	3 10	3 6	
Muriate of potash (Pot. 50·53½%)	9 10	9 0	9 9	10 0	3 9	
Sulphate " (Pot. 48·51½%)	11 10	11 0	11 14	12 2	4 9	
Basic Slag (T.P. 34%) ..	3 6§	2 12§	2 12§	..	..	
" (T.P. 32%) ..	3 3§	2 10§	2 10§	..	..	
" (T.P. 30%) ..	3 1§	2 7§	2 7§	2 15e	1 10	
" (T.P. 24%) ..	2 7§	1 18§	1 19§	..	..	
Ground rock phosphate (T.P. 58%)						
Very fine grade ¶	2 15	..	..	2 10d	0 10	
Fine grade||	2 10	2 10	..	2 7d	0 10	
Superphosphate (S.P. 35%) ..	3 0	..	3 1	3 0	1 9	
" (S.P. 33%) ..	..	..	2 19	..	..	
" (S.P. 30%) ..	2 15	2 12	2 15	2 15	1 10	
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 12	8 2	..	
Steamed bone flour (N. ½%, T.P. 60·65%)	5 17†	6 2†	6 5	5 15	..	

Abbreviations: N.=Nitrogen; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. 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.

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

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

§ Prices for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of town mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

|| Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

e F.o.r. Northern rails; 3s. 6d. per ton extra on Southern rails.

f Delivered in 6-ton lots at purchaser's nearest railway station.

g F.o.r. Gloucester.

h F.o.r. Goole.

NOTES ON FEEDING STUFFS FOR MAY

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Maize as an English Silage Crop.—Practical interest in this subject will probably be confined to farmers in the southerly counties of the United Kingdom, since in the northern regions there can scarcely be any doubt as to the unsuitability of the climate for the successful cultivation of maize. In such parts, oats and tares, with or without beans and peas, will continue to be the typical silage crops, especially since such mixtures have been found to give excellent results in all parts of the British Isles, the encouraging experiences of Mr. Cruickshank in this connexion, on clay land as far north as Aberdeenshire, being familiar to all who have been concerned in furthering the practice of ensilage in this country.

There can be little doubt, however, that maize is pre-eminently the best crop for silage in those parts of the world which favour its growth. Where climate and soil are suitable, it produces a splendid silage crop—heavy, nutritious, easy to cut and handle, and giving rise to excellent silage.¹ Unfortunately, maize is very sensitive to frost, both in the seedling stage and when maturing, so that in this country the growing period is short. Nevertheless, in countries where somewhat similar conditions prevail, varieties have been bred and selected for habits of quick maturity, and such varieties are being grown for silage with success.

In England, isolated farmers in warm localities and on early soils have regularly made good silage from maize, but others on later soils have succeeded in producing only very sour silage, an experience which must be regarded as disappointing and unsatisfactory. This misfortune has largely been due to the circumstance that our seedsmen have selected, or our farmers have demanded, a variety of maize known as American Horse Tooth, which is most unsuited for ensilage. It is a very tall, showy variety which takes the eye because of its size; but it is slow to start and late to mature, so that it rarely, if ever, becomes really ripe enough for silage.¹

Between the years 1920 and 1925, Mr. A. Amos investigated at Cambridge the yielding and maturing qualities of some 12 varieties of maize commonly grown for silage in Canada and elsewhere. It was found that varieties like Saltzer's North Dakota, Longfellow, Compton's Early and White Cap all displayed much earlier maturity than American Horse

Tooth, and the conclusion was drawn that such varieties would be far superior to Horse Tooth for ensilage in this country.² During the season of 1925, however, trials were carried out on the University Farm of a variety of maize obtained from France, known as Jaune Gros du Domaine. The results were highly promising; the variety proved not only to be very early, but also to be capable of producing a heavy crop. It was decided, therefore, to conduct a more extensive trial of this crop during the season of 1926.³

The crop was grown upon 3 acres of light, thin gravel, manured with 12 loads of dung per acre. The seed was drilled on May 28, at the rate of 1 bushel per acre, in 19 in. rows. Germination was quick, but just before the plants appeared above ground, the field was lightly harrowed to kill seedling weeds—an operation which was most successful. The crop was horse-hoed twice and hand-hoed once. During the latter operation, surplus plants were cut out, so as to leave the plants roughly 9 in. apart in the row.

The season of 1926 suited the crop admirably, so that when cut for silage on September 27, it was 6-7 ft. high and weighed about 17 tons to the acre. Each plant was carrying one or two cobs of corn, the latter being at the proper stage of maturity for ensiling. The maize grains were firm and in the "glazed" condition, which is considered ideal for silage in America. In passing, however, the reader should be reminded that the crop would not have matured so satisfactorily had the experiment been made during the 1927 season; but maize is by no means the only crop which fails to grow normally under such wet and sunless conditions as characterized the unfortunate summer of 1927.

The crop was preserved in a commercial wooden tower silo, and the quality of the resulting silage was excellent, an opinion which was endorsed by several independent observers with American experience of maize silage. Its smell and appearance were all that could be desired, there being a complete absence of any indications of the presence of undesirable constituents like butyric acid. It was eagerly consumed by animals on the farm. The composition of the silage, compared with the mean composition of 53 samples of American maize silage, is shown in Table I.

Considerable similarity is to be noted between the composition of the maize silage of the present trial and that of American maize silage, the agreement being especially noteworthy in respect of moisture and carbohydrate content. On the whole,

TABLE I.—COMPOSITION OF MAIZE SILAGE.

			<i>Jaune Gros Maize Silage.</i>	<i>American Maize Silage.</i>
			per cent.	per cent.
Moisture	..	..	79.08	79.0
Crude protein	..	..	2.32	1.9
Crude oil	..	..	1.18	0.6
Carbohydrate	..	..	11.29	11.3
Crude fibre	..	..	4.88	5.8
Ash	..	..	1.25	1.4
True protein	..	..	1.09	—
"Amides"	..	..	1.23	—

however, the English silage displays a composition slightly superior to that indicated by the average American data, being somewhat richer in crude protein and crude oil, and somewhat lower in fibre.

With the object of instituting a comparison in respect of digestibility and nutritive value between maize silage as made in America and that resulting from the preservation of the Jaune Gros maize grown at Cambridge, a digestion trial was carried out with wether sheep, each animal receiving throughout the trial a daily ration of 5,000 gm. of the Jaune Gros maize silage. The results of the trial are summarized in Table II, together with corresponding data for oat and tare silage and for green maize.

TABLE II.—COMPARATIVE SUMMARY OF DIGESTION COEFFICIENTS.*

	<i>"Acid brown"</i>	<i>"Green fruity"</i>	<i>Maize Silage (Present trial)</i>	<i>Maize Silage (American)</i>	<i>Green Maize (American)</i>
	Oat and Tare Silage	Oat and Tare Silage	per cent.	per cent.	per cent.
Dry matter ..	55.3	64.1	68.4	64	68
Organic matter ..	55.8	65.9	70.9	—	—
Crude protein ..	67.2	65.1	65.4	53	66
Crude oil ..	78.9	73.4	89.1	71	86
Carbohydrate ..	52.2	70.5	69.9	66	71
Crude fibre ..	49.7	57.1	70.3	68	65

* The digestion coefficient of a feeding stuff constituent is the number of parts of that constituent which are digested and utilized by the animal per 100 parts consumed.

The results shown in Table II constitute a distinct encouragement to farmers in the southerly counties of this country to attempt the cultivation of Jaune Gros maize for the purposes of ensilage. The maize silage of the present investigation displayed a higher digestibility than is indicated by the mean results of trials carried out in America, the differences in favour of the English sample being pronounced in the case of the protein and crude oil constituents. There is, it will be noted, very close correspondence between the digestion coeffi-

cients of the English maize silage and those obtained in American trials on *green* maize. It would thus appear that the preservation of the Jaune Gros maize fodder in the silo had not had the effect of depressing digestibility to any marked extent. Indeed, the coefficient for the fibre in the silage is actually higher than that for the fibre in the green crop, although this is in agreement with the fact, established in earlier Cambridge investigations, that the digestibility of the fibre in a green crop is enhanced as a result of the actions which go on during storage in the silo.

It will further be noted that maize silage is much more digestible than "acid brown" oat and tare silage. Even "green fruity" oat and tare silage, a type highly prized in this country on account of its palatability and digestibility, is not as digestible as the maize silage, the fibrous constituent in the latter material being assimilated by ruminants to a much greater extent than is the fibre of the oat and tare silage. The results suggest that the maize crop, when cut for silage in late September, is not so advanced in lignification as is the oat and tare crop when cut for the same purpose in June.

TABLE III.—SUMMARY OF DIGESTIBLE NUTRIENTS IN MAIZE SILAGE.

	Maize Silage (79.08 per cent. moisture). (Present investigation) per cent.	Maize Silage (79.0 per cent. moisture). (American investigations) per cent.
Digestible protein	1.52	1.01
Digestible oil	1.05	0.43
Digestible carbohydrate	7.89	7.46
Digestible fibre	3.43	3.94
Digestible organic matter	13.89	12.84
Starch equivalent per 100 lb. silage	12.10	10.80
Starch equivalent per 100 lb. dry matter	57.90	51.50
Nutritive ratio	9.00	12.30

The results recorded in Table III further emphasize the very satisfactory nutritive properties of the silage made from the Jaune Gros maize crop. In respect of total digestible carbohydrate (carbohydrate and fibre) the English and American figures show remarkably close agreement; on the other hand, however, the English sample was richer in respect of digestible protein and was therefore characterized by a rather narrower nutritive ratio. The starch equivalent of 100 lb. of the dry matter of the silage amounted to 57.9, a value which must be regarded as high, when it is compared with the corresponding figure of 45.6 for "green fruity" oat and tare silage. In

conclusion, it need only be added that further feeding trials on calves fully confirmed the results of the digestion trial in respect of the feeding value of Jaune Gros maize silage.

REFERENCES.

- ¹ "Ensilage," *Miscellaneous Publications*, No. 53. Min. of Agric. and Fisheries, 1926.
- ² "Maize Silage, I." H. E. Woodman and A. Amos. *Jour. Agric. Sci.*, XIV, 1924.
- ³ "Maize Silage, II." H. E. Woodman and A. Amos. *Jour. Agric. Sci.*, XVIII, 1928.

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	11 2
Maize	81	6.8	10 14
Decorticated ground nut cake	73	41.0	12 2
" cotton cake	71	34.0	11 5

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

The cost per unit starch equivalent works out at 2.92 shillings, and per unit protein equivalent, 0.88 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, 1927, 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	10 19
Oats	60	7.6	9 2
Barley	71	6.2	10 13
Potatoes	18	0.6	2 13
Swedes	7	0.7	1 1
Mangolds	7	0.4	1 1
Beans	66	20.0	10 10
Good meadow hay	31	4.6	4 15
Good oat straw	17	0.9	2 10
Good clover hay	32	7.0	5 0
Vetch and oat silage	13	1.6	1 19
Barley straw	19	0.7	2 16
Wheat straw	11	0.1	1 12
Bean straw	19	1.7	2 17

DESCRIPTION	Price per qr.		Price per ton		Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.				s. d.	d.		%
Wheat, British..	—	—	10 12	0 13	9 19	72	2 9	1-47	9-6		
Barley, British feeding ..	—	—	10 0	0 10	9 10	71	2 8	1-43	6-2		
" Canadian No.3 Western	41 9	400	11 13	0 10	11 3	71	3 2	1-70	6-2		
" American ..	39 9	"	11 3*	0 10	10 13	71	3 0	1-61	6-2		
" Danubian ..	39 9	"	11 3*	0 10	10 13	71	3 0	1-61	6-2		
" Karachi ..	39 6	"	11 2	0 10	10 12	71	3 0	1-61	6-2		
" Tunisian ..	37 6	"	10 10†	0 10	10 0	71	2 10	1-52	6-2		
Oats, English, white ..	—	—	11 17	0 11	11 6	60	3 9	2-01	7-6		
" " black and grey ..	—	—	11 10	0 11	10 19	60	3 8	1-96	7-6		
" Canadian No. 2 Western	36 9	320	12 17*	0 11	12 6	60	4 1	2-19	7-6		
" " 3 ..	36 0	"	12 12	0 11	12 1	60	4 0	2-14	7-6		
" " feed ..	27 9	"	9 15‡	0 11	9 4	60	3 1	1-65	7-6		
" Argentine ..	33 0	"	11 12	0 11	11 1	60	3 8	1-96	7-6		
Maize, American ..	44 0	480	10 5‡	0 11	9 14	81	2 5	1-29	6-8		
" Argentine ..	47 9	"	11 3	0 11	10 12	81	2 7	1-38	6-8		
Beans, English, winter ..	—	—	9 17†	1 6	8 11	66	2 7	1-38	20		
Peas, English, blue ..	—	—	16 0†	1 3	14 17	69	4 3	2-28	18		
" Japanese ..	—	—	24 10‡	1 3	23 7	69	6 9	3-62	18		
Dari, Persian ..	—	—	10 10	0 13	9 17	74	2 8	1-43	7-2		
Millers' offals—											
Bran, British ..	—	—	8 7	1 3	7 4	42	3 5	1-83	10		
" broad ..	—	—	9 5	1 3	8 2	42	3 10	2-05	10		
Middlings, fine, imported ..	—	—	10 0	0 18	9 2	69	2 8	1-43	12		
" coarse, British ..	—	—	8 12	0 18	7 14	58	2 8	1-43	11		
Pollards, imported ..	—	—	8 2	1 3	6 19	60	2 4	1-25	11		
Meal, barley ..	—	—	12 7	0 10	11 17	71	3 4	1-78	6-2		
" maize ..	—	—	11 10	0 11	10 19	81	2 8	1-43	6-8		
" " S. African ..	—	—	10 5	0 11	9 14	81	2 5	1-29	6-8		
" " germ ..	—	—	10 15	0 16	9 19	85	2 4	1-25	10		
" " gluten feed ..	—	—	11 10*	1 1	10 9	76	2 9	1-47	19		
" locust bean ..	—	—	9 0	0 8	8 12	71	2 5	1-29	3-6		
" bean ..	—	—	12 17	1 6	11 11	66	3 6	1-87	20		
" fish ..	—	—	21 10	3 10	18 0	53	6 10	3-66	48		
Maize, cooked flaked ..	—	—	13 0	0 11	12 9	85	2 11	1-56	8-6		
Linseed—											
" cake, English 12% oil	—	—	13 2	1 11	11 11	74	3 1	1-65	25		
" " " 10% "	—	—	12 12	1 11	11 1	74	3 0	1-61	25		
" " " 9% "	—	—	12 7	1 11	10 16	74	2 11	1-56	25		
Soya bean " 6% "	—	—	11 0	2 4	8 16	69	2 7	1-38	36		
Cottonseed cake English—											
" Egyptian 5½% "	—	—	8 7	1 10	6 17	42	3 3	1-74	17		
" " Egyptian, 5½% "	—	—	8 2	1 10	6 12	42	3 2	1-70	17		
Decorticated cottonseed meal, 8% oil	—	—	12 10‡	2 5	10 5	74	2 9	1-47	35		
Coconut cake, 6% oil ..	—	—	11 5	1 6	9 19	79	2 6	1-34	16		
Decorticated ground-nut cake, 7% oil	—	—	12 2†	2 5	9 17	73	2 8	1-43	41		
Palm kernel cake, 6% oil ..	—	—	8 17‡	0 19	7 18	75	2 1	1-12	17		
" " " meal, 6% oil	—	—	10 15†	0 19	9 16	75	2 7	1-38	17		
" " meal 2% "	—	—	9 5†	1 0	8 5	71	2 4	1-25	17		
Feeding treacle ..	—	—	6 5	0 9	5 16	51	2 3	1-20	2-7		
Brewers' grains, Dried ale ..	—	—	9 0	1 0	8 0	49	3 3	1-74	13		
" " " porter ..	—	—	8 10	1 0	7 10	49	3 1	1-65	13		
Malt culms ..	—	—	8 15‡	1 9	7 6	43	3 4	1-78	16		

* 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 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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. 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. 5d. Dividing this again by 22-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1-29d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 11d.; P₂O₅, 3s. 10d.; K₂O, 3s. 3d.

MISCELLANEOUS NOTES

THE following description of the Trials of Potatoes variety "Clovullin" should be substituted for that which appeared in the Wart Disease, 1927 issue of this JOURNAL for March, 1928, page 1166.

"Clovullin."

Sprout .. Pink.

Tuber .. Oval, frequently tapering towards the heel; skin white; flesh lemon; eyes shallow.

Haulm and Open, spreading, only moderately vigorous; Foliage. leaflets dark grey-green, soft appearance, dull, rather broad and short, drooping; stems numerous, pink colouration at the base only; wings straight.

Flowers .. None observed.

* * * * *

AGRICULTURAL produce during March was 45 per cent. dearer than in the base years 1911-13, the index number showing a rise of two points on the month.

The Agricultural Prices of fat cattle and sheep showed Index Number further substantial advances, and oats, potatoes, and wool were dearer than

in February.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13					
	1923	1924	1925	1926	1927	1928
January ..	67	60	71	58	49	45
February ..	63	61	69	53	45	43
March ..	59	57	66	49	43	45
April ..	54	53	59	52	43	—
May ..	54	57	57	50	42	—
June ..	49	56	53	48	41	—
July ..	50	53	49	48	42	—
August ..	52	57	54	49	42	—
September ..	52	61	55	55	43	—
October ..	50	66	53	48	40	—
November ..	51	66	54	48	37	—
December ..	55	65	54	46	38	—

Grain.—Wheat at an average of 9s. 8d. per cwt. and barley at 10s. 9d. showed very little alteration from the values ruling in February, but oats at 10s. 7d. were 6d. per cwt. dearer, thus

continuing the advance in price which has been noticeable since about the end of December last. Oats are now 49 per cent. dearer than pre-war, as compared with 30 and 36 per cent. for wheat and barley respectively, whereas a year ago wheat averaged 57 per cent., barley 38 per cent., and oats only 14 per cent. above the level of 1911-13.

Live Stock.—Most descriptions of fat stock and store stock showed the customary rise in price which occurs about this season of the year, but in several instances, *e.g.*, fat cattle and sheep, the rise was greater than usual. Fat cattle averaged about 3s. per live cwt. more during March, and at 38 per cent. above pre-war the index number was six points higher on the month: fat sheep were dearer by $\frac{3}{4}$ d. per lb., estimated dressed carcass weight, and the index number was five points higher at 61 per cent. above the base years. Bacon pigs and pork pigs were slightly dearer at 40 and 45 per cent. above pre-war, against 38 and 42 per cent. respectively in February. Prices for dairy cattle in March were a little lower than in the previous month, but as the fall was not so great as in the corresponding period of 1911-13 the index number rose by two points to 31 per cent. above the base years. In the case of store cattle and pigs, however, the increase in price during March was not so great as in the base period, and the index numbers show a corresponding decline, the former being two points lower at 23 per cent. and the latter six points lower at 35 per cent. above pre-war. Store sheep were three points higher on the month at 47 per cent. above pre-war.

Dairy and Poultry Produce.—Milk prices in the Manchester area were reduced during March, and the index number for this commodity fell by 10 points to 56 per cent. above the base years 1911-13, while the slight fall in butter prices was insufficient to cause any alteration from the level of 47 per cent. recorded in February. Cheese, however, was appreciably dearer, and the index number six points higher at 65 per cent. above pre-war, as compared with 36 per cent. a year ago. The seasonal decline in egg prices was very marked during the month, a reduction of $5\frac{1}{2}$ d. per dozen being recorded, and at 26 per cent. above 1911-13 the index number was 13 points lower than in March, 1927. Poultry prices were a little higher on the month at an average of 40 per cent. dearer than pre-war.

Other Commodities.—Potatoes advanced in price during the month under review and at 82 per cent. above 1911-13 the index number was 11 points higher than in February, but three points lower than in March last year. A slight fall in hay prices was

recorded, but there was a reduction also in the base years, and the index figure remained unaltered at 12 per cent. above pre-war. Vegetables were very dear in March, the increase over 1911-13 being about 150 per cent. as compared with just over 100 per cent. in the previous month. Wool prices continued the rises shown in recent months, and the index number was eight points higher at 70 per cent. above pre-war, or 37 points higher than in March, 1927.

Index numbers of different commodities during recent months and in March, 1926 and 1927, are shown below:—

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

Commodity	1926	1927		1928		
	Mar.	Mar.	Dec.	Jan.	Feb.	Mar.
Wheat	55	57	34	34	29	30
Barley	14	38	35	40	34	36
Oats	25	14	31	39	42	49
Fat cattle ..	43	26	16	28	32	38
Fat sheep ..	52	45	44	63	56	61
Bacon pigs ..	85	63	20	34	38	40
Pork pigs ..	89	76	33	44	42	45
Dairy cows ..	37	25	28	26	29	31
Store cattle ..	31	27	13	24	25	23
Store sheep ..	61	41	35	42	44	47
Store pigs ..	115	116	41	47	41	35
Eggs	41	39	41	77	33	26
Poultry	50	34	37	38	39	40
Milk	72	56	66	66	66	56
Butter	46	40	47	47	47	47
Cheese	77	36	55	61	59	65
Potatoes	31	85	75	74	71	82
Hay	6	—	20	18	12	12
Wool	39	33	50	58	62	70

* * * * *

A CORDIAL invitation is again extended to Farmers' and Farm Workers' Associations and Clubs, Chambers of Agriculture and Horticulture, Students' Societies and other bodies interested in agriculture or market gardening to inspect the Rothamsted and Woburn Experimental Plots during the coming summer. Mr. H. V. Garner, M.A. (Camb.), and Capt. E. H. Gregory will be available to demonstrate the Plots at any time, and all who come can be certain that under their guidance a visit will prove both useful and interesting.

At Rothamsted the soil is heavy. The experiments deal with the manuring of arable crops, especially sugar beet, potatoes, mangolds, barley, oats, wheat; manuring of meadow hay; effect of modern slugs and mineral phosphates on grazing land and hay land; inoculation of lucerne; crop diseases and pests; new experiments are in progress on the laying down of land to grass; demonstrations of modern implements, tractors and good types of tillages.

At Woburn the soil is light. The experiments there are concerned more particularly with the manuring of potatoes, sugar beet, wheat, malting barley, and the use of green manures. At any convenient time between May and October 30 there is sufficient to occupy a full day, and there is provision for assuring that the time shall not be lost, even if the weather turns out too bad to allow of close investigation of the fields. It is not possible to see both Rothamsted and Woburn in one day.

The Director, Sir John Russell, will be happy to arrange full details with organizations of farmers, farm workers and others wishing to accept this invitation; small groups of farmers are specially welcomed. If possible, arrangements should be made beforehand; but it is recognized that farmers' movements must often depend on the weather, and no farmer need stay away because he has been unable to write fixing a date.

All communications and requests to visit the Stations should be addressed to the Secretary, Rothamsted Experimental Station, Harpenden. It would be a convenience if ample notice could be given so as to avoid the possibility of dates clashing.

* * * * *

ACCORDING to returns rendered to the Ministry by the beet sugar factories operating in Great Britain, the total

quantity of home-grown beet sugar manufactured during March, 1928, together with the quantity produced during the corresponding month in 1927, was :—

				Cwt.
March, 1928	..	..	..	109
March, 1927	..	..	..	Nil

The total quantities of sugar produced during the two manufacturing campaigns to the end of March were :—

				Cwt.
1927-8	..	..	..	3,804,853
1926-7	..	..	..	3,069,757

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on April 17, at 7 Whitehall Place, S.W. 1, the Chairman, 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 into effect the Committees' decisions :—

Herefordshire.—An Order to come into operation on May 1 and to continue in force until April 30, 1929, fixing minimum and overtime rates of wages for male and female workers. The minimum rates in the case of male workers of 21 years of age and over are : for bailiffs, waggoners, stockmen and shepherds, 36s. per week for all time necessarily spent on the immediate care of animals not exceeding 60 hours, and for other male workers 31s. per week of 54 hours in summer (instead of 53 hours as at present), and 48 hours in winter, the overtime rates in the case of all classes of male workers being 9d. per hour. The minimum rate for female workers of 18 years of age and over is 4½d. per hour, with overtime at 6d. per hour.

Lancashire.—An Order to come into operation on May 1 and to continue in force until April 30, 1929, 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 remain as at present, viz. : In the Southern area, for stockmen and teamsmen, 37s. per week of 52½ hours, and for other male workers, 33s. 6d. per week of 50 hours; in the Eastern area for all classes of male workers, 42s. per week of 60 hours; 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. The overtime rate in the case of male workers of 21 years of age and over throughout the county is 10d. per hour (instead of 11d. per hour as at present). In the case of female workers of 18 years of age and over the minimum rate remains at 6d. per hour for all time worked.

Suffolk.—An Order to come into operation on April 23 and to continue in force until further notice, making various amendments in regard to the application of the existing minimum rates, including a definition of the term horseman, and provisos with regard to cases where a worker, through his own default, fails to complete the number of hours in respect of which the weekly minimum wage is payable and in regard to time lost on account of wet weather. The minimum rate in the case of male workers of 21 years of age and over remains at 30s. per week of 50 hours in summer and 48 hours in winter, except in the case of horsemen, cowmen and shepherds, where the rate is applicable to all employment other than employment up to 10 hours per week on duties in connexion with the immediate care of animals with, in addition, an inclusive sum of 6s. in respect of employment up to 10 hours per week on such duties. The overtime rate for all classes of male workers of 21 years of age and over is 9d. per hour.

Anglesey and Caernarvon.—An Order to come into operation on May 13 and to continue in force until further notice, varying the 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: for horsemen, cowmen, shepherds or hwsmyrn (bailiffs), 35s. per week of 60 hours (instead of 58 hours as at present), and for other male workers 31s. per week of 50 hours, overtime being payable in each case at 9d. per hour. The minimum rate for female workers of 18 years of age and over is 6d. per hour for all time worked.

Merioneth and Montgomery.—An Order to come into operation on May 2 and to continue in force until May 1, 1929, 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: for stockmen, teamsters, carters and shepherds, 33s. per week of 60 hours (instead of 34s. 6d. as at present), and for other male workers 30s. per week of 54 hours (instead of 31s. 6d. as at present). Overtime is payable in the case of all classes of male workers of 21 years of age and over 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 as from May 1 until April 30, 1929, the minimum and overtime rates of wages at present in force for male and female workers. 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 6½d. 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 15, legal proceedings were instituted against eight employers for failure to pay minimum and overtime 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 concerned
		£	s.	d.	£	s.	d.	£	s.	d.	
Devon ..	S. Molton ..	0	10	0	3	10	6	10	0	1	2
Hereford ..	Hereford ..	3	0	0	2	12	0	3	12	3	2
„ ..	Bromyard ..	4	10	0	8	9	2	14	0	0	2
Salop ..	Wem ..	3	0	0	—	—	—	20	0	0	1
„ ..	Shifnal ..	*	—	—	—	—	—	41	14	3	3
„ ..	Clun..	—	—	—	0	8	6	6	6	6	1
Surrey ..	Kingston ..	15	0	0	1	2	6	31	7	0	3
Flint ..	Caerwys ..	2	0	0	1	3	6	7	5	3	1
		£28	0	0	£17	6	2	£134	5	4	15

* No conviction recorded.

Foot-and-Mouth Disease.—Since the report in last month's (April) issue of this JOURNAL, 6 outbreaks of foot-and-mouth disease have been confirmed in Great Britain. These outbreaks were in the following counties: Yorks (West Riding), 3; Cheshire, 1; Cornwall, 1; and Nottingham 1. The outbreaks in Yorkshire and Cheshire were in already existing "infected" areas, but those in Cornwall and Nottingham were in hitherto "clean" areas.

The number of outbreaks confirmed since January 1 last is 91, involving 13 counties, and the slaughter of 2,599 cattle, 3,478 sheep, 1,522 pigs and 5 goats.

* * * * *

APPOINTMENTS

THE Ministry feels that it may be of considerable assistance to farmers and others to know to whom they may apply in their own county for guidance on the various technical matters connected with their work on which they may be glad of advice. It is accordingly proposed to publish in this JOURNAL a list of the principal officers of the county agricultural education staffs, and farm institutes; also agricultural colleges and university agricultural departments; and a list of the principal workers at research institutes, etc. Thereafter, changes in these staffs will be notified from time to time as they occur; and various other appointments of interest to farmers may be similarly recorded.

A list of the staffs employed by certain English county authorities was given in last month's (April) issue; the remainder of the English county staffs and those in Wales are given below.

Principal Members of Teaching Staffs Employed by County Agricultural Education Authorities in England and Wales.

ENGLAND (concluded)

Northamptonshire

Principal of County Farm Institute and County Agricultural Organizer	..	..	..	W. A. STEWART, M.A., B.Sc.
Warden and Assistant Agricultural Organizer	..	..	..	W. R. SEWARD, N.D.A.
Horticultural Superintendent	..	..	..	C. F. LAWRENCE, F.R.H.S.*
Assistant Horticultural Superintendent	..	..	..	H. J. WYLES*
Instructress in Dairying and Poultry-keeping	..	..	..	Miss J. W. STRANG, N.D.D., C.D.D.
Assistant Instructor	..	..	..	R. A. JEFFERY, N.D.A., N.D.D.

* Wholly employed by the County Council but only partially on agricultural education work.

Northumberland

Agricultural Organizer ..	..	W. S. CHALMERS, B.Sc., B.Com.
Instructor in Horticulture ..	..	C. W. MAYHEW*
Instructress in Dairying and Poultry-keeping ..	..	Miss A. BRETHERTON, N.D.D.

Nottinghamshire

Agricultural Organizer ..	..	R. N. DOWLING, N.D.A.,
Assistant Agricultural Organizer ..	..	N. HOWARD, B.A.
Instructor for Smallholders ..	..	C. H. MARR
Horticultural Organizer ..	..	C. TABORN, F.R.H.S., F.L.S.
Assistant Instructors in Horticulture ..	..	{ H. J. MANSEY
	..	{ A. SMITH*
Instructress in Dairying ..	..	Miss H. S. WOOD, N.D.D.
Instructor in Small Livestock ..	..	H. D. DAY
Instructor in Manual Processes ..	..	J. S. FEATHERSTONE

Oxfordshire

Agricultural Organizer ..	..	G. R. BLAND, N.D.A., N.D.D.
Instructor in Horticulture ..	..	S. HEATON, F.R.H.S.*
Instructresses in Dairying and Poultry-keeping ..	..	{ Miss K. BOYES, N.D.D., B.D.F.D.
	..	{ Miss V. C. STAMPER, N.D.D.

Instructor in Farriery and Welding J. WILSON

Rutland

Agricultural Organizer ..	..	I. P. MACLEWAN, B.Sc.*
Instructress in Dairying and Poultry-keeping ..	..	Miss E. WEBB, N.D.D.

Salop

Agricultural Organizer ..	..	E. DRUCE, F.C.S., P.A.S.I.
Horticultural Adviser ..	..	G. T. MALTHOUSE*
Instructress in Horticulture ..	..	Miss M. HERON, N.D.H.
Instructress in Dairying ..	..	Miss E. M. DAWSON, N.D.D.
Instructor in Poultry-keeping ..	..	O. CROWTHER
Instructor in Farriery ..	..	C. RICHARDSON, F.W.C.F.

Somerset

Agricultural Organizer and Principal of Somerset Farm Institute ..	..	W. D. HAY, B.Sc.
Vice-Principal ..	..	C. F. PORTEOUS, N.D.A., N.D.D., B.D.F.D.
Assistant Agricultural Organizer ..	..	J. W. DALLAS, M.Sc.
Horticultural Superintendent ..	..	A. D. TURNER, N.D.H.
Instructor in Horticulture ..	..	J. GLAVIN, F.R.H.S.
Assistant Instructor in Horticulture ..	..	J. E. FORSHAW
Instructor in Gardening and Head Gardener ..	..	K. V. CRAMP
County Superintendent of Dairying ..	..	Miss M. C. TAYLOR, N.D.D.
Head Instructress in Dairying ..	..	Miss E. M. MONIE, N.D.D., C.D.D.
	..	{ Miss O. E. MASTERS, N.D.D.
Instructresses in Dairying ..	..	{ Miss M. BRITAIN, N.D.D.
	..	{ Miss L. C. FURNELL, N.D.D., B.D.F.D.

Chief Instructor in Poultry-keeping ..	B. C. BREWER
Instructress in Poultry-keeping ..	Miss N. COLLIER, N.D.P.

Staffordshire

Agricultural Organizer and Principal of County Farm Institute ..	J. C. RUSHTON, F.H.A.S.
Instructor in Agriculture ..	H. B. TILLEY, B.Sc.
Horticultural Superintendent ..	J. STONEY, F.R.H.S.
Instructor in Horticulture ..	C. D. DEMPSTER*
Instructor in Bee-keeping ..	J. PRICE, F.E.S.
Instructor in Dairying ..	E. KNOWLES, N.D.A., N.D.D.
Instructress in Dairying ..	Miss E. NOBLE, N.D.D.
Instructor in Poultry-keeping ..	A. THOMPSON.
Assistant to Instructor in Poultry-keeping ..	T. B. WOODCOCK
Instructor in Farriery ..	J. D. G. HARRIS, A.F.C.L., R.S.S., M.W.I.E.
Instructor in Woodwork ..	J. CRUTCHLEY*

Suffolk, East

Agricultural Organizer ..	A. W. OLDERSHAW, B.Sc.
Instructress in Dairying and Poultry-keeping ..	Miss C. E. SPEAKMAN, N.D.D.

Suffolk, West

Instructor in Horticulture and Bee-keeping ..	E. G. CREEK*
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Surrey

Agricultural Organizer ..	J. H. MATTINSON, B.Sc.
Assistant Instructor in Agriculture ..	G. T. MORGAN, N.D.A., N.D.D.
Superintendent of Horticulture ..	A. E. BURGESS, M.B.E., F.R.H.S.*
Instructors in Horticulture ..	{ C. H. MIDDLETON, F.R.H.S.*
	{ C. H. WALKDEN*
Instructress in Small Livestock ..	Miss E. E. KIDD

Sussex, East

Agricultural Organizer and Principal of Agricultural Institute ..	R. H. B. JESSE, B.Sc., N.D.A.*
Lecturer in Agricultural Chemistry ..	R. C. SAXBY
Lecturer in Agriculture ..	B. J. FRICKER, N.D.A., N.D.D.
Horticultural Superintendent ..	G. C. JOHNSON
Instructor in Poultry-keeping ..	S. C. SHARPE
Instructresses in Dairying ..	{ Miss J. MACGILLIVRAY, N.D.D.
	{ Miss M. A. HUNT, B.D.F.D.*
	{ Miss M. MARTIN*
Instructor in Farriery ..	A. KEMBER, A.F.C.L., R.S.S., F.W.C.F.
Instructor in Hedging and Thatching ..	H. E. CANDY

Sussex, West

Agricultural Organizer ..	W. LAWSON, M.B.E., N.D.A., N.D.D.*
Horticultural Superintendent ..	F. W. COSTIN, N.D.H., F.R.H.S.
Instructor in Poultry-keeping ..	F. A. KENT, N.D.P.
Instructor in Dairying ..	J. C. W. SIMMS, B.Sc., N.D.D.
Instructor in Farriery ..	G. KEMBER, A.F.C.L., R.S.S.

Warwickshire

Agricultural Organizer	W. IRONS, M.A., B.Sc.
Assistant Agricultural Organizer..	T. C. GODDARD, B.Sc., N.D.D.
Horticultural Adviser	H. DUNKIN, N.D.H.*
Assistant Horticultural Adviser..	C. R. S. GREGORY, N.D.H.*
Instructor in Poultry-keeping ..	A. F. TOMEY

Westmorland

(See Cumberland.)

Wiltshire

Agricultural Organizer	W. T. PRICE, M.C., P.A.S.I., N.D.A., N.D.D.
Instructors in Agriculture ..	{ H. W. TOMLINSON, N.D.A., N.D.D.
Horticultural Superintendent ..	R. WIGHTMAN, B.Sc.
Instructor in Poultry-keeping ..	W. C. CRISP, N.D.H.
Instructress in Dairying	A. E. HOLMAN
	Mrs. A. C. BULL*

Worcester

Agricultural Organizer	R. C. GAUT, M.Sc., N.D.A.
Instructor in Horticulture ..	H. PATIENCE
Instructress in Dairying	Miss E. M. PRITCHARD, N.D.D.
Instructor in Poultry-keeping ..	B. WILCOCK, N.D.P.

Yorkshire

(University of Leeds, Agricultural Department.)

Professor of Agriculture	R. S. SETON, B.Sc.
Professor of Agricultural Chemistry	N. M. COMBER, D.Sc., A.R.C.S., F.I.C.
Lecturer in Agriculture	G. C. A. ROBERTSON, M.C., M.A., B.Sc.
Assistant Lecturers in Agriculture	{ G. F. PILLING, B.A., N.D.A. W. B. NICOLL, B.Sc.
	{ J. ROBB, B.Sc.
	{ J. STRACHAN, M.A., B.Sc., N.D.A.
District Lecturers in Agriculture..	{ H. THOMPSON, B.Sc.
	{ D. H. FINDLAY, B.Sc., N.D.A., N.D.D.
	{ W. D. D. JARDINE, B.Sc., N.D.A., N.D.D.
	{ W. S. GIBSON, B.Sc.
Lecturer in Dairy Husbandry ..	J. MCGREGOR, B.Sc., N.D.A., N.D.D.
Assistant Lecturer in Dairy Husbandry	A. McVICAR, B.Sc., N.D.A., N.D.D.
Assistant Lecturers in Agricultural Chemistry	{ G. MILNE, M.Sc., A.I.C.
	{ J. S. WILCOX, B.Sc., A.I.C.
Assistant Lecturer and Advisory Chemist	H. T. JONES, M.Sc.
Lecturer in Agricultural Economics	A. G. RUSTON, B.A., D.Sc.
Assistant Lecturer in Agricultural Economics	C. V. DAWE, M.Com.
Assistant Science Tutor	H. PRESTON, B.Sc.
Lecturer in Agricultural Botany and Advisory Mycologist ..	W. A. MILLARD, B.Sc.

Assistant Lecturers in Agricultural Botany	{ A. POWELL JONES, B.Sc. S. BURR, M.Sc.
Demonstrators in Agricultural Botany	{ C. H. CHALMERS, B.Sc., N.D.A. W. A. JACQUES, B.Sc.
Lecturer in Agricultural Zoology and Advisory Entomologist ..	{ D. GREEN, M.Sc.
Assistant Lecturer in Agricultural Zoology	T. H. TAYLOR, M.A.
Lecturer in Veterinary Hygiene..	L. R. JOHNSON, B.Sc.
Assistant Lecturer in Poultry- keeping	H. G. BOWES, F.R.C.V.S.
Lecturer and Organizer in Horti- culture	C. W. GOODE, N.D.A., N.D.D.
Instructors in Horticulture ..	{ A. S. GALT J. W. EVES
	{ W. LODGE G. H. NASH, N.D.H.
Instructor in Bee-keeping	W. HAMILTON
Instructress in Dairying	Miss B. L. S. PROWSE, N.D.D., B.D.F.D.
Assistant Instructress in Dairying	Miss H. CRAWFORD, N.D.D.
Warden at the Askham Bryan Farms	G. G. MACDONALD, B.Sc.

WALES AND MONMOUTHSHIRE**Anglesey**

Agricultural Organizer	GRIFFITH JONES, B.Sc., N.D.D.
Instructor in Horticulture ..	W. G. WILLIAMS
Instructress in Dairying and Poultry-keeping	Miss JENNIE JONES, N.D.D.

Breconshire and Radnorshire (Joint Staff)

Agricultural Organizer	DAVID THOMAS
Instructor in Horticulture and Bee- keeping	J. G. WATSON, F.R.H.S.
Instructress in Dairying and Poultry-keeping	Miss E. JONES, N.D.D.

Caernarvonshire

Principal of Farm School and Agricultural Organizer	ISAAC JONES, N.D.A., N.D.D.
Assistant Organizer and Lecturer in Agriculture	EDWIN JONES, B.Sc.
Instructor in Horticulture ..	J. ROBERTS
Instructress in Dairying	Miss M. ROBERTS, N.D.D.
Instructor in Poultry-keeping and Bee-keeping	J. ROWLANDS, B.B.K.A.

Cardiganshire

Agricultural Organizer	D. J. MORGAN, B.Sc.
Instructor in Horticulture ..	W. LEWIS, F.R.H.S.
Instructress in Dairying and Poultry-keeping	Miss R. M. EVANS, N.D.D.

Carmarthenshire

Principal of Farm Institute and Agricultural Organizer	J. L. LLOYD, M.Sc.
Vice-Principal	A. D. THOMAS, B.Sc.

Instructor in Horticulture ..	W. ROADLEY
Instructress in Dairying ..	Miss R. WILLIAMS, N.D.D.
Instructor in Poultry-keeping ..	H. E. BREEN-TURNER

Denbighshire

Principal of Farm Institute and Agricultural Organizer ..	ISAAC JONES, B.Sc.
Instructor in General Science ..	J. H. HUMPHREYS, M.Sc.
Instructor in Horticulture ..	CHAS. ROBERTS
Instructress in Dairying ..	Miss M. A. INGLIS, N.D.D.
Assistant Instructress in Dairying ..	Miss A. DAVIES, N.D.D.
Instructor in Poultry-keeping ..	O. R. STEVENSON, N.D.P.

Flintshire

Agricultural Organizer ..	W. E. LLOYD, M.Sc.
Horticultural Superintendent ..	H. L. JONES, N.D.H.
Instructress in Dairying ..	Miss R. A. DAVIES, N.D.D.
Instructress in Poultry-keeping ..	Miss V. D. HARRISON, N.D.D.

Glamorganshire

Agricultural Organizer ..	J. D. DAVIDSON, A.R.C.Sc.I., N.D.A., N.D.D.
Instructor in Agriculture ..	J. DAVIES, B.Sc.
Horticultural Superintendent ..	GEO. H. COPLEY, N.D.H.
Horticultural Instructor ..	E. W. WITHERS
Instructor in Dairy and Poultry Husbandry ..	H. WIGNALL, N.D.A., N.D.D.
Instructresses in Dairying and Poultry-keeping ..	(Miss A. PRITCHARD, N.D.D.) (Miss K. EDWARDS, N.D.D.)
Instructress in Dairying ..	Miss M. BOWEN

Merionethshire

Agricultural Organizer ..	MOSES GRIFFITH, M.Sc.
Instructor in Agriculture and Rural Science ..	G. EVANS, B.Sc.*
Instructor in Horticulture ..	C. H. JONES, F.R.H.S., N.D.H.
Instructress in Dairying and Poultry-keeping ..	Miss M. DAVIES, N.D.D.

Monmouthshire

Principal of Farm Institute and Agricultural Organizer ..	G. H. PURVIS, F.C.S.
Assistant Lecturer in Agriculture ..	E. DAVID, B.Sc.
Instructor in Poultry-keeping ..	K. WILSON
Instructress in Dairying ..	Miss M. TRIPPE, N.D.D.
Assistant Instructress in Dairying ..	Miss A. HALL, N.D.D.
Instructor in Horticulture ..	W. H. C. BEVAN, F.R.H.S.

Montgomeryshire

Agricultural Organizer ..	J. L. JOHN, B.Sc.
Instructress in Dairying and Poultry-keeping ..	Miss M. J. WILLIAMS, N.D.D.

Pembrokeshire

Agricultural Organizer ..	W. E. D. JONES, M.A., Dip. Agric.
Horticultural Instructor ..	H. W. EVANS
Instructress in Dairying ..	Miss A. S. PRICE, N.D.D.
Instructress in Poultry-keeping ..	Miss M. P. BALLY, N.D.P.

NOTICES OF BOOKS

British Farmers in Denmark. By J. R. Bond. Reprinted from the *Daily Telegraph*. (London: Ernest Benn, Ltd. 1928. Price 1s. 6d.)

This book is a survey of Danish systems and methods, examined from a British "angle." Comparisons and contrasts are made with British conditions, and concrete suggestions are offered regarding practices which might usefully be adapted in this country. The evidence of higher milk yields and heavier corn crops, of the advanced state of live stock improvement schemes, and of co-operation, attributed largely to "education and research," is possibly somewhat discounted when we read that "the Danish farmer is not enjoying at the moment any outstanding measure of prosperity." The most important factor appears to be an external one: Currency, which is outside the control of the most scientific and practical farmer. To all who would learn more of Danish farming, as well as to those who feel they have heard too much about it, this book may safely be recommended. One would like to see a similar survey of districts in our own country by the same author—it would be equally interesting and no doubt just as instructive.

Handbuch der Landwirtschaft. In five volumes, to be published in about 20 parts at a subscription price of Rm. 5.80 each. (Berlin: Paul Parey, 28-29 Hedemannstrasse, S.W.11.)

This new large "Handbuch," edited by Fr. Aereboe, J. Hansen and Th. Roemer, with some 40 collaborators, is designed to give a comprehensive account of the progress made in German agriculture since the war, and to co-ordinate the knowledge gained from scientific research and practical experience. Each part consists of about 128 pages and contains numerous illustrations. Two parts have already been issued, and the remainder are to be issued at intervals of four weeks. The first two parts (Vol. II, part 1, and Vol. III, part 2) contain "The Origin, Characteristics and Classification of Soils," by Professor Dr. Schucht, Berlin; "The Biology of Soil," by Professor Dr. Löhnis, Leipzig, and the commencement of "Climate in Relation to Agriculture," by Professor Dr. Münzinger, Hohenheim, as well as "Cereal Culture," by Professor Dr. Berkner, Breslau, and the beginning of "Potato Growing," by Professor Dr. Opitz, Berlin. These articles reach a high level of presentation of themes important to agriculturists, and offer a very promising picture of the whole work.

The Soil and Civilization: A Modern Concept of the Soil and the Historical Development of Agriculture. By Milton Whitney. Pp. x+278. (London: Chapman & Hall, Ltd. 1926. 15s. net.)

As the last work of the late Chief of the United States Bureau of Soils, this is a book of undeniable importance. It is remarkable for the breadth as well as for the novelty of its conception: "The World of Milton Whitney" suggests itself inevitably as an alternative title, for the author has attempted here in agriculture what H. G. Wells has done in history. But Whitney lacked Wells' literary facility, and a little of the other's gift of seeing things in proportion as well as in relation to each other.

The book sets forth the "Modern concept" of the soil as a living thing: in the first chapter this theme is developed with a wealth of analogy from the higher animals and a description of the farmer's part in controlling soil functions. Among others there are sections on The Man, and on Tragedies of the Soil, "revealing," as one might say,

"the human interest in farm management and the need for master minds"—but in a "non-technical" book written for the public that learns from "movie" sub-titles, such features may be necessary. More important is the section that emphasizes the endurance of the soil where cultivation has continued for tens of centuries.

The second chapter consists of a description of the important soils of the United States and their classification, an account thorough and informative, as only a writer of the author's position could make it. Next comes a short account of methods of soil control, wherein the principles of crop adaptation and of cultivation, and the function of liming, are described in terms of the soil's digestive system: ploughing is "a method of exercising the soil to promote digestion." The stress placed here and in other chapters on the importance of cultivation in maintaining soil fertility will not come amiss in these times of fertilizer propaganda.

A long chapter follows on the use of fertilizers, and here the animal analogy is elaborately applied. Introductory sections develop the history of manurial and chemical knowledge; the processes of plant physiology are described (here it may be noted that several of the bonds of xanthine on p. 118 are conspicuous by their absence, and that the formula given for sucrose has recently been modified); germination and growth are briefly treated; and the nature of the soil-plant-animal cycle is well and broadly stated. Then we read: "Our present concept of the soil is that it is dynamic, that it has functional parts and functional activities that give it many of the attributes of a living thing, and that it functions internally in much the same way as the higher order of animals"; and on this basis the ordinary conception of fertilizer action and the significance of plot experiments with fertilizers are destructively criticized. A detailed examination of the new concept or a criticism of the evidence and arguments presented cannot be attempted here; but it may be observed that the author's account is no less vitalistic than dynamic. A thoughtful account of the soil's properties from the chemical and physical point of view would be equally dynamic; the influence of biological factors cannot be overlooked—but can be over-stated. Moreover, while an analogy is a very instructive method of presenting a subject, it lacks value as a form of scientific proof, and makes a treacherous argument. The proofs given that direct plant nutrition is a minor function of fertilizers are not entirely convincing; it may be observed that the theory of nutrient uptake presented, by which only soluble nutrient salts in the free solution are available to the plant, is not the only one tenable. Further, the criticisms of long-time plot experiments and their results appear to have been written before information as to improved plot technique had become available—the more recent methods permitting of statistical treatment answer many of the objections raised. The author, indeed, seems to have misjudged the type of question that long-time continuous cropping experiments are nowadays expected to answer.

The last third of the book constitutes a rather fascinating outline of history, by no means purely agricultural; it shows the development of agriculture under different civilizations, illuminating both the knowledge of the ancients and the rudimentary condition of much of present-day farming. The author calls for a development of agriculture to parallel the general development of our civilization; this, the final chapter, ends on an optimistic note: "The future seems most hopeful, the soil seems to be awaiting our pleasure. . . . Man's best armour against the inscrutable laws of nature is the application of science to agriculture."

Orcharding. By Victor Ray Gardner, Frederick Charles Bradford, and Henry Daggett Hooker. Pp. xi+311. (London: McGraw-Hill Publishing Co., Ltd. 1927. Price 15s.)

The Fundamentals of Fruit Production, published in 1922 by the same authors, dealt with the fundamentals rather than with the practical side. In the present book the authors have left, as it were, the laboratory and the lecture room and written of orcharding when viewed as an industry. The text of the book is clearly expressed in their words, "Orcharding is based on a body of scientific facts and principles; some of these must remain basic so long as there is any fruit growing, and some are applicable only as economic conditions determine. The accelerating trend of the industry from farm orcharding to highly specialized enterprises makes all the more imperative keen discrimination between what is good science and what is good business." In the 22 chapters of the book the authors try to show how an understanding of good science and good business can assist orcharding—particularly in producing fruit that appeals—which they term "Consumers' fancies."

The chapters on Tree Structure and Growth, its water and nutrient requirements, are a clear exposition of accepted knowledge.

Whilst a good deal of space has been devoted to tree propagation, nursery practices, nursery catalogues, and training the young tree, little has been said concerning stocks, probably because the influence of the stock on tree growth and fruit fullness is not recognized in the U.S.A. to be so intense as in this country. Pruning, it is stated, has a dwarfing influence on young trees, and on bearing trees it also usually thins the crops, but improves the grade of fruit produced. Fertilization and cultivation are regarded as more effective and, often, cheaper agents than pruning in promoting vigorous growth; whilst thinning of the crop can, in many cases, be done more intelligently by the removal of the fruits than by pruning. Pruning, it is contended, is not simply to be practised in the dim hope that it may do some good; it should be used only to attain a very definite end. Lacking this, it is better omitted. This sounds queer doctrine to European pomologists, who are much wedded to pruning; though it will be no shock to our research workers, whose experiments on pruning have failed to provide evidence to support pruning as it is so commonly done.

The chapters on Consumers' fancies, fruit coloration, finish and quality show that these scientists are not unfamiliar with fruit marketing; they have even dared to write a chapter on Orchardng as a business, and given in it quite good advice. An interesting book to read.

Soil Management. By Firman E. Bear, Ph.D. Second edition, thoroughly revised and enlarged. (The Wiley Agricultural Series.) Pp. v + 412. (London, Chapman & Hall, Ltd. 1927. 17s. 6d. net.)

¶ A book must be considered in relation to its purpose: this, intended as a text-book for American students with some knowledge of the sciences, is admirable. How wide is the range of processes operating in the soil and influencing soil management, is well exemplified in the scope of the book. The author leads up to his subject through a well planned survey of soil science and the relationships of soil and plant; he deals in detail with the utilization and conservation of soil resources; and he concludes with a clear, fully reasoned account of the use of fertilizers. This edition is "right up to date": it includes such matters as a useful summary of the classification of soil groups on the climatic basis (in an earlier chapter), and (near the end) some mention of the value of the newer "concentrated" fertilizers.

A surprising amount of relevant information has been packed in—more, indeed, than the large index can deal with completely. Many illustrative tables are used, and they are rarely presented without some cautionary remark to remind a student of the limited value of selected and local data. It might be made clear, however, that the availability of cyanamide nitrogen in general field experience is much nearer that of ammonia than appears in the pot experiments quoted in Table CXXI. Even in explanations of some apparently simple action or effect, the complexity of soil processes and the interaction of soil and plant are not overlooked.

American conditions naturally form the background of the book, and this should be borne in mind in the fertilizer-section especially; but the attention paid to the fundamental reasons for things, coupled with clear and full explanations, makes *Soil Management* a profitable study here as well as there.

The Diseases of Sugar Beet. By Dr. O. Appel. English edition edited by R. N. Dowling, translated by C. L. Wood. (London: Ernest Benn, Ltd., 1927. Price 6s.)

This little book is an English edition of No. 3 of Paul Parey's "Pocket Atlas" series. It contains 22 coloured plates by A. Dressel, illustrating the chief diseases of sugar beet and the principal insect and other pests that attack this crop plant. Facing each illustration is a brief popular description of the disease or pest concerned. The book will probably prove useful to those who are interested in the cultivation of sugar beet in this country, but it is greatly to be regretted that the text was not submitted to some plant pathologist familiar with the subject before it was sent to press. The names given to some of the diseases and pests are not those at present in common use in this country, and this is likely to lead to some confusion. Curious expressions like "suctiferous insects," and "ampulla of the germ" occur, and technical words, such as "exogenous" and "cuticle" are employed when not strictly applicable. Again, who has ever heard of a native British tree called the "wahoo"? Perhaps because this book was printed in Germany, there are numerous typographical errors, some of them very obvious. All these imperfections might easily have been avoided with due care in the preparation of the edition for English readers.

The History of Our Food Plants. (Die Geschichte unserer Pflanzennahrung). By Professor Dr. A. Maurizio. Pp. xx + 480. (Berlin: Verlagsbuchhandlung Paul Parey, 1927. Price 32 Reichmarks.)

A work in German under the above title has recently been published in Berlin, and through it the author has found a unique means of presenting a vast amount of interesting information upon an important group of economic plants. The book is divided into nine Sections, each of which deals with a definite phase of the subject.

In the First Section the food of man is traced from the time that man was in his most primitive stage up to a period when he had come to require his food boiled. In those remote times cultivation had not begun to be practised, but man's instinct led him to collect various kinds of wild roots, herbs, fruits and seeds, and by "trial and error" to select the most suitable kinds and recognize the stage of development when they were most nutritious. He hunted animals and gradually came to appreciate their flesh as food. Later, he began to use herbs and flesh together in a cooked state, and used the water in which they were cooked as a kind of broth. At the end of this Section the author traces the methods pursued in times of scarcity and famine. This leads to a description of the general characteristics of wild crops in Section

Two, in which their collection is dealt with, as also their use in various ways—such as in sweet and sour infusions and ferments. Instances are given of certain preparations that have been handed down amongst the peasantry in certain countries from remote times to the present day.

In Section Three the author carries his subject to the time when cultivation was commenced. He describes cultivation by the hoe, the digging stick and the plough, and then gives details concerning broth foods and various processes in cooking that followed change of taste. Reference is made to roasting and grilling in addition to boiling. The cultivation of many of the plants used in very early days has long ceased to be practised, although modern forms of some of the old cereals may still be in use. The use of grains in the preparation of gruels and porridge is dealt with, millets, buckwheat, groats and grasses being specially mentioned.

Sections Four and Five trace the art of milling from primitive times and introduce the reader to the early attempts at cooking ground meal, i.e., the baking of flat unleavened cakes. The drying of food-stuffs is also introduced. Porridge and bread cereals and the mixing of various kinds of corn are considered in the next Section, and in Section Seven the reader is carried to the introduction of ferments in the preparation of bread and beer. Breads of the present day, and bread made during the great war, are described in Section Eight, special reference being made to the coarse bread of the Slavs and inhabitants of Alpine regions, as well as to rye bread and various other kinds. In Section Nine, a review is given of wheaten bread, the present-day black- and white-bread eating peoples, and the gradual change of taste in peoples with regard to vegetables eaten from early times up to the present day.

The author appears to have gone into his subject very thoroughly, and to have produced a very interesting and useful book dealing with a large number of plants.

Green Manuring: Principles and Practice. By A. J. Pieters, Ph.D., Agronomist in Charge of Clover Investigations, U.S. Dept. of Agriculture. Pp. xiv + 356. (London: Chapman & Hall, Ltd. Wiley Agricultural Series. Price 22s. 6d. net.)

Those who wish to obtain a good general view of the problems and practices of green manuring have hitherto been compelled to seek information in scattered and often rather inaccessible sources. For such readers Dr. Pieters' book will be most valuable, since it provides a great body of information concerning the objects, methods, and achievements of green manuring as practised in many parts of the world. In the opening chapter, the author sets out the main facts of the carbon and nitrogen cycles in the soil, with special reference to the gain of nitrogen obtainable by the growth of leguminous crops. Interesting chapters follow dealing with the decomposition of vegetable matter in the soil, and some functions of green manuring apart from the provision of nitrogen. Discussing the practical side of the subject, the difficulties and drawbacks of green manuring are not shirked; perhaps the most serious of these is the claim which the green crop makes in dry districts on the water supply. Indeed, the maintenance of soil humus in regions of low rainfall is a problem as yet unsolved. Much evidence is quoted showing the increased yields following green manuring, and the undoubted failures which occur from time to time are noted as problems requiring further study. The section dealing with green manuring practice in the various agricultural areas of the United States is full of useful information. In many districts, soil improvement by the ploughing under of leguminous crops is a regular feature of farming, and details of a large number of local practices of this kind have been collected by the author. Systems which do not interfere with the

cultivations of the main crop have developed to the greatest extent, e.g., autumn-sown vetches or trifolium are turned under for maize or cotton, while sweet clover (*Melilotus alba*), which promises to be the most important green manuring crop in the States, is undersown in cereals to be ploughed in for maize, potatoes or sugar beet. Green manuring also finds a prominent place in orchard practice and to a lesser extent in market gardening. The systems developed in Germany and England are next described, and it is interesting to note that the plants most used in Germany (Lupines and Serradella) and in England (Mustard) are scarcely employed at all in America. A chapter is also devoted to the extensive use of green manuring in China, Japan, and the tropics.

The book is full of information and also forms interesting reading. A very complete list of references is appended and this should be useful to students.

"The Feathered World" Year Book, 1928. Pp. 437. (London: "The Feathered World," 9 Arundel Street, W.C. 2. Price 2s.)

The seventeenth issue of this annual well maintains the standard set by its editors in previous years. In addition to a large number of articles dealing with such subjects as "backyarders," blood-testing, breed oddities, the colour of chicks, planting fruit trees, poultry in the Orkneys, racing pigeons, etc., there are nearly 200 illustrations, besides information of a useful character, such as lists of county instructors and of specialist clubs. Dr. Edward Brown contributes a short survey of the poultry industry in 1927.

Mr. S. H. Lewen contributes interesting notes on the marking of foreign eggs, the Canadian Poultry Congress, the work of the National Poultry Council, and other matters of topical interest. Dr. H. A. Mitchell gives some points in favour of blood-testing as a means of dealing with bacillary white diarrhoea. In this connexion it may be pointed out that during the past few years agglutination tests have been carried out for the benefit of the public at the Ministry's Veterinary Laboratory and, despite occasional failures, they may be said to afford the most practicable method of preventing the spread of the disease. A chapter by Mr. Powell-Owen, entitled: "Making the most of 18 feet by 5 feet," shows the possibilities of poultry-keeping under somewhat difficult conditions. Many important aspects of the industry are represented either by an article or photograph in this useful and informative reference book.

Practical Vegetable Growing. By J. W. Morton, F.R.H.S. Pp. 180. (London: Ernest Benn, Ltd. Price 10s. 6d.)

Few English writers have attempted to compile a book on vegetable growing, yet the industry which is engaged in vegetable production is one of considerable importance. This little book is in consequence very welcome, for it provides just the information that a market gardener needs.

Artichokes, beans, broccoli, cabbage and all other market crops are dealt with in a manner that should commend itself to the practical man. Suitable soils for these crops, and the manuring, cultivation and harvesting of each, are considered, although the information given is general rather than detailed. For this very reason the book should prove valuable for the market gardener, whose business is concerned with the production of all kinds of vegetables, rather than for the specialist.

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NOTES FOR THE MONTH

READERS of the JOURNAL may care to have the following information regarding the circulation of the Ministry's

Official Agricultural Publications

publications. For many years past the Ministry has issued Leaflets and various Miscellaneous Publications, with the special object of affording guidance and assistance to all who are concerned with food production. The first Leaflet was issued in 1894, and this JOURNAL commenced publication in 1895, but special reports on crop pests were published from 1887 onwards (one, in 1892, contained coloured plates), and other subjects followed. At the present time, a number of the Ministry's publications have an excellent sale, and among the more popular publications may be mentioned the following, with their sale figures: *British Breeds of Live Stock*, five English editions, nearly 14,000; Professor T. B. Wood's invaluable little book, *Rations for Live Stock*, five editions, nearly 19,000; *Construction of Cowhouses*, two editions, nearly 6,000; *Collected Leaflets on Manures and Manuring*, three editions, over 9,000; *Insect Pests of Fruit Trees*, four editions, over 11,000; *Poultry, Rabbits and Goats*, two editions, over 8,000; and the Report on the *Marketing of Milk in England and Wales*, recently issued by H.M. Stationery Office, over 7,000. The Economic Series of Reports, which deal, in the main, with methods of marketing, have also had a very good reception, over 50,000 copies, in all, having been sold up to the present.

It must not, however, be assumed from these sales that farmers and horticulturists, as a whole, are making as much use of the Ministry's publications as they should, or as the Ministry would like them to, if they desire to profit by the latest knowledge, specially collected by the Ministry on their behalf.

THE final programme of the World's Dairy Congress, to be held from June 26 to July 12, has recently been issued. In addition to the paper-reading sessions, **World's Dairy Congress, 1928** which will deal with a great many of the leading problems in dairying, a series of tours has been arranged throughout Great Britain and Northern Ireland, which will afford delegates a unique opportunity of obtaining, at small cost, an insight into all branches of the industry. The Headquarters of the Congress will be at the Central Hall, Westminster, where the Congress will be centred from June 26 to 30, but regional meetings will be held on July 2 and 3 at Reading, from July 4 to 8 at Edinburgh and Glasgow, and from July 10 to 12 at the Royal Agricultural Show, Nottingham. Hospitality will be given by H.M. Government, the Corporation of the City of London, the Congress Committee and other bodies. The fee for membership of the Congress is one guinea, and forms of application may be obtained from the Organizing Secretary, World's Dairy Congress, 28 Russell Square, London, W.C.1. It is hoped that farmers and others interested in the question of milk and dairy products will attend in large numbers.

* * * * *

THE International Institute has recently published the *International Yearbook of Agricultural Legislation* dealing with the laws relating to Agriculture passed during 1926 throughout the world. The volume, which consists of 800 pages, contains a complete series of **Agricultural Legislation in 1926** laws, decrees and regulations on Agriculture, published in 133 different countries during 1926, 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; agricultural machinery, fertilizers and live stock; laws dealing with finance and customs regulations; plant and animal production and the related industries; agricultural organization and instruction; plant diseases; co-operation, insurance, agricultural credit; land tenure; relations between capital and labour in agriculture.

Owing to the importance of the questions treated and the comprehensive character of the documentary material con-

tained, 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, price 12s. 6d.

* * * * *

AN important contribution to the question of the residual values of manures has been recently made by Professor Gerlach, of Berlin, in a paper read to the German Agricultural Society.* In this paper the subject was treated more particularly from the point of view of the effect of rainfall on manurial residues, and various points made by Professor Gerlach may usefully be noted here.

Experiments carried out over many years, on four different kinds of soil differently manured, indicated that the average annual losses per acre, by drainage at one metre depth, and the contents of the drainage water, were:—

	Lb.	Gms. per c.c.
Nitrogen ..	18 to 29 ;	·000019 to ·000024
Potash ..	16 to 57 ;	·000014 to ·000032
Lime ..	130 to 240 ;	·000131 to ·000194
Phosphoric acid	Nil	Nil

A proportion of these amounts—which would usually not be large—would, in practice, be regained through rising soil water.

In general, it must be accepted that the larger the rainfall the larger the drainage, and hence the loss of nitrogen, potash and lime. There is less loss on heavy than on light soils, on manured than on unmanured soils, on soils bearing a crop than on bare soils, and with even distribution of rainfall than with distribution in “downpours.”

As regards the residual effect of different classes of manures, that of *farmyard manure* may last a number of years and give appreciable increases in the yield of following crops. The extent of the residual effect depends on the amount and composition of the manure, the soil and the rainfall. The

* *Mitteilungen der Deutschen Landwirtschafts Gesellschaft*, February 18, 1928.

larger the rainfall for the first crop, the larger the quantity of nutrients removed by the crop from the manure, the larger the loss by drainage, and hence the smaller the residual effect. The larger the rainfall in the period between the two crops, while the soil is bare, and the longer this period, the larger are the losses to the drainage.

As regards *green manuring*, Beseler, from green manuring with lupins, serradella and other leguminosae, obtained increased crops of rye (grain per acre) of 5 cwt. in the first year, 4 cwt. in the second year, and 3.7 cwt. in the third year, in one experiment; and, in a second experiment, 11.7 cwt. in the first year and 2.5 cwt. in the second year. In long periods, before the following crop is taken, and with heavy rainfall, large quantities of the constituents of green manure are washed out of the soil, so that it is important to plough in green manure for the coming year as late as possible in winter.

The residual effect of artificial manures is smallest with nitrogen. With customary nitrogenous manuring, a weak residual effect is obtained only if the summer is dry and if the second crop follows early in autumn; otherwise there is no residual effect. Phosphates are retained in the soil and are not washed away in the drainage, so that what is not used by one crop is at the disposal of following crops. Potash salts, on the other hand, may be washed out, and losses may be quite large; their residual effect is the smaller, the greater the rainfall, the poorer the soil, the smaller the manuring, the greater the growth through rainfall of the first crop, and the longer and wetter the period between the harvesting of the first crop and the growth of the second.

Next to nitrogen, lime is the most easily soluble fertilizer. The soil water dissolves it so easily, that in course of time, the top soil becomes much poorer in lime than the subsoil. Losses of lime are more considerable in years with heavy rainfall and on uncropped fields, and are increased with large applications of potash salts.

In these German experiments, in spite of over-average manuring in the 11 years involved, more nitrogen, potash and lime were removed from the soil in crops and drainage than were given in manuring (the phosphates in the soil were, however, increased). The difference in nitrogen would be largely made up through rainfall nitrogen and the activity of bacteria, but the losses of potash and lime merit serious attention.

THE annual agricultural returns of crops and live stock will be collected again this year on the 4th of this month (June). These returns are compulsory

Agricultural Returns, 1928 under the provisions of the Agricultural Returns Act, 1925. 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 were issued immediately before the 4th instant, 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 Agricultural Returns Act.

* * * * *

THERE are, in the British Isles, approximately 34 million acres of permanent and temporary grassland, out of a total cultivated area of 47 million acres. Grass covers, therefore, about 70 per cent. of the so-called cultivated area of the British Isles, and the proportion is likely to

increase. In recent years there has been a considerable revival of interest in grassland problems, and in April, 1927, the Ministry held, at Cambridge, an Agricultural Organizers' Conference on the subject. In response to a general demand, the Ministry has now issued a new Miscellaneous Publication, No. 60,* entitled "Grassland Problems," comprising seven papers which were read at the Conference. The titles of the papers are as follows:—

"The Nutritive Value of Pastures from the Point of View of the Manurial Content," by Dr. J. B. Orr.

"The Nutritive Value of Pasture Grass from the Point of View of Energy and Protein," by Dr. H. E. Woodman.

"Sectional Grazing of Grassland," by Mr. W. Brunton.

"The Use of Nitrogen in the Manuring of Pastures," by Mr. J. G. Stewart.

"Grassland Problems in Some Counties," by Dr. J. A. Hanley.

* Obtainable from the Ministry, 10 Whitehall Place, S.W. 1, price 2s. (cartridge covers), 2s. 3d. (quarter bound), net, post free.

"Permanent and Temporary Grass," by Professor R. G. Stapledon.

"Grassland Husbandry of the Future," by Professor T. B. Wood.

Each paper is the work of an expert, and together they sum up, in a convenient form, modern knowledge on the subject of grassland. Nowhere else is the information so compactly presented or so easily accessible, and the volume should be of value not only to Agricultural Organizers and to County staffs but to many others engaged in the teaching and study of agriculture.

* * * * *

THE value of transplantation as a means to the improvement of certain crops, particularly of those grown in gardens, has long been recognized. It is, therefore, not

Transplantation of Cereals surprising that experiments should have been carried out with the transplanting of cereals. Indeed, such experiments have

been made periodically for many years past, and records are easily traced of their having been carried out, both in this country and abroad, as far back as the eighteenth century. The subject has, however, attracted little attention in this country in recent years, but was rather abruptly reopened by statements which appeared in the Press in January last, to the effect that, in Germany, a method of transplanting cereals by machinery had been devised, for which the claim was made that it would result in very greatly increased yields.

It is clear that, in the absence of machinery, transplantation makes heavy demands on hand labour, but it is not so evident that it is for that reason alone that neither the experiments of the eighteenth century nor those made subsequently have led to the adoption of transplantation as a regular practice in corn cultivation.

Some 20 years ago two Russians, N. A. and B. N. Demtschinsky, made experiments with the transplantation of cereals, and with the alternative method of thin seeding and earthing up of the plants, their object being the improvement of yields. They thus again introduced into Europe the inquiry into the value of methods which have been practised in the East for centuries. As a result of their propaganda, a large number of trials of their methods* were conducted in Germany,

* See this JOURNAL, Vol. XVIII, 1911-12, pp. 857-859. (Notes on these methods also appeared in this JOURNAL in Vol. XVI, 1909-10, p. 740; XVII, 1910-11, p. 932; XVIII, 1911-12, p. 330 and p. 857; and XX, 1913-14, p. 1102.)

and the results were ultimately brought together in *Landwirtschaftliche Jahrbücher*, Vol. XLI, 1911. The general conclusion arrived at was that both methods resulted in greatly increased tillering and yield of grain in individual plants, and in some cases in an increase in the yield on small experimental plots. In many cases in field conditions, however, the yields of corn per unit of area cultivated under the new methods were inferior in quantity to those of crops grown under the ordinary methods of cultivation.

In the light of past experience, then, the claims which have been put forward that the introduction of transplanting machinery will lead to a revolution in cereal production must be accepted with reserve.

It is understood that, both in this country and in Germany, a new transplanting machine will undergo extensive trials this year. The results will be watched with interest.

* * * * *

The Council for Scientific and Industrial Research.—The Australian Science and Industry Research Act of 1926 placed the control of the activities of the Commonwealth of Australia in the field of scientific and industrial research in the hands of a Council, which is a corporate body consisting of:—

- (a) Three members nominated by the Commonwealth Government (one being chairman), and appointed by the Governor-General.
- (b) The chairman of each State Committee of the Council (see later).
- (c) Other members co-opted by reason of their scientific knowledge.

An Executive Committee, consisting of the three members nominated by the Commonwealth Government, exercises, between meetings of the full Council, all the powers and functions of the Council.

The State Committees.—An important feature of the Science and Industry Research Act, 1926, is the provision made for the appointment of State Committees, whose main functions are to advise the Council regarding its general business and any particular matter of investigation and research. Each of these Committees consists of a Chairman selected by the Commonwealth Government, three members nominated by the State Government from the staffs of its scientific departments, and three members, eminent in science, of whom at least two are members of the staff of the local University, all

* Summarized from the First Annual Report of the Commonwealth of Australia Council for Scientific and Industrial Research, for the period from April 13, 1926, to June 30, 1927.

three being nominated by the Australian National Research Council. In addition, the chairman and the six members thus appointed have the right to nominate three members associated with industry, while further members, not exceeding six, may be co-opted by reason of their special qualifications, with the consent of the Executive Committee.

Powers and Functions of the Council.—The powers and functions of the Council as defined by the Act are as follows :—

- (a) The initiation and carrying out of scientific researches in connexion with, or for the promotion of, primary or secondary industries in the Commonwealth.
- (b) The training of research workers, and the establishment and awarding of industrial research studentships and fellowships.
- (c) The making of grants in aid of pure scientific research.
- (d) The recognition or establishment of associations of persons engaged in any industry or industries for the purpose of carrying out industrial scientific research, and the co-operation with, and the making of grants to, such associations when recognized or established.
- (e) The testing and standardization of scientific apparatus and instruments, and the carrying out of scientific investigations connected with standardization of apparatus, machinery, materials, and instruments used in industry.
- (f) The establishment of a Bureau of Information for the collection and dissemination of information relating to scientific and technical matters.

It is also provided that the Council shall act as a means of liaison between the Commonwealth and other countries in matters of scientific research.

Co-operation with States.—The Council is intended to supplement, and not take the place of, existing scientific industrial research institutions and departments in the several States, and the Act specifically states that the Council shall, as far as possible, co-operate with existing State organizations in the co-ordination of scientific investigations with a view to :—

- (a) the prevention of unnecessary overlapping, and
- (b) the utilization of facilities and staffs available in the States.

The Commonwealth Government desires to bring into being a real co-operation between all those engaged in applying science and research to industry. The States have accepted this position, and are already co-operating whole-heartedly with the Council. Nearly all of the more important investigations which the Council has initiated are being conducted in co-operation either with State Government Departments, the Universities, or other existing institutions.

Science and Industry Investigation Fund.—By the Act of 1926, a sum of £250,000 was appropriated for the purposes of scientific and industrial investigations carried out in pursuance

of the Act. The appropriation of that sum, which has been paid into a Trust Account, obviates the necessity for Parliament being asked to make annual votes for the purpose of the Council's work. Parliamentary control over the operations of the Council is effected by a clause in the Act providing that no money can be expended from the Trust Account except in accordance with Estimates passed by Parliament. It has been announced that a further sum of £250,000 is to be appropriated for the purpose of the Trust Account from the Surplus Revenue for the financial year 1926-27.

Preliminary Work of the Council.—At the first meeting of the Council, it was decided that efforts should for the present be concentrated primarily on the organization of research work in the following five main groups of problems :—

- (1) Animal pests and diseases.
- (2) Plant pests and diseases.
- (3) Fuel problems, especially liquid fuels.
- (4) Preservation of foodstuffs, especially cold storage.
- (5) Forest products.

A considerable amount of time and attention had to be devoted to making a survey of the whole field of industrial research to ascertain the most pressing problems : their economic importance ; what facilities in the way of laboratories, equipment, and staff were available ; whether they were already being attacked by existing institutions ; and, if so, in what way these efforts could best be supplemented.

Agricultural Research.—A great deal of attention has been given by the Council to the possibility of initiating new researches on agricultural problems, and supplementing, where necessary, the admirable work of the State Departments. It was perfectly clear that, in this field perhaps more than in any other, close co-ordination was essential if overlapping and waste of effort were to be avoided. The Council, therefore, convened in March, 1927, an Agricultural Conference to advise it as to what place it could best fill in the field of agricultural research, and as to how it could best co-operate with the State Departments.

To effect co-operation and collaboration between the Commonwealth and the State Departments, a Standing Committee on Agriculture was appointed on the recommendation of this Conference, consisting of the permanent Heads of the State Departments of Agriculture and representatives of the Council. This Committee acts as the advisory and consultative body on matters relative to agricultural and live stock research undertaken by the Commonwealth.

The report under review gives an account of the plans for the establishment of a Tropical Agricultural Research Institute in Queensland (see this JOURNAL, March, 1928, p. 1086); it also surveys in detail the problems under investigation and those needing research, relating to plants, irrigation, entomology, animal pests and diseases, and animal nutrition.

* * * * *

THE Minister's powers under the Corn Production Acts (Repeal) Act, 1921, regarding the destruction of certain injurious weeds, were delegated to agricultural committees by the Agricultural Committees (Injurious Weeds) Order, 1921. The following table shows the number of cases in which action has been taken by agricultural committees in England and Wales to enforce the regulations for the destruction of weeds, in each year from 1922 to 1927:—

Cases	Year ended September 30.					
	1922	1923	1924	1925	1926	1927
Reported to agricultural committees ..	241	936	1,481	1,451	2,188	2,740
Dealt with by arrangement* ..	187	917	1,426	1,321	2,109	2,688
Notices served ..	82	91	104	190	284	217
Prosecutions—						
Successful ..	1	6	9	14	12	5
Unsuccessful ..	—	3	—	1	2	1

* Some cases were dealt with satisfactorily by arrangement without the matter being reported to the agricultural committees.

The total number of cases dealt with year by year shows a marked increase, the figures for 1927 being about 25 per cent. higher than those for 1926. Under the provisions of the Act, a notice may be served upon an occupier of land requiring him to cut down or destroy certain weeds, and it is significant that, in spite of the increase in the number of cases dealt with, the number of notices served decreased from 284 in 1926 to 217 in 1927, while the number of prosecutions, consequent on failure to comply with the notices, decreased from 14 to six. The figures would appear to indicate not only increased activity on the part of agricultural committees in the matter of weed destruction, but a more successful outcome of that activity. A few committees apparently took no action, but others, notably Surrey, Kent and Lancashire, have shown very great energy in the matter.

MAINTENANCE AND PRODUCTION REQUIREMENTS OF EWES AND LAMBS

PROFESSOR T. B. WOOD, C.B.E., F.R.S., and
W. S. MANSFIELD, M.A.,

Animal Nutrition Institute, School of Agriculture, Cambridge.

SEVERAL papers, dealing with the maintenance and production requirements of adult sheep have already been published from the Cambridge Animal Nutrition Institute^{1, 2, 3}. In the present communication, the authors attempt to find similar data for ewes and lambs, their intention being to fill this important gap in the information required for computing rations for sheep from birth to maturity.

Production Requirement of Lambs.—The method used in this determination was the direct method of comparative slaughter. A typical Suffolk lamb was killed at birth. The whole carcass, except the contents of the alimentary canal and bladder, which were found to be negligible, was reduced to pulp in a mincing machine, weighed, sampled, and analysed.

The carcass of the lamb weighed, before mincing, 2,780 gm. = 6.13 lb. Analysis showed its composition to be as follows:—

COMPOSITION OF LAMB AT BIRTH.			
	Per cent.	Actual weight, gm.	
Water	75.85	2,110	
Protein (N × 6.25) ..	16.82	468	
Fat	1.51	42	
Ash	5.18	144	
	99.36	2,764	

The analysis was made in 1925 by the late Mr. Charles Bryant.

In the spring of 1927, by permission of Mr. A. Amos, Director of the University Farm, two typical lambs were selected from his half-bred flock. They were killed, sampled, and analysed by the method already described.² Their composition was found to be as follows:—

COMPOSITION OF LAMBS, 25 DAYS OLD.			
Lamb No. 1. Single Lamb.—Live wt. :		15.295 kilo = 33.6 lb.	
		Empty wt. : 13.857 kilo = 30.5 lb.	
	Per cent. in empty wt.	Actual wt. in carcass, gm.	
Water	66.10	9,159	
Protein (N × 6.25) ..	17.82	2,470	
Fat	12.96	1,795	
Ash	3.64	504	
	100.52	13,928	

¹ Wood and Capstick: *Jour. Agric. Sci.*, XVI, 326 (1926).

² T. B. Wood: This JOURNAL, July, 1927, p. 295.

³ T. B. Wood: This JOURNAL, Nov., 1927, p. 697.

Lamb No. 2. Twin.—Live wt. :	13.080 kilo=28.8 lb.	
Empty wt. :	12.388 kilo=27.2 lb.	
Per cent. in empty wt.	Actual wt. in carcass, gm.	
Water	64.76	8,022
Protein (N×6.25) ..	18.06	2,237
Fat	13.78	1,707
Ash	3.87	480
	100.47	12,446

The analyses were made by Mr. A. J. Codling. They agree so well that it is legitimate to average them, when the following figures are obtained for the weights in the carcass of a 25 days' old lamb weighing, alive, 31.2 lb.: protein 2.353 kilo., fat 1.751 kilo., ash .492 kilo.

The composition of the increase from birth to 25 days' old can now be calculated as follows:—

	Live wt. gm.	Protein gm.	Fat gm.	Ash gm.
At birth ..	2,780	468	42	144
At 25 days ..	14,187	2,353	1,751	492
Increase ..	11,407	1,885	1,709	348

Expressed as percentages of the increased live-weight, these figures give the following results:—

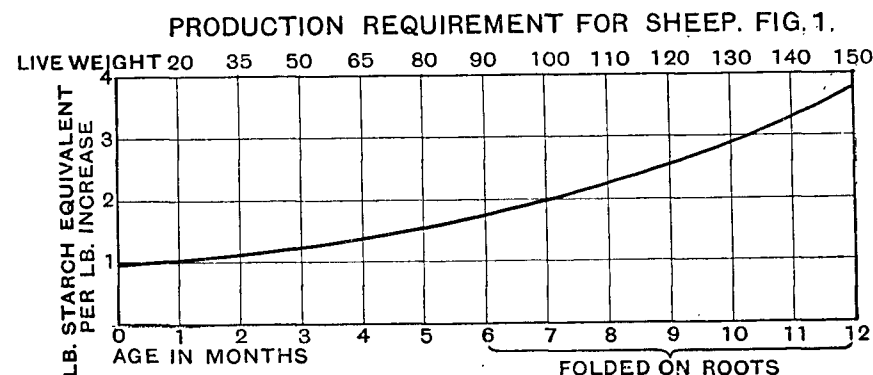
Percentage Composition of Live-weight increase of Lamb.			
Protein	16.5	Average live-weight at 25 days=31.2 lb.	
Fat	14.9		
Ash	3.0		
Water (by difference) ..	65.6		
	100.0		

The heats of combustion of protein and fat being respectively 2,600 Cals. and 4,300 Cals. per lb., the following calculation gives the number of calories in 1 lb. of live-weight increase.

Protein, $16.5 \div 100 \times 2,600 = 429$ cals.
Fat, $14.9 \div 100 \times 4,300 = 641$ cals.
1 lb. increase contains 1,070 cals.

It was shown in², quoted above, that in the sheep, as in the ox, 1 lb. of starch equivalent produces 1,070 cals. in live-weight increase. The production requirement of suckling lambs is therefore 1 lb. of starch equivalent per lb. of live-weight increase. In papers² and³, quoted above, figures are given for the production requirement of sheep fattening on roots from six months to 12 months old. By interpolation,

it is now possible to construct a curve showing the production requirements of sheep from birth to 12 months old. The curve, of course, refers only to lambs and sheep which are well fed from birth onwards, and fattened by folding on roots during the winter months. Such a curve is shown in Fig. 1.



Maintenance Requirement.—The direct determination of basal metabolism in the case of ruminants presents many difficulties. In the sheep, on account of the nervous excitement produced by its introduction into a calorimeter, such direct measurement seems to be quite impossible. It was decided, therefore, to use the indirect method described in paper (1), quoted above. The method, however, was modified since it was thought advisable to let the lambs suckle their mothers. Rearing by hand would, in the authors' opinion, have introduced such artificial conditions as might have made the results unreliable.

It was therefore decided to proceed as follows:—By the courtesy of Mr. A. Amos, the authors were allowed to select, from his pedigree Suffolk flock, five ewes due to lamb early in April. These ewes were penned in the lambing yard and their food consumption accurately recorded. They were given a full ration, their leavings being weighed and deducted. They produced seven lambs, the average date of birth being April 5.

From lambing until the end of the experiment—63 days—the ewes consumed the following weights of feeding stuffs:—

Mangolds	3,400 lb.	Beans	116.5 lb.
Dried sugar beet pulp ..	630 "	Crushed oats ..	116.5 "
Hay chaff	578 "	Crushed barley ..	116.5 "
Linseed cake	116.5 "		

It is estimated that these feeding stuffs supplied 990 lb. of starch equivalent, or 22 lb. per ewe per week.

The average live-weight of the ewes during the period of the trial was 140 lb. Four of the ewes gained in live-weight during the trial, their total gain being 40.25 lb. The fifth ewe, which suckled twins, lost 11.5 lb. Wood and Capstick¹ have estimated the starch equivalent corresponding to gains and losses of live-weight in adult sheep on rations producing little or no change in live-weight. They find that, in such circumstances, 1 lb. live-weight gain corresponds to .77 lb. S.E., 1 lb. live-weight loss to 1.41 lb. S.E. Adopting these figures, no other figures being available, the total gain of the four ewes corresponds to $40.25 \times .77 = 31$ lb. S.E., and the loss of the fifth ewe to $11.5 \times 1.41 = 16.2$ lb. S.E. The changes in live-weight of the five ewes, therefore, correspond to $31 - 16.2 = 14.8$ lb. S.E. in nine weeks, or .33 lb. S.E. used for live-weight increase per ewe per week.

From these figures it is possible to calculate the weight of starch equivalent per ewe available for milk production. Thus :—

If R = lb. starch equivalent consumed per ewe per week.

M = lb. starch equivalent required for maintenance per ewe per week.

x = number of gallons of milk per ewe per week.

p = lb. starch equivalent required to make one gallon of ewe's milk.

Then, $R = M + px + .33$.

The figure .33 is the weight of starch equivalent per ewe per week used in making live-weight increase.

R is known from the experimental records to be 22 lb. starch equivalent per ewe per week.

M , the maintenance requirement, is read off from the curve given in Fig. 2, based on paper¹, quoted above.

Before proceeding further it is necessary to know the value of p . An approximate estimate can be made from figures given by Henry and Morrison in *Feeds and Feeding*, p. 556. Quoting from Shepperd⁴, late of Madison, Wisconsin, Henry and Morrison state that five ewes consuming, on the average, 61 lb. of concentrates, 60 lb. hay and 34 lb. potatoes per head, corresponding to 75 lb. of starch equivalent, produced per head 100 lb. of milk. Unfortunately, there is no record of their live-weights or of their average yield per day. Assuming an average live-weight of 140 lb., in which case maintenance

⁴ The authors are indebted to the Librarian of the United States Department of Agriculture, for a photostat copy of Shepperd's paper, which, however, gives no more information than Henry and Morrison's quotation.

requirements would be 11 lb. starch equivalent per ewe per week, and an average milk yield of $2\frac{1}{2}$ gallons or 25 lb. per ewe per week, in which case one ewe would yield 100 lb. of milk in four weeks and consume for maintenance in that period 44 lb. of starch equivalent, then

$$R = M + 10p$$

$$75 = 44 + 10p$$

$$10p = 31$$

$$p = 3.1 \text{ lb. of starch equivalent per gallon.}$$

Returning now to the equation

$$R = M + px + .33$$

and inserting the values given above for R , M and p ,

$$22 = 11 + 3.1x + .33$$

$$3.1x = 10.67$$

$$x = 3.44 \text{ gallons of milk per ewe per week.}$$

This is probably only an approximate figure, as it clearly depends on the accuracy of the assumptions made in working out the value of p from Henry and Morrison's quoted figures. It is, however, quite in accord with the yield of ewes which are good mothers.

From analyses of ewe's milk, also given by Henry and Morrison (*Feeds and Feeding*, pp. 555 and 556), the approximate average composition of ewe's milk is 6 per cent. protein, 7 per cent. fat, and 5 per cent. sugar, from which it is estimated that its starch equivalent is 2.67 lb. per gallon.

The ewes' contribution towards the ration of their lambs was, therefore, 3.44 gallons of milk per ewe per week, containing 2.67 lb. of starch equivalent per gallon, which is equal to $3.44 \times 2.67 = 9.2$ lb. of starch equivalent per ewe per week.

Since the five ewes produced and reared seven lambs, this corresponds to $9.2 \times 5 \div 7 = 6.6$ lb. of starch equivalent per lamb per week.

In addition to the milk they obtained from their mothers, the lambs were allowed access, through creeps, to a suitable supply of food. A careful record of their consumption was kept. It was found that in the 63 days of the experiment they ate :—

Mangolds	..	710 lb.	Peas	..	..	2.5 lb.
Linseed cake	..	86 "	Beans	..	..	38 "
Crushed oats	..	43 "	Flaked maize	..	..	43 "

This was estimated to contain 178 lb. of starch equivalent, or 2.8 lb. starch equivalent per lamb per week. The average total ration consumed by the lambs was, therefore, 6.6 lb. (in mother's milk) + 2.8 lb. (in foods) = 9.4 lb. starch equivalent per head per week.

The average live-weight of the lambs during the experimental period—weight at birth + weight when 63 days old $\div$ 2—was 38 lb. Their average live-weight increase during the experimental period was 5 lb. per head per week.

From these figures it is possible to calculate the maintenance requirement by using the equation $R=M+GK$, given in papers² and³ already quoted, R being the ration consumed per week, 9.4 lb. starch equivalent, M the maintenance requirement which it is desired to find, G the average live-weight increase per head per week, and K the production requirement, already found to be 1 lb. starch equivalent per lb. increase. Inserting these figures:—

$$9.4=M+5 \times 1$$

$$M=9.4-5=4.4 \text{ lb. starch equivalent per head per week for a lamb of 38 lb. live-weight.}$$

Wood and Capstick¹, quoted above, found the maintenance requirement of adult sheep of 100 lb. live-weight to be 1.26 lb. of starch equivalent per head per day. If the maintenance requirement per unit of surface area remains constant throughout life, then the maintenance requirement of a lamb of 38 lb. live-weight should be:—

$$\begin{aligned} & 1.26 \times \sqrt[3]{38^2} \div \sqrt[3]{100^2} \\ \text{thus } & \sqrt[3]{38^2} \div \sqrt[3]{100^2} \\ & = 1.26 \times 3.37 \div 4.65 \\ & = 1.26 \times 11.35 \div 21.6 \\ & = .662 \text{ lb. starch equivalent per day,} \\ & \text{or } .662 \times 7 = 4.6 \text{ lb. starch equivalent per week.} \end{aligned}$$

It is interesting and important that the figure, obtained from Wood and Capstick's figures for adult sheep—adjusted by the surface law—agrees as well as could be expected with the figure calculated from the present experiment. This indicates that, in the lamb, there is no increase in basal metabolism per unit surface area soon after birth. In this respect, therefore, the lamb differs from the young pig, in which, as Deighton⁵ has shown, the basal metabolism per unit surface area, at four months, is over 70 per cent. higher than it is in the adult.

Although this physiological difference between the lamb and the young pig appears, at first sight, to be somewhat remarkable, it is not really surprising, for the lamb is born after a comparatively long gestation period—154 days—and in an active and well-developed condition, whilst in the sow the gestation period is comparatively short—115 days—

⁵ Proc. Royal Society, B. Vol. 95, 1923.

and the newly-born pigling is in a much less developed condition.

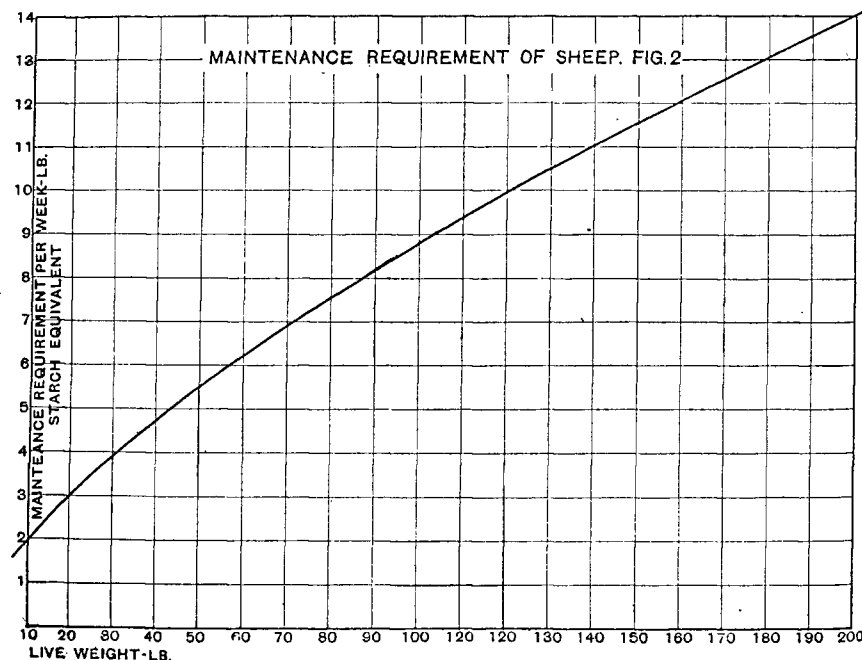
This suggests that there is a relation between the degree of development of young animals at birth and the intensity of their subsequent basal metabolism. The subject is of great interest and of considerable practical importance. It is under further investigation in the Animal Nutrition Institute.

Finally, the authors wish to state that the work, described above, is essentially preliminary in character. They have no reason to doubt the accuracy of the results at which they have arrived. They realize, however, that the number of ewes at their disposal was too small, and they have already made arrangements for repeating the experiment, in 1928, with much larger numbers. They hope to make direct measurements of the milk yield of the ewes, and to sample and analyse their milk. They propose also to attempt a direct estimation of the weight of starch equivalent required to make one gallon of ewe's milk.

Summary.—The investigation described above has provided the following facts which may be useful in computing rations for ewes and lambs:—

- (1) The maintenance requirement per unit of surface of sheep is constant throughout life—(49 calories per square metre per hour)—and can be found by inspection of the curve in Fig. 2, which gives maintenance requirement in relation to live-weight.
- (2) The production requirement of lambs for the first month of life is 1 lb. of starch equivalent per lb. of live-weight increase. For other ages it can be found by inspection of the curve in Fig. 1, which gives production requirement in relation to age.
- (3) The production requirement of suckling ewes is about 3 lb. of starch equivalent per gallon of milk.
- (4) Average ewe's milk contains 2.67 lb. of starch equivalent per gallon, or .33 lb. of starch equivalent per pint.
- (5) An average ewe yields from $2\frac{1}{2}$ to 4 pints of milk per day, or from $2\frac{1}{4}$ to $3\frac{1}{2}$ gallons per week.

Conclusion.—Examples illustrating the use of the data, given above, may usefully be given here. The information, given above, provides a scientific basis for computing rations for suckling ewes and young lambs, by the method of maintenance requirement + production requirement = total ration,



Ration for Ewe.—Thus, the ration for a ewe weighing 135 lb. and suckling a single lamb may be found as follows:—

Maintenance requirement of ewe from Fig. 2=10.8 lb. starch equivalent per week.

Production requirement for 3 pints of milk per day or $2\frac{1}{2}$ gallons per week= $2\frac{1}{2} \times 3 = 7\frac{1}{2}$ lb. starch equivalent per week.

Total ration=10.8+7.5=18.3 lb. starch equivalent per week.

The authors have not investigated the protein requirement of suckling ewes, but accepted standards suggest that $\frac{1}{2}$ lb. of digestible protein per week should suffice for maintenance, to which should be added about 1 lb. of digestible protein for each gallon of milk which the ewe is estimated to yield. Thus the ration for the ewe above should contain $\frac{1}{2} + 2\frac{1}{2} = 3$ lb. of digestible protein per week.

Ration for Lambs.—Again, the ration for twin lambs five weeks old, and weighing about 40 lb. each, may be calculated as follows:—

Maintenance per lamb per week from Fig. 2, $4\frac{1}{2}$ lb. starch equivalent: for the two, $9\frac{1}{2}$ lb.

Production requirement for average growth rate of 5 lb. each per week at 1 lb. starch equivalent per lb. increase=10 lb. starch equivalent for the two lambs.

Total ration, $9\frac{1}{2} + 10 = 19\frac{1}{2}$ lb. starch equivalent per week.

The authors have not investigated the protein requirement of growing lambs, but they have no reason to doubt the

accuracy of the accepted standards which for 40 lb. lambs indicate a requirement of 1 lb. of digestible protein per lamb per week, or 2 lb. for the two lambs. An average ewe with double lambs may be expected to yield per week 3 gallons of milk, which at 2.67 lb. of starch equivalent per gallon would supply to her two lambs 8 lb. of starch equivalent per week. Ewe's milk contains 6 per cent. of protein, practically all digestible: consequently 3 gallons would supply for the two lambs $1\frac{3}{4}$ lb. of digestible protein per week. Subtracting the starch equivalent and digestible protein supplied by the ewe from the requirements for the two lambs, it appears that the ration provided for the two lambs should supply $19\frac{1}{2} - 8 = 11\frac{1}{2}$ lb. of starch equivalent, which should include $2\frac{1}{2} - 1\frac{3}{4} = \frac{1}{4}$ lb. of digestible protein. A ration of this kind is by no means in accord with accepted practice. Lamb foods generally include considerable quantities of such protein-rich feeding stuffs as linseed cake, beans, peas.

The results of the present investigation certainly indicate that a lamb food should be rich in starch equivalent and poor in protein, but, as was pointed out above, the investigation is only of a preliminary character, and some of its results may be revised on repetition.

* * * * *

THE SWEDISH MEADOW AND PASTURE ASSOCIATION*

GUNNAR GÖBEL, M.Sc., Ph.D.

WHILE animal husbandry, particularly dairying, has for many decades occupied a prominent place in the agriculture of Sweden, grassland farming, on grass of a permanent type, has in general played a rather unimportant rôle in the fodder production of the country. At the beginning of this century, rapid progress had been made along most lines of agriculture, and especially in matters relative to dairying and the cultivation of field crops, but little attention had been given to the improvement of pastures and meadows. Hay was—as it still largely is—obtained from temporary leys of timothy and clover and from natural meadows. On estates or farms, provided with natural pasture, grazing in the summer-time was, of course, common. High-milking cows, however, were usually kept in the byre to ensure a more uniform milk production,

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and, in places where suitable pastures were scanty or lacking, the entire herd was fed in the byre with mown grass, soiling crops, cakes, etc., all the summer. As a rule, however, neither this form of grazing on unimproved land, nor the summer feeding in the byre, gave quite satisfactory results, the grazing often causing a falling off in yields; while the latter method, besides being uneconomical, failed to provide sufficient exercise for the healthy development of the animals.

A more keen interest in pasture problems was, however, then beginning to develop, and thanks to the splendid pioneer work of a number of practical and scientific men, among whom Mr. A. Elofson, of Upsala, Mr. N. R:son Kleen, of Valinge, and Captain H. Hegardt, of Thorsätra, are prominent, valuable experience on the improvement of natural pasture grounds, as well as on the establishment and maintenance of permanent pastures on land formerly under crop rotation, was gathered in various parts of the country. In general, the experience at hand some 10 years ago seemed to indicate that, per feeding unit, grass and hay could not be so cheaply produced in temporary leys of timothy and clover as on improved pasture grounds and permanent leys of a pasture type.

All in all, there was in Sweden, in the early period of the world war, a strong interest in pastures and pasture problems, and although some attention had already been given to the matter by the Central Agricultural Experiment Station of Stockholm and the Agricultural Peat Society of Jönköping—at that time under the direction of Dr. H. von Feilitzen—it was, nevertheless, deemed desirable to have an organization with the sole purpose of gathering evidence and spreading knowledge on these questions. To this end the Swedish Meadow and Pasture Association was formed. The foundation of the Association took place at a large meeting of agriculturists in Malmö in November, 1916, on the immediate initiative of its present Director, Mr. A. Elofson, of Upsala, who, for many years, had worked most actively and enthusiastically for a more economical production of hay and grass crops, and was a close student of the agriculture of the Continent.

During the first year, the association naturally had to concentrate largely on propaganda, but since then it has divided its activities between experimental work and extension service. The latter will always constitute a most important part of the work, since large domains, especially in the northern part of the country, are awaiting appropriation and improvement, but the research side is coming more and more to the fore,

The main features on the Association's programme are, therefore :—

- (1) To work for an economical production of hay and grass crops in general;
- (2) To encourage a better utilization of the national resources of natural pasture grounds and meadows, by the introduction of rational methods for their management and cultivation;
- (3) To bring about enclosures and the separation of pasture grounds from such lands as can more profitably be used for forestry;
- (4) To assist landowners and farmers in the preparation of plans for the establishment and improvement of their pastures and meadows, etc.; and
- (5) To spread knowledge on these questions among the farmers.

At the outset, the Association had scarcely any other funds at its disposal than those obtained from its members and private benefactors, but, in recent years, it has received such hearty support from the State that it, at present, approaches the position of a State institution. This makes it possible for the Association to give its service practically free of charge to its members, who pay only the small yearly fee of 5 kr. (5s. 5d.), and then receive, gratis, its year-book, containing much valuable information on the latest developments and experience in pasture problems and the cultivation of hay crops, etc., in Scandinavia and elsewhere.

While the Association had thus to commence work on moderate means and in modest circumstances, the demand for its service has steadily increased, and the personnel employed has more than doubled. At present, the Director has the aid of four assistants, clerks, one special research assistant, and three counsellors or agents, who are always at the service of farmers or agricultural institutions in want of expert advice, demonstrations, or lectures on pasture problems, etc.

Every year, several thousand acres of meadows and pastures are improved, and permanent leys of a pasture type, especially on estates lacking natural pastures, are laid out, on formerly cultivated land, under the immediate guidance and supervision of the agents of the Association.

Short courses, varying from one to six days in length, and covering lectures, demonstrations and practical instruction, relative to the best methods of establishing and managing good pastures, are given free to farmers and smallholders in various parts of the country every year. During the summer of 1926, for instance, such courses were held in 21 different places, with a total attendance of over 1,000 farmers.

In addition to these, two courses in the management of pasture lands, each covering a period of 10 days, are given yearly, with the aid of special State funds, to a limited number

of people engaged in instruction work in agriculture and forestry, such as county agents, teachers and foresters.

So far, the research work has been chiefly confined to field problems of a more or less direct economic bearing, but, as data on such matters become available, problems of a more fundamental nature crop up and demand solution. Various botanical studies have been undertaken in collaboration with scientists at the University of Upsala. Experiments are at present being carried out on an extensive scale in most sections of the country, relating to the use of stable manure, lime and artificial fertilizers for increasing yields from pastures and meadows. Particular attention is given to the study of the effects of the various materials on the botanical composition of the herbage. Other questions that are now being investigated are the effect of manuring on the content of mineral matter, feeding value and palatability of the grass.

The question of the best methods and seasons of the year for clearing is one item on the research programme that has received a good deal of attention, and has led to the development and manufacture of various practical tools and implements for the clearing and levelling of land, the destruction of shoots and stubbles, etc. In general, a good deal of practical information along these lines, and on fencing, has been gathered, and is freely given to farmers who need it.

The Association also maintains a special laboratory for the determination of soil reaction and lime requirement, to which farmers can send in soil samples and receive advice on the question of liming.

In the experimental work, regarding the use of manures and fertilizers on pastures, results have been obtained which point decidedly in certain directions, and which seem to be of sufficient general interest to warrant some statements as to their nature.

Liming.—In general it might be said, therefore, that liming has usually been found to have a negligible effect on yields from pastures and does not seem to be necessary except on very acid soils, on which a small dressing of burned lime has usually proved to give as beneficial results as larger doses, while it is always more economical. In certain cases the use of larger amounts of lime has even had a depressive influence on yields. On soils bearing a vegetation of heather and blueberries and similar plants, however, having a top layer of undecomposed raw humus material, considerable amounts

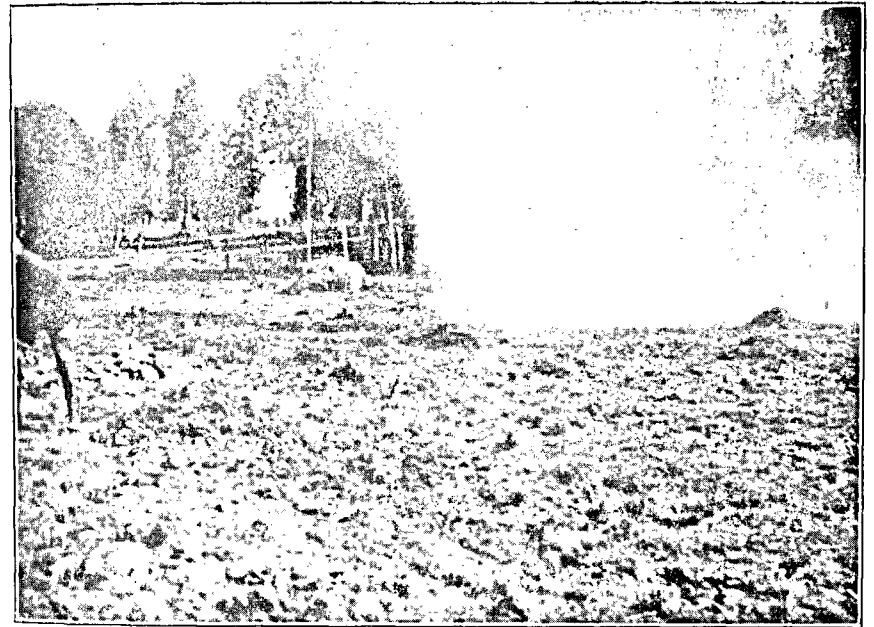


FIG. 1.—After the clearing of natural pasture grounds, roots and shoots, etc., are burnt, and the ashes obtained spread over the field.

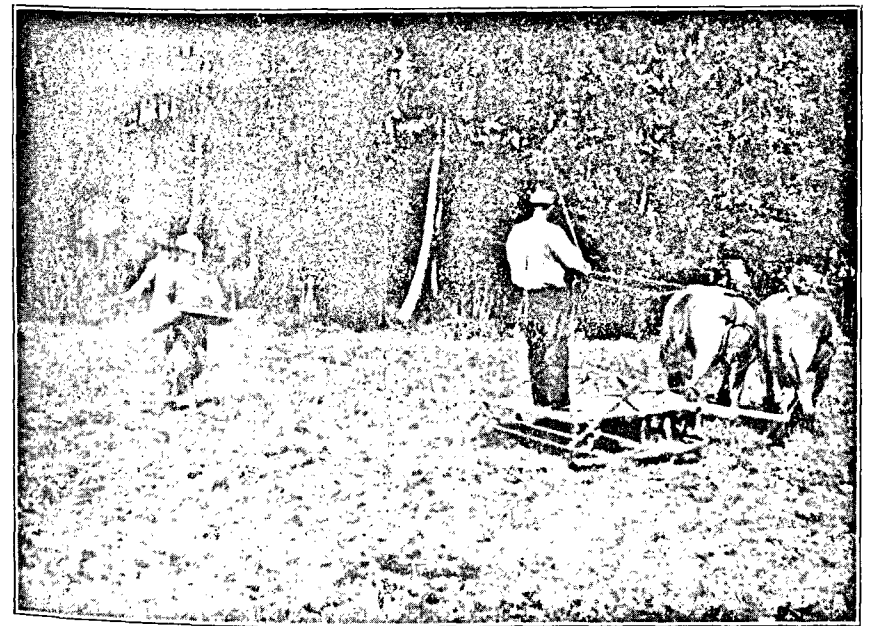


FIG. 2.—The clearing of the land is usually followed by harrowing, re-seeding, and the application of fertilizers.



FIG. 3.—Improvement of natural meadow pasture land through tile drainage.

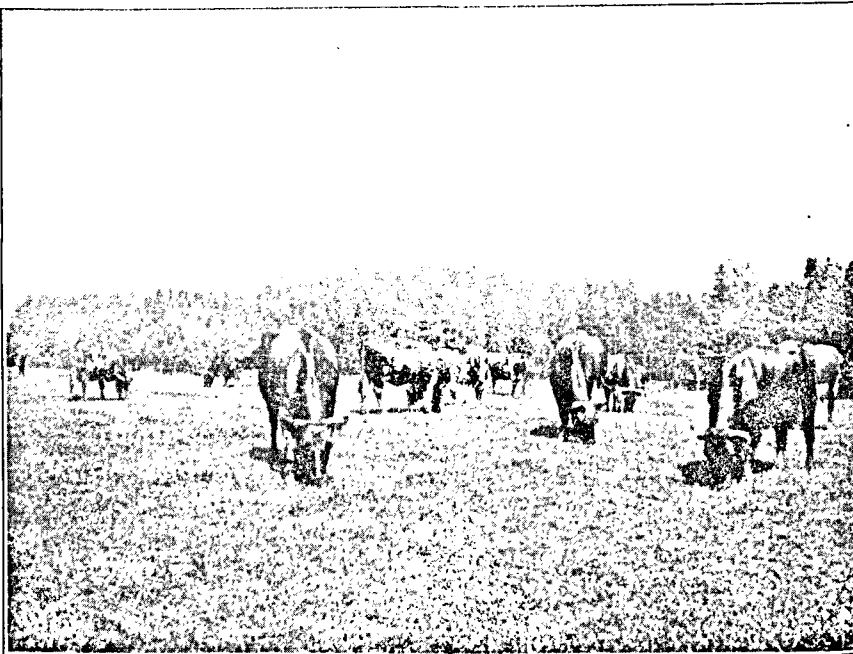


FIG. 4.—Red Swedish cattle grazing on a permanent pasture on formerly cultivated soil at Hasselfors, Sweden; flowers of white clover visible.

of lime are generally required to effect sufficient decomposition of the organic matter for the proper establishment of the pasture plants.

Phosphates.—On the other hand, almost all soils have been found to respond quickly to the use of phosphatic fertilizers. While basic slag has been found to give excellent results, and is used, particularly, on light and acid soils, phosphoric acid can be more easily procured, and at a slightly lower price, in the form of superphosphate, which is therefore the most common phosphatic fertilizer in Sweden. In general it has been found that a basic treatment of 400 lb. per acre per annum of this material, or the equivalent of basic slag per annum during the first two years, and a dressing of 200 lb. per acre in following years, does, as a rule, increase yields from grassland by 50-200 per cent. Increments of 300-400 per cent.—and in certain cases, even much more—have not infrequently been recorded. In addition to the effects on the yields, a decided improvement in the quality, palatability and nutritive value of the herbage has in most cases been observed.

Potash.—On light soils and loams, potash has, of course, also been found to increase yields considerably, and in such cases dressings of 75-150 lb. of muriate of potash per acre, when given in conjunction with phosphatic fertilizers, have given good returns.

Nitrogen.—Nitrogenous fertilizers have, in most cases, been found to increase yields, but there have been many failures. Since nitrogen, in whatever form it be given, clearly tends to increase the proportion of grasses to legumes, its use on pastures has often been found to be rather uneconomical. On meadows cut for hay, or on temporary leys containing little clover, the manuring problem is usually different, and here the addition of nitrogen is frequently required to secure maximum yields and a good net profit.

Farmyard Manure.—In general, solid and liquid stable manure, as well as certain other kinds of organic manures, such as straw and potato stalks, have proved to be of great value in increasing the productiveness of pastures and particularly in tightening the sward. The evidence at hand points to the summer as the best time for hauling and spreading of the solid stable manure. When applied at that time, after the pasture has been grazed off once or twice, it does not seem to interfere in any way with the palatability of the

pasture grass, as seems to be the case when it is spread in the early spring before the vegetation has started.

With regard to the effect of various fertilizers on the composition of the herbage, results of a great number of botanical analyses of samples, from plots located in different parts of the country, point very definitely to the conclusion that phosphatic manures in particular have a greatly stimulating effect on the legume flora, and most particularly on the growth of indigenous wild white clover, which is by far the most important pasture plant in Sweden. Potash, especially, when applied in conjunction with phosphates, also has a similar, although perhaps less pronounced, effect, while nitrogen, as already mentioned, usually has an opposite effect.

On the whole, therefore, the evidence, so far obtained by the Association on the economical use of fertilizers on natural grasslands, tends to support the results of the earlier work in England and on the Continent. In Germany, however, where artificial nitrogenous fertilizers can at present be procured at a relatively low cost, the tendency is now towards an ever-increasing use of nitrogen on the grasslands. It is claimed that vegetable protein can be produced more cheaply and with greater certainty in this way than solely through the encouragement of the legume flora.* Similar results have, also, recently been obtained in Great Britain. In order to test the efficacy of the new system under Swedish conditions, the Association has begun a number of carefully controlled experiments with high-milking cows on fields differentially manured in respect of nitrogen.

While the results of the application of fertilizers, as outlined above, are always most easily observed and controlled by measurement of the bulk and botanical composition of the herbage produced, other effects, such as the effect of the manuring on the quality and palatability of the grass, can hardly be so easily determined. Evidence has, however, been obtained which points to the conclusion that the latter effect is by no means of least importance. Previous to the introduction of intensive manuring systems, additional feeding stuffs would have to be used if yields of high-milking cows were to be kept up during the grazing season; now, however, the experience of progressive farmers indicates that during the early part of the summer—say until the middle of July—

* Schneider, K., 1926: *Die Anlage von Dauerweiden und ihr Betrieb nach neueren Erfahrungen* (Verlag von W. G. Korn, Breslau 1).

even the highest-yielding cows find sufficient food on well-manured pastures to maintain their milk production at the highest level without any addition of concentrates. After mid-July, there is often a gradual falling off in milk yields owing to a decline in the nutritive value of the grass. Proper manuring, however, tends to delay this declining tendency and, in general, also tends to prolong the grazing season.

There seems to be no effort on the part of the Swedish farmer which leads to so rapid and sure results as measures taken to improve his natural meadows and pastures; and, if drainage is sufficient, no particular measure will give better money returns than judicious manuring.

In localities where pasture grounds are rare or entirely lacking, it seems but natural that, to a certain extent, the substitution of permanent field pastures for temporary leys of timothy and clover should be a sound policy. Experience so far indicates, however, that this question is worthy of careful attention elsewhere, and that it may be of a far more general importance on dairy farms than might at first be expected. It goes without saying, of course, that for hay production for winter feeding, leys of the ordinary type will always be more or less necessary. Whether hay can be equally well produced on leys of a pasture type is a matter that remains to be determined. It will suffice to state that, in most cases, where a system of permanent field pastures has been tried, it has been found that grass yields, in terms of feeding units, may be considerably higher from these than from temporary leys, and that, in addition, the cost of production in the former case is usually materially less than in the latter.

There are, therefore, indications that, even under average conditions, it may be desirable, from an economic point of view, to extend the acreage of field pastures to that of temporary leys. This question has been made the subject of thorough investigation by one of the foremost experts of agricultural economics in the country. With due allowances for differences in respect to local circumstances and individual needs, he finds that under the present systems of farming, where dairying plays a most important rôle, the acreage of permanent field pastures may, under average conditions, be increased with great economical advantage to constitute around 25 per cent. of the total area formerly under cultivation on a farm.

It may be said, therefore, that there is at present in Sweden—and in this statement all the three Scandinavian countries,

as well as Finland, might be included, all being by location and inclination destined to base their agricultural production to a large extent on dairying—not only a strong, growing interest in matters relative to pastures, but that actual work is under way towards the realization of a more general development of the national resources of natural meadows and pastures. It is estimated that the 2.5 million acres of meadows, as well as the vast domains suited for pastures that are at hand in Sweden at present, could, through proper cultivation and management, easily be made to yield at least double their present produce. That this would be a matter of no little economical importance to a country with a growing population, and considerable imports of feeding materials, is a foregone conclusion.

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CONTROL OF APPLE SCAB ON ALLINGTON PIPPIN AND NEWTON WONDER BY TWO TYPES OF BORDEAUX MIXTURE

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IN 1927, spraying experiments were carried out in one of the apple plantations at the South-Eastern Agricultural College, Wye, Kent, with the object of determining (a) whether the prevention of scab could satisfactorily be secured on the varieties Allington Pippin and Newton Wonder by spraying with ordinary Bordeaux Mixture; and (b) whether a Bordeaux Mixture made with ready-prepared slaked lime (*i.e.*, commercial hydrate of lime or calcium hydrate) was equal in fungicidal power to the usual one in which lump quicklime is freshly slaked at the start.

The trees of Allington Pippin and Newton Wonder selected comprised the whole of a small plantation. They were half-standards (on Crab stocks) and had been planted in 1913, both varieties being at 28 feet square. The height of the Allington Pippin trees was 12-15 feet and their spread 21 feet; that of the Newton Wonder trees was 15 feet and their spread 24 feet. There were 42 trees of the Newton variety and 36 of the Allington. The plots were arranged in such a way that three control blocks, each consisting of 9 trees to be left unsprayed, were distributed in different parts of the plantation. These plots were numbered 1, 2, and 3, and they included altogether 12 trees of Allington Pippin and 15 of Newton Wonder. The remaining trees in the plantation were then divided into two plots: A, to be sprayed with hydrate of

lime Bordeaux Mixture (12 Allington Pippin and 12 Newton Wonder), and B, to be sprayed with ordinary Bordeaux Mixture (12 Allington Pippin and 15 Newton Wonder).¹

For Plot B, the ordinary quicklime Bordeaux Mixture was prepared according to the formula 8-8-100 (8 lb. copper sulphate, 8 lb. quicklime, 100 gal. water). The freshly burnt quicklime, of good quality and free from ashes, etc., was slaked in the usual way with a small quantity of water and was then diluted to make 92 gal. of milk of lime. The copper sulphate was dissolved in 8 gal. of water and was then poured into the tank containing the milk of lime. The resulting Bordeaux Mixture was well stirred and carried at once to the spraying machine. As regards the hydrate of lime Bordeaux Mixture for Plot A, owing to the chemical difference between this form of lime and quicklime, it is necessary to use more of the former—1½ lb. in the place of every 1 lb.; the formula thus becomes 8-12-100. The method of making is similar in both cases, except that the hydrate of lime, being already in the slaked form, requires only to be stirred up with a little water to form a thin cream, and it is ready to be diluted to 92 gallons and then to have the copper sulphate added.

Prepared hydrate of lime (calcium hydrate) can now be obtained as a fine dry powder containing 95 per cent. of hydrate, and it costs, as sent out in paper-lined bags, about 50s. per ton on rail. A minimum hydrate content of 90 per cent. should be insisted upon by the buyer. The material used was obtained from the Callow Rock Lime Co., Shipham, Winscombe, Somerset. It can also be obtained from the Snodland (Kent) Works of the Cement Marketing Company and from the Buxton Lime Company. It was found that, if the paper-lined bag was closed at once after the required quantity of hydrate of lime had been weighed out, there was very little transformation of the hydrate into carbonate during the period between the first and the third sprayings. This point is important, because hydrate of lime changes into the carbonate on exposure to air, which normally contains some carbon dioxide, and then becomes unsuitable for the preparation of Bordeaux Mixture. The bag must therefore not be left open, but the paper lining should be carefully closed again and the bag fastened up; an empty sack or two thrown over the bag of hydrate of lime will also help to keep out the air.

The first spraying was carried out on May 2, 1927. The

¹ One Newton Wonder tree had recently been replaced by a small tree (about 6 ft. high) which was too young to bear more than a negligible crop.

hydrate of lime Bordeaux Mixture was applied to Plot A at the start. A small hand-spraying machine, with pump and tank, required one man to work the pump, maintaining a pressure of 75 lb., and one man carrying buckets from the mixing tub to replenish the tank as it was moved about in the plantation. The application of the spray was performed by two men, each using a 6 ft. rod with a "Mistifier Junior" nozzle fitted with the smallest aperture disc. Each rod was attached to a 60 ft. length of rubber hose. The weather was fine; and, with no more than an occasional faint breeze, ideal conditions obtained for the work. The quantity of hydrate of lime Bordeaux Mixture used in spraying Plot A was 61 gallons, or $2\frac{1}{2}$ gallons per tree, the work being done carefully and the leaves well covered.

At the time of spraying Plot A, scab spots were found on a few leaves of all the Allingtons; the trees were in the "pink bud" stage, with one or two blossoms already open here and there in a few of the trusses. On the Newtons single spots of scab were found on each of a very few leaves, but only on some of the trees. This variety was more backward, being in the "close pink bud" stage.

Plot B was sprayed next, on the same day (May 2), with ordinary quick-lime Bordeaux Mixture, after the tank and pipes had been washed out with water. The amount of mixture used on this plot was 62 gallons. Scab was found here on a few leaves of every Allington tree, but in the Newtons it was so rare that only one spot was found on each of two trees.

As regards the condition of the unsprayed (control) plots 1, 2, and 3, at this date, many leaves of the Allingtons showed scab, and a few were marked with brown areas on both surfaces where the fungus had killed the underlying tissues. On the Newtons, however, scab was rare. One tree of Allington Pippin (Plot 2) was especially noticeable, owing to the presence of numerous one-year-old shoots which remained. Many of these were covered with scab pustules.

The second spraying was carried out on May 23. The weather was sunny but cool, and there was only a suspicion of a breeze during the spraying of Plot A, which was done first. Later, however, when spraying was in progress on Plot B, the wind increased and became gusty, with intervals of complete calm. Plot A received 67 gallons and Plot B about 65 gallons. At this date there was a growth of 9 inches of new wood on the Allingtons, with as many as 8 new and expanded leaves on each shoot. Several of the older leaves showed brown,

dry, dead areas, $\frac{3}{8}$ in. diameter, either at the apex or at the margin. It was at first thought that this might be an injury resulting from the first application of the spray, but the scab fungus was found above or below each spot. The fungus was producing an abundance of spores on many of these older leaves, and a rather severe early attack was undoubtedly in progress. The more recently expanded leaves on the young wood, although unsprayed, showed no signs of scab—perhaps owing to the dry weather of the preceding few weeks. The petals of the Allington blossom had fallen, but a few remaining flowers could be seen high up in the trees. On the Newtons a growth of 7 inches of new wood had taken place, and as many as 7 new leaves were expanded on these fresh shoots. A small amount of scab was present on the oldest (sprayed) leaves, but brown, dead patches caused by the fungus were rare, and no more than two were seen on any one tree. As with the Allingtons, the leaves which had expanded after the first application were found not attacked. There was no spray injury or leaf fall in either variety.

As regards Plot B, which was sprayed next (on the same day), both varieties were exactly as described for Plot A with respect to new growth, immunity of the fresh foliage from scab and absence of spray injury; also with respect to intensity of scab attack, except that, in Plot B, the attack on Newton Wonder was even less than it was on that variety in Plot A.

In the control plots 1, 2, and 3, a general and rather severe attack was developing on the older leaves of the Allingtons; there were large spreading patches of scab on both surfaces, and sometimes brown, dry areas showed where the leaf had been killed through from one surface to the other. These were most commonly situated at the margin. A few of the older leaves were completely covered with scab, and many were puckered. The new foliage on the young wood was not attacked. As regards the Newtons, a few of the older leaves on every tree showed a dry, brown area at the apex. From this the scab fungus was spreading over the remaining healthy leaf surface in widening zones. As in Plots A and B, the young foliage on the new wood was not attacked. After examination of the trees in these unsprayed plots, where large dendritic patches of scab occurred on the leaves, it was evident that the result of spraying the trees in Plots A and B had been to check the development of a severe attack.

The third application was made on June 13, Plot A being sprayed first and Plot B about an hour later. The

day was dull, cloudy, and calm, except for an occasional gusty breeze. Fifty-eight gallons of hydrate of lime Bordeaux Mixture were used on Plot A and 60 gallons of ordinary mixture on Plot B. On the Allingtons, 6 to 8 inches of new wood, bearing five to seven fresh leaves, had grown since May 23. The Allington apples were much more numerous than the Newton and showed greater variation in size. A few spots of scab were seen on the oldest leaves, but the fungus had apparently been killed by the former sprayings. There was no scab on the new, unsprayed foliage, and the heavy crop of small apples was quite clean. Traces of a brown coloration, thought to be incipient russetting, were seen occasionally on the fruit, and very minute cracks (visible with a lens) were associated with it.

The new wood on the Newtons had grown a further 7 inches since the previous spraying, and on this there were four to six fresh leaves; these were green and contrasted with those lower down which were covered with the bluish spray deposit. By this date the largest Newton apples had grown to a diameter of 1 in., and it was noticed that a few of these larger fruits were brown on one side, and minute cracks were visible with a lens. There appeared no doubt that this was russetting in its earliest stage, and it was most frequently, although not always, in parts of the tree which, judging by the very blue colour of the foliage, had been sprayed heavily on the previous occasion. There was, however, no fruit drop and no injury to the leaves.

In the unsprayed (control) plots, 1, 2, and 3, there was no russetting of the fruit in either variety. On the Allingtons, a very few apples showed as many as a dozen minute spots of scab. The fungus also occurred on brown, dead spots at the tips of the oldest leaves (often those surrounding the fruit trusses) and could be seen spreading over the surfaces of the leaves from these spots. The youngest foliage on the upper part of the new growth (leaders and breastwood) was not attacked. Thus, it was only rarely that scab was found to have progressed as far as the fifth or sixth leaf from the base of a shoot measuring 15 in. and bearing as many as 11 or 12 leaves—in spite of the fact that the fifth or sixth leaf must have been exposed to infection for longer than three weeks. On the Newtons, the new wood had grown to a length of 13 in. and bore 12 fresh leaves. Scab was only rarely found, and then it occurred on and near the brown, killed patches at the tips and margins of the older leaves. At that date, the

disease was not threatening, and was apparently making no progress.

In Plot B, the Allington fruit showed slight spray damage, which was less conspicuous than in the Newtons. The foliage was uninjured and healthy, except that occasionally spots of scab occurred on a few older leaves on brown, dead areas. The Newton apples, like the Allingtons, showed the early stages of russetting in the same manner and to the same extent as in Plot A. This was not always found close to foliage which had obviously been heavily sprayed, and it was roughly estimated that not more than 5 per cent. of the apples were thus affected. No scab was found on the leaves or fruit of Newtons in Plot B. As regards spray injury to the foliage, on some of the larger branches there were three or four leaves of a pale yellow-green colour which were about to fall. There was no purple spotting of the foliage, and no leaves had fallen to the ground.

During the abnormally wet weather which prevailed in the succeeding months, the scab fungus found conditions suitable for a rapid and overwhelming attack on the leaves and fruit in the unsprayed plots. The extent of it could be seen while the crop was still on the trees, and, by comparison of the apples on the sprayed and unsprayed trees, it was evident that both Bordeaux Mixtures had provided adequate protection.

The Crop Graded for Scab.—The crop was very heavy in all the plots, and was picked on October 8, being graded by hand² for the amount of scab present. The system of grading adopted was as follows: Grade 1 consisted of apples free from scab³; Grade 2, of those apples on which scab spots were few or many, but which were not unmarketable; Grade 3, of apples which were so cracked or disfigured by scab as to be unmarketable.

The total crop of Allingtons was 4 tons, 2 cwt., and of Newtons, 4 tons, 7 $\frac{3}{4}$ cwt. From each plot, the number and also the weight of apples in every grade was ascertained, and the results are summarized in Table I. Taking first the unsprayed (control) trees, it will be found that the incidence of disease was very considerable in all three

² All the grading was carried out by the same two persons.

³ Whilst from the commercial standpoint these apples were free from scab, as many as three very minute spots on an apple (each not larger than the head of a pin) were not considered sufficient to reduce that fruit to the level of Grade 2. Such cases were numerically very small.

plots.⁴ The Allingtons in them, taken together, yielded 93 per cent. by weight⁵ of scabbed apples, *viz.*, 80 per cent. in Grade 2, and 13 per cent. in Grade 3; only 7 per cent. of the crop was scab-free (Grade 1).

TABLE I.

Plot and treatment	Variety	No. of trees	No. of apples picked	Percentage No. of apples in grade			Weight of apples lb.	Percentage weight of apples in grade		
				1	2	3		1	2	3
A. Hydrate of lime Bordeaux	Allington	12	17720	89	11	0	3362	88	12	0
	Newton	12	9985	88	12	0	2524	88	12	0
B. Quicklime Bordeaux ..	Allington	12	15094	88	12	0	2841	88	12	0
	Newton	15*	15319	87	13	0	3807	86	14	0
1, 2, & 3, taken together. Control (unsprayed)	Allington	12	16782	6	78	17	2973	7	80	13
	Newton	15	16388	14	79	7	3400	14	80	6

* See footnote, p. 227.

The Allingtons sprayed with the two Bordeaux Mixtures—whether made with quicklime or with hydrate of lime—gave no less than 88 per cent. of scab-free apples. In the unsprayed plots, as have been mentioned, only 7 per cent. of the fruit was clean. Further, whilst 13 per cent. of the unsprayed Allingtons were so scabbed and cracked as to be unmarketable, no apples at all were thus affected on the trees sprayed with ordinary quicklime Bordeaux Mixture, and only one apple in a thousand occurred in this unmarketable Grade 3 in the Allingtons sprayed with hydrate of lime Bordeaux Mixture.

Newton Wonder in the three control (unsprayed) plots taken together, yielded 86 per cent. of scabbed apples, *viz.*, 80 per cent. in Grade 2, and 6 per cent. in Grade 3; only 14 per cent. of the fruit was scab-free. The Newtons sprayed with hydrate of lime Bordeaux Mixture gave 88 per cent. of scab-free

⁴ It must be remarked that all the plots were used in 1926 for a similar series of spraying experiments. Owing to the failure of the crop in that year, the results of the spraying as regards control of scab on the fruit could not be ascertained. As has been pointed out previously (Goodwin, W., and Salmon, E. S., "Notes on Two Fungicides: Sulphur and Bordeaux Mixture," this JOURNAL, XXXIV, 517-528, September, 1927), it was observed that the foliage on the unsprayed plots became severely infested with the scab fungus, while that on the sprayed plots remained clean. It is necessary, therefore, to bear in mind the possible cumulative effects of spraying or not spraying, when considering the striking results obtained in 1927 on these plots and described in the present paper.

⁵ As will be seen by reference to Table I, the percentages according to number approximate very closely to those according to weight,

apples, and with quicklime Bordeaux Mixture 86 per cent. Here again the remarkable protective power of Bordeaux Mixture is shown, since only 14 per cent. of the unsprayed Newtons were scab-free.

During grading, a record was kept of all apples that showed distinct russetting, with the following results:—

Plot	Variety	Number of Apples	Weight of Apples (lb.)	Percentage russetted. (by number)	Percentage russetted. (by weight)
A	Allington	475	82	2.7	2.5
	Newton	62	15	0.6	0.6
B	Allington	455	79	3.0	2.8
	Newton	34	6.5	0.22	0.17

From the control (unsprayed) trees there were only two small apples (Allington) that showed any signs of russetting. From the above figures it is seen (*a*) that the Bordeaux Mixtures, whether made with hydrate of lime or with quicklime, behaved alike as regards russetting, and (*b*) that Allington Pippin is more susceptible to injury than Newton Wonder. Although the russetting of Allington Pippin was appreciable—*viz.*, from 2.5 to 3.0 per cent., this percentage included all apples that were distinctly russetted. A considerable proportion of the apples in the rest of the crop had a slightly roughened skin; this, however, was not sufficient to depreciate their market value. In view of the fact that the effect of Bordeaux Mixture was to convert a crop of Allingtons showing 93 per cent. of scabbed apples into one showing only 12 per cent., the existence of about 3 per cent. of russetted fruit is of little moment.

General Discussion.—The results obtained in 1927 show clearly that even in a wet summer Bordeaux Mixture applied three times controlled Apple Scab to a remarkably satisfactory degree. The results of other spraying experiments which have been published from time to time in this JOURNAL⁶ have given similar evidence.

We may, therefore, consider now the reason why home-made Bordeaux Mixture is not used to any considerable extent by the commercial apple grower in this country. The main objections appear to be (*a*), the trouble involved in making the mixture, and (*b*) the fear that serious injury, either in the form of leaf scorch and leaf fall, or of russetting and cracking of the fruit, may occur.

⁶ Bagenal, N. B., Goodwin, W., Salmon, E. S., and Ware, W. M., Vol. XXXII, 137-149, May, 1925, and XXXIII, 38-49, April, 1926; Petherbridge, F. R., and Dillon Weston, W. A. R., Vol. XXXII, 1119-1127, March, 1926.

With regard to (a), it has been pointed out previously in this JOURNAL⁷ that when making Bordeaux Mixture with lump quicklime, the trouble involved is in reality slight, and can be reduced appreciably by making stock solutions; further, now that it has been shown by the results just presented, that Bordeaux Mixture of equal fungicidal efficiency can be made with prepared hydrate of lime in powder form, the trouble involved has been reduced to a minimum.

With regard to (b), where serious scorching or russetting have been reported, this has usually resulted from one or other of the following causes:—

(a) *Susceptibility of the Variety*.—Certain varieties are particularly susceptible to injury by Bordeaux Mixture, and this spray must not be used on these under any conditions. A list of these varieties will be found in Leaflet No. 131, Apple and Pear Scab, published by the Ministry of Agriculture and Fisheries.⁸

(b) *Over-spraying*.—Frequently too much Bordeaux Mixture is applied to the trees at the second and third sprayings. A nozzle must be used throwing a fine, mist-like spray, the very fine drops of which will adhere to the leaf surfaces without causing any considerable amount of drip.

If spray guns are used, they should be set to throw the finest spray, and the operators must be taught to keep them in proper order and to move quickly so as to avoid drenching any part of the tree. A strictly temporary and sparing use of the coarse jet in reaching the upper parts of the tree must be enforced. In the third application, the aim should be to confine the spray to the foliage on the newly-formed wood; foliage already protected by a coating of dried-on Bordeaux Mixture should, as far as possible, not again be sprayed. It will be noted that, in the experiments described above, a smaller quantity of spray fluid was used in the third than in the second application.

For the successful control of Apple Scab, the time, as well as the method, of application of Bordeaux Mixture is of the greatest importance. In certain seasons, when frequent gales and rains occur in spring and early summer, it is very difficult to find weather conditions suitable for spraying. It may be pointed out, however, that it is just these weather conditions which suit the scab fungus and enable it to infect heavily

⁷ Salmon, E. S., *The Making and Application of Bordeaux Mixture*, January, 1910. Vol. XVI. p. 793.

⁸ Single copies of this leaflet can be obtained free, on application to the Secretary, 10, Whitehall Place, London, S.W. 1. The most recently revised edition was issued in January, 1928.

both leaves and fruit. Consequently, it is in such seasons that the preventive effects of Bordeaux Mixture are shown to the full. The grower who has everything ready so that he can spray with home-made Bordeaux Mixture at a few hours' notice, on such fine days as do occur in a wet May or June, can confidently expect to reap his reward.

In conclusion, it must be emphasized again that in home-made Bordeaux Mixture apple growers have a sure protection against scab. Scientific experiments in this country have proved that on certain varieties, *e.g.*, Bramley's Seedling, Allington Pippin and Newton Wonder, Bordeaux Mixture (when home-made) can be used with perfect safety and success. At the present time, a considerable quantity of apples of these varieties, heavily infested with scab, are put on the English market, and compare very unfavourably with the clean, sprayed fruit imported from overseas parts of the Empire and from the United States. Growers in this country, by failing to control scab, on varieties such as these, by intelligent spraying, are not taking advantage of the results offered by modern research.

Summary.—(1) Similar plots of trees of Allington Pippin and Newton Wonder were sprayed three times with two kinds of Bordeaux Mixture:—A, made with prepared, slaked lime (hydrate of lime or calcium hydrate), and B, made, as is ordinarily done, with lump quicklime. The fungicidal powers of the two mixtures proved to be identical and eminently satisfactory.

(2) Three control (unsprayed) plots were left adjoining those sprayed. The attack of the scab fungus during the wet summer of 1927 was very severe, as shown by the amount of this disease on the crop when hand-graded. The percentage by weight of scab-affected apples was 93 in the Allingtons (total crop, 12 trees, unsprayed, 1½ tons) and 86 in the Newtons (total crop, 15 trees, unsprayed, 1½ tons).

(3) The percentage by weight of scab-affected apples in the sprayed plots was as follows: Allington Pippin, Bordeaux Mixture A, 12; Bordeaux Mixture B, 12; Newton Wonder, Bordeaux Mixture A, 12; Bordeaux Mixture B, 14. The total crop (sprayed) was 2¾ tons of Allington Pippin (24 trees) and 2¾ tons of Newton Wonder (27 trees).

(4) No appreciable leaf scorch was caused on either variety by the spraying. Russetting of the fruit occurred to a slight extent, but was appreciable in only 2·5 to 3·0 per cent. of the Allington and 0·2 to 0·6 per cent. of the Newton variety.

GRAIN MIXTURE CROPS

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MIXED cereal and pulse crops have long formed part of the common farm practice of certain districts in Scotland, and are there known by the name of Mashlum or Mashlin. Similar mixtures are grown in the East Riding of Yorkshire under the name of Pease-away-Beans. The exceptional reliability and productiveness of the crop first attracted the writer's attention when experimenting with green forage crops. Mixtures of this kind are excellent green fodder, and a similar type of crop has become popular for use as silage.

Advantages of the Crop.—A suitable, mixed crop will give good yields, on many soils, where the cereal crops are not satisfactory. Where it is known that a heavy pure corn crop can be grown, there is no gain from substituting the mixture, but on such land it can be taken, with advantage, as a second grain crop. Under favourable conditions, the dense canopy, which the crop makes, smothers out all the common weeds of arable land except docks. Whether the crop will actually clean land of weeds depends on its getting a start in growth in advance of them. It is most successful for this purpose when sown in February, and straight after the plough. On clean land a succession of crops can be taken without any falling off in yield, and without injury to the land. The grain is a suitable concentrate for all classes of farm live stock, and the straw is a useful rough fodder.

Soils Suitable.—The crop can be grown with success on a wide range of soils, but probably has its greatest use on the weaker wheat soils. On rich soils, it gives a very great bulk, tending towards an excess of straw. On light soils, autumn sowing gives the best results. The crop can be adapted to differences of soil by the selection of varieties and the adjustment of relative quantities.

Seed.—Every soil has its own peculiar needs as regards seed, and only by experience can the best proportion to use be arrived at. However, a mixture of 2 bus. beans, 1½ bus. oats, 1 bus. barley, and 1 bus. field peas, sown at the rate of 4 bus. per acre, is likely to give good results on all soils. The same mixture of seed gives different proportions in the resulting crop in different years. The character of the crop can be varied, to some extent, by the selection of varieties of the

several grains. Tick beans should be sown on the lighter soils, and, where the common varieties of field pea make a too luxuriant growth, the Early Dun variety should be substituted. For autumn sowing, winter varieties must be chosen, and, if the seed is sown earlier than mid-November, vetches should replace the peas.

Sowing.—The crop may be sown successfully at any time from early September until the end of March, the varieties chosen being altered according to the season. It has been noted that early autumn sowing gives good results on light land. Very heavy crops are obtained from January and February sowing. For these sowings, Bountiful or Marvellous oats are preferable, while the black or grey winter varieties are to be preferred for autumn sowing. The seed may be mixed and sown broadcast or drilled in the usual manner. When sown broadcast on the raw furrow, two bouts of the spring tined harrow will cover the seed securely. On light soils, it is a good plan to plough in the beans and sow the remainder of the mixture in the usual way. On these soils the land, after sowing, should be rolled with a heavy roller—in no other case should any cultivation be given after sowing is completed.

Position in Rotation.—This mixture may be taken as an extra corn crop, following a pure cereal, without the risk of injury to the land which usually follows two white straw crops taken in succession. It may be grown several years in succession and then be followed by a cereal. In this case, it is desirable that the crop, immediately preceding the cereal, should be cut in a green state. It may also take the place of the cereal crops in the usual rotation.

Manuring.—Where the land is in fair heart, no manure need be given; otherwise 5 cwt. of high-grade basic slag should be given previous to sowing; on the lighter soils, 2 cwt. of kainit should be applied in addition. On these soils, the crop receives a very marked benefit from dressings of farmyard manure, the effect being particularly marked on the beans. Quick-acting nitrogenous manures do not appear to add much to the yield of the crop.

Yield.—On suitable soils, the yield is heavy; the green weight may reach 19 tons per acre, representing over 4 tons total dry weight. An average crop is 25 cwt. of grain and 35 cwt. of straw. The grain : straw ratio is generally better on the smaller crops. It is often possible to grow much heavier crops of the mixture than could be secured by sowing any of its

components separately. The legumes stimulate the growth of the cereals in the mixture, resulting in taller straw carrying heavier heads.

Harvesting.—The cereals ripen in advance of the pulse and the crop should be reaped as soon as the former are ripe. It is an advantage to cut the beans while they are still carrying the green leaf if the seed has reached a firm condition. When this is done, the haulm has a considerable food value and no grain is lost by shedding; ripening is completed in the stook. Mixture crops of this kind rarely become lodged if a sufficient proportion of beans be included, but their weight and bulk, when reaped in a partly unripe state, present some unusual harvesting problems. On many soils, both peas and vetches make excessive growth and their luxuriance among the cereal plants results in a tangled crop. Stiff-strawed varieties of the cereals should be selected, when otherwise suitable, to help to keep the crop upright. To make the most of the crop for feeding purposes, it should be reaped while the beans are still somewhat unripe: if they are allowed to become dead ripe, not only is a considerable loss involved through the shedding of the seeds, but the feeding value of the straw is much reduced.

Harvesting with the reaping machine is in most cases possible. An up-to-date binder is required, and a greater strain is placed on the machine than when the usual cereal crop is being reaped; but the modern reaper is equal to the increased demand made on its strength. The chief difficulty is experienced where the ground is soft and inclined to yield beneath the weight of the machine, as a greater tractive force is then applied at the land wheel to effect the cutting, and "wheel slip" may result, with the consequent stopping of the machine. The importance of keeping the knife sharp need scarcely be emphasized. The draught may be eased by leaving a somewhat longer stubble than is usual.

The binder should be adjusted to deliver large sheaves, as these are more easily ejected from the machine and stand better in the stook than smaller ones; the common objection that large sheaves do not dry easily does not apply in this case as the mixture does not pack close. It may, in some cases, be necessary to provide a man to walk by the machine to pull away any sheaves not thrown clear. The greater weight of the crop, compared with a cereal, demands more power to operate the machine. The dividing prongs may be strengthened and made longer to deal with an exceptional crop. Four horses

should be employed and an additional driver; the speed of the team should be increased consistent with steadiness. It is important that the knife should not be overloaded, and where the crop overhangs the driveway the machine should be driven well outside it, even if this means cutting only a small swath. When the crop overhangs in patches only, it may be lifted back by hand. Where the land slopes considerably, it is desirable to avoid cutting uphill if the crop leans over the cut portion in that direction.

Sheaves made in this way are large, open and rough, and, once stooked, are rarely blown over. The stooks take longer to dry than the usual corn crop, but are very resistant to bad weather, and any unripe beans or peas ripen out satisfactorily during the drying process. To avoid moulds developing in the stack, it is desirable that the seeds of the beans and peas should be hard when the crop is carried.

Thrashing.—Mixed crops can be thrashed satisfactorily with the ordinary thrashing box. When the grain is intended for use on the farm, the splitting of the beans and peas, which takes place to some extent, is no drawback. This can, however, be avoided and the straw still be thrashed clean, by setting the concave wider than usual and speeding up the drum.

Feeding the Crop.—The writer has had quite good results from feeding the crop simply chaffed, grain and straw together, without thrashing. Young cattle thrive well on it when fed this way with chaffed marrow-stem kale. For other classes of stock it is probably better dealt with in the usual way. The cost of grinding the grain reaches 15s. to 18s. per ton, and experiments are needed to test the efficiency of soaking the grain instead of grinding.

Cost of Growing.—Costs vary greatly between different farms, but the crop should not in any case cost more, ton for ton, than a cereal crop. The following example of costs applies to very adverse conditions of soil and situation:—

	£	s.	d.	
Manual labour	2	2	0	per acre
Horse labour	2	4	0	"
Artificial manure		15	0	"
Seed	2	1	0	"
Rent and rates	2	0	0	"
Depreciation of implements		8	0	"
	£9	10	0	"

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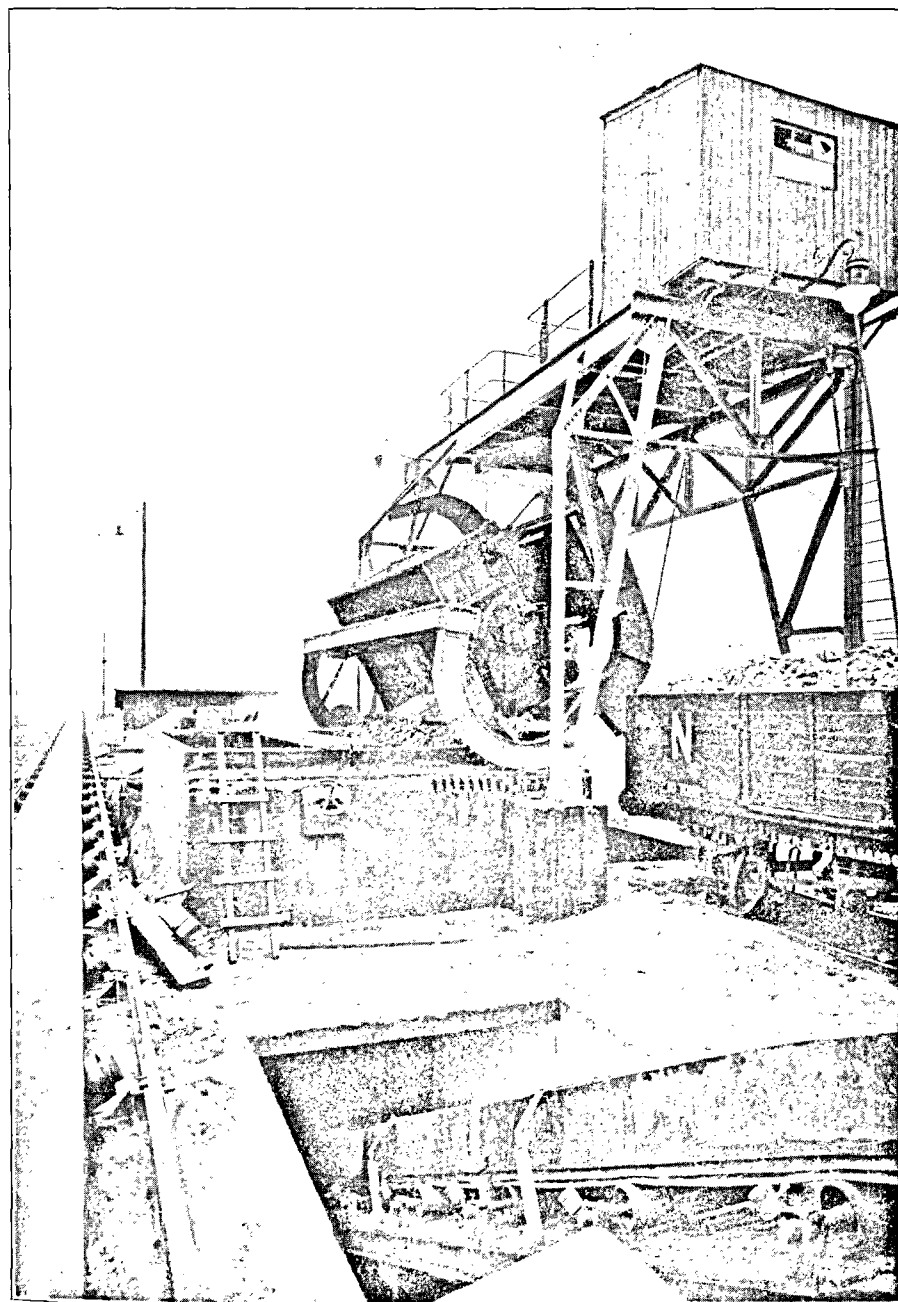
THE ALLSCOTT (SALOP) BEET SUGAR FACTORY

THE Shropshire Beet Sugar Company, Ltd., erected their factory at Allscott in 1927. The factory was commenced in May and finished in November, a remarkably rapid achievement in construction. It is situated on an excellent site about three miles west of the town of Wellington, Salop, and lies between the main L.M.S. and G.W. Joint Railway line and the river Tern—which joins the Severn some four miles further west. The factory is also well served by roads. Supplies of beet are drawn chiefly from within a radius of 15 miles of the factory, although, outside this area, there are three districts, namely, North Shropshire, Newport and Bridgnorth, which grow considerable quantities of beet, in addition to which the Staffordshire borders are also a useful source of supply.

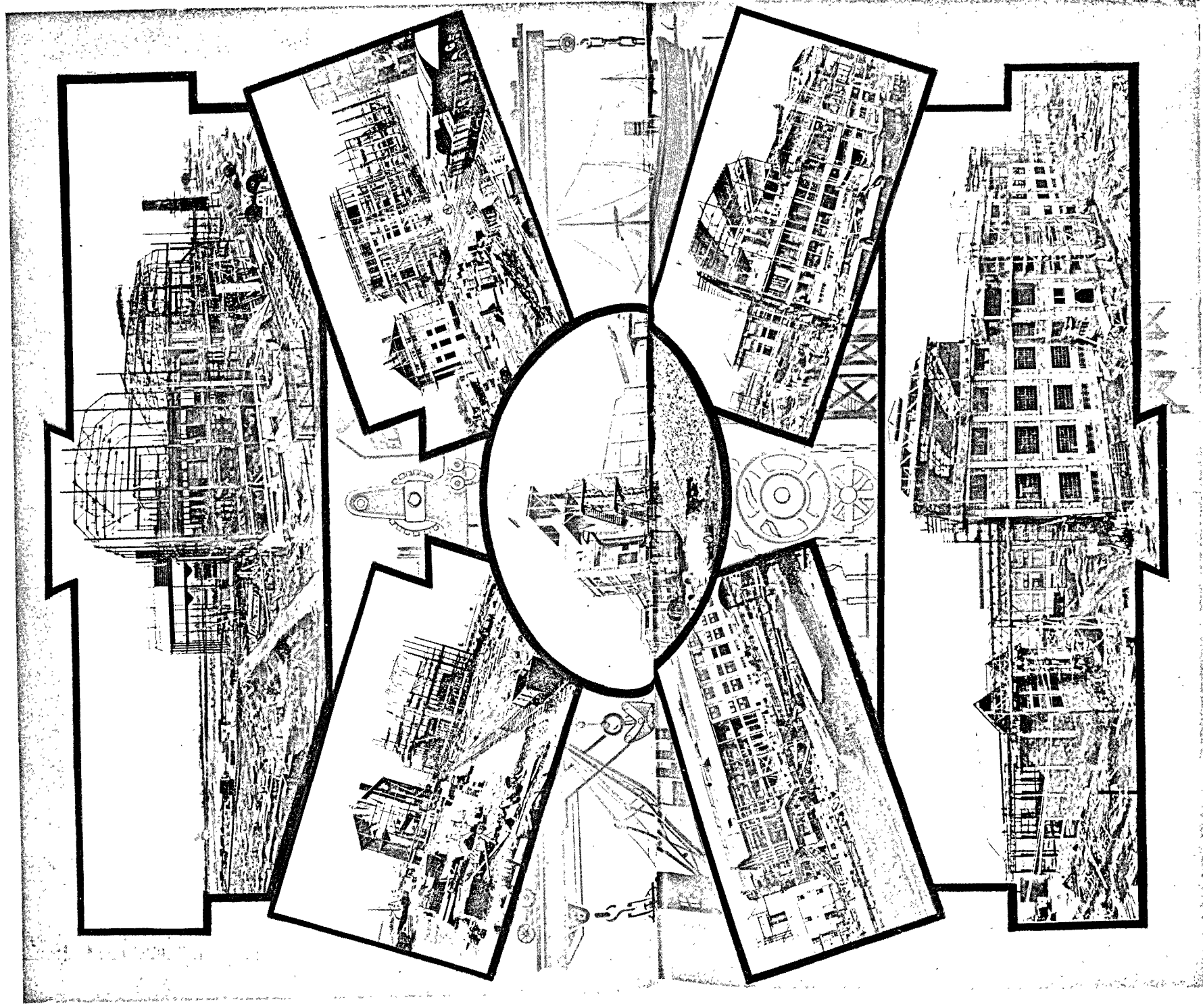
An interesting feature of this factory, as distinct from other British factories, is the beet storage system. On arrival, the beets are passed through rotary dry cleaners on to endless conveyor belts which pass them either to ground level "dumps," or direct to the factory. This makes it possible to ensure that only clean and well-topped beets are stored, the remainder being conveyed direct to the factory on arrival. This year, however, on account of the increased acreage contracted for, additional facilities, in the form of water-flume conveyors, are to be installed to relieve the existing plant.

Washing.—The beets, having reached the factory on the endless belt conveyor, are diverted to a large trough-shaped bath or washer, where adhering dirt is removed. The beets thus cleaned, are then passed over the stone catcher, whence they are conveyed by a worm-conveyor to the bucket elevator and lifted to the top floor of the factory.

Automatic Weighing.—The beets fall from the bucket elevator into a weighing machine which empties automatically after each filling of 1,000 lb., and registers the quantity passed. The object of this weighing is to enable the factory manager at any moment to determine the amount of raw material received into the factory during a given period. This control, when related to the quantity of sugar manufactured, and to the laboratory tests of sugar-content of the beets used, makes it possible to exercise a strict supervision of the process and to ensure economical working.

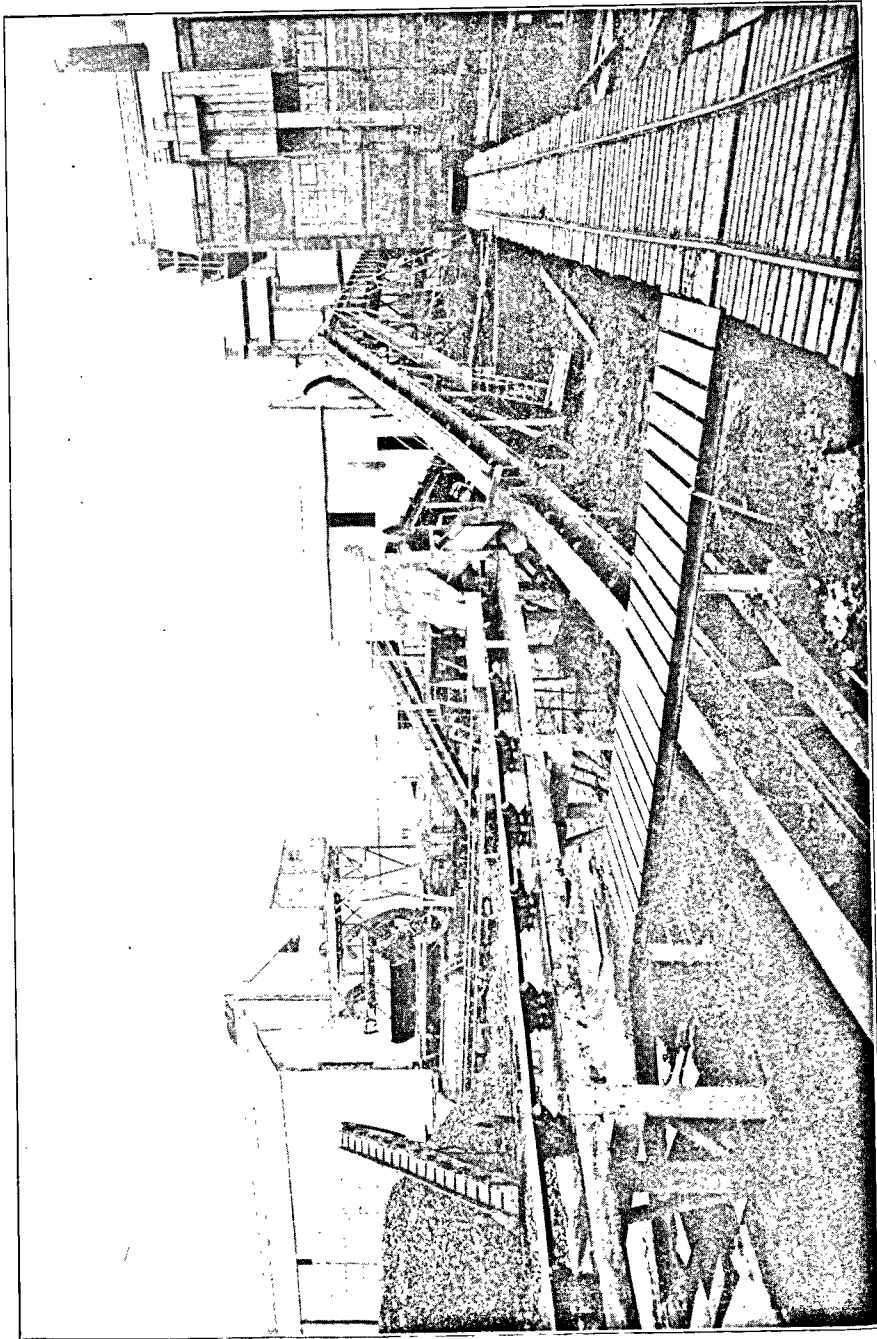


Allscott (Salop) Beet Sugar Factory: beet unloading and conveying system.



Stages in the construction of the Allscott Beet Sugar Factory, 1927.

[Reproduced by the courtesy of Aerocrete Units (London) Ltd.]



Allscott (Salop) Beet Sugar Factory: beet storage and conveyor system.

Slicing.—From the automatic weigher, the beets fall into three slicing machines, which, fitted with three-cornered knives fixed on discs rotating in a horizontal plane, cut the roots into thin fingers or cosettes. The slicing capacity of the factory is 800 tons of beet in 24 hours.

Diffusion.—The extraction of the juice from the slices at the Allscott factory is carried out by means of the ordinary diffusion battery, as distinct from the continuous diffuser employed at the Poppleton factory and described in the October, 1927, issue of this JOURNAL. At Allscott, the battery consists of 16 vertical cylindrical vessels of 80 hectolitres (1760 gal.) capacity. The slices are conveyed to each diffusion vessel by a rake conveyor, and extraction of the sugar takes place by the physical process known as osmosis, *i.e.*, the slices are surrounded by hot water or thin juice into which the sugar diffuses, the action continuing until the concentration of juice around the beet cosettes is equal to that within the cosettes themselves. The vessels are so arranged that, at any one time, each contains cosettes in varying stages of exhaustion, the juice being circulated from one to another, thus ensuring the maximum extraction of sugar. The whole circulation process takes about an hour. The concentrated raw juice is passed through a strainer, which removes fibrous matter and other impurities, and is drawn into a measuring tank, after which it is subjected to purification.

Meantime, the exhausted slices are withdrawn from the diffusion vessels, put through presses, and the water content reduced to 84 per cent. The slices pass to the pulp-drying plant, which consists of a slowly rotating drum in which they are exposed evenly to hot air. The slices finally obtained contain only from 12 to 13 per cent. of water. The dried pulp is then bagged. Facilities are also available for mixing hot molasses with the wet slices before drying, when molassed pulp, an excellent cattle food, containing nearly 20 per cent. of sugar, is obtained.

Carbonation.—The first stage in the purification of the juice is effected by the addition of milk of lime, the limestone for the production of which is burnt in a vertical kiln on the premises. The limed juice then passes to the carbonation tanks, where, by the introduction of carbon-dioxide gas derived from the burning of the limestone, the lime and impurities are precipitated. The liquor is then passed through filter presses. The lime mud deposited on the filter cloths contains 58 per cent. of carbonate of lime, with quantities of

organic matter, phosphates, nitrates, and salts of potash, and makes a very good fertilizer. The clear juice from the filters is again treated with carbon-dioxide and subjected to a further filtration.

Sulphitation.—Remaining traces of lime are removed from the filtered juice by sulphitation (sulphur-dioxide treatment) and final filtration. A juice containing 86 per cent. of water and with a purity of 93 per cent. is then obtained.

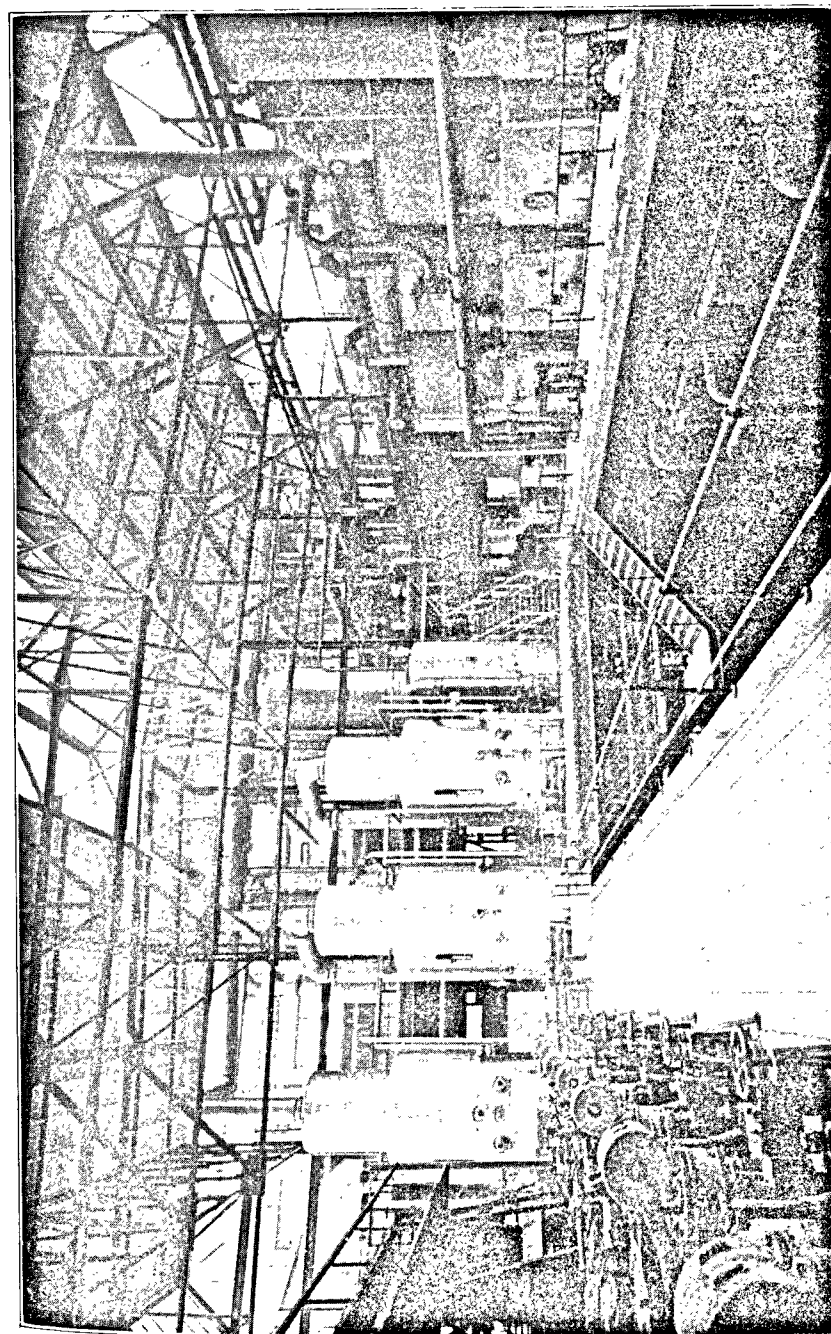
Evaporation.—The concentration of the juice takes place in a pressure steam evaporation station (Turek system), consisting of three vessels, in the first of which back-pressure steam from the turbine and direct steam are used. The other vessels are treated with steam from the preceding evaporator. In this way, the steam consumption is regulated on an economical basis. From the last evaporator, the steam does not pass to condensers but to the pre-heaters, thus making full use of all heat available and reducing the coal consumption to a minimum. From these three evaporators, a thick juice, containing from 35 to 40 per cent. of water and with a purity of from 94 to 95 per cent., is obtained.

Crystallization.—The juice is then passed through filters to a large tank which supplies the vacuum pans, two of which boil fine crystals. The vacuum pans are heated with the steam from the evaporators, and only to a small extent with return or live steam. When the boiling process is finished, the massecuite (crystals mixed with syrup) flow into large tanks (strike mixers) with revolving gear, whence the massecuite passes through a screw conveyor to the various centrifugals.

Centrifugation.—Large Weston centrifugals are used, consisting of baskets revolving on a perpendicular shaft at 800-1,000 revolutions per minute, the drive being above. The sides of the baskets are made of perforated brass screen, through which, when the centrifugal is rotating, only the syrup can penetrate.

When the centrifugals are stopped, the sugar crystals that have collected around the sides of the basket are scraped off with wooden shovels and pass out through the bottom, whence they fall on to a shaking conveyor. They then travel up a bucket elevator and along an endless band to another screen conveyor, or "shaker," which acts also as a grader of the crystals.

Owing to the climatic conditions prevalent in this country, it has been deemed advisable to install a granulator, which will be in operation next season.



Interior of the Allscott (Salop) Beet Sugar Factory.

The syrup, thrown off by the centrifugals, is collected in tanks, from which it returns to the process, and as much sugar as possible is separated, leaving thick molasses containing about 50 per cent. of sweetening matter.

Weighing and Bagging.—The sugar is weighed and bagged automatically. The bags are sewn up by machine, and conveyed to the sugar store, where they are loaded into trucks immediately alongside the store and dispatched.

Factory Output and Working.—The following were the production figures for the 1927 campaign :—

Sugar	6,420 tons.
Wet pulp	6,350 "
Dried pulp	2,475 "
Dried pulp molassed .. .	185 "
Molasses	1,737 "

The sugar was sieved and graded into three classes—fine granulated, which was 70 per cent. of output; medium, 20 per cent.; and coarse grain, 10 per cent. Alterations in plant should enable the whole of the 1928-29 output to be classed as fine granulated.

The raw material used included :—

Clean beet	51,561 tons.
Limestone	3,100 "
Coal	6,200 "
Coke	320 "

Many thousands of bags for sugar and pulp, and large quantities of chemicals, were also used. Steam is provided by three Babcock and Wilcox boilers, and the power and lighting is derived from two turbo-generators of KVA 1,500 each, supplied by the General Electric Company.

The amount of water consumed daily by the factory during the manufacturing campaign is approximately $3\frac{1}{2}$ million gallons. The effluent from the factory—consisting of the conveying and washing water which forms the greatest proportion of the effluent, the diffusion waste water and the pulp press water—is screened and filtered by means of the Brackett screen, which is described in the "Report on an Investigation into the Desiccation of Sugar Beet and the Extraction of Sugar" (H.M. Stationery Office).

In 1927, 7,300 acres of beet were contracted for with the Allscott factory by 1,179 growers, and in 1928—in spite of the reduction in the beet price—contracts have been made with 1,230 growers for 9,175 acres. The amount of beet transported by road to the factory during the 1927-28 campaign was approximately 30 per cent. of the total tonnage received. In the coming campaign a road transport organization,

with headquarters at the factory, will contract with the growers to haul beets from farms situated at an uneconomical distance from a railway station.

In the 1927-28 campaign, 573 workers were employed in the factory, and 93 are estimated to be employed during the summer months.

On the agricultural side, tests are being carried out with varieties of seed, including early maturing varieties, and with manures, with a view to discovering those most suitable for the Shropshire area. Tests are also being made of British and foreign implements for use in beet cultivation and harvesting. It is interesting to note that growers within a short distance of the Allseott factory are appreciating the value of *wet pulp* as a cattle food, and arrangements are in hand for daily deliveries to be made to growers.

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COST OF PRODUCING FARMYARD MANURE ON THE FARM OF THE HERTFORDSHIRE INSTITUTE OF AGRICULTURE

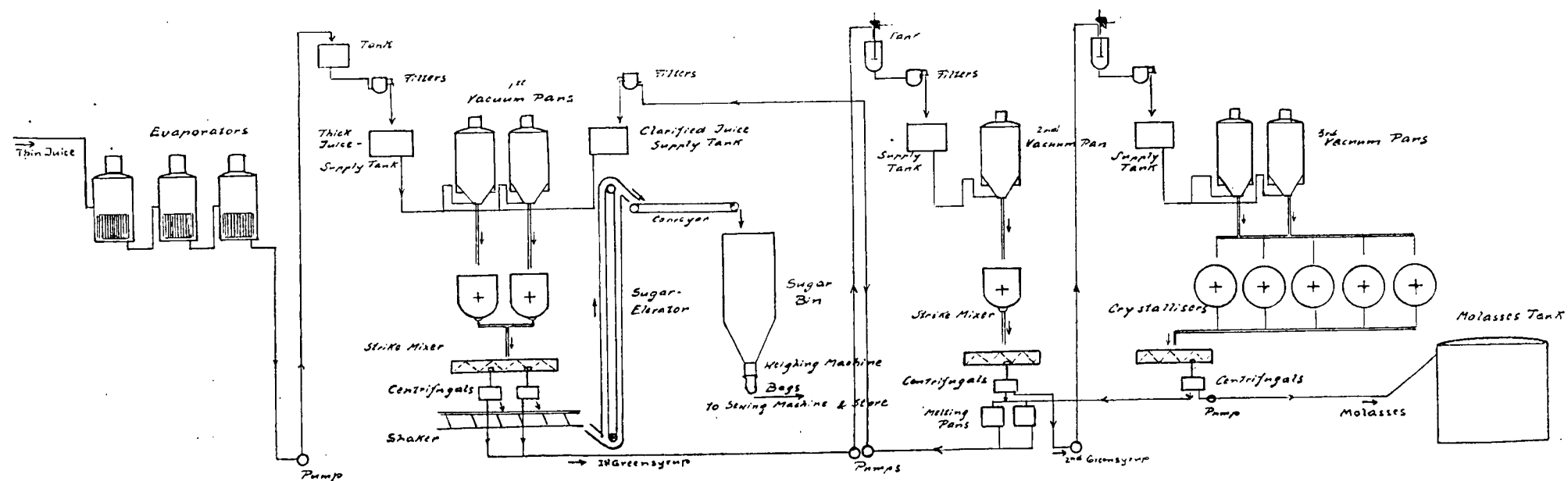
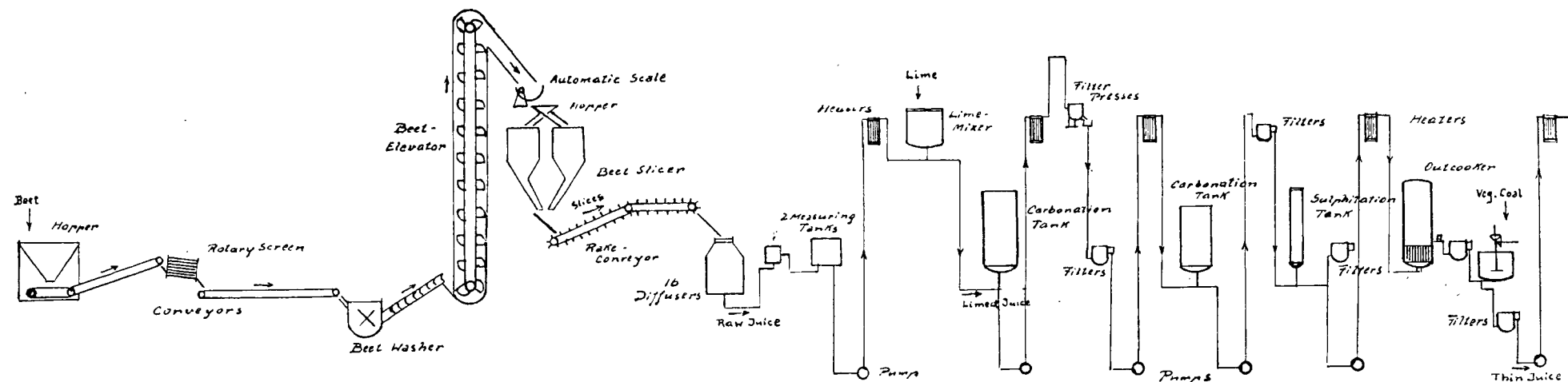
J. W. REID, N.D.A., C.D.A. (Glas.),
Hertfordshire Institute of Agriculture.

COMPLETE cost accounts have been kept on the farm of the Institute since 1923, and much useful information regarding costs of production has been accumulated. The following notes are based on the cost of production of farmyard manure during the years 1923-26.

The Production of Manure on the Farm.—The farm at Oaklands extends to 222 acres, of which $87\frac{1}{2}$ acres are permanent pasture, and during the three years under review, the stocking gradually increased until in 1925-26 there were approximately 18 dairy cows, 20 other cattle, 100 pigs and 6 horses. A record is kept of the production and utilization of the manure. Manure made by the dairy cows is wheeled to a yard and thence carted to a clamp in the field; manure from other cattle is carted direct from the yards and boxes to the clamp; horse and pig manure goes first to the yard and later to the clamp.

The following table shows the cost of production of dung in each of the three years 1923-24, 1924-25, and 1925-26, with the total for the period, the proportion of cost due to each item, the quantity of manure made, and the cost of production per ton.

In the first table the manual and horse labour charged against the manure covers all labour involved from the pro-



The Allseott (Salop) Beet Sugar Factory. Flow Sheet.

Particulars	1923-24	1924-25	1925-26	Total	Pro- portion
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	Per cent.
Manual labour	22 6 10	14 2 7	21 5 11	57 15 4	6.4
Horse labour	20 5 6	9 13 9	14 10 6	44 9 9	4.9
Straw for litter	79 2 6	74 19 5	106 18 8	261 0 7	29.4
Manurial resi- due of food ..	159 11 5	165 11 9	202 6 3	527 9 5	59.3
Total cost ..	281 6 3	264 7 6	345 1 4	890 15 1	100.0
Tons made ..	400	490	506	1,396	
Cost per ton ..	s. d. 14 1	s. d. 10 9	s. d. 13 7	s. d. 12 9	

duction of the manure to the finishing of the clamp. The labour of carting and spreading in the field is charged against the crop and does not, therefore, appear in the figures given. The litter used is charged at its cost of production. The manurial value of the foods consumed by the animals is calculated from recognized tables, and only those foods consumed in the buildings are charged against the manure.

The manurial values of the food consumed account for about three-fifths of the total cost, and manual and horse labour for rather over 11 per cent. Thus, while it is desirable to effect economy in the production of manure, any economy in labour is not likely to effect more than a very slight reduction in the cost of the manure.

The Purchase of London Manure.—Large quantities of London dung come into Hertfordshire each year, and although, in the case of Oaklands, large purchases have not been made, sufficient figures are available to offer a comparison between farmyard manure and London manure costs on the farm.

The following table shows the quantity of manure purchased each year, its cost at London, the railway carriage, the cost of carting from the station to the clamp, and the total cost in the clamp.

Year	Quantity	Purchase price	Carriage	Cartage to clamp	Total cost
	tons cwt.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1924-25	71 3	12 9 0	11 11 7	10 11 5	34 12 0
1925-26	22 10	3 15 3	3 10 0	3 12 5	10 17 8
	93 13	16 4 3	15 1 7	14 3 10	45 9 8

The average cost per ton over the two years is, therefore, approximately 9s. 9d. in the clamp, compared with the figure of 12s. 9d. for the manure produced on the farm.

The Application of Farmyard Manure.—At Oaklands, farmyard manure is used almost exclusively for roots and potatoes. The average annual production of 465 tons is practically sufficient to satisfy requirements. The area of arable land is 134½ acres, and, with a five-course rotation, the production of manure on the farm is sufficient to provide a dressing of approximately 17 tons per acre of arable land.

Figures relating to the cost of the application of manure to the land from the clamp are available for 800 tons of manure. The following table shows the cost of manual and horse labour for the loading at the clamp, carting to the field and spreading in the field.

Year	Tons	Manual labour	Horse labour	Total cost	Cost per ton
		£ s. d.	£ s. d.	£ s. d.	s. d.
1924-25	400	22 4 11	10 13 9	32 18 8	1 8
1925-26	400	23 15 0	11 0 0	34 15 0	1 9

The average cost of production in the clamp is 12s. 9d., the average cost of application to the field 1s. 8½d., and the average total cost of the manure when applied to the field is, therefore, 14s. 5½d. per ton.

WEEDS OF ARABLE LAND—III*

H. C. LONG, B.Sc. (Edin.),

Ministry of Agriculture and Fisheries.

Methods of Prevention and Suppression.—As already indicated, weeds may be *annual*, *biennial* or *perennial*, and must be combated by somewhat different methods according to their habit of growth. Whatever methods are adopted they must be promptly, vigorously and faithfully carried out: systematic well-timed effort is the foundation of success.

(1) *Prevention of Seeding* is the most obvious means of suppressing weeds. When it is recognized that an ordinary charlock plant produces from 1,000 to 4,000 seeds, and a moderate-sized poppy 10,000 to 15,000, and large plants 50,000 seeds, the force of the adage that "one year's seeding

* See this JOURNAL for April, p. 50, and May, p. 147, for the first and second articles. These articles will embody material from certain leaflets issued by the Ministry. The present article is a slightly revised form of material from Leaflet No. 112.

is seven years' weeding" is obvious. Further, as many weeds produce seeds which do not all germinate at the same time, the mischief is greater than appears at first sight, for they may lie dormant in the soil and grow after several years. In destroying weeds of this type it is an advantage if root and other crops which permit thorough cleaning are frequently introduced into the rotation. Seeding of weeds growing in hedgerows, on roadsides and waste places, and round farm buildings should be prevented.

(2) *Use of Clean Seed.*—In no circumstances should imperfectly cleaned seed be either purchased or sown. The Seeds Act, 1920, and Seeds Regulations, 1922, require, in the case of a sale of any of the principal kinds of farm or garden seed, that the seller shall declare in writing to the purchaser, at or before the time of sale or delivery, certain essential particulars as to the quality of the seed in question, including in the case of grasses and clovers a statement of the percentage of injurious weed seeds present, if present to the extent of more than 1 per cent. The Seeds Act also makes it illegal for any person to sell or knowingly to sow any seeds referred to in the Act which contain more than 5 per cent. by weight of injurious weed seeds. The injurious weed seeds scheduled under the Act are docks and sorrels, cranesbills, wild carrot, Yorkshire fog and soft brome grass. *The Ministry desires to impress upon farmers the great importance of taking steps to ensure that there shall be no failure of crops due to the sowing of poor seed.* Farmers are urged to take advantage of the facilities for having seeds tested at the Ministry's Seed Testing Station for a nominal charge. (See the Ministry's Leaflet No. 297.) Care should be exercised as to the disposal of refuse seeds from thrashing, screenings, sweepings of hay lofts, etc. Such refuse should be burnt.

(3) *Ploughing, Cultivation, Hoeing and Harrowing.*—(a) Deep ploughing is sometimes very successful, many seeds rotting when deeply buried. Others, however, remain dormant under such conditions, without losing their vitality, and may later on be brought to the surface. Shallow cultivation and the preparation of a good tilth before the sowing of a crop will encourage weed seeds to germinate, and the seedlings may then be destroyed by further stirring of the soil, harrows being freely used to this end. Such a method will help to clear the ground of many annual and biennial weeds.

(b) Where it is intended to hand-hoe corn, care should be taken not to drill it too closely. There should be room for the

hoer's feet between the drills. If it is intended to horse-hoe, the drills should be 8 or 9 in. apart. The horse-hoe is very useful for cleaning spring-sown corn.

(c) If weeds are plentiful the land should be disked or lightly scarified immediately after harvest. This will encourage seeds of annual weeds to sprout, and the young weeds can be ploughed down.

(d) Such perennial weeds as couch, field bindweed and creeping thistle need careful and well-directed effort. These plants spread by underground runners bearing buds, and hence the object must be to remove the root-stocks as far as possible unbroken. This will usually be best accomplished by shallow ploughing followed by grubbing or cultivating, rolling and harrowing. As a rule the weeds should be collected and either be burnt or made into a compost with lime. Sometimes, as in fallowing, they may first be brought to the surface and left to the destructive effects of wind and sun.

(4) *Pulling, Digging and Cutting*.—(a) Hand-pulling, digging with fork or spade, and total removal of weeds are efficient means of destruction, but these methods are all expensive, and are only resorted to when other plans have failed or are inapplicable. In every case the weeds collected should be burnt.

(b) Any perennial weeds may be cut down frequently to exhaust the supplies of food stored up in their root-stocks and prevent storage of further supplies. Judicious cutting with spade, hoe, or scythe, will destroy all weeds if the cutting is repeated often enough. Many weeds when cut near the ground send up new stems, and these are produced at the expense of food stored below ground in the previous season. The growth of these new stems weakens the plant as a whole, and if, when produced, they are cut off and the process repeated, total destruction will be the result, no matter what the plant may be.

The first cutting should be made when the plants have grown appreciably and are coming into bud, but before they have any opportunity to flower; further cuttings should be made during the summer as often as new shoots appear. If left too long the weeds may either seed, or again store up food in the root, in preparation for the next season's growth. One cutting, in the case of perennials like creeping thistle, field bindweed and couch, is insufficient.

(5) *Fallowing*.—Fallowing, either bastard or bare, as a cleaning process, is largely practised with good results on the

heavy classes of soils on which root crops are uncertain and expensive to produce. Bare fallowing, however, should be reduced as much as possible, "smother" crops being substituted (*see* 8, below).

(6) *Liming and Draining*.—Rushes, sedges and horsetails are usually signs of a sour, damp soil, which can be remedied by draining and liming. A dressing of lime is often of considerable use against sheep's sorrel, corn marigold, spurrey and some other weeds.

(7) *Manuring*.—The application of dung and artificial manures induces considerable changes in the character of the herbage on pastures, and of the weeds on arable land. The application of 5 to 8 cwt. of basic slag per acre to pastures on stiff clay land often has a wonderful effect in encouraging clovers and generally improving the herbage, while a dressing of superphosphate and sulphate of ammonia is often an effective means of reducing such weeds as buttercups, daisies and plantains. Suitable manuring may so stimulate cultivated crops that many of the worst weeds will be crowded out. This fact is of especial significance in connexion with the growing of successive corn crops.

Farmyard manure, believed to contain weed seeds in any quantity, should be applied to land on which the particular weeds concerned are unlikely to cause damage. For example, manure containing the seeds of charlock or spurrey could be applied quite well to permanent meadows.

(8) "*Smother*" Crops.—Weeds may often be suppressed or much reduced by the growth of dense, heavy "smother" crops which choke them out. On foul land such crops may be of much value before a root crop. Suitable crops for the purpose are vetches; a mixture of vetches or peas with oats or rye with a few beans, to be mown in early summer and either used green or made into hay or silage; mustard; rape; and maize (*see* the Ministry's Leaflet No. 392). The last-named casts a dense shade, but it must be kept clean by horse and hand-hoeing in the early stages of its growth. It can, however, be grown only in the warmer southern counties. (*See* the Ministry's Leaflet No. 73.)

(9) *Cleaning Crops*.—In every system of arable farming the growth of a root crop is the most important means of suppressing weeds of all kinds, and as a rule the state of a farmer's root crop towards the end of summer is a good indication of the level of his farming.

Wherever possible the first cleaning operations in connexion with the root crop begin in the previous autumn as soon as the stubbles have been cleared. Given a fine September and October, couch can then easily be separated from the soil and dragged to the surface to be collected and burnt.

The methods of cleaning naturally depend on circumstances. On a light or medium soil a cultivator will penetrate sufficiently deeply to drag out the weeds, but in most cases it is safest to give a preliminary shallow ploughing, followed by the cultivator and harrows. On very foul land it may be necessary to take off two or three "crops" of weeds and the operations may have to be continued in spring, but always the autumn cleaning should (especially on heavy land) be as thorough as possible, as at no other time does the same amount of work have such a great effect. Furthermore, in the case of crops, such as potatoes and mangolds, which are sown comparatively early, there is little chance of cleaning the ground in spring before the seed is put in.

Potatoes are one of the most effective cleaning crops, and they are all the more useful because they are best suited for light soils, which become foul so quickly. They require deep cultivation, and on couch-infested land the deep winter ploughing, if properly done after the couch has been dragged to the surface, will itself be a cleaning operation of no little importance. There is usually little chance of cleaning in spring before potatoes are planted, but repeated harrowing (with chain or saddleback harrows) and scuffings may be given at a small cost before the young plants appear, and prove effective in dealing with both annual and perennial weeds. Once the potatoes have secured a good start weeds will have little chance of asserting themselves, and even couch will often be suppressed, the more so if the soil is in good heart and a vigorous variety of potatoes has been selected.

On suitable land a crop of drumhead cabbages probably comes next to potatoes as a cleaning crop. If planted out so that they can be scuffed in two directions, they are easily kept clean in the early stages, and if well manured their later growth is so rapid and strong that the ground is soon covered.

Mangolds are perhaps the least satisfactory root crop on very foul ground. They have to be sown comparatively early, leaving little time for preliminary cleaning, and their growth at first is almost invariably slow and irregular. Even when well established they do not cover the ground in the way that even a good crop of swedes or turnips will do.

When there is a shortage of labour it is necessary to consider means of reducing the work involved in dealing with a large area of roots, and one of the best methods is to sow a part of the root break in autumn with a vetch mixture to be mown not later than the end of June, either for use as green forage or for making into hay or silage. This crop will smother out a large proportion of the perennial weeds, it will be cut before the annuals have formed seed, and it will be removed in time to allow either a half fallow or the sowing of a crop of white turnips, rape or mustard.

(10) *Feeding Off with Sheep*.—Running sheep over weedy, arable land will often check many weeds, but it is desirable that it shall be done before the weeds reach the seeding stage. On grassland close grazing with sheep in spring and early summer will often check certain plants and prevent their seeding, *e.g.*, ragwort, yellow rattle, and hardhead or knapweed. Grazing is more effective when combined with manurial treatment to encourage vigorous growth of bottom herbage.

(11) *Spraying*.—Finally, spraying crops with chemical substances, more especially with sulphate of copper (bluestone) and sulphate of iron, has been found exceedingly useful in destroying weeds. The destruction of charlock in corn crops by spraying is dealt with in the Ministry's Leaflet No. 63. Solutions of the sulphates of copper and iron, however, may be employed against other weeds, some of which may be destroyed and others crippled. *Persicaria*, or red-shank, and spurrey may be killed by spraying with 4 and 5 per cent. solutions of copper sulphate respectively; while the following weeds are more or less crippled and seeding largely prevented by spraying with a 5 per cent. solution of copper sulphate, or a 15 per cent. solution of sulphate of iron: poppy, corn cockle, black bindweed, dock, groundsel, dandelion, perennial sow thistle, cornflower, hoary pepperwort, thistles and coltsfoot.

Spraying with a solution of sulphate of ammonia has also been tried (1 to 2 cwt. in 60 gallons of water per acre), and plants said to yield to this treatment are corn buttercup, spurrey, ivy-leaved speedwell, large field speedwell, charlock and wild radish. It is most important to remember that most cultivated crops, with the exception of wheat and oats, and possibly barley and rye, are damaged by spraying with sulphate of ammonia, which should never be sprayed on crops other than cereals, and even then not when "seeds" have been sown with the corn.

In a fair number of cases calcium cyanamide has been found

valuable in destroying certain weeds, while providing both nitrogen and lime for the use of the cultivated crop.

Dry-spraying or dressing cereal crops (only) with specially finely ground kainit has also been found extremely useful in destroying charlock and runch, while it has a strongly injurious effect upon various other weeds, such as mayweed, chickweed, thistles, etc. It should be used at the rate of 4 to 6 cwt. per acre, and be applied when the crop and weeds are wet with dew and when the charlock is at the third or fourth leaf stage.

Labour.—Labour requirements may sometimes be met, in so far as the destruction of weeds is concerned, by the employment of women and temporary workers who may be in a position to do work of this kind for short periods. Such employees should work under the guidance of practised hands.

Compulsory Destruction of Weeds.—It is desirable that all occupiers of land should cut down and destroy injurious weeds growing on their land, especially those weeds that may readily spread to adjoining lands.

Under the Corn Production Acts (Repeal) Act, 1921, the Ministry of Agriculture and Fisheries may serve on the occupier of any land infested with certain injurious weeds a notice in writing requiring him to cut down or destroy the weeds in the manner and within the time specified in the notice; and where the occupier unreasonably fails to do so, he is liable, on summary conviction, in respect of each offence, to a fine not exceeding £20, and a further fine not exceeding £1 per day while default continues after conviction.

The Minister has delegated his powers to the various County Agricultural Committees, and any communication on the subject of putting the Act into operation as regards particular land should be addressed to the Clerk of the County Agricultural Committee at the offices of the County Council for the Administrative County in which the land is situated.

If the land is situated within the boundaries of a County Borough for which there is no Agricultural Committee, communications should be addressed to the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

The injurious weeds to which this provision applies are ragwort, spear thistle, creeping or field thistle, curled dock and broad-leaved dock.

The expression "occupier" means, in the case of any public road, the authority by whom the road is being maintained, and, in the case of unoccupied land, the person entitled to the occupation thereof.

AGRICULTURAL MANUAL PROCESS CLASSES IN THE COUNTY OF DEVON

COLIN D. ROSS, B.Sc.,

County Agricultural Organizer, Devon.

DURING the last generation, there has been a considerable decrease in the number of skilled workers employed on the land, with an ever-increasing tendency for the most technical and highly skilled work to devolve upon the older workers. To such an extent has this become the case that, not only in the county of Devon, but generally throughout the country, farmers deplore the increasing scarcity of young men skilled in the arts of thatching, hedging, ditching, stone-walling, sheep shearing, ploughing, and kindred matters.

Realizing this, the Devon County Agricultural Committee formulated a scheme of instruction to encourage the training of the younger men in various agricultural processes. The original scheme has been added to and gradually built up as circumstances have shown to be necessary, so that the one now in force, and which is described, is the result of several years' experience and practical trial.

Administration.—The county of Devon is the second largest single administrative area in England, and its main industry is agriculture. The provision of Agricultural Education is one of the duties with which the County Agricultural Committee is directly charged, and for the convenience of working such a large county it has been divided into four districts (North, South, East, and West), each supervised by a District Sub-Committee for Agricultural Education, acting in an advisory capacity to the County Committee. The latter body is largely composed of practical farmers, and each District Sub-Committee has for its nucleus the members of the County Committee resident in the area, with the addition of progressive local members who are co-opted to represent agriculture and horticulture in all their phases. The establishment of the District Sub-Committees has not only considerably stimulated the demand for instruction in manual processes, but has created a spirit of friendly rivalry in the various districts.

Growth of the Movement.—The demand for the instruction has been progressive. Whereas, in 1924, nine classes were held, and attended by 134 pupils, in the year ending March, 1927, 45 classes were held, and attended by 551 pupils. During the past year there was a large increase in the number of applications for classes, particularly classes for sheep shearing,

and in the year ending March last 77 classes were held, attended by 765 pupils.

Subjects.—The subjects at present included in the scheme are thatching, which includes rope and spar-making; ploughing; hedging, which includes ditching; stone ditching or stone facing; sheep shearing; live stock judging. Provision may also be made for classes in rick-making, milking, farm machinery, wattle hurdle making, etc., provided the Local Committee submits a scheme for approval.

Arranging Classes.—Application for classes is made, in the first instance, by a Local or Parish Committee, Local Higher Education Committee, or Ploughing Association Committee; and these local committees arrange for the provision of horses, ploughs, ricks for thatching, sheep for shearing, etc. The local committee also nominates an instructor, who is usually a local man who has won prizes at shows and who is fully conversant with the custom of the district. It will be realized that the methods employed vary considerably in different districts in the county, and therefore a competent man versed in the local practice is essential.

Applications are approved periodically by the District Sub-Committees, and, on receipt of details as to places and times of meeting of the classes, every assistance is given as regards advertising by means of printed posters and circulars. Arrangements are usually made for the classes to be held at several farms centrally situated in the parish, instead of all being at one farm, and at the termination of the course of instruction a competition is held, and prize money and certificates are provided by the County Committee for award to successful students. Keen local interest is generally taken in the competition, and at some centres a public tea (with possibly a lecture on a topic of seasonable interest) is arranged.

Where there is a Ploughing Association already established in the district, it is customary for the Association to conduct the classes and have the competition on the day of their ploughing match, the prize money for the classes being provided from the county grant.

Rules and Regulations.—Grants in respect of classes are made by the County Agricultural Committee in accordance with a scale which allows for a payment to the instructor on the basis of his having given a stated minimum number of hours of instruction, and also for payment of prize money at the competition at the rate of so much per "eligible" competitor. An "eligible" competitor is defined as one who



Sheep Shearing at the Devon County Show, 1927.



Spar Making at the Devon County Show, 1927.

is over 14 years of age, and who has attended a specified minimum number of hours of instruction. He must, also, not have previously won a first prize at any competition in the same subject held under the Committee's regulations, nor must he have been a prize-winner at the Royal, Bath and West, or Devon County Shows. Where there are more than 10 pupils at a centre further classes are arranged.

The regulations stipulate that no class shall be held unless there are at least three pupils, and no applicant over 14 years of age may be refused admission to a class. No payment is made by the County Committee to any pupil on account of work done by him in the classes, nor for the use of horses, ploughs, etc.

Travelling Allowances.—In special cases, a travelling allowance may be made to farm workers who have to travel considerable distances, and a grant may also be made towards the travelling expenses of an Instructor under similar circumstances.

Register of Attendance and Claim for Grant.—A register of attendance is kept in connexion with each class, and this must be certified by the instructor and signed by any member of the Local or County Committee, or of the County Agricultural Education Staff, who may visit the class. At the conclusion of the class and competition, application for grant is made by the Local Correspondent or Secretary of the Ploughing Association on an approved form, which must contain details of receipts and expenditure and be accompanied by receipts for the amounts paid to the instructor and prize-winners. The actual division of the prize money is left to the discretion of the Local Committee, and in some cases the grant from the County Committee is supplemented by local subscriptions.

Value of the Classes.—The decision reached, in February, 1926, to extend the scope of these classes to enable pupils between the ages of 14 and 16 to attend, has met with a very encouraging result, and during the year 1926-27 approximately one-fifth, and during 1927-28 about one-fifth of the total number of students attending Manual Process Classes were between these ages. It is realized that the success of the instruction and training in agricultural subjects of persons between 14 and 16 depends very greatly upon the foundations laid before the age of 14, and every opportunity is therefore taken to encourage the children of rural schools to take an interest in such processes.

Apart from the actual classes, considerable interest is evinced in the competitions in manual processes which are arranged by the County Agricultural Committee at the Devon County Show and various local shows, the prize money for which is provided by the County Committee. These competitions are usually divided into sections for farmers and farmers' sons, agricultural workers, and students who have attended the County Manual Process Classes, and at the 1927 County Show no fewer than 47 entries were received for the sheep-shearing competitions alone. It is worth noting that the second-prize winner, out of 29 entrants in one of the sheep-shearing sections, was a youth of 16 who had attended one of the County classes. At such shows, the work of the competitors is often watched by hundreds of people who are very keenly interested, and there is no doubt that the instruction provided by the classes is appreciated generally by farmers and farm workers.

Conclusion.—An article such as this would not be complete without referring to the services rendered in connexion with the carrying out of the scheme by the Local Committee, Correspondents, and Association Secretaries, upon whom the major part of the work falls. Active local members of a committee, and keen and enthusiastic correspondents and secretaries contribute greatly to the success of these classes, and Devon is indeed fortunate in this respect.

As the above notes deal with this branch of Agricultural Education in a general way only, the writer will be pleased to forward fuller details to persons interested if they will apply to him at the Agricultural Education Department, 1 Richmond Road, Exeter.

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SOME POULTRY ACCOUNTS

E. T. BROWN.

WHILE poultry-keeping is known to be a profitable business, it is extremely difficult to obtain particulars regarding actual profits. This is attributable to the fact that poultry-keepers do not, as a rule, record all transactions faithfully, and often do not know themselves exactly the extent of the profit realized. It is also due to the fact that no successful man wants to bring his financial affairs into the limelight. When obtainable, however, a poultry account makes interesting and instructive reading, and much information may be derived from it. From time to time, the writer has been called upon to audit numerous poultry farm books, dealing with all

branches of the industry, and some results from these, with the permission of the owners, are here made public.

The accounts appended are authentic so far as they go, but, in all cases, many details in book-keeping have been omitted. They do serve, however, to indicate the profit that is made by the average man who manages his fowls on business lines. The poultry accounts in question are those of a general farmer, a specialist breeder, a smallholder, a backyarder, a poultry-keeper specializing in ducks for laying, and a man who caters for the demand in spring ducklings.

The following general remarks apply in each case. The value of the stock, excepting where bought, is taken at production cost and not selling value. Only the total cost of food has been available; hence it has been necessary to estimate the cost per adult bird per week. The market price of eating eggs varies each week, and the return for surplus cockerels and old hens was not always the same for each batch marketed. The total receipts have been added together under each heading and divided by the number of eggs and birds sold. Depreciation of appliances is reckoned at 10 per cent. per annum of the original cost.

No sum has been set down for rent in the accounts of the general farm and of the backyarder because, if no fowls were kept, the rent paid would be just the same. In the other cases, where the place is run more or less for the poultry, a rent must obviously be charged up.

Labour was an item so extraordinarily difficult to arrive at that it has been thought advisable to omit it in all the accounts. In the cases of the specialist breeder, the smallholder and the duck plant owners, no regular outside help was required. The backyarder and his wife carried out all the work of their plant. The only case in which labour might be charged is that of the general farm, but here again it was very difficult to arrive at a definite figure. The farmer's wife looks after the hatching and rearing; one of the farm hands does the feeding; a boy does the cleaning; and the farmer himself does the marketing. Now and then an extra hand may be taken on for whitewashing, etc.

The General Farm.—The year under review is the fifth since this poultry department was reorganized, and covers the period from October 1, 1925, to September 30, 1926. The hens and pullets were reared on the place; the males were bought and proved good stock getters as cockerels, and are to be kept on for a third season. The breed kept is the Buff

Plymouth Rock. The geese and ganders were purchased and are to be retained for another two years; one goose was killed by a fox.

The houses consist of nine portable sheds and a large laying shed, the original cost of which was £131 10s. The coops, half-way houses and other small appliances cost £31. There is very little arable land on the farm; it is chiefly grass, on which young beasts and sheep are raised. It is situated in the Yorkshire dales.

The eggs, surplus cockerels, culled pullets and old hens were sold in the local market. The goslings were sold to two local shops. The goslings, a Toulouse-Embsden cross, were on the small side; they were late hatched and had not been sufficiently fed during the autumn, although they were well fattened.

The food for the fowls and geese was not separated; therefore the cost per bird per week and the profit per bird per year can only be estimated.

The account is as follows:—

GENERAL FARM PROFIT AND LOSS ACCOUNT			
EXPENDITURE		REVENUE	
	£ s. d.		£ s. d.
Valuation, Oct. 1, 1925—		Eggs sold, 2,760 doz.	
77 hens @ 3/6 ..	13 9 6	@ 1/4½ ..	186 17 6
106 pullets @ 6/- ..	31 16 0	Surplus cockerels, 119	
4 males @ £1 ..	4 0 0	@ 3/1 ..	18 6 11
6 geese @ 15/- ..	4 10 0	Goslings, 91 @ 11/10	53 16 10
2 ganders @ £1 ..	2 0 0	Old hens, 75 @ 2/6 ..	9 7 6
96 goslings @ 7/- ..	34 17 6		
Houses	78 18 0	Valuation, Sept. 30, 1926—	
Small appliances ..	18 12 0	103 hens @ 3/6 ..	18 0 6
Cost of food, litter, ..		111 pullets @ 6/- ..	33 6 0
medicine, etc. ..	155 14 2	5 geese @ 12/- ..	3 0 0
		2 ganders @ 15/- ..	1 10 0
Profit	102 8 1	108 goslings @ 7/6 ..	40 10 0
	£446 0 3	Houses	65 15 0
		Small appliances ..	15 10 0
			£446 0 3

The estimated profit on the 187 fowls was £87 15s. 4d., which shows a profit, per bird, of approximately, 9s. 4d. The rest of the profit was made on geese.

The Specialist Breeder.—This breeder specializes in heavy-laying strain White Wyandottes. The farm consists of just over 11 acres and is situated two miles from an industrial centre in Lancashire. The year under review is the sixth since the farm was started, and is from January 1, 1926, to December 31, 1926.

No eggs are used for hatching from pullets; only second season birds are used for this purpose. The stock is of first-class quality; some of the hens are kept until their third year, since at this age the owner believes that they throw equally good stock as when a year younger. The males are valued at 30s. all round, although some cost as much as £3 3s., while the majority of them have been "proved," that is, their pullet progeny has given a good account of itself in the trap-nests. All food is purchased, save a proportion of the green food. The cost of feeding the adult birds works out at 3d. per head per week.

The housing consists of two large laying sheds, original cost £130, and 20 breeding houses, original cost £100. The small appliances include two incubators, brooders, coops and half-way houses, original cost £68.

The rent of the land is £23 10s. a year. Advertising costs £73 15s. 6d., the money being expended chiefly on prepaid advertisements in the poultry Press during the breeding season and autumn months.

The account is as follows:—

SPECIALIST BREEDER PROFIT AND LOSS ACCOUNT			
EXPENDITURE		REVENUE	
	£ s. d.		£ s. d.
Valuation, Jan. 1, 1926—		Sale of—	
173 pullets @ 8/6 ..	73 10 6	Day-olds, 181 doz.	
186 hens @ 4/6 ..	41 17 0	@ 13/- ..	117 13 0
17 males @ 30/- ..	25 10 0	Hatching eggs, 103	
Laying sheds ..	65 0 0	doz. @ 6/6 ..	33 9 6
Breeding houses ..	50 0 0	Eggs for eating,	
Incubators, coops, ..		4,763 doz. @ 1/0½	238 3 6
brooders, etc. ..	34 0 0	Stock pullets, 340	
Cost of food, litter, etc.	408 9 0	@ 12/6 ..	212 10 0
Rent	23 10 0	Hens, 20 @ 6/6 ..	6 10 0
Advertising	73 15 6	159 @ 2/9 ..	21 17 3
		Stock males, 19 @	
		25/- ..	23 15 0
		Surplus cockerels,	
		671 @ 3/3 ..	109 0 9
		Valuation, Dec. 31,	
		1926—	
		203 pullets @ 8/6 ..	86 5 6
		159 hens @ 4/6 ..	35 15 6
		17 cocks @ £1 ..	17 0 0
		Laying sheds ..	52 0 0
		Breeding houses ..	40 0 0
		Coops, etc. ..	27 4 0
Profit	227 12 0		
	£1,021 4 0		£1,021 4 0

Profit per bird (including males), approximately 11s. 10d.

The Smallholder.—This small-holding is typical of its class and was started four years ago by an ex-service man. Poultry-keeping is only one branch, since other stock includes two cows, three goats, rabbits and bees, while the greater part of the land is utilized for the production of market garden crops. The rent has been approximated at £7 10s. per annum.

Successful marketing is difficult, as the holding lies—in County Durham—about nine miles from the nearest town of any size, and prices do not rule very high. Although a large proportion of the eggs were produced during the winter, the average price for eggs marketed was only 1s. 2d. per dozen.

The pullets and hens are good quality White Leghorns and Rhode Island Reds, but not sufficiently good to make it worth while specializing in the sale of day-old chicks or eggs for hatching. The ducks are a mixed lot of different breeds and ages; their production was on the low side, averaging only 173 eggs per bird. These ducks are being disposed of this year, and hatching eggs from a good strain of Khaki Campbells purchased.

SMALL HOLDING PROFIT AND LOSS ACCOUNT

EXPENDITURE			REVENUE		
	£	s. d.		£	s. d.
Valuation, Oct. 1, 1925—			Sale of—		
202 pullets @ 7/6	75	15 0	Hens' eggs, 6,093 dz.		
189 hens @ 3/9 ..	35	8 9	@ 1/2	353	14 8
3 males @ 15/-	2	5 0	Ducks' eggs, 922 doz.		
64 ducks @ 4/- ..	12	16 0	@ 1/-	46	5 1
6 drakes @ 15/-	4	10 0	Hatching eggs, 29 dz.		
Laying houses ..	73	3 0	@ 8/6	12	6 6
Breeding houses ..	16	12 6	Old hens, 186 @ 2/10	26	7 0
Duck houses ..	14	14 0	Surplus cockerels,		
Small appliances ..	10	3 0	219 @ 2/11 ..	31	18 9
Cost of food, litter, etc. 300	4	1	Valuation, Sept. 30,		
Rent (estimated) ..	7	10 0	1926—		
			201 pullets @ 7/6	75	7 6
			198 hens @ 3/9 ..	37	2 6
			3 males @ 12/6	1	17 6
			62 ducks @ 3/- ..	9	6 0
			6 drakes @ 12/6	3	15 0
			Laying houses ..	62	14 0
			Breeding houses ..	14	5 0
			Ducks' houses ..	12	12 0
			Small appliances ..	8	14 0
Profit	143	4 2			
	£696	5 6		£696	5 6

The ducks showed no profit.

Profit on ordinary poultry (including males), approximately 7s. 3d. per bird.

The housing accommodation consists of four large laying sheds, original cost, £104 10s.; three breeding pens, original cost, £23 15s.; four duck houses, original cost, £21; and the small appliances, original cost, £14 10s.

The cost of feeding the adult fowls works out at 2½d. per bird per week, and of the ducks 3½d. The food is bought in large quantities, and all green food is produced on the place.

This farm showed good organization and very careful management. The account is shown on the opposite page.

The Backyarder.—This poultry-keeper works in an average garden in a London suburb. He does not attempt breeding, but buys fresh pullets every second year, obtaining these as half-grown birds in July.

The house consists of a large scratching shed, and attached to it is an open run of "turned" soil measuring 70 ft. by 18 ft. This house was built at home, the material costing £14 four years ago.

The breed kept is Barnevelder, and the average production was about 209 eggs per bird per year. All eggs were sold retail to neighbours, this accounting for the high average price obtained. The cost of feeding was 2½d. per head. per week. The account is as follows:—

BACKYARD PROFIT AND LOSS ACCOUNT

EXPENDITURE			REVENUE		
	£	s. d.		£	s. d.
Valuation, Oct. 1, 1925—			Sale of eggs, 400 doz.		
23 pullets @ 9/3 ..	10	12 9	@ 1/5½	28	15 0
House	9	16 0	Valuation, Sept. 30,		
Cost of food, litter, etc. 12	9 2		1926—		
Profit	9	4 1	22 hens @ 4/6 ..	4	19 0
	£42	2 0	House	8	8 0
				£42	2 0
			Profit per bird, 8s.		

Duck Eggs Plant.—This plant was started four years ago, with the ultimate intention of establishing a large commercial duck farm. The profit secured does not, however, appear to warrant this; therefore the farm is to be maintained at its present size. The breed kept is Fawn and White Indian Runner, and the birds are of excellent quality. The area consists of 10 acres of fairly rough grass land and the approximate rent is £11 10s.

The farm is situated in Westmorland and all eggs are sold to local dealers once a week. The old ducks were sent to Blackpool, while the young drakes were marketed in London

and Birmingham. The price given is after deducting transit costs. The birds are of all ages up to four years old, the drakes being two years old.

There are 21 houses and runs to accommodate the layers and breeders, the original cost of which was £89 15s. The majority of these were home-made. The small appliances cost £13 10s.

The cost of feeding was 3½d. per adult bird per week. The account is as follows :—

DUCK EGGS PLANT PROFIT AND LOSS ACCOUNT

LIABILITIES			ASSETS		
Valuation, Oct. 1, 1925—			£ s. d.		
119 yearling ducks	£	s. d.	Sale of—	£	s. d.
@ 8/-	47	12 0	Eggs, 7,189 doz.		
162 2-year-old @ 6/6	33	3 0	@ 1/2½	434	17 4
117 3-year-old @ 5/-	29	5 0	Drakes, 147 @ 3/6	25	14 6
87 4-year-old @ 3/6	15	4 6	Old ducks, 85 @ 3/3	13	16 3
4 drakes @ 12/6	2	10 0	Valuation, Sept. 30,		
Houses	62	16 6	1926—		
Small appliances ..	9	9 0	131 yearling ducks		
Cost of food, litter, etc.	300	6 0	@ 8/-	52	8 0
Rent	11	10 0	117 2-year-old @		
			6/6	37	15 6
			98 3-year-old @		
			5/-	24	10 0
			116 4-year-old @		
			3/6	20	6 0
			4 drakes @ 10/-	2	0 0
			Houses	53	17 0
			Small appliances ..	8	2 0
Profit	161	10 7			
	£673	6 7		£673	6 7

Profit per bird, approximately 7s. 6d.

Table Duckling Production.—The place consists of a little more than three acres, and is situated in Bedfordshire. Breeding ducks are kept, a larger number being maintained than might be necessary, so as to ensure a plentiful supply of eggs during the autumn and winter. The breed is pure Aylesbury; young ducks are used exclusively for egg production, as older birds do not lay sufficiently heavily. The first eggs are laid down about the third week in October and the last about the middle of March. Six hens are set each week—on the same day—and hatching is continued for 22 weeks.

The ducks are kept on after the last eggs have been set and their eggs sold for eating, although a few dozen are generally disposed of for hatching purposes. The birds are

sold in late August or early September and new young ducks purchased.

The dead stock consists of a large rearing and fattening shed, original cost £43 10s. (the plant was established five years ago), and three breeding houses, original cost £15 10s.

Sitting hens are bought, and sold again later; the loss on each hen works out at 2s. 6d. A total of 857 ducklings were hatched and 803 marketed. The following is the account :—

TABLE DUCKLING PLANT PROFIT AND LOSS ACCOUNT

EXPENDITURE			REVENUE		
£ s. d.			£ s. d.		
Valuation, Oct. 1, 1925—			Sale of—		
28 stock ducks @			Ducklings, 803 @		
10/-	14	0 0	6/11	277	14 1
8 drakes @ 15/- ..	6	0 0	Sitting hens, 139 @		
			2/3	15	12 9
Rearing shed ..	26	2 0	Surplus eggs for		
Breeding houses ..	9	8 0	hatching, 17 doz.		
			@ 8/6	7	3 6
Sitting hens bought,			For eating, 258 doz.		
141 @ 4/9	33	9 9	@ 1/4	17	12 3
Stock ducks bought,			Old ducks, 28 @ 5/-	7	0 0
30 @ 10/-	15	0 0	Valuation, Sept. 30,		
Stock drake bought,			1926—		
@ 15/-	0	15 0	30 ducks @ 10/- ..	15	0 0
Cost of food, litter, etc.	183	8 4	9 drakes @ 15/- ..	6	15 0
Rent	4	0 0			
			Rearing shed ..	21	15 0
Profit	84	6 6	Houses	7	17 0
	£376	9 7		£376	9 7

Profit per stock bird, including drakes, approximately £2 6s. 10d.

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JUNE ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),
Agricultural Organizer for Derbyshire.

Seasonal Notes.—Last year, June, after a typically fine beginning, departed from its customary dryness, and in its second half so much rain fell that the total for the month amounted to twice the half-century average. At Belper, in Mid-Derbyshire, the gauge registered 4.76 inches, compared with the 50 years' normal of 2.22, and it is necessary to go back to 1892 for a higher figure, 5.09, that for 1912 being only 3.73. The year 1892, however, does not rank with 1927, 1912, 1900, 1891, 1880 and 1879, which were notoriously bad hay-making years: these had three wet months in succession, whereas 1892 had normal rainfall in both July and August.

The dry weather of the latter part of April and the first half of May this year has favoured tillage operations and the overtaking of the arrears of spring work, except on the heavier soils. Some resemblance between the weather conditions of this year and last at the corresponding period has naturally caused farmers to wonder as to the chances of a repetition of the remainder of last year. Rainfall records do not lend much support to this suggestion. Repetition of the preceding year's weather is very exceptional. It is nearly half a century since the three months June, July and August were all wet in two successive years; indeed it is rare for both June and July to be wet months two years in succession.

Hay-Making.—The difficulties encountered last season were such as not to be soon forgotten, and it must be conceded that much of the loss of crop could not have been avoided by the exercise of ordinary care and foresight. The heavy and continuous rains which overtook the half-dried crops of clover and rotation grasses in the third week of June did damage that could not be repaired. There was perhaps truth in the criticism which I received from two correspondents later in the summer that farmers ("and their advisers") were too inclined to accept the situation as an inevitable adversity, instead of attempting to harvest the crop in the way that is customary where such seasons are common. Many farmers did manage to secure a fair proportion of good hay by curing the crop in cocks, neatly trimmed to turn rain; others had even better results from this method amplified by a further curing in small field ricks, with or without central frames, as is common in Scotland and Ireland. Others made one or more stacks of silage.

The special methods and equipment for haymaking under various conditions have been fully described in previous issues of this JOURNAL; in June, 1924, a special article was devoted to the subject, and in "June on the Farm" in 1926 the American method of curing on sheeted trucks was explained. Certain points may, however, be here repeated or amplified. Half-dried hay may, if free from rain or dew, be placed out of danger, and allowed to complete its curing without further handling, in two ways. The first is that of building it in small ricks containing about two loads, firmly trodden down, so that it will sweat the excess of moisture away without firing. The other method is that of hanging the hay upon frames of various kinds to allow of air-drying. Sheep hurdles leaning together in pairs represent one pattern; single poles with cross

pieces are extensively used in many parts of the Continent; but large tripods with framework stages are perhaps the best. Lines of rope or strong twine supported by stakes are a common device in Scandinavia, and one of my correspondents made extensive and, according to his report, very successful use of this method in England last summer; binder twine served as the lines, five being used on each series of poles.

Sugar Beet: Time of Singling.—The influence of late singling in depressing the yield of beet has been repeatedly stressed by writers on this subject, and, as illustrated by the Cambridge experiment quoted by Amos in this JOURNAL, April, 1925, p. 29, delaying the operation until the seedlings are obviously overcrowded may reduce the yield by two tons per acre. Nevertheless, the crop is not so dependent on perfect punctuality in this matter as some writers endeavour to prove; and it is fortunate from the point of view of farm management that the proper time for singling extends over a period of two to three weeks for each sowing.

During the past few years, experiments on date of singling have been carried out at many centres. The general plan of the experiment has been to single one plot of beet as soon as the first pair of foliage leaves appeared, another plot 10 days later, and a third plot 20 days later than the first. As a rule the second pair of foliage leaves were well developed at the time of operation on the second plot, the plants then having, including the seed leaves, six leaves in all.

At three centres in Ireland in 1926 the results were slightly but clearly in favour of the plants being singled at the time of the appearance of the second pair of foliage leaves, but there was little difference between the results of earlier and later singlings. Very similar results had been obtained in 1925, and the conclusion drawn from the experiments was that advantage should be taken of suitable soil and weather conditions, irrespective of whether the plants had reached or passed the supposed ideal stage for singling.

Reports of last year's experiments in Yorkshire, Kesteven and East Suffolk have been received, and, while in each case the averages of the yields at the several centres are *slightly* in favour of early singling, the results are variable. In the East Suffolk report Oldershaw mentions that on heavy land serious damage was done by singling under wet conditions, and suggests that it may be preferable to defer singling for a time rather than attempt the operation when the soil is unfit. One can imagine, however, that singling in dry, parching

weather conditions might be equally injurious on light as well as on heavy soils, especially if the operation of bunching is carried out in the customary fashion of pushing the protective mulch of fine soil away from the line of plants. The hoe should be sharp and should cut very shallow.

There are other considerations which in special cases may influence the date of striking and singling. Where the mangold fly has appeared and laid its eggs on the leaves of the seedlings, it is desirable to thin out the plants before the grubs hatched from these eggs have reached the stage when they are capable of pupating. This precaution considerably reduces the numbers of the next generation of flies. Similarly, early thinning is an important measure in the control of beet eelworm, a serious pest on the Continent. Whereas early thinning destroys large numbers of the eelworm, delay in the operation allows of the production of another and still more numerous generation. On the other hand, when the braird is being thinned by wireworm, cutworm or pigmy beetle in dry conditions, or by slugs or leather jackets in moist conditions, it is advisable to delay final singling-out until the seedlings are larger than usual.

Singling Distances.—The County experiments last year of which reports have been received did not deal with distance apart of singling, but only with width of drilling; and the results show that, when singled at the same distance in the rows, the closest rows yield the heaviest crops. In a year when growth was relatively slow that result might always be expected, but it would be less marked under conditions more favourable to the crop. It is noteworthy that the trend of leading opinion on the Continent is away from the very close spacing formerly advocated; a width of 20 inches is now recommended. The gain from closer rows is not sufficient to outweigh the additional cost of cultivating the crop in that manner.

Singling distances have been the subject of innumerable experiments in Germany, and the present recommendation is that the plants be left from 8 inches to 10 inches apart when the rows are 20 inches wide. Experiments carried out in Ireland and during 1925 showed little difference between singling at 8 inches, 10 inches and 12 inches respectively, but in 1926 there was a slight advantage in close singling. Last year, as the recent Norfolk report indicates, the yield of washed beet per acre was proportional to the number of plants. Singling experiments might be more helpful if the

variety of beet were always stated, with a note as to whether it was a large or a small-topped kind; but it is obvious that there can be no hard-and-fast rule in this matter. Where the prospects of large individual roots are remote, owing to late sowing, insect attack or adverse soil or weather conditions, then close singling should be adopted. Where, however, there are reasonable hopes of rapid growth, more space per plant may be desirable, for leaves are of no service to the plant unless they have access to light and air.

Close singling requires considerable skill on the part of the labourer, the tendency being to exceed the intended distance by two or three inches. An excellent illustration of this point is given in the Norfolk report above mentioned.

Live Stock.—Although June brings its special cares and attentions in the live stock departments—those for sheep having been dealt with fully in June, 1926—this month is generally one of the best of the summer from the grazing point of view. The grass is at its most productive stage, and the abundance of food and favourable conditions of temperature conduce to growth, fat production or milk secretion as the case may be. As a rule there is less need for supplementary cake feeding in June than at any time of the year.

At the present moment farmers are discussing the question of contracting for their future requirements of concentrates, and weighing up the prospects of rise or fall in the prices. It is impossible to offer advice on the subject, but it would seem wise not to enter into contracts for next winter's supplies just yet. Present prices are doubtless inflated by the very heavy demand that followed last year's bad hay harvest and by the lateness of the growth of spring grass. It is not unlikely that prices will fall when the demand becomes less. Another consideration which it is difficult to assess at this stage, is the volume and quality of the home-grown fodders. Many farmers believe that by signing a contract containing a "fall clause" they are securing themselves against a rise in prices and also ensuring the receipt of a rebate in the event of a fall. The latter chance is not of great value. One can easily imagine that if a manufacturer can secure contracts for the disposal of the greater part of his output, he will naturally have little inducement to reduce his prices.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending May 9				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	11 7	11 15	10 12	10 5	13 3
" " lime (N. 13%) ..	..	..	..	11 7½	17 6
Nitro-chalk (N. 10%) ..	7 0f	7 0f	7 0f	7 0f	14 0
Compound white nitrates of lime and ammonia B.A.S.F. (N.15½%)	11 19g	11 3h	..	..	..
Sulphate of ammonia:—					
Neutral (N. 20·6%) ..	10 13*	10 13*	10 13*	10 13*	10 4
Calcium cyanamide (N. 19%) ..	9 0†	9 0†	9 0†	9 0†	9 6
Kainit (Pot. 14%) ..	3 7	2 17	2 18	3 1	4 4
Potash salts (Pot. 30%) ..	5 2	..	..	4 19	3 4
" (Pot. 20%) ..	3 17	3 5	3 10	3 10	3 6
Muriate of potash (Pot. 50·53½%)	9 10	9 0	9 9	10 0	3 9
Sulphate „ (Pot. 48·51½%)	11 10	11 0	11 14	12 2	4 9
Basic Slag (T.P. 34%) ..	3 6§	2 12§	2 12§	..	..
" (T.P. 32%) ..	3 3§	2 10§	2 10§	..	..
" (T.P. 30%) ..	3 1§	2 7§	2 7§	2 15e	1 10
" (T.P. 24%) ..	2 7§	1 18§	1 19§	..	..
Ground rock phosphate (T.P. 58%)					
Very fine grade ¶	2 15	..	..	2 10d	0 10
Fine grade ¶	2 10	2 10	..	2 7d	0 10
Superphosphate (S.P. 35%) ..	3 0	..	3 1	3 0	1 9
" (S.P. 33%) ..	..	..	2 19	..	..
" (S.P. 30%) ..	2 15	2 12	2 15	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 12	8 2	..
Steamed bone flour (N. ½%, T.P. 60·65%)	5 17†	6 2†	6 5	5 15	..

Abbreviations: N.—Nitrogen; S.P.—Soluble Phosphate; T.P.—Total Phosphate; Pot.—Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. 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.

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

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

§ Prices for 4-ton lots delivered to purchaser's nearest railway station in neighbourhood of town mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

|| Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London Stations the cost to purchasers is 2s. 6d. per ton extra.

e F.o.r. Northern rails; 3s. 6d. per ton extra on Southern rails.

f Delivered in 6-ton lots at purchaser's nearest railway station.

g F.o.r. Gloucester.

h F.o.r. Gooles.

NOTES ON FEEDING STUFFS FOR JUNE

H. E. WOODMAN, M.A., Ph.D., D.Sc.,

School of Agriculture, Cambridge.

The Losses in the Tower Silo.—The early work of Annett and Russell on ensilage¹ gave rise to the impression that the losses of nutrient matter, accompanying the preservation of green crops in the tower silo, were necessarily excessive. The heavy loss of dry matter (namely, 36 per cent. of that contained in the crop as ensiled) recorded in this pioneer investigation can, in the light of subsequent work, be attributed to two circumstances. In the first place, the experiments were carried out on maize, a crop which further experience has shown not to be unreservedly suitable for purposes of ensilage in this country, mainly on account of the difficulty of growing it to the desirable stage of maturity in an English season.² In the second place, the conditions under which the trial was carried out were such as to give rise to "sour" silage, that is to say, silage which is rendered objectionable by the presence of butyric acid. Recent work has demonstrated that the production of "sour" silage, which is now looked on as partially spoilt silage, usually involves very heavy losses of nutrient matter.³

The results of the investigations of Annett and Russell exerted for some years a depressing influence on the growth of the practice of ensilage in this country. With the gradual recognition of the conditions which determine the production of the more desirable types of silage, it became possible, however, to re-examine the question of the losses in the tower silo under more favourable conditions. During recent years, the results of numerous trials carried out at Cambridge under varying conditions have shown very conclusively that, under proper conditions of ensilage, the losses are by no means as excessive as previously supposed.⁴

The plan, adopted in these trials, has been to bury large jute bags containing weighed amounts of crop of known moisture content at different heights in the mass of material being filled into an American wooden tower silo. As the different bags were encountered during the period of utilization of the silage for feeding, the contents were again weighed and the percentages of moisture in the samples of silage were determined. Data were thus obtained showing the losses of dry matter in a large number of equally-spaced layers in the

silo. The measurements were made over a period of two silage seasons. The crops which were filled into the silo consisted mainly of oats and tares (with and without peas and beans), green maize and lucerne. The results of the investigation, a summary of which is given below, may be regarded as affording a reliable indication of the loss of dry matter which will be sustained in practice during the preservation of green crops in a tower silo.

That the attainment of a high temperature in the silo necessarily implies an excessive loss of dry matter appears to have been accepted as an established fact by writers on ensilage. The assertion, however, rests on no very convincing evidence, and has its origin in the assumption that the heating of the chaffed crop is only brought about by the destruction of considerable amounts of the carbohydrate constituent as a consequence of oxidation during the early period of cell respiratory activity.

It is not difficult to disprove this idea by simple theoretical reasoning. From a knowledge of the specific heat of dry silage, it can be demonstrated that, if the amount of carbohydrate oxidized during the period of cell respiration is equal to 1 per cent. of the dry matter of the crop, the heat generated is sufficient to raise the temperature of the ensiled crop about 16° C. If twice this amount be oxidized, and the initial temperature of the crop be 20° C., then a temperature of 52° C. will be attained, *i.e.*, a temperature at which the plant cells cease to respire and high enough to ensure the production of "sweet" silage.

It may, therefore, be concluded that the attainment of such relatively high temperatures as are necessary for the production of "sweet" silage does not necessarily involve an excessive loss of the dry matter of the crop as a consequence of the oxidation of carbohydrate. This conclusion is in harmony with the results obtained by experiment, the Cambridge trials having demonstrated that "sweet" silage, if made under favourable conditions in a tower silo, can be produced with a loss of dry matter equal to about 6 per cent. of that contained in the green crop. Indeed, the amount of destruction of carbohydrate during ensilage appears to bear no relation to the temperature attained during preservation, such factors as (1) juice drainage, (2) bacterial decomposition of carbohydrate, and (3) partial spoiling as a result of undesirable bacterial activity (as with "sour" silage) being

of much greater significance in causing unduly large losses of carbohydrate.

The results, obtained with crops containing from 26 to 34 per cent. of dry matter, showed that "acid brown" silage can also be made in the tower silo with a loss of dry matter no greater than about 6 per cent. of that contained in the green crop. If a silo be filled with a crop of such moistness, then the lowest losses of nutrient matter appear to occur in the middle layers of the column of silage. The average loss in the middle layers during two separate fillings of the silo was found to be as low as 4.4 per cent.

If it is desired to produce "green fruity" silage, which entails not only cutting the crop at a somewhat earlier stage of maturity, when the dry matter content may be from 23 to 26 per cent., but also ensiling the crop without a period of wilting, then the farmer must be prepared for slightly higher losses of dry matter, since a larger volume of juice, carrying with it dissolved material, will drain away from the somewhat sappier crop required for this type of silage. The loss of dry matter in making "green fruity" silage amounts, under favourable conditions, to about 9 per cent. The superior nutritive qualities of this type of silage, however, largely compensate for this higher loss.

It should be emphasized at this point that the foregoing conclusions respecting losses during preservation are only tenable when ensilage in tower silos is carried out under the most favourable conditions. The losses may be very much greater when the silo is filled with very sappy crops, such as green maize containing round about 20 per cent. of dry matter, and sugar beet tops containing from 12 to 15 per cent. It has been shown recently, for instance, that the ensilage of sugar beet tops may involve a loss of something like a quarter of the dry matter present in the tops as ensiled.⁵ Such heavy losses are the result of the copious drainage of juice, containing dissolved food material, from the sappy crops during storage.

The results of the Cambridge experiments serve to bring out a further point of practical importance. If, in a tower silo already partly filled with silage made under good conditions, there be ensiled a further green crop which is very wet, as a result of sappiness or included rain, then the losses of dry matter in the earlier lot of material may be much increased by the solvent action of the juice which drains from the wet crop placed above. Such increased loss is to be feared:

(1) when the later stages of filling the silo are conducted in rainy weather; (2) when a crop like oats and tares is ensiled during June or July under good weather conditions, followed at a later date, say in September or October, by the filling in of a later-maturing and more succulent crop like green maize, or, in October or November, of an exceedingly sappy crop like sugar beet tops. If the later ensiling be done in wet weather, not only will the losses sustained by the late crop be excessive, but those in the underlying layers of the early crop are likely to be increased very considerably. It is clearly desirable, where possible, to take advantage of a spell of fine weather for filling in the second crop.

It is frequently stated that the special merit of ensilage is its complete independence of weather conditions. This statement, however, should not be interpreted too literally, since, although silage of good quality may be produced from wet crops, it is clear that an excessive moisture content may lead to heavy losses of nutrient matter during ensilage. When it is desired not only to produce silage of good quality, but also to do this with a minimum loss of dry matter, the most favourable figure for the dry matter content of the crop appears to lie in the region of 26 to 34 per cent. According to the temperature attained during the period of cell respiratory activity, which in its turn depends primarily on the procedure adopted during the filling of the silo, a crop containing oats and tares (with or without beans) of such moisture content will give rise either to "acid brown" or "sweet" silage. If the crop, at the time of cutting, be wetter than is represented by the lower of the dry matter figures given above, it will be necessary to allow a period of wilting, if weather permits, so that the moisture content of the crop may be reduced to the neighbourhood of 70 per cent. An oat and tare crop, cut at a moderately matured stage and allowed to wilt for some hours before carting, will contain approximately this percentage of moisture.

The evidence available from the Cambridge trials, therefore, disproves the assertion that the ensilage of green crops cannot be accomplished without large losses of nutrient matter. On the contrary, the losses, under favourable conditions of practice, may be kept down to an amount certainly no larger than those incidental to the conversion of a green crop into hay. It is true that the preservation of very sappy or rain-laden crops may lead to an appreciable increase of the losses; it is equally true, however, that the losses during hay-making

are affected in a similar manner if the operation be carried out under adverse weather conditions.

REFERENCES.

- ¹ Annett and Russell, *Jour. Agric. Sci.*, II, 382, 1908.
- ² Woodman and Amos, *Jour. Agric. Sci.*, XIV, 461, 1924.
- ³ Amos and Woodman, *Jour. Agric. Sci.*, XV, 444, 1925.
- ⁴ Woodman and Amos, *Jour. Agric. Sci.*, XVI, 539, 1926.
- ⁵ Woodman and Amos, *Jour. Agric. Sci.*, XVI, 406, 1926.

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	11 3
Maize	81	6.8	10 10
Decorticated ground nut cake	73	41.0	13 5
" cotton cake	71	34.0	11 5

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

The cost per unit starch equivalent works out at 2.87 shillings, and per unit protein equivalent, 1.29 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, 1927 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	10 19
Oats	60	7.6	9 2
Barley	71	6.2	10 12
Potatoes	18	0.6	2 12
Swedes	7	0.7	1 1
Mangolds	7	0.4	1 1
Beans	66	20.0	10 15
Good meadow hay	31	4.6	4 15
Good oat straw	17	0.9	2 10
Good clover hay	32	7.0	5 1
Vetch and oat silage	13	1.6	1 19
Barley straw	19	0.7	2 15
Wheat straw	11	0.1	1 12
Bean straw	19	1.7	2 17

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv. %
	s. d.	lb.	£ s.	£ s.	£ s.	100 lb.	s. d.	d.	%
Wheat, British..	—	—	11 10	0 13	10 17	72	3 0	1-61	9-6
Barley, British feeding ..	—	—	10 5	0 10	9 15	71	2 9	1-47	6-2
" Canadian No. 3 Western	41 6	400	11 12	0 10	11 2	71	3 2	1-70	6-2
" Danubian ..	39 6	"	11 2*	0 10	10 12	71	3 0	1-61	6-2
" Karachi ..	39 3	"	11 0†	0 10	10 10	71	2 11	1-56	6-2
" Messina ..	40 0	"	11 3‡	0 10	10 13	71	3 0	1-61	6-2
" Persian ..	39 0	"	10 18	0 10	10 8	71	2 11	1-56	6-2
Oats, English, white ..	—	—	13 13	0 11	13 2	60	4 4	2-32	7-6
" black and grey ..	—	—	12 10*	0 11	11 19	60	4 0	2-14	7-6
" Canadian No. 2 Western	40 0	320	14 0	0 11	13 9	60	4 6	2-41	7-6
" " 3 ..	37 6	"	13 2	0 11	12 11	60	4 2	2-23	7-6
" feed ..	30 0	"	10 1‡	0 11	9 19	60	3 4	1-78	7-6
" Argentine ..	34 9	"	12 3	0 11	11 12	60	3 10	2-05	7-6
Maize, American ..	44 0	480	10 8‡	0 11	9 17	81	2 5	1-29	6-8
" Argentine ..	45 6	"	10 12	0 11	10 1	81	2 6	1-34	6-8
Beans, English, winter ..	—	—	10 2†	1 6	8 16	66	2 8	1-43	20
Peas, English, blue ..	—	—	16 0†	1 3	14 17	69	4 4	2-32	18
Dari, Persian ..	—	—	10 10	0 13	9 17	74	2 8	1-43	7-2
Millers' offals—									
Bran, British ..	—	—	9 0	1 3	7 17	42	3 9	2-01	10
" broad ..	—	—	9 17	1 3	8 14	42	4 2	2-23	10
Middlings, fine, imported ..	—	—	10 0	0 18	9 2	69	2 8	1-43	12
" coarse, British ..	—	—	8 17	0 18	7 19	58	2 9	1-47	11
Pollards, imported ..	—	—	8 5	1 3	7 2	60	2 4	1-25	11
Meal, barley ..	—	—	12 7	0 10	11 17	71	3 4	1-78	6-2
" maize ..	—	—	11 10	0 11	10 19	81	2 8	1-43	6-8
" " S. African ..	—	—	10 7	0 11	9 16	81	2 5	1-29	6-8
" " germ ..	—	—	10 0	0 16	9 4	85	2 2	1-16	10
" " gluten feed ..	—	—	9 10	1 1	8 9	76	2 3	1-20	19
" locust bean ..	—	—	9 0*	0 8	8 12	71	2 5	1-29	3-6
" bean ..	—	—	12 17	1 6	11 11	66	3 6	1-87	20
" fish ..	—	—	21 10	3 10	18 0	53	6 10	3-66	48
Maize, cooked flaked ..	—	—	13 0	0 11	12 9	85	2 11	1-56	8-6
Linseed—									
" cake, English 12% oil	—	—	13 2	1 11	11 11	74	3 1	1-65	25
" " " 10% "	—	—	12 12	1 11	11 1	74	3 0	1-61	25
" " " 9% "	—	—	12 7	1 11	10 16	74	2 11	1-56	25
Soya bean " 6% "	—	—	11 0	2 4	9 6	69	2 8	1-43	36
Cottonseed cake English—									
" Egyptian 5½% "	—	—	8 15	1 10	7 5	42	3 5	1-83	17
" " Egyptian 5¼% "	—	—	8 7	1 10	6 17	42	3 3	1-74	17
Coconut cake, 6% oil ..	—	—	11 10	1 6	10 4	79	2 7	1-38	16
Ground nut cake 7% oil ..	—	—	10 7*	1 7	9 0	57	3 2	1-70	27
Decorticated ground-nut cake, 7% oil	—	—	13 5*	2 5	11 0	73	3 0	1-61	41
Palm kernel cake, 6% oil ..	—	—	10 5†	0 19	9 6	75	2 6	1-34	17
" " " meal, 6% oil	—	—	10 15†	0 19	9 16	75	2 7	1-38	17
" " meal 2% "	—	—	9 5†	1 0	8 5	71	2 4	1-25	17
Feeding treacle ..	—	—	6 5	0 9	5 16	51	2 3	1-20	2-7
Brewers' grains, Dried ale ..	—	—	9 2	1 0	8 2	49	3 4	1-78	13
" " " porter ..	—	—	8 12	1 0	7 12	49	3 1	1-65	13
Malt culms ..	—	—	9 0‡	1 9	7 11	43	3 6	1-87	16

* 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 April 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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. 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. 5d. Dividing this again by 22-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1-29d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 11d.; P₂O₅, 3s. 10d.; K₂O, 3s. 3d.

MISCELLANEOUS NOTES

THE following particulars have been received from Mr. Wilfred H. Parker, Director of the National Institute of Agricultural Botany:—

Indoor Testing
for Wart
Disease

It is a matter of common knowledge that field trials of new varieties of potatoes for immunity from wart disease are conducted annually at the Potato

Testing Station, Ormskirk, by the National Institute of Agricultural Botany, on behalf of the Ministry.

During the past winter Mr. H. Bryan, Superintendent of the Station, has been carrying out investigations with the aid of his Assistant, Mrs. McDermott, on a practical adaptation of the method devised by Miss Glynne for testing indoors the immunity or susceptibility of potato varieties to wart disease. The present field tests extend over at least two years, and if the seasons are unfavourable, three years. Indoor testing would have many advantages; among others may be mentioned that it could be carried out at a time of year when field testing is impossible. It would enable the potato breeder to discard his susceptible seedlings at the earliest possible stage, a large number of varieties could be tested in a small space, and optimum infective conditions could be maintained independent of external weather conditions. In addition, the time required to determine immunity would be materially reduced.

One method suggested by Miss Glynne's work has been under investigation by the Scottish Board of Agriculture for two years, but has not met with entire success.* Nor was it satisfactory when tried also on a large scale at Ormskirk in 1927. Consequently, a more rapid and reliable method was adopted—also based on Miss Glynne's work—but with greatly simplified apparatus. It consists of infecting by summer sporangia the clean growing sprouts of the tubers under test. The tubers, with small pieces of fresh developing wart pinned on to the eyes, are placed rose-end upwards on damp, thin flannel; they are sprayed once daily with water and are covered with flannel kept moist. This insures as far as possible the maintenance of a film of moisture connecting the young shoots and the attached wart which is the essential factor in the success of the method. The tubers are contained in wire trays which are enclosed in shallow wooden boxes with glass lids. The work has been carried out in a greenhouse slightly heated during the winter months.

* *The Scottish Journal of Agriculture*, Vol. IX, No. 3, p. 302, and Vol. X, No. 3, p. 333.

Extensive test has given such satisfactory results that there is little doubt that the method will prove to be infallible. In a matter of such importance, however, there must be no loophole for error, and the investigation is, therefore, being continued on an extensive scale with the object of confirming beyond any doubt the conclusion drawn from last season's work, that it is possible to establish the susceptibility or immunity of varieties at any time of year in some three to four weeks from the beginning of the test, and independently of the character of the season.

A full description of the technique and exhaustive details of the results obtained will be published shortly.

* * * * *

FARMERS and all who are interested in agriculture are invited by the National Institute of Agricultural Botany to visit, either individually or in parties during June or July, its Headquarters **N.I.A.B. Trials** Trial Grounds at Cambridge or its five sub-stations mentioned below. At any of these centres visitors can see accurate trials on a field scale of the leading varieties of cereals and roots, and a comprehensive collection of $\frac{1}{2}$ -acre observation plots of new and old varieties of cereals numbering nearly a hundred in all. Visitors to Cambridge can also see the Official Seed Testing Station for England and Wales.

It is desirable that arrangements be made beforehand. Requests to visit the trial grounds should be addressed to the Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge, or, in the case of the sub-stations, direct to the Crop Recorder. The addresses of the Recorders are given below :—

Mr. G. D. Stevenson, The Church Farm, Sprowston, Norwich.
 Mr. G. N. Herington, Ivy Cottage, Good Easter, near Chelmsford, Essex.
 Mr. G. E. Furse, Somerset Farm Institute, Cannington, near Bridgwater.
 Mr. W. C. Grandi, The Lord Wandsworth Agricultural College, Long Sutton, Basingstoke, Hants.
 Mr. H. E. F. Maddrell, Harper Adams Agricultural College, Newport, Salop.

* * * * *

At the Olde Englysshe Fayre and Empire Exhibition held at the Alexandra Palace from May 5 to 12, the Empire Marketing Board arranged a very attractive exhibit. A milk fountain, at which milk drinks of all kinds were sold, proved an attraction, and the idea will probably be

developed as part of the milk advertising campaign. "Empire teas" were served in the centre of the hall, the bread and butter consisted of milk-loaves, made from English-grown wheat flour and liquid milk, and pure English butter. The loaves were of excellent quality, and it is hoped that a demand for this type of bread will be stimulated.

The Great Britain stand was arranged with the co-operation of the National Farmers' Union and other national organizations, and comprised canned and bottled fruits, jams and cyder, hothouse tomatoes, cucumbers and beans, and a representative display of cheeses, bacon, hams, potted meats, packed cereals and tinned vegetables.

* * * * *

THE general level of prices of agricultural produce during April was 51 per cent. above the base years 1911-13, and was appreciably higher than in any preceding month since September, 1926. The **The Agricultural Index Number** index number showed a rise of six points on the month and is eight points higher than in April, 1927. The continued advance in the prices of fat cattle and fat sheep is mainly responsible for the rise in the index number, but the further considerable increases in prices of oats and potatoes have also contributed.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :—

				Percentage increase compared with the average of the corresponding month in 1911-13				
Month	1923	1924	1925	1926	1927	1928		
January	67	60	71	58	49	45		
February	63	61	69	53	45	43		
March	59	57	66	49	43	45		
April	54	53	59	52	43	51		
May	54	57	57	50	42	—		
June	49	56	53	48	41	—		
July	50	53	49	48	42	—		
August	52	57	54	49	42	—		
September	52	61	55	55	43	—		
October	50	66	53	48	40	—		
November	51	66	54	48	37	—		
December	55	65	54	46	38	—		

Grain.—The average price of wheat advanced from 9s. 8d. per cwt. in March to 10s. 2d. per cwt. in April, and barley was 1d. dearer at 10s. 10d. per cwt., while oats rose by no less than 1s. per cwt. to an average of 11s. 7d. At this price oats are 64 per cent. dearer than pre-war, and have not touched so high a level since the summer of 1922. Wheat at 34 per

number of poultry on such holdings. Information is also given as regards the principal live stock products.

The tables attached to the report contain detailed figures for each county in England and Wales for the years 1927 and 1926 of the acreage under each crop, the numbers of each class of live stock, and the yields per acre of the principal crops. Summaries for Great Britain and Ireland over the last 10 years are also given.

The report forms Part I of the Agricultural Statistics of England and Wales, 1927, and may be obtained through any bookseller, or direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price, 1s. 3d. net.

* * * * *

THE Potato and Onion (Grading) Act, 1927, South Australia, will apply to all potatoes and onions grown within the portions of the State as may be declared by proclamation, which will also fix the date when the Act is to come into operation. The Act, which is to be administered out of funds provided by Parliament, prohibits the sale of potatoes or onions in packages unless they are packed, graded and marked as prescribed by regulation. Penalties of £5 for a first offence, and £10 for subsequent offences, may be imposed for failure to comply with this section of the Act. Proceedings may be taken by Inspectors, if so authorized by the Minister, either generally or in any particular case, and all proceedings are to be disposed of summarily.

Inspectors appointed by the Governor are empowered to open and examine packages anywhere, and to mark all packages "Falsely Packed" or "Falsely Marked" if they are not packed, graded or marked in the prescribed manner, notice of such action to be given to the owner within 24 hours. Samples may also be taken, or the potatoes or onions seized and detained for inspection, at the risk and charge of the owner, who may also be directed to comply with the Act under a penalty of £10 for non-compliance.

The penalty for altering or defacing prescribed marks on packages is one not exceeding £50 or imprisonment up to 12 months. For resisting or obstructing an Inspector, or refusing to give information or giving false information, a penalty of £5 for a first offence and £10 for each subsequent offence may be inflicted. When an offence is committed by a person without the authority of the vendor, the latter, when charged, may have such person brought before the Court, and on

conviction such person will be liable to the penalty and costs as if he were the vendor.

Regulations will prescribe the standards and methods of packing and grading of potatoes or onions for sale, whether in packages or in lots; and whether grading shall be according to number, variety, size, soundness, colour, maturity or otherwise. They will also prescribe the description, kind, capacity, materials, dimensions, measurements, conditions and marking of packages (including the regulation or prohibition of the use of second-hand packages), as well as the maximum quantity of foreign substances (earthy matter, leaves, stalks, etc.), wrappers, packing material or advertising matter which may be contained in the packages. A penalty of not more than £10 may be inflicted for non-compliance.

* * * * *

In order to encourage the trade in home-grown seeds exported to the Colonies, the Ministry made arrangements in December, 1926, with the assistance of a grant from the Empire Marketing Board, that, in cases where Colonial Import Regulations require that consignments of seeds shipped from this

country shall be accompanied by a certificate of test carried out at a British Official Seed Testing Station, such test should be made at Cambridge free of charge. As this scheme was not put into operation until the middle of the 1926-27 season, it was only made use of by exporters during that period to the limited extent of having 453 samples tested. During the 1927-28 season, however, i.e., from April 1, 1927, to March 31, 1928, the response has been more satisfactory, some 1,371 samples being submitted for the free test. These samples included 50 of grasses and clovers, 1 of cereals, 8 of seed mixtures, 200 of mangold and beet, and 1,112 of vegetables and pulses.

Samples sent to the Official Seed Testing Station, Cambridge, for these free tests, should be of the normal quantity sent for testing, and must be accompanied by a statement to the effect that the bulks from which the samples are drawn are intended solely for export to a named colony, and that the sender guarantees that the certificates issued by the Official Station in respect of these samples will be used for no other purpose than in connexion with the export of the bulks, from which the samples are drawn, to the countries specified.

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended March 31, 1928, compared with the corresponding period in 1927. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	Jan. to Mar., 1928		Jan. to Mar., 1927	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	68	7,200	168	72,808
China	10	275	0	0
Columbia	6	640	0	0
Denmark	1	40	9	344
Ecuador	1	30	7	799
Netherlands	5	200	0	0
Uruguay	0	0	32	7,026
United States of America	3	110	0	0
Canada	35	1,500	0	0
Falkland Islands	4	259	0	0
Irish Free State.. ..	827	17,541	1,250	29,416
Kenya	16	496	8	389
Other countries	4	354	10	938
Total	980	28,645	1,484	111,720
SHEEP AND LAMBS				
Argentina	160	3,690	310	6,571
Brazil	10	250	4	210
Chile	21	894	1	75
France	9	45	14	43
Peru	0	0	30	360
Uruguay	17	390	20	600
United States of America	58	800	0	0
Canada	12	350	0	0
Irish Free State.. ..	21	104	79	248
Other countries	3	57	1	8
Total	311	6,580	459	8,115
SWINE				
Argentina	1	70	4	160
Brazil	5	80	0	0
France	31	566	2	73
Germany.. ..	3	120	9	405
Hungary	27	810	0	0
Irish Free State.. ..	71	212	264	1,414
Kenya	4	100	2	32
Tanganyika territory	6	60	0	0
Other countries	9	259	7	306
Total	157	2,277	288	2,390

THE German journal, *Illustrierte Landwirtschaftliche Zeitung*, in the issue of December 30 last, records the results of experiments carried out by Dr. Lütthge, of Halle, on feeding potatoes to pigs. The conclusion to which Dr. Lütthge came was that potatoes should never be fed in an uncooked condition to fattening pigs. An interesting fact recorded is that a pen of pigs which received one-half cooked and one-half uncooked potatoes showed an increase in weight which was practically midway between that shown by pigs fed entirely on cooked and those fed entirely on uncooked potatoes.

* * * * *

THE Minister of Agriculture and Fisheries has made an Order regulating the importation of cherries into England and Wales during the 1928 season. The object of the Order is to prevent the introduction of the Cherry Fruit Fly, a pest which is very prevalent in certain Continental countries, but from which English orchards are at present free.

French cherries will be admitted without restriction until June 5, after which date those grown in the Southern part of France will be prohibited; cherries from Central France will be admitted until June 12, and those grown in the Northern Departments until June 21, after which date the importation of French cherries will be entirely prohibited.

Italian cherries imported after June 5 must be accompanied by a certificate of origin; after June 16 their importation will be prohibited.

Certificates of origin must accompany cherries grown in any other European country which are imported after June 5.

* * * * *

THE Protection of Lapwings Act, 1928, which received Royal Assent on March 28 last, provides that it shall not be lawful for any person—

- (a) during any time between the first day of March and the thirty-first day of August to sell any lapwing for human consumption, or to have any lapwing in his possession for the purpose of sale for human consumption; or

(b) to sell for human consumption, or to have in his possession for the purpose of sale for human consumption, any egg of the lapwing.

The Act provides that any person guilty of an offence against its provisions shall be liable on summary conviction to a fine not exceeding £5.

Alternative names for the lapwing are green plover, peesweep or peewit.

* * * * *

THE New Zealand Wheat Research Regulations, 1928, issued under the Scientific and Industrial Research Act, 1926, of New Zealand, provide for levies on all

Wheat Research in New Zealand wheat grown in New Zealand. These levies are 1½d. payable by the producer on every 50 bushels delivered by him to a flour miller or grain merchant; 1½d. payable by the flour miller for every ton of flour or wheat meal delivered by him from the flour mill; and of 1½d. payable by the person taking delivery of every ton of flour or wheat meal received by him.

The produce of these levies is to be applied towards the cost of establishing laboratories and carrying out scientific researches in relation to the growing of wheat in New Zealand, and its manufacture into flour and bread.

The Regulations provide further for the establishment of a Wheat Research Committee, containing representatives of wheat growers, flour millers and bakers in New Zealand, to assist the New Zealand Department of Scientific and Industrial Research in carrying out research work on wheat and flour.

* * * * *

ACCOUNTS have been given in this JOURNAL, from time to time, of the various activities undertaken by the Ministry, with the aid of the grant of £40,000 a year

Marketing of Home Produce : Report for five years, which has been made by the Empire Marketing Board. This grant was given for the purpose of carrying out investigations into the marketing of home-grown agricultural produce and for demonstrating improved methods. A further brief report of progress for the three months ended March 31, 1928, may prove of interest.

Publications.—The "Report on the Pork and Bacon Trades in England and Wales" (Economic Series No. 17) was completed during the quarter under review, and has since been

published at a nominal price of 6d. Good progress has been made with the second report on fruit (apples, pears, plums and strawberries) and also with reports on the marketing of cattle, cereals and cheese. The preparation of the report on the markets and fairs in the northern counties is nearing completion.

Sales of the reports in the Economic Series during the quarter totalled 2,376 copies, bringing the total sales of the series, up to March 31, 1928, to 50,000 copies.

Marketing Investigations.—Field work in connexion with the marketing of vegetables continues. Inquiries are also being made in the eastern and southern counties with the object of preparing a report on the markets of that area.

Leaflets.—A leaflet—No. 6 (see this JOURNAL for May, 1928, page 154)—has been added to the marketing series, explaining the national scheme of egg marketing reform adopted by the Minister's Poultry Advisory Committee. The National Farmers' Union has circulated this leaflet, through the medium of its county branches; copies have also been widely distributed amongst specialist poultry societies, distributors' organizations, co-operative societies, etc.; about 100,000 copies have been, or are in course of being, distributed.

Marketing Demonstrations.—(1) On the invitation of the Kent Agricultural Education Committee, and with the support of the Maidstone Branch of the National Farmers' Union, a fruit marketing demonstration was given at the Maidstone Corn Exchange on March 15 and 16. The demonstration, which included machine grading and packing of apples, was given continuously throughout each day and was well attended. A meeting was held on the evening of the 15th, when an address on the fruit marketing scheme was given by one of the Ministry's officers, and the terms of the Agricultural Produce (Grading and Marking) Bill were enthusiastically approved. Over 400 copies of the "Fruit Marketing Report" (Economic Series No. 18) were sold at this demonstration.

(2) Twenty-nine marketing demonstrations were staged during 1927, 23 shows or centres being attended. The total cost of these demonstrations, including ground space and erection expenses, was £8,970.

(3) Following the fruit marketing demonstration given at Swanley, Kent, in December last, a strong movement is on foot amongst the principal growers of the district to set up a fruit

packing station. The station is to be incorporated with a share capital of £1,000 (10s. paid up), the shares being held by the growers. An advance equal to the uncalled share capital has been promised by Martin's Bank.

(4) An extensive programme of demonstrations has been arranged for the ensuing season. These will cover the marketing of eggs and poultry, pigs, pork and bacon, fruit and potatoes. A new feature will be a series of demonstrations relating to the marketing of cattle. The full programme, as at present arranged, was given in the March issue of this JOURNAL (page 1080).

Empire Marketing Board's Publicity Schemes.—(1) Accounts have already been given in this JOURNAL of the displays of home produce staged under the aegis of the Empire Marketing Board at exhibitions.

(2) The Empire Marketing Board is arranging a display of Empire produce at the Canadian National Exhibition to be held at Toronto in August. The Ministry is organizing the United Kingdom section, in which representation will be given to those commodities which are exported to North America or for which there is a potential market in that part of the world. Special attention will be given to pedigree live stock.

(3) The Ministry is keeping in close touch with the Board in regard to other means of propaganda, *e.g.*, press advertising, posters, films and lectures.

Lectures and Addresses.—Many requests were received during the quarter from county branches of the National Farmers' Union and other organizations for officers of the Markets Branch of the Ministry to give addresses on marketing. Such addresses were given at Worthing (marketing of glass-house produce), at Blackminster, Paddock Wood and Wisbech (fruit marketing), and at Newbury, Reading, Lincoln and Crickhowell (egg marketing). A special meeting in London of chairmen and vice-chairmen of all County Poultry Committees of the National Farmers' Union was addressed on the egg marketing scheme. Meetings of distributors at Liverpool and Manchester were addressed in regard to the fruit marketing proposals.

Schemes for Improved Marketing.—A scheme for the better marketing of Devonshire butter has been discussed with representative producers and others of that county, and is now being discussed locally with a view to the mobilization of support.

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on May 9 at 7 Whitehall Place, S.W. 1, the Chairman, Viscount Ullswater, G.C.B., presiding.

The Board considered a notification from the Buckinghamshire Agricultural Wages Committee of a decision varying the minimum and overtime wages for male workers and minimum rates of wages for female workers in their area in respect of employment of male workers on public holidays, and made an Order carrying the decision into effect as from May 14. The minimum rate fixed in the case of male workers of 21 years of age and over remains at 31s. per week of 50 hours in summer and 48 hours in winter. The overtime rates are 9d. per hour on weekdays, and 11d. per hour on Sundays and in respect of employment after 1 p.m. or in excess of 5½ hours on Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and Boxing Day. In the case of female workers of 18 years of age and over, the minimum rate remains unchanged at 6d. per hour for all time worked. The Order will remain in operation until further notice.

Copies of the Order 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 May 15, legal proceedings were instituted against 17 employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

cases are as follows :—												
County	Court	Fines			Costs			Arrears of wages			No. of workers concerned	
		£	s.	d.	£	s.	d.	£	s.	d.		
Cambs.	.. Wisbech	..	0	10	0	2	12	0	8	9	6	2
Devon	.. Hatherleigh	3	3	0	0	9	0	33	10	0	1	
Essex	.. Chelmsford	..	0	10	0	—	—	0	2	7	1	
Kent	.. Tonbridge	..	—	—	—	—	—	—	—	—	1	
"	.. Tunbridge Wells	..	20	0	0	4	9	0	91	3	5	2
"	.. Cranbrook	..	—	—	—	—	—	—	—	—	1	
Lancs.	.. Chorley	..	1	0	0	3	3	0	5	2	0	2
Middlesex	.. Uxbridge	..	—	—	—	—	—	—	—	—	2	
Somerset	.. Axbridge	..	1	0	0	0	10	0	31	0	0	2
"	.. Bridgwater	..	—	—	—	—	—	14	8	6	1	
Stafford	.. Stafford	..	—	—	1	4	0	26	0	0	3	
Wilts	.. Marlborough	..	—	—	—	—	—	—	—	—	1	
Yorks, W.R.	.. Rotherham	6	0	0	0	13	0	2	12	0	2	
Denbigh	.. Glyn Ceiriog	1	0	0	—	—	—	30	19	6	1	
"	.. " "	..	1	0	0	—	—	12	14	6	1	
Flint	.. Holywell	..	1	0	0	—	—	2	10	0	1	
Pembroke	.. Mathry	..	1	0	0	—	—	11	0	0	1	
		£36	3	0	£13	0	0	£269	12	0	25	

* * * * *

Special Minimum Rates of Wages for the Hay Harvest.—Special rates of wages for employment on this year's hay harvest have been fixed by Agricultural Wages Committees in respect of the following areas, *viz.*: Devon, Dorset, Hertfordshire, Somerset, and Wiltshire. In every case similar rates were fixed for last year's harvest; the

Derbyshire Committee, however, have decided not to fix special rates as they have done in previous years.

The special rates take the form of increased overtime rates and, except in the case of Hertfordshire, apply to male workers only. In Devon, Dorset, Hertfordshire and Somerset, the special overtime rate for male workers of 21 years of age and over is 10d. per hour and in Wiltshire 9d. per hour, whilst the rate for female workers of 19 years of age and over in Hertfordshire is 7½d. per hour. Lesser rates are fixed for younger workers.

Where no special rates are fixed for the hay harvest, employment on harvest work must be paid for at not less than the ordinary minimum and overtime rates.

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Foot-and-Mouth Disease.—Since the report in last month's issue of this JOURNAL, fresh centres of disease were discovered on May 9 at Salt, Stafford, and Hopton, Stafford, on premises about one mile apart. The usual infected area restrictions were imposed on an area of approximately 15 miles from the infected farms, and 9 further outbreaks have since been confirmed in the area. No other outbreak has been confirmed in Great Britain during the month.

The number of outbreaks confirmed since January 1 last is 102, involving 13 counties and the slaughter of 2,922 cattle, 4,165 sheep, 1,562 pigs and 5 goats.

* * * * *

APPOINTMENTS

Pig Industry Council.—Sir Alfred Mond having, for business reasons, withdrawn his acceptance of the Chairmanship of the above Council, Mr. E. R. Debenham has consented, on the invitation of the Minister of Agriculture, to preside over the Council's deliberations.

County Agricultural Education Teaching Staffs: England, Yorkshire, (University of Leeds, Agricultural Department). Mr. A. Murchie, B.Sc., has been appointed an Assistant Lecturer in Dairy Husbandry. This appointment is additional to those given in last month's (May) issue of this JOURNAL, and is to fill a vacancy.

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NOTICES OF BOOKS

Agricultural Research Work in the Sudan. Reports for the Season 1926-27 and Programmes for the Season 1927-28. (Obtainable from the Controller, Sudan Government Offices, Wellington House, Buckingham Gate, London, S.W. 1. Price, post free, 2s. 10d.)

Scientific work in connexion with agriculture in the Sudan is under the joint control of the Director of Agriculture and Forests and the Director of the Wellcome Tropical Research Laboratories, and is carried on at the Gezira Research Farm, Wad Medani (Gezira), at the Wellcome Tropical Research Laboratories at Khartoum, and at the Botanical and Plant Breeding Station, Shambat (Khartoum North). This volume describes work carried out at these places in 1926-27, and gives in some instances programmes for the season 1927-28. Much of the work described has been carried out in co-operation with the Empire Cotton Growing Corporation and with their assistance in regard to finance and technical staff. The Report is published in collaboration with the Corporation.

The Gezira Research Farm was established in 1918 in connexion with the Gezira irrigation project, it having been realized that the initiation of such a scheme of irrigation in a semi-arid region involved dealing with a variety of problems which would require careful scientific investigation for their successful solution. This station, situated in the centre of the irrigated areas, comprises an area of some 420 acres, and has well-equipped laboratories in which work in connexion with the different lines of scientific investigation are being carried out.

Experiments are carried out on various matters connected with cotton growing, and a seed farm deals with the propagation of improved varieties of cotton, and carries out variety and strain experiments.

Chemical and entomological research work is carried out in connexion with the Gezira and in collaboration with the Wellcome Tropical Research Laboratories. A soil survey of the Gezira is also being carried out.

In entomological research, progress is being made in the study of various pests and their control. Research in plant physiology and pathology at the Gezira Research Farm has related to the effect of various manures; irrigation; the effect of climate; and bacterial disease, root rot and leaf curl of cotton.

At the Shambat Botanical and Plant Breeding Station, work is carried out on cotton variety testing, including both Egyptian and American varieties, and there are "pedigree line," "new selection" and hybrid plots.

Insect and Fungus Pests of the Farm.—By J. C. F. Fryer, M.A., and F. T. Brooks, M.A. Pp. 198. "The Farmer and Stockbreeder Manuals." (London: Ernest Benn, Ltd., 1928. Price 7s. 6d. net.)

In their preface to this handbook, the authors disclaim any intention of attempting to teach the farmer his business, their object being to discuss, from the farming standpoint, some of the difficulties due to plant pests and diseases which have to be faced on the average farm, and to indicate the general lines along which these evils may be mitigated and sometimes avoided. Writing thus for the initiated reader, to whom textbook descriptions of the different pests are familiar, they are able to start immediately with the fundamental problem. This arises, under the intensive cultivation of to-day, from the growing together of enormous numbers of the same kind of plant, thus giving exceptional opportunity for the multiplication of insect and fungus enemies, which, under natural prairie or jungle conditions, have to face the risks and difficulties of finding their suitable prey in the comparatively isolated positions in which it grows, and are prevented by this and other factors from multiplying unduly. Thus the "mass production" of plants carries a possible corollary in the "mass production" of pests. Moreover, the plant which withstands the competition of its neighbours, and the attacks of organisms, under purely natural conditions, is far removed from that cultivated for some special characteristic, such as the ability to yield food; so that man has been led to retain varieties which are but partially resistant to insect and fungus attack, and which would never have survived in the wild state. "In agriculture, man upsets the balance of nature—usually to his own advantage, but not without risks which sometimes result in heavy crop losses."

With the problem thus broadly stated, the authors proceed to discuss "some of the measures which can be taken to restore again the proper balance between the crop plants and the organisms which prey upon them," and the manner in which this is done constitutes the particular fascination of the book as well as its special appeal. No cut-and-dried rules are laid down, it being recognized that, however

attractive such instructions may appear on paper, conditions in practice vary so greatly as between one farm and another, that the exact method of applying any general principle to a particular case must usually be worked out by the man on the spot. By drawing that individual into consultation, as it were, and enlisting his practical consideration of the results of recent scientific research, the authors have produced a work that should prove both interesting and helpful to the agricultural community.

Black's Veterinary Dictionary. Edited by William C. Miller, M.R.C.V.S. Pp. ix + 1061. (London: A. & C. Black, Ltd., 1928. Price 21s. net.)

It is a common charge against writers of technical works that the lay reader is unable to become acquainted with the present knowledge of a given subject or to keep himself informed of the progress of research because the literature is burdened with scientific terms. This, however, is unavoidable, as precision requires that the terminology shall be definite and not liable to misconstruction. On veterinary subjects, there is not much literature upon which the stockowner can rely to give him a reasonable amount of information of which he may be in need.

The Editor of *Black's Veterinary Dictionary* has as far as possible avoided the use of technical terms in the text, and the book is therefore suitable to the general reader, who will find definitions of terms which at first are not understood. It describes the diseases of animals usually at a length commensurate with the importance of the subject, and it also contains articles on anatomy, poisoning by drugs and plants and the relative antidotes, hygiene, and parasites of the domestic animals.

The development of veterinary science has naturally tended to the introduction of vaccines, sera, etc., against numerous specific diseases, and some of these products are of the greatest value in minimizing losses amongst live stock: others, however, are of doubtful value. The general attitude of the compilers of the Dictionary towards these biological products is reasonable, although many will not agree with the suggestion that a dog bitten by a rabid animal can in exceptional cases be submitted to the Pasteurian method of vaccination. In dealing with rabies no risk should be taken, and it should be an invariable rule that a dog bitten by another known to be rabid should be destroyed.

In this country the mortality from anthrax is low, but occasionally a considerable number of animals become infected. In such circumstances it is advisable to administer a dose of serum to all animals which may have been exposed to infection, including those which are clinically affected. Good results have been obtained by this means, but the Dictionary does not refer to this line of treatment.

The article on tuberculosis shows the difficulties which lie in the path of eradication, and gives good advice to the owner who would undertake the elimination of this disease from his herd, but the recommendation of partial segregation is one which is likely to lead to disappointment. If an owner decides to attempt eradication, half-measures in any direction will end in failure to achieve his object.

The Dictionary contains descriptive notes on the breeds of horses, cattle, sheep and swine, and the accompanying illustrations are very good. This is a commendable departure from the usual practice of veterinary writers in this country where the subject, in general opinion, is not so closely associated with primary veterinary work as is the case in many other countries. In this connexion, however, vain search has been made for notes under the heading of Mendelism and analogous questions.

To understand the nature of disease should be the aim of all stock-owners, and the volume will be found very helpful to them, but the

first practical issue which will arise is how to prevent or minimize losses. Not sufficient stress has been laid upon the desirability of isolation of newly purchased animals: many farmers have few facilities for segregating stock on purchase, but any available facilities should be used in preference to the common practice of placing animals whose previous history is not known among the home stock and thereby incurring the risk of involving the whole herd or flock in an outbreak of contagious disease.

The life-cycles of the more important parasites of animals are adequately described: these are in many cases fascinating and to many stockowners are still mysterious. This chapter, as, indeed, the whole volume, is up-to-date, but a word of warning is necessary in connexion with the new treatment by carbon tetrachloride of sheep affected with liver-fluke. Although the drug is administered in small doses, and many sheep can tolerate comparatively large doses, occasionally the small dose will prove poisonous to the sheep. Practically all the recorded accidents have occurred among sheep receiving artificial foodstuffs or special field crops, but the reason why in these circumstances some sheep are unable to tolerate a medicinal dose of the drug is unknown.

The authors appeal to stockowners to render all possible assistance to the authorities in connexion with foot-and-mouth disease. It is well known that some owners have been negligent in the past in reporting outbreaks promptly, but the implication, nay, direct statement, that owners have deliberately withheld assistance to the Ministry's staff in their duties on infected places is not correct. The work is always arduous and exacting, it must be carried through promptly, often under adverse conditions, and the Inspectorate look to the owner for assistance in the supply of materials, labour, and in many other ways; this assistance is invariably given willingly.

Truck Crop Plants. By H. A. Jones and Joseph Tooker Rosa. Pp. xiv + 538. (London: McGraw-Hill Publishing Co., Ltd., 1927. Price 25s.)

It is necessary to say that a "Truck Crop" farmer of America is equivalent to the market gardener of England. The book concerns itself with a description—history, botany, genetics, etc.—of market garden plants, giving the kind of information that a university teacher would give to a class of advanced students.

The cultural side and the trade side are dealt with, although very briefly. Curious to relate, however, considerable space has been devoted to notes on insects and diseases, the explanation given being that their control is so intimately associated with production and marketing, that closer study is desirable. The book deals with American plants such as sweet corn, sweet potato and pumpkins, as well as with the onion, spinach, cabbage, etc., of our market gardens, and, although American methods and conditions only are described, there is, nevertheless, much in the book to interest the student of horticulture, or even the practical grower here, if he is fond of reading.

Rats and How to Kill Them. By A. Moore Hogarth, F.E.S. Pp. 46. (London: John Bale, Sons & Danielsson, Ltd. Price 6d. net.)

Mr. Moore Hogarth's book, *Rats and How to Kill Them* (6d. net), published by Messrs. John Bale, Sons & Danielsson, Ltd., contains useful information and advice concerning the preparation and use of poison baits, traps and fumigants for the destruction of rats, and deals with the question of the responsibility of rats for the spread of diseases dangerous to man and to other animals.

The author lays stress on the international importance of rat repression, having regard to the immense damage caused by these

rodents. He places the cost of the rat in this country at the high figure of £100,000,000 yearly, and advocates, *inter alia*, the setting up of an International Commission for the purpose of codifying rat legislation with a view to its being concurrently effective throughout the world; the amendment of the Rats and Mice (Destruction) Act; the registration of *bona fide* rat catchers; and the dissemination of information about the rat in elementary schools and other educational institutions. Mr. Moore Hogarth also suggests that storerooms on ships should be rat proofed, and that the question of shipowners paying bounties for rats caught by members of the crew whilst on a voyage might be considered.

The full text of the Rats and Mice (Destruction) Act, 1919, is given as an Appendix to the book.

Indian Agriculture. By Albert and Gabrielle L. C. Howard. *India of To-day Series.* Pp. 98. (Oxford: The University Press, 1927. Price 3s. 6d.)

This book contains a short account of the present position of agriculture in India. The factors underlying production are analyzed, the organization of agricultural research is traced, and some results of research are indicated. Interesting chapters deal with the human factor, and with some community problems. The authors stress the importance of agriculture to India, 71 per cent. of the total population of which are directly dependent upon the soil, mainly in small holdings. The monsoon is the dominant factor in rural India. To its effects the authors attribute the fatalism and low morale of the country people.

The problem of agricultural education has been rendered more acute by the illiteracy of the peasantry, who are described as being incapable of learning to read or of thinking for themselves. An additional adverse factor is the poverty of the peasant class as a whole. It is said that the majority of them are "born in debt, live in debt, and die in debt."

The final chapter of the book is devoted to arguments in favour of the formation of a Development Board of Rural Re-construction, and the authors consider that India will remain in its present largely undeveloped condition until a fund can be established for the purpose of providing suitable agriculturists with financial assistance.

As an appendix, the book has a short directory of the Agricultural Departments of British India.

Essex County Farmers' Union Year Book, 1928. Edited and compiled by John B. Gill. (Published at the Office of the Union, Corn Exchange, Chelmsford. Price 2s. 6d.)

This substantial volume of 368 pages gives a very complete record, in letterpress and illustrations, of agricultural activities and events in Essex during the past year. It gives, however, much more than this, for over half its space is devoted to special contributions on various aspects of agricultural work and science by well-known authorities. These are far too numerous to mention in detail. It is sufficient to state that the contributors' list includes the names of Professor T. B. Wood, Professor R. G. Stapledon, Dr. Stenhouse Williams, Dr. B. A. Keen, Dr. A. G. Ruston, Mr. Arthur Amos, Mr. W. A. Stewart, Mr. H. V. Garner, Dr. H. E. Woodman, Mr. Johnstone-Wallace, Mr. E. T. Halnan and Mr. J. C. Wallace, in addition to prominent agriculturists of the county, like Mr. Alec Steel, Mr. W. Hasler, Mr. A. W. Ruggles-Brise and Mr. James Tabor, to indicate that this excellent publication should appeal to agriculturists in many counties beside that for which it is ostensibly published.

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NOTES FOR THE MONTH

THE Burlingham Estate, Norfolk, which is the largest and one of the most successful small holdings schemes promoted under the Land Settlement Scheme for

Small Holdings: ex-service men, has recently been visited **Burlingham Estate,** by members and officers of the Councils of the adjoining counties who are concerned in small holdings administration, accompanied by representatives of the Ministry.

The Estate, which comprises nearly 4,000 acres, consists of two properties known as "Burroughes" (over 3,000 acres) and "Jary's" (over 800 acres). These two properties, which are contiguous and for all practical purposes form one estate, were purchased by the Norfolk County Council in the years 1919 and 1920 for the sum of £170,000. The Estate is situated in what is considered the best corn and root growing district in Norfolk, within eight miles of Norwich and ten miles of Yarmouth. Five villages lie within the boundaries or on the outskirts of the property, which is approached and well served by good hard roads. Before its acquisition by the County Council, the "Burroughes" property formed part of a still larger estate of nearly 5,600 acres, known as the Burlingham Hall Estate, which has always borne the reputation of being the best property in East Norfolk as regards the quality of its land. Included in the purchase, by the Council, were Burlingham Hall—a substantial residential mansion which is now let as a girls' school, 16 farm houses, numerous farm buildings and nearly 100 cottages. 171 smallholders are now settled on the Burlingham Estate, and the rent roll amounts to over £8,000 per annum.

The soil is a free-working loam of very uniform quality. Whilst a number of the smaller tenants are engaged in market gardening and fruit growing—the growing of black currants being a prominent feature—the land is mainly cultivated on the four-course system, combined with bullock-feeding, cow-

keeping and the rearing of young stock. A considerable area is devoted to sugar-beet, the Cantley factory being within easy reach of the estate.

The visitors were not only much impressed by the excellence of the individual holdings inspected, but showed, by their observations, that they were perhaps even more struck by the general high standard of cultivation which they noticed whilst travelling between the holdings selected for inspection.

The party also inspected a demonstration plot of some eight acres, managed by the Agricultural Education Committee of the County Council, for carrying out trials of new varieties of fruit, testing systems of cultivation, and demonstrating the economic value of methods of controlling pests. The appearance of this plot clearly demonstrated the suitability of the land for the growth of all kinds of fruit; and, in view of its situation in the centre of the estate, the plot must be of great educational value to the smallholders.

Two of the tenants who were visited were keeping bulls provided under the Ministry's Live Stock Improvement Scheme.

The Norfolk County Council are to be congratulated on the success of this large scheme, which should prove a stimulus to the Small Holdings movement in the Eastern Counties.

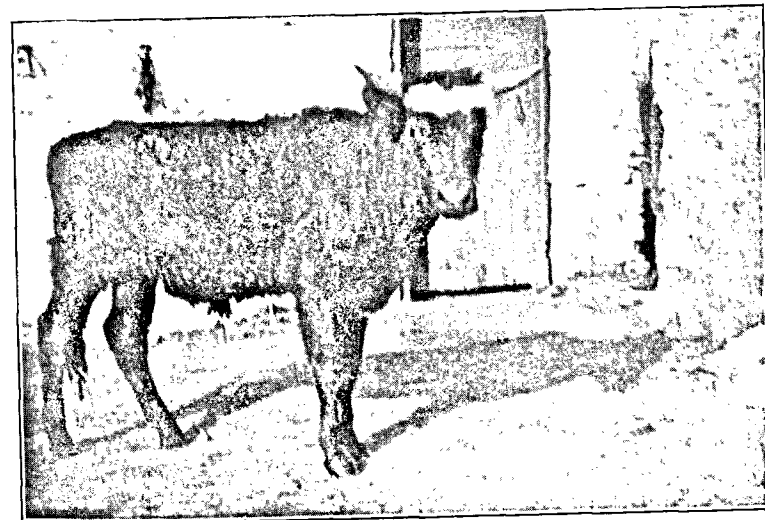
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RENEWED interest appears to have been taken recently in the question of introducing in Great Britain a scheme for the

licensing of bulls on the lines of that in operation in Ireland, and discussions
What is a "Scrub Bull"? have taken place on the subject at meetings of breed societies and of other associations which are interested in the improvement of live stock.

In the course of some of these discussions, the question has been raised as to the interpretation of the term "Scrub Bull." In the Live Stock Breeding Acts, which are in force in Northern Ireland and the Irish Free State, it is prescribed *inter alia* that a licence shall not be granted in respect of any bull "that is calculated to beget defective or inferior progeny."

The Ministry is satisfied, on the information before it, that there are many bulls in this country which answer to that description, and which are known as "scrub bulls." The accompanying photo is a bull of that type. The animal in question was discovered by one of the custodians of bulls



A "Scrub Bull"!

provided under the Ministry's Live Stock Scheme. It was on a farm where 20 good Shorthorn cows were kept, and when the owner was asked why he did not use a better bull he replied that he didn't care what sort of a bull he kept so long as his cows were got in calf—an excuse which is far too general and one that probably accounts for a large number of the scrub bulls in the country.

It might be added that the bull in question is over two years of age, has a coat of many colours, and is so nondescript in appearance that it cannot be described as being of any particular breed or type. It was purchased for £7 by the premium bull custodian, who was ashamed to see such a bull in his district. He is trying to get a little meat on the beast before sending it to the butcher.

* * * * *

DURING the autumn of 1925, an investigation was made into the varieties and quality of seed wheats used in some of the Eastern Counties. The results

Seed Wheat in of this inquiry were published in this Eastern England JOURNAL (April, 1926, p. 15).

Efforts were made in the following autumn to obtain a more representative collection of samples, but, owing largely to weather conditions and the lateness of the season, insufficient data were obtained to warrant any conclusions. A third attempt, made in the late months of 1927, met with a little more success, 249 samples being taken, of which eight were duplicates. Of these, 120 were obtained in Cambridgeshire, 51 in Hertfordshire, 38 in Suffolk and the remainder in Huntingdonshire, Essex and Bedfordshire.

Varieties.—The varieties which were found to occur most frequently were Little Joss (59 samples), Squareheads Master (46 samples), Red Standard (20 samples), Victor (18 samples), and Yeoman and Yeoman II (11 and 14 samples respectively). Other varieties which were met with three or more times were Rivetts, Wilhelmina, Million III and Croxton Champion. Dixon's Bountiful Setter, Carter's Standup and Bacton Champion were met with twice; 17 samples were of varieties encountered only once, 18 were unnamed, and 6 were mixed. It is interesting to note that mixtures of seed wheats were found in five of the six counties visited. In those cases where the investigating officer made inquiry as to the reason for mixing, he was told that better results were obtained with a mixture than with a single variety.

Of the samples of Little Joss, 37 were taken in Cambridgeshire, 14 in Hertfordshire and 7 in Suffolk. Squareheads Master was found on 23 farms in Cambridgeshire, on 11 in Suffolk and on 5 each in Hertfordshire and Huntingdonshire. Ten of the 20 samples of Red Standard were taken in Hertfordshire and 5 in Cambridgeshire. The remainder of the varieties sampled were fairly evenly divided among the six counties in proportion to the numbers of samples taken.

Taking Yeoman and Yeoman II together, the five varieties most widely used are the same as those which headed the list in 1925, although the order of preference appears to have changed. The figures for Little Joss and Squareheads Master stand out well above all others.

Purity.—All but one of the samples taken were tested for purity. Of the 248 examined, 74 samples showed a purity of more than 99.5 per cent.; 167 gave a result between 97 per cent. and 99.5 per cent.; and 7 fell below 97 per cent. Weed seeds of one kind or another occurred in 155 of the samples. Seeds of cleavers (*Galium aparine*) were found fairly frequently, Ergot (*Claviceps*) was present in 7 samples and Ear Cockles (*Tylenchus Scandens*) was met with twice.

Germination.—The germination test showed that 159 of the samples germinated to the extent of 95 per cent. or over; 52 gave results of 90 per cent. or more, but less than 95 per cent.; 7 were between 85 and 89 per cent.; 14 from 80 to 84 per cent.; 9 from 65 to 79 per cent.; and 8 below 65 per cent. The lowest figures recorded were 28 per cent. and 51 per cent. Thus, out of the 249 samples taken, 38, or 15 per cent., had a lower germination than the authorized minimum prescribed in the Seeds Regulations. These poor growth figures were due, in all probability, to the bad harvesting conditions.

Prevalence of Bunt.—Of the 236 samples examined for bunt, 11 contained no trace of spores. In 148 samples the infection was so slight as to be negligible, 50 were more heavily infected and 27 contained bunt balls. From inquiries which were made as to the treatment used to deal with bunt, it was found that in 126 cases the seed had been dressed with copper sulphate and in 11 with formalin, while dry copper carbonate had been used for one sample. In 9 instances the grower did not propose to dress the seed at all, but each of the remaining 102 samples had been treated with a proprietary dressing.

In seven cases it was possible to obtain samples of the seed

before and after dressing for bunt. Only two of these showed that the treatment had had any appreciable effect on germination. Copper sulphate had been used in both instances and the decreases in germination were from 90 to 84 per cent., and from 97 to 92 per cent., respectively.

As mentioned in the earlier articles on this subject, the Official Seed Testing Station is now prepared to examine wheat samples for bunt spores at a charge of 2s. per sample. A leaflet dealing with this disease is obtainable (single copies free of charge) from the Ministry at 10 Whitehall Place, London, S.W.1.

Rate of Sowing.—The replies to questions as to the rate of seeding show that there are wide differences, due to varying circumstances, and that the quantities sown range from $1\frac{1}{2}$ to $3\frac{1}{2}$ bushels per acre. As a general rule, the lightest sowings are on the best soils and the heaviest on poor lands, while in most cases the rate of sowing increases as the season advances.

Source of Seed.—No fewer than 152, or 61 per cent., of the samples obtained were of home-grown seed, saved for one or more years. In 36 cases the seed had been purchased from merchants and in 35 cases from neighbours. The sources of the remaining 26 samples were not ascertained. Many of the farmers using their own seed said they sowed it only for one or, at most, two seasons and then obtained fresh seed from their merchants. In a few instances, farmers kept the same stock over a number of years, and the whole of their surplus was in demand by merchants and other farmers for seed purposes. There were some cases where farmers had friends or relatives in other districts with whom they exchanged seed. One grower obtained his seed from Yorkshire every year or two, while another, in Suffolk, had wheat from a friend in Lincolnshire, grew one crop and sent the produce back to Lincolnshire the following year. It was found that some farmers firmly believe in planting seed grown on a different class of land from their own and that many of those interviewed were eager to discuss the performances of individual varieties in different districts.

Comparative Quality of Home-saved Seed.—One of the objects of the investigation was to afford a comparison between the quality of home-grown seed and that of seed obtained from merchants. For this purpose, samples were divided into four grades, namely, "good," "satisfactory," "poor" and "very poor." In classifying each sample, regard was had to

the presence of broken, sprouted, shrivelled and small seed, and to the colour and condition. The samples of known origin which were submitted to examination numbered 181, of which 131 were of the farmer's own seed, 27 had been obtained from other farmers and 23 were of seed purchased from merchants. In round figures, 5 per cent. of the home-grown seed was classified as "good," 43 per cent. as "satisfactory," 25 per cent. as "poor" and 27 per cent. as "very poor." Of the seed obtained from other farmers, only one sample, or roughly 4 per cent., was graded as "good," 37 per cent. as "satisfactory," 44 per cent. as "poor" and 15 per cent. as "very poor." None of the samples of seed bought from merchants was shown as "good," but 65 per cent. were classified as "satisfactory," 26 per cent. as "poor" and only 9 per cent. as "very poor." Taking the samples examined as a whole, including a few of unknown origin, about 4 per cent. were "good," 47 per cent. "satisfactory," 27 per cent. "poor" and 22 per cent. "very poor."

As already mentioned, only 23 of the samples were of seed purchased from merchants and it is obviously not safe to draw any definite conclusion from such small numbers as were examined. It will be observed, however, that while none of the seed obtained from merchants was graded as "good" and only 9 per cent. as "very poor," practically two-thirds of it came within the classification "satisfactory." Samples grown at home or by other farmers, on the other hand, were considerably more irregular in quality. They included 4 per cent. of "good" and 25 per cent. of "very poor" seed, while less than one-half were of, or above, "satisfactory" quality.

If these samples may be taken to represent a rough average of the seed wheat sown in the Eastern Counties, perhaps the most important indication which the investigation affords is that, whether the seed is home-saved or purchased, there is still ample room for improvement in quality.

* * * * *

THE question of setting up an International League to deal with the question of rat repression, both from the hygienic and the economic point of view, was considered at the Congress of the Royal Institute of Public Health held at Paris in May, 1913. It was then decided to hold an inaugural conference at Copenhagen to deal with the question in the summer of 1914, but the outbreak of the war prevented the carrying out of this plan.

International Conference on Rats

The occasion of the session of the International Office of Hygiene in May, 1928, was considered an excellent opportunity to secure a large attendance at a Conference to deal specifically with the rat question, as many of the foreign delegates to the former were also very much interested in the question of rat repression. A Conference was accordingly arranged for and was attended by 72 representatives of 46 different countries. The British Government was represented by Sir George Buchanan and Dr. P. G. Stock, of the Ministry of Health, and Mr. E. C. Read, Technical Adviser on Rat Destruction to the Ministry of Agriculture and Fisheries.

The delegates attended the formal inauguration of the Conference on May 16 at the Sorbonne, which took place in the presence of several members of the French Government, French Savants, and some 2,000 interested members of the public.

Having regard to the short time available for making the necessary arrangements for the Conference, the organization of the meetings and the preparation of the subjects for discussion reflected much credit on Professor Gabriel Petit, the Secretary to the Conference, upon whom the bulk of the preliminary work had fallen. Professor Petit promised that the papers read by the various delegates at the meeting should be printed and circulated to the Governments represented.

The great importance of the proper control of rodents, both from an economic and from a hygienic point of view, was emphasized, it being suggested that, in many cases, the economic danger was even more important than that to be apprehended from the spread of plague and other human and animal diseases.

The Rats and Mice (Destruction) Act, 1919, in force in England and Wales was considered by the Conference to be very practical. Denmark is the only other country in which legislation of a national character is in force, but the German delegates stated that they were urging their Government to introduce a national measure on similar lines to the English Act, and it appeared that the delegates of other Powers were also recommending their Governments to introduce unified legislation on the subject.

The Conference decided to recommend the setting up of an International League for the purpose of rat repression. The object of the League would be to facilitate an exchange of views and ideas on rat repression, including the results of experience of the use of poisons, gases, and other means of

rat destruction, and the results of research work on the question carried out in the countries of the members of the International Conference. This recommendation will doubtless shortly be submitted to the constituent Governments for their consideration.

* * * * *

As there appears to be a decided prejudice against the use of beet sugar in the manufacture of jams, and the bottling and canning of fruit, comparative tests have been carried out at the Fruit and Vegetable Preservation Research Station, Campden, Glos., using cane and beet sugar in order to ascertain if there is any difference between them.

(1) *Examination of Sugars.*

SUGAR :	Grade :	<i>Beet</i>		<i>Cane</i>
		Ely	Granulated English	Lyle's No. 2
		Beet		
	Appearance :	Slight greyish-brown tint		Pure white
	Odour :	Distinctly stronger than cane ; characteristic "beet sugar" odour		Slight
ANALYTICAL FIGURES :	Sucrose (polarization)	99.71 per cent.	99.94 per cent.	
	Invert Sugar	Trace	Trace	
	Moisture	0.05 per cent.	0.02 per cent.	

Of the two samples, the cane sugar was found to contain the greater quantity of invert sugar, but in both cases this amounted to considerably under 0.05 per cent. The beet sugar bulked rather lighter than the cane sugar.

(2) *Syrups.*—In the canning industry, sugar is used in the form of a syrup prepared by dissolving sugar in water. Identical syrups made from cane and beet sugar were examined with the following results :—

(60 grammes sugar dissolved in 100 cc. water) :

	<i>Beet</i>	<i>Cane</i>
Appearance :	Fairly clear	Fairly clear
	Faint yellow-brown tint	
Suspended and Foreign Matter :	Small quantity	
Taste :	No difference detectable	
Ultramarine :	Nil	Nil

(3) *Canned Fruits.*—Various fruits canned in a syrup containing 10 lb. of beet sugar to one gallon of water were compared with samples of the same fruits canned in a cane sugar syrup of the same strength. In each case, six cans in each group were examined. The cane and the beet sugar samples were satisfactory as regards taste, smell, and general

appearance, and there was no difference whereby one could be distinguished from the other. The percentages of sugar, and the extent to which inversion had taken place, were practically the same in each case. The cans were all examined in the same way, and the following figures show the type of examination carried out :—

CANNED RASPBERRIES :—(Canned July 19, 1927)

(Six cans in each group were examined)

	<i>Beet Sugar</i>	<i>Cane Sugar</i>
Appearance :	Good ; berries firm	Good
Taste :	Good	Good
Smell :	Good	Good
Can :	Lacquer attacked where scratched	Lacquer attacked where scratched
Weight of Fruit :	262 grammes	252 grammes
Volume of Syrup :	260 cc.	275 cc.
Weight of Syrup :	297 grammes	316 grammes
Density of Syrup :	25° Balling	26° Balling
Total Sugars in Syrup :	24.3 per cent.	25.2 per cent.
Reducing Sugars :	8.7 per cent.	8.0 per cent.
	Sugars expressed as sucrose.	

(4) *Jams.*—Blackcurrant, raspberry, and damson jams were prepared, using cane and beet sugar, and the samples in each case were carefully compared. No difference in colour, flavour, or set could be detected, and the degree of inversion was approximately the same in each case.

(5) *Jelly-Forming Properties.*—An important factor in the use of beet sugar in jams and jellies, and one which has recently received a certain publicity in the Press, is the capacity of the sugar to set to a jelly in the presence of pectin and acid.

In order to effect a comparison of the setting properties of sugar from the two sources, a similar range of jelly samples from cane and beet sugar were prepared.

Douglas pectin with a titratable acidity of 2.56 per cent. as tartaric acid was used, and additional tartaric acid was added in each case to bring the acidity of the final jelly up to 1.0 per cent. strength.

The required weights of sugar (55 to 62 grammes) were dissolved in a suitable quantity of water, and added to 12 grammes of the pectin solution, so that, on the addition of the remainder of the tartaric acid, the weights of the final solutions were 105 grammes. These solutions were then evaporated to 100 grammes, and poured into glass moulds.

The jellies were cut into small cubes and compared in the usual manner—by appearance, touch, and preservation of sharpness of the cut edges. Analyses for percentages of sugar and acid were carried out as a check.

The results showed quite definitely that, under these conditions, beet sugar gives quite as firm a jelly as cane sugar. In fact, in the range of sugar percentages chosen, the beet sugar samples were, if anything, the better of the two.

Conclusion.—From the foregoing tests, there is no indication whatever that beet sugar is in any way inferior to cane sugar for use in jams, jellies, and canned fruits. Several years ago, beet sugar was in some cases poorly refined, and occasionally of poor flavour on this account. This condition no longer exists, and beet sugar can now be used in fruit preservation with satisfactory results.

* * * * *

RETURNS have now been received from the beet sugar factories in Great Britain showing the production and sales of sugar beet pulp during the 1927–28 campaign. The total figures, compared with those for the previous year, are as follows :—

	<i>Dry</i>		<i>Wet</i>	
	1927–28	1926–27	1927–28	1926–27
	Tons	Tons	Tons	Tons
Total production	91,436	62,801	*16,163	26,138
Sold for use in U.K.	66,588	25,457	8,875	5,245
Exported	23,164	36,760	—	—
Losses owing to deterioration	1,684	584	6,488	20,893

* 800 tons ensiled for experimental purposes.

The prices at which pulp was sold to farmers in this country under the terms of the beet contract ranged from £4 2s. 6d. to £5 a ton (*ex factory*) for dried pulp, and from 4s. to 7s. a ton (*ex factory*) for wet pulp. Specially low prices were offered by some of the factories as an inducement to growers to place their orders at an earlier date than that specified in the beet contract. It should be remembered that dried pulp is difficult to store owing to its bulky nature and is liable to deteriorate rapidly if not adequately protected from damp. It is, therefore, important from the factories' point of view that they should know their customers' requirements well in advance in order to avoid congestion of their warehouses during the manufacturing season. Growers could therefore materially assist them by stating their pulp requirements early—if possible before August 1 in each year—and taking delivery of the pulp from the factory as early in the season as possible. It was chiefly this difficulty of storage that forced most of the factories to export a proportion of their dried pulp last year, but it is

satisfactory to note that the proportion of dried pulp exported to the total production fell from 59 per cent. in 1926–27 to 25 per cent. in 1927–28. Owing to the increasing popularity of this valuable feeding stuff, the factories anticipate very little necessity to export pulp in the coming campaign.

* * * * *

It is important that the attention of farmers and stock-feeders should be drawn to one of the changes introduced by the new Fertilizers and Feeding Stuff Regulations, 1928; this change, though of minor importance in itself, might otherwise be the cause of some

misunderstanding.

Under the Fertilizers and Feeding Stuff Act, 1926, sellers of certain feeding stuffs for cattle and poultry are required to inform each purchaser of the percentage of oil which the feeding stuff contains. This percentage is arrived at by treating a weighed portion of the article with a solvent which washes out the oil, and then determining the quantity of oil present in the solvent used; but the quantity of oil removed from the article depends upon the solvent used.

Up to the present, methylated ether has been the prescribed solvent, but experiment indicates that it dissolves rather more than that which, from the point of view of animal nutrition, should be regarded as “oil.” The new Regulations, therefore, following the recommendation of the Advisory Committee, prescribe that the solvent to be used for the future shall be petroleum spirit.

In some cases, the figure obtained for oil by the new method may be as much as 1 per cent. below that given by the old method. In consequence, a manufacturer who has hitherto sold a certain cake as containing 9 per cent. of oil may be obliged to describe it now as containing 8 per cent. of oil, although no change whatever has taken place in the quality or method of manufacture of the cake.

If, therefore, a farmer who gives a repeat order for a feeding stuff finds a difference in the warranty of oil of $\frac{1}{2}$ or 1 per cent., it does not follow either that he is getting an inferior article or that his previous deliveries have been over-guaranteed. In any given sample, the figure for oil content obtained by the new method of analysis is invariably lower than that obtained by the old method, and the discrepancy between the two guarantees may be due solely to the new method of analysis.

IN 1926, the Ministry of Agriculture issued an Order prohibiting the use of arsenical dips for the second of the two statutory dippings for scab, where a dip of that character had been used for the first dipping. This Order was made because of the complaints received from farmers of the serious losses some of them had sustained through the use of arsenical dips for both dippings, where, as is essential for sheep scab, the second dipping has to be carried out within not more than 14 days of the first dipping. The Ministry felt that unless such losses were prevented the policy of double dipping would be discredited.

Since that Order was made, the Ministry has received representations from farmers in Wales and other parts of Great Britain urging that they should be allowed their former discretion in the choice of an approved dip, so that they might use an arsenical dip for both dippings where desired.

The National Farmers' Union of England and Wales, in support of these representations, has informed the Ministry that a guarantee has been obtained from the manufacturers of the bulk of the arsenical dip used in this country, for the payment of compensation to farmers who sustain losses through the use of arsenical dips for both dippings, provided that the manufacturers' instructions are carried out in all respects, and that the manufacturers are given an opportunity of investigating the losses. Provision is also made in this guarantee whereby any disputes between manufacturers and the farmer will be settled by an arbitrator to be appointed by mutual agreement of the parties concerned, or, failing such agreement, to be appointed by the Auctioneers' Institute, who will select an arbitrator possessing a knowledge of agriculture and of sheep. The Ministry is informed that the National Farmers' Union is satisfied that this guarantee will afford an adequate safeguard to farmers against losses from dipping in arsenical dips not due in any way to carelessness in dipping. In view of this arrangement, and the persistent demands for the restoration of full discretion in the choice of an approved dip, the Ministry is satisfied that it can now properly remove its prohibition on the use of an arsenical dip for both dippings, and an Order to that effect was accordingly issued in the first week of June.

This means that in future, wherever the double dipping of sheep is required under an Order of the Ministry of Agriculture

or under any regulation of a Local Authority, a sheep owner may use any sheep dip which bears a label to the effect that it has been approved by the Minister of Agriculture for that purpose. Some 306 sheep dips have been approved, of which 222 are non-arsenical. An owner has, therefore, a wide range of choice, and there is no compulsion upon him to use an arsenical dip if he does not wish to do so. Where an arsenical dip is used for both dippings, however, the Ministry approves the use of such dips at half-strength for the second dipping, which must take place not earlier than the tenth and not later than the fourteenth day after the first dipping.

* * * * *

It is announced that an application for an Order-in-Council under the Merchandise Marks Act, to require the marking with an indication of origin of imported rose trees, has been referred for inquiry to the Standing Committee set up under the Act by the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department, and the Secretary of State for Scotland, acting jointly.

Attention is called to the fact that, under the provisions of the Act, while the Committee in every case referred to them must consider whether the goods should bear the indication of origin at the time of sale or exposure for sale, they may also, at their discretion, consider and report upon the question whether such goods should bear an indication of origin at the time of importation.

The date of the inquiry in this case will be announced later. Any communication with regard to the matter should, however, be addressed, as early as possible, to Mr. H. J. Johns, the Secretary of the Standing Committee, 10 Whitehall Place, London, S.W.1.

* * * * *

It is desirable that it should be more generally known that a scheme is in existence whereby persons who wish to receive the Ministry's leaflets as issued may do so on payment of a nominal registration fee. In order to extend the scope of this useful service the Ministry has recently approved a reduced scale of registration fees.

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 Domestic Live Stock (Poultry, Rabbits, Bees, Goats, etc.).
- (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 leaflets only,	per annum
(1) Of any one or two of the above groups ..	6d.
(2) Of any three or of all four groups ..	1s.
To receive both new and revised leaflets,	
(1) Of any one or two groups ..	2s.
(2) Of any three or of all four groups ..	3s.

It is hoped that a largely increased number of readers will take advantage of the facilities now offered.

* * * * *

THE Ministry of Agriculture and Fisheries recently instituted proceedings under the Merchandise Marks Act, 1887, against a dealer in Kent for applying a false trade description to a quantity of rose trees.

Sale of Foreign This firm had been extensively advertising

Rose Trees as guaranteed "English-grown" rose trees

English Grown in the Sunday and gardening papers during the season. A small quantity of trees purchased by an Inspector of the Ministry proved, however, to be typical Dutch produce. The defendant admitted that the rose trees purchased by the Ministry were Dutch, but claimed that he supplied English-grown roses when they were specifically asked for. Evidence was brought by the Ministry to show the large number of cases of Dutch roses that had been imported by the defendant during the season. The Bench eventually imposed a fine of £10 and costs amounting to £22.

* * * * *

THE Ministry's Electro-Culture Committee has recently issued its 9th and 10th Interim Reports, which deal with the results of the experimental work carried out, in accordance with the Committee's programme, in the years 1926 and 1927 respectively. Copies of these reports may be obtained on application to the Secretary to the Electro-Culture Committee, 10 Whitehall Place, S.W.1.

AN INTERESTING WEST RIDING FARM

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ONE of the most interesting of the 88 Yorkshire farms whose accounts have, for some years, been supervised through the Department of Agriculture of the University of Leeds, is that to which has been given the code designation of W.M.C.5.

It is a mixed farm of 150 acres, 68 per cent. of which is under grass, and is situated on the coal measure soils in the industrial area of the West Riding. As far as stock are concerned it concentrates, like other farms similarly situated, mainly on milk and pork production, and, with the single exception of potatoes, grows its crops mainly for consumption on the holding.

From an economic point of view, the farm is of interest from the fact that during the period of agricultural depression through which the industry has been passing, it has uniformly been well able to hold its own, leaving a surplus, after meeting all direct and overhead charges,

In 1921-22 of £35 per 100 acres, or of	3.1 per cent. on the capital.
In 1922-23 of £87	8.0
In 1923-24 of £160	14.0
In 1924-25 of £262	23.0
In 1925-26 of £197	16.0
In 1926-27 of £165	14.0

These financial results are in marked contrast to the average of the whole of the farms under investigation, which showed deficits in 1921-22 of 18 per cent. and in 1922-23 of 11 per cent. of the capital invested; while in not one of the six years mentioned has the average return been equivalent to what could have been obtained by investing the farm capital in trustee stock.

It must, however, be remembered that this farm is not a normal or average farm. From its geographical position the markets are, or ought to be, good, for the purchasing population is near at hand, and the holder is concentrating mainly on products which should give him quick sales and a high capital turnover. It is still more interesting from the fact that a study of its records shows it to be a well balanced holding, the management of which leaves little cause for complaint from whatever angle it is viewed.

The chief interest, however, lies in the ingenuity, skill and adaptability shown by the holder. Coming some years ago from the East Riding of Yorkshire to the industrial area of the West, he brought with him that love of stock, and more

particularly of young stock, which is so typical of the area in which he had been bred. The problem he had to face consisted mainly in finding the direction along which that love could be developed on the soundest lines of financial success.

In the heart of an industrial area, with a good market at his door, he quickly realized the possibilities of the milk industry. At heart and by instinct a breeder, and recognizing the difficulties of rearing and breeding in that locality, he first turned his attention to the improvement of his grassland; then to finding a breed of cattle which would successfully put up a fight against adverse atmospheric and climatic conditions. The effect of lime and slag has been most marked on the pastures.

The Cattle.—A very successful herd of Welsh cattle has been got together, which, though not heavy milkers, have still milked well and been kept cheaply, so that the cost of milk production has always been well below the normal for the district. Welsh cattle in a district like this undoubtedly have their good points; they are hardy, can apparently withstand adverse climatic and atmospheric conditions, are remarkably free from tuberculosis, can be kept in condition with a minimum expenditure on foodstuffs, and apparently always keep themselves well covered. Further, the richness of their milk in butter fat is a point which should not pass without comment, as it has certainly proved a factor of importance when the milk contracts were being made. On the other hand, they are not the heaviest of milkers, though the records of this particular herd leave little cause for complaint in this direction.

The following comparison of the average annual food consumption per head over a period of six years in this herd, and in all the other Yorkshire herds under investigation, should not be without interest:—

	W.M.C.5	Average of all Yorkshire herds
Grazing	1.72 acres	1.5 acres
Forage crops	0.06 "	0.08 "
Hay	14 cwt.	20 cwt.
Straw	8 "	15 "
Roots	65 "	71 "
Concentrates	20 "	24 "

The low cost of upkeep of the cows has been mainly due to the smallness of the food bill, and to the fact that depreciation in the herd has been kept at a minimum.

On this farm the cows have been kept cheaply, the milk has been produced cheaply and sold in a good market, so that

RECORDS OF DAIRY HERD.

	1921-22	1922-23	1923-24	1924-25	1925-26	1926-27
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
COST OF UPKEEP PER COW PER YEAR—						
Grazing and Forage Crops ..	6 11 3	6 6 9	5 18 8	4 9 11	4 12 11	4 5 6
Hay and Straw ..	3 1 1	2 16 11	4 5 1	4 2 1	4 0 6	4 3 3
Roots ..	6 14 11	4 18 9	4 15 6	4 5 9	3 8 8	2 13 5
Concentrates ..	11 17 9	13 13 9	10 11 10	9 15 8	12 11 8	11 1 7
TOTAL FOOD ..	28 5 0	27 16 2	25 11 1	22 13 5	24 13 9	22 3 9
Depreciation ..	5 5 1	3 11 11	1 9 1	0 7 9	0 12 10	0 2 6
Incidentals ..	2 10 3	2 17 8	1 12 11	1 18 11	1 15 3	1 17 0
Labour ..	13 1 2	10 17 2	9 2 9	8 5 5	9 3 4	9 8 0
Gross Cost ..	49 1 6	45 2 11	37 15 10	33 4 7	36 5 2	33 11 3
Less Manure ..	3 11 2	2 18 3	2 0 8	1 15 6	1 16 8	1 18 0
Less Calves ..	1 16 1	1 18 0	1 14 0	1 5 7	1 10 0	1 15 0
NET COST ..	43 14 3	40 6 8	34 1 2	30 3 6	32 18 6	29 18 3
Annual average Milk Yield per Cow (gal.) ..	636	584	546	554	545	544
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Cost of Milk Production per gal. ..	1 7 1/2	1 4 3/4	1 3	1 1	1 2 1/2	1 1 1/4
" " Selling Price per gal. ..	2 3 1/2	1 8	1 8	1 7	1 7	1 6
" " Profit per Cow ..	15 8 4	7 8 6	11 13 5	13 16 0	9 16 2	10 14 6

the margin of profit per cow and per gallon of milk produced has been high in both cases. The milk yield, however, though far from low, has not been as high as one would have liked.

Pigs.—Undoubtedly, the most interesting feature of the farm is the management of the pigs. An excellent breeding herd of pedigree Large Blacks has been built up. The pigs are mainly kept on an old pit tip which makes an excellent run from which they seem to pick up the minerals they require, and they use for shelter an old engine house near the original old pit shaft. They are dry fed, when running outside, though no dry feeder is being used, the food being scaled to them on to the ground so that the rations fed can be strictly limited. The dry feed is changed to wet when the stores are brought inside for finishing.

The sows are prolific and good mothers, last year dropping and rearing 15 piglets per head. They run outside with their litters, farrowing down in the old engine house from which they have an open run to the pit tip. The youngsters are weaned at 10 weeks, run on as stores outside, winter and summer alike, for another six or eight weeks, when they are brought in to finish, being got off as pork at about 24 weeks old at from 8 to 10 stone dead weight. Last year

85	per cent.	of the pigs sold	went as	pork
10	"	"	"	breeding gilts
3	"	"	"	young boars
2	"	"	"	either old boars or

sows were disposed of as fat pigs.

The sows, after the youngsters have been weaned, are run with the boar outside at grass, when they are kept cheaply on a ration of approximately 3 lb. per head per day during the summer months and 4 lb. during the winter.

Fencing costs have been practically non-existent, as most of the grass fields are bounded by stone walls, in the corners of which improvized shelters have, where necessary, been cheaply erected.

The output of pork has been high, averaging last year no less than £83 0s. 9d. per breeding sow. The cost of upkeep has been low, averaging £46 10s. 10d. for each sow with her two litters, leaving a net surplus of £36 9s. 11d. per breeding sow, or 79 per cent. of the cost of upkeep. The ration fed has apparently been well balanced, 5 per cent. of the concentrates consumed being rich in protein. The foods have been bought at an average cost of 10s. 4d. per cwt. and the ratio of the "cost of the food consumed" to the "value of pork produced"

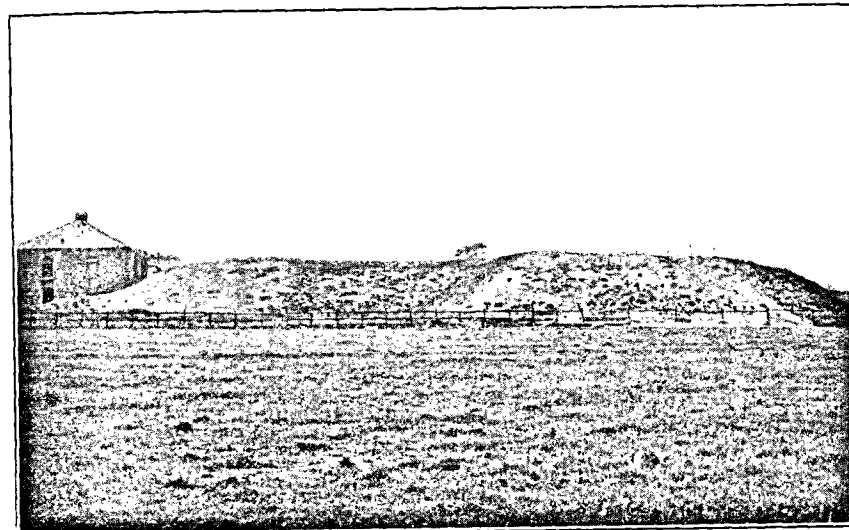


FIG. 1.—Pit tip on which the pigs are run.

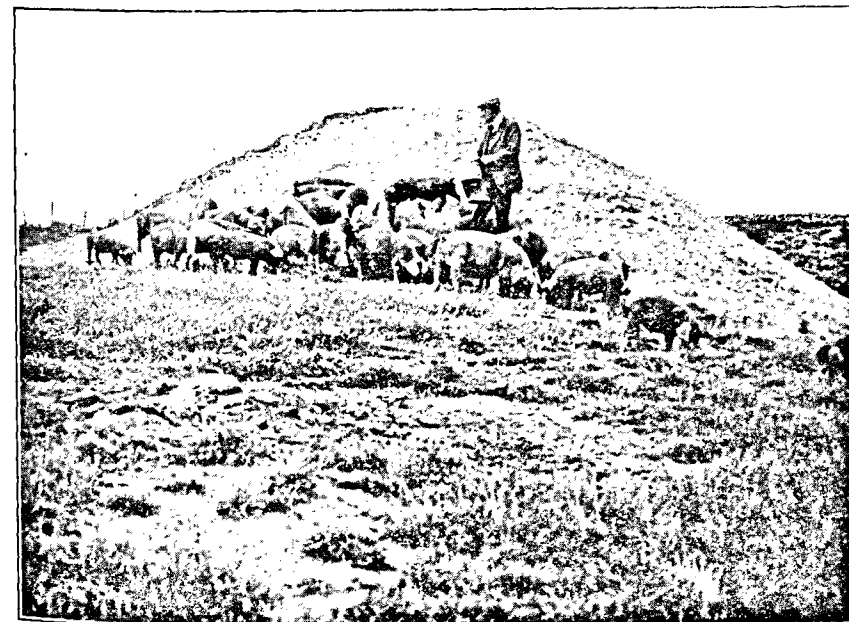


FIG. 2.—Showing method of feeding pigs, and gradual covering of the tip with grass.

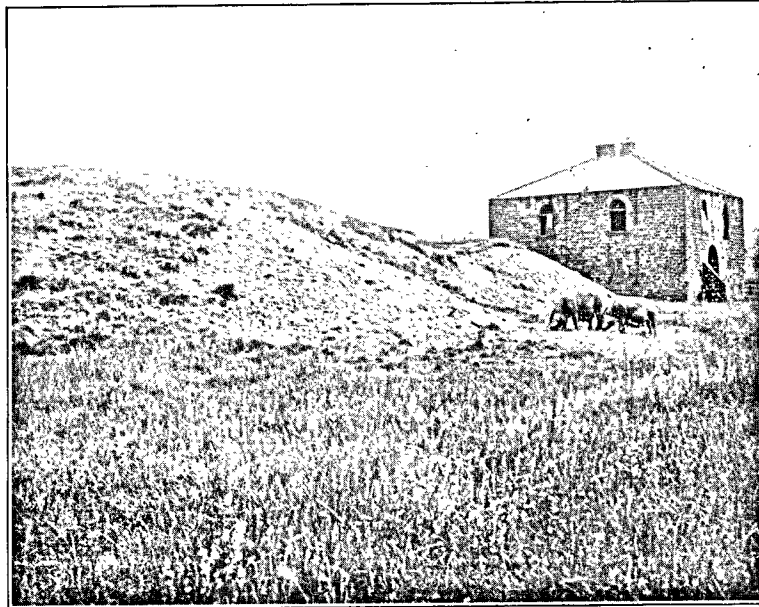


FIG. 3.—Showing shelter which two breeding sows have just vacated, leaving the suckers still inside.

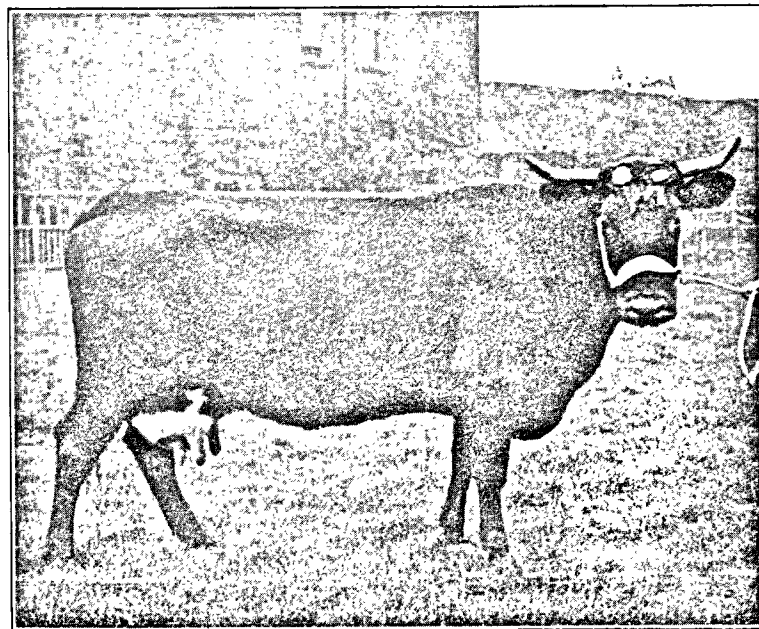


FIG. 4.—One of the Welsh Blacks. Milk yield last year, as second calver, 924 gal. Butter fat, 4.4 per cent.

has worked out at 100/178, one of the highest ratios met with by the writer, who knows few herds of pigs which have been better managed or which have left higher financial returns.

More detailed information as to the feeding and management of the herd can be obtained from a study of the pig account for the year 1926-27.

PIG ACCOUNT, 1926-27

Valuation, April, 1926				Valuation, April, 1927			
		£	s. d.			£	s. d.
9 Sows ..	..	90	0 0	8 Sows..	..	80	0 0
1 Boar ..	..	10	0 0	2 Gilts ..	..	12	0 0
54 Porkers ..	..	261	0 0	1 Boar..	..	10	0 0
35 Suckers ..	..	70	0 0	53 Porkers ..	..	246	0 0
				43 Suckers ..	..	86	0 0
		£431	0 0			£434	0 0
PURCHASED—				SALES—			
1 Boar ..	..	6	10 0	May 10 Porkers	70	0 0	
FOODSTUFFS—				June 8 Porkers	57	3 1	
	t. c.			„ 8 Gilts ..	44	10 1	
Grazing 6½ acres		16	16 2	July 19 Porkers	104	13 6	
Straw ..	1 10	2	11 0	„ 3 Gilts ..	19	10 0	
Chat potatoes	4 0	6	0 0	Aug. 4 Porkers	24	3 0	
Wheat (H.G.)	0 14	9	0 10	„ 2 Gilts ..	12	0 0	
Sharps ..	19 9	180	19 0	Sept. 15 Porkers	86	5 0	
Indian corn ..	14 17	147	4 6	Oct. 1 Old boar	6	0 0	
Barley meal ..	3 0	33	0 0	„ 6 Porkers	39	0 0	
Wheat ..	0 9	6	1 9	Nov. 12 Porkers	89	7 10	
Maize ..	0 4	1	19 0	Dec. 28 Porkers	138	1 0	
Uveco ..	0 2	1	4 0	„ 1 Fat sow	10	0 0	
Vitamealo ..	0 15	15	3 10	1927			
Gromax ..	0 15	14	19 6	Mar. 5 Strong			
Fish meal ..	0 8	8	4 0	stores	17	3 0	
Cod liver oil ..	..	0	14 0	Apl. 12 Porkers	73	1 0	
SUNDRIES ..	..	7	0 0	Service fees ...	1	9 0	
LABOUR—				Manurial value of	40	0 0	
Man ..	..	26	16 5	foods consumed			
Horse ..	..	4	8 4				
PROFIT ..	..	346	14 2				
		£1,266	6 6			£1,266	6 6

In the year 1926-27, therefore, the average cost of maintaining a breeding sow, and getting off her litter largely as porkers at about 24 weeks old, worked out at £46 10s. 10d. per head. The pigs on the farm at the beginning of the financial year were valued at £431, and one boar was bought in during the year at a cost of £6 10s. 0d. The money realized from service fees and the sales of pigs during the year amounted to £792 6s. 5d., while pigs on the farm at the end of the year were valued at £434; so that the monetary value of the pig meat produced on the farm during the year, mainly in the

SUMMARY OF COSTS (9½ Breeding sows)

	Total			Per breeding sow and litter		
	£	s.	d.	£	s.	d.
Grazing ..	16	16	2	1	15	6
Straw ..	2	11	0	0	5	4
Potatoes ..	6	0	0	0	12	8
Concentrates ..	418	10	5	44	1	0
TOTAL FOOD	443	17	7	46	14	6
Sundries ..	7	0	0	0	14	9
Labour ..	31	4	9	3	5	9
GROSS COST..	482	2	4	50	15	0
Less manure	40	0	0	4	4	2
NET COST ..	442	2	4	46	10	10

form of pork, amounted to £788 16s. 5d., leaving a net profit of £346 14s. 1d., or £36 9s. 11d. per breeding sow, or 79 per cent. of the production costs.

	Total			Per breeding sow and litter		
	£	s.	d.	£	s.	d.
Output of pig meat ..	788	16	5	83	0	9
Production costs	442	2	4	46	10	10
SURPLUS ..	346	14	1	36	9	11

Surplus as percentage of production costs = 79 per cent.

The herd is noteworthy, partly because of the novel and unusual lines upon which it is run, but still more because its records illustrate so well many of the economic points which one has learnt to associate with a breeding herd of pigs on the farm.

One of the handicaps with which the farming industry as a whole has to contend is the fact that its capital turnover is small, largely because :—

- (1) as far as crops are concerned the farmer has for sale the produce of one crop each year from a given acreage; and
- (2) that the farm, and more especially the arable farm, has to carry a dead weight of a very large proportion of non-productive capital in the form of dead-stock, implements and equipment.

The result is that on the average, as far as our records show, less than 90 per cent. of the farm capital is turned over during the year. The farming industry needs quicker sales and a higher capital turnover, and these needs the breeding sow can supply, possibly to a greater extent than anything else. Certainly it has done so on this farm; for, over a period of six years, each breeding sow, valued on the average at £10 9s. 0d., has dropped and reared 14 pigs per annum, the

annual sales of which have realized £75 6s. 6d., approximately 7½ times her own value.

A breeding herd of pigs can be built up quickly and at very little expense, for starting with a nucleus of 3 gilts on May 1, 1921, within less than three years, a herd of 10 breeding sows had been got together with the purchase of only one additional young boar to prevent in-breeding. It is this aspect of pig-keeping which should appeal so strongly either to the small-holder who wants ready money, or the man who has started farming handicapped through lack of capital.

In spite of the fact that pigs are said to be "muck or money," they should be "money" every time to the man who, having adopted the system which is best adapted to his local conditions, local requirements and local markets, follows that system right through, modifying it perhaps with widening experience, but not changing it, as is frequently done from year to year.

With all the variations in the price of pork during these six years, the pigs on the farm left :—

	£	s.	d.
in 1921-22 a profit of	5	8	2
in 1922-23 a profit of	24	6	1
in 1923-24 a profit of	226	5	10
in 1924-25 a profit of	171	4	5
in 1925-26 a profit of	406	13	1
in 1926-27 a profit of	346	14	1

giving a total profit of £1,180 11 8 or

an average profit of £200 a year, equal to £26 4s. 9d. per breeding sow each year, or more than 2½ times its original value.

During these six years, 201 tons 11 cwt. of concentrates have been consumed by the pigs, at a total cost of £2,206 7s. 0d., or an average cost of 10s. 11d. per cwt.

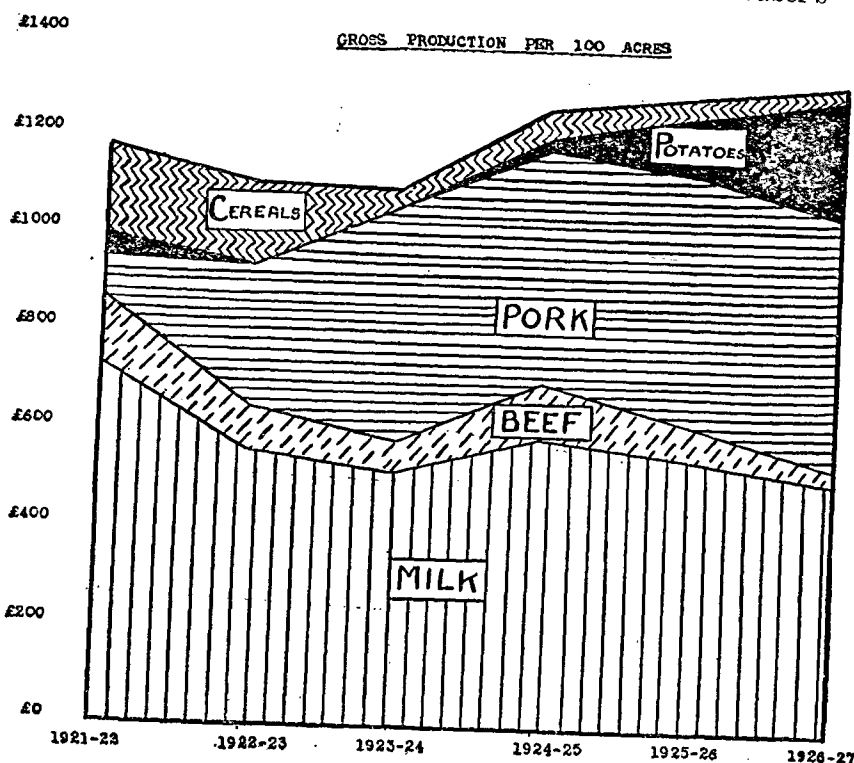
The margin shown in the financial returns from this breeding herd of pigs, which has produced pork to the value of £168 for every £100 spent on concentrates, makes it unlikely that, in the near future, given a continuance of good management, the keeping of pigs will become unremunerative through a fall in the price of pork. Still less is this to be apprehended since the bacon factories of the country are now beginning to compete with the pork market as an alternative outlet for the disposal of the produce.

Cows and Pigs Compared.—The relative economic importance of the cows and pigs on this farm can possibly best be brought out by a study of the records of 1925-26. In that year

Cows : The initial valuation of the cows was ..	£ 464
Their cost of upkeep	575
Giving a total monetary outlay of	1,039
The sales of milk during the year were ..	771
Leaving a profit of	196
or 19 per cent. on the total capital invested.	£
Pigs : The initial valuation of the pigs was ..	395
Their cost of upkeep	377
Giving a total monetary outlay of	772
The sales of pork during the year were ..	783
Which left a net profit of	406
or 48 per cent. on the capital invested.	£

Yet this profit of £406 was made by the pigs using land which had previously been regarded as useless.

Output.—Looking at the farm as a whole it will be seen that the first essential of success—a high output—has been obtained throughout the whole period. The output or production has been uniformly high, well above Faber's



estimated output for Denmark, and 50 per cent. higher than that shown on the average of the 88 commercial farms whose accounts are under observation at Leeds University. Further, in spite of the general drop in prices of agricultural products during the period, there has been a general tendency for the money value of the output to increase.

The varying relative proportions of the output in successive years, which can be readily followed in the accompanying diagram, are not without significance, as they afford an excellent illustration of the adaptability of the farmer to changing economic conditions.

Thus, of the total output :—

Cereals formed in 1921-22	16 per cent.	and in 1926-27	2 per cent.
Beef	"	"	"
Milk	"	"	"
Pork	"	"	"
Potatoes	"	"	"

Apparently there can be little cause for complaint in the output from the farm on the acreage basis.

High production however, though essential to success, does not assure it, for high production, if the most is to be made of it, must be accompanied by low production costs and a minimum capital outlay.

1925-26 RESULTS

Gross production	W.M.C. 5	Average of all Yorkshire farms
	£	£
Per 100 acres	1,288	832
Per £100 total production costs	118	108
Per man employed	496	329
Per £100 spent on labour ..	413	320
Per £100 paid in rent	1,020	660
Per £100 spent in raw materials	248	310
Per £100 spent in general expenses	1,000	658
Per £100 capital invested ..	109	62

A study of the above table will make it quite clear :—

- (1) that the organization of the labour leaves little to be desired ;
- (2) that the land is not too heavily rented, and that the most effective use is being made of it ;
- (3) that the capital invested in the holding is well invested and should be leaving a good financial return ;
- (4) that the non-productive expenditure is being watched carefully and cut down to the lowest possible limit compatible with efficiency ; but
- (5) that the monetary outlay on raw materials, most

probably on purchased foodstuffs, does need closer investigation, being influenced possibly by the fact that owing to lack of storage accommodation on the holding, these are at present being bought in small quantities; and possibly also by the fact, already referred to, that the milk yield of the cows might with advantage be higher.

Finally, high production at low costs must be accompanied by good salesmanship, so that what has been produced in large quantities cheaply, may be disposed of to the best advantage—an essential which has certainly not been lost sight of.

* * * * *

SOME SUGAR BEET COSTS

THE HON. E. G. STRUTT, C.H., and W. GAVIN, C.B.E., M.A.

THE processes of farming are continuous, and though, from season to season, certain produce is sold off the farm, or consumed, there are many unassessable factors at work bridging one period with another or one branch of production with another, making the determination of the cost of any particular crop dependent on a number of arbitrary and approximate estimates.

At the present time, however, it is of great importance to many of us to gain all the information we can regarding sugar beet, and to this end the more estimated costs that are available the better. Two Reports have already been published* giving analysed costings of a number of crops grown in 1924 and 1925, to be followed, we understand, by further reports from the same investigators, Messrs. A. Bridges and R. N. Dixey, dealing with later years. Since these will necessarily take some months to prepare, it may, perhaps, be of interest to give, meanwhile, the results obtained on a few farms in the Eastern Counties, especially as sugar beet has now been grown on some of them for several years in succession.

The farms in question are the property of Lord Rayleigh and of Strutt and Parker (Farms) Ltd. They are all situated on the boulder clay overlying London clay, with the exception of one farm (Lavenham) which is on boulder clay overlying chalk. They show, however,

* *Sugar Beet: Research Monograph No. 3.* Ministry of Agriculture and Fisheries. Post free, 1s. *Sugar Beet: Costs and Returns for 1925-6.* Agricultural Economics Research Institute, Oxford. Price 2s. 6d.

considerable range of texture, varying from medium-heavy to medium-light. They would probably all fall within Soil-Groups I of Bridges and Dixey's classification in the Reports already mentioned, and they all lie within the same writers' District-Group II.

The methods of costing followed are generally in accord with the principles adopted by advisory economists (see Report No. 4, Farm Economics Branch, School of Agriculture, Cambridge, p. 4) with two notable exceptions.*

Table I gives a general summary in the same form as that adopted in Bridges and Dixey's Reports, the averages being weighted on an acreage basis (see overleaf).

Details of the figures averaged in Table I are given in Appendix A, where also the labour costs have been subdivided under manual, horse and machinery. Before discussing them it may be well to present an alternative analysis of costs by operations, instead of by expenditure headings. This is given for every field in Appendix B, and summarized in Table II. The figure for manures is a net one, after allowing an addition or deduction, as the case may be, for residual values. The cost of farmyard manure (at 5s. per load) is spread over three years, but all artificials and all costs of spreading farmyard manure are charged to the crop to which they are applied. In a few cases a small charge for lime residues has been brought in, and is spread over five

* (a) Establishment and overheads are charged at a uniform figure of £1 2s. 0d. per acre instead of being allocated in proportion to the man-labour expended. Since sugar-beet involves a large amount of hand-labour, this system tends to favour the crop. This is offset, however, by the fact that the charge under this head is perhaps higher than that incurred on many smaller farms where more of the supervision and management is performed by the farmer himself, and, consequently, does not appear amongst the expenses. (b) The charge for horse-labour, including implements, in the present costings is varied from time to time throughout the year according to the demand and assumed value of the work done. Immediately harvest is completed, the charge is 6s. per day per horse, and this extends to the close of the autumn drilling season. Some time in November (according to weather conditions) the charge is dropped to 4s., and about Christmas to 3s. per day. When spring cultivations commence in February it rises again to 4s., and from March to mid-May is 6s. On completion of root-drilling it falls again to 4s., and remains at that figure until corn-harvest when 5s. is charged. The sum total of all these charges has been found, over a number of years, to coincide very closely with the total annual cost of the horses and the implements they use. In order, however, that exact comparisons may be possible between the present figures and other costings, the actual number of horse-days worked has been recorded for each field in Appendix A (see pp. 331-333).

TABLE I.—SUMMARY OF COSTS UNDER EXPENDITURE HEADINGS

Year of Crop	1924	1925	1926	1927
No. of costs	1	3	11	11
Acres	10	23	118	87
PER ACRE	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Labour (men, horses and machinery) ..	12 6 7	13 4 4	14 4 6	14 8 11
Farmyard manure ..	3 18 9	2 15 3	2 13 2	2 12 10
Artificial manure ..	2 16 3	3 2 11	3 13 5	2 17 8
Seed	0 8 9	0 8 1	0 7 3	0 7 10
Rent and rates ..	1 13 0	1 16 5	1 18 6	1 17 6
Other expenses ..	1 2 0	1 2 0	1 2 0	1 2 0
PRODUCTION ..	22 5 4	22 9 0	23 18 10	23 6 10
Transport (rail or lorry) ..	4 9 0	3 3 7	3 6 10	2 13 10
GROSS EXPENSES	26 14 4	25 12 7	27 5 8	26 0 8
GROSS RECEIPTS	27 13 10	28 6 11	31 8 8	20 11 1
Manurial residues ..	0 19 6	2 14 4	4 3 0	-5 9 7
	2 12 6	0 18 7	1 7 3	1 3 2
PROFIT	3 12 0	3 12 11	5 10 3	—
Loss	—	—	—	4 6 5
YIELD OF WASHED BEET PER TON	Tons 9.25	Tons 10.61	Tons 9.80	Tons 7.29
PRODUCTION ..	£ s. d. 2 8 2	£ s. d. 2 2 4	£ s. d. 2 8 10	£ s. d. 3 4 0
Transport (rail or lorry) ..	0 9 7	0 6 0	0 6 10	0 7 5
GROSS EXPENSES	2 17 9	2 8 4	2 15 8	3 11 5
GROSS RECEIPTS	2 19 10	2 13 5	3 4 2	2 16 5
Manurial residues ..	0 2 1	0 5 1	0 8 6	-0 15 0
	0 5 8	0 1 9	0 2 9	0 3 2
PROFIT	0 7 9	0 6 10	0 11 3	—
Loss	—	—	—	0 11 10

years. Charges for steam ploughing are standardized at 20s. per acre ploughed, inclusive of coal and labour (except man and horse to cart coal and water) and for tractor work as follows: ploughing, 15s. per acre; subsoiling, 10s. per acre; cultivating, 4s. per acre; harrowing or rolling, 2s. per acre; all exclusive of labour.

In summarizing these results for Table II, the figures have not been weighted on an acreage basis (as in the previous table) but a simple average of the fields has been taken. It is fair to mention that one of the best farms (Lavenham)

is not included in the 1927 costings, thus making the results for that year considerably worse than they otherwise would have been. A rough calculation indicates that their inclusion would have reduced the average loss by about £1 per acre,

TABLE II.—SUMMARY OF COSTS UNDER OPERATIONS HEADINGS

Year of Crop	1924	1925	1926	1927
No. of costs	1	3	11	11
Acres	10	23	118	87
OVERHEADS :—	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Rent, rates and overheads	2 15 0	2 19 0	2 19 3	2 19 11
MANURES and spreading	5 2 9	5 16 9	5 16 11	5 2 7
PREPARATORY CULTIVATIONS ..	2 16 10	3 16 9	3 5 2	3 8 5
	10 14 7	12 12 6	12 1 4	11 10 11
GROWTH OF CROP :—				
Horse hoeing ..	0 15 3	0 8 8	0 10 3	0 10 4
Singling and hand-hoeing ..	2 2 7	2 12 6	2 13 5	3 2 7
Headlands, weeding, etc. ..	0 1 8	0 1 2	0 1 10	0 2 1
	13 14 1	15 14 10	15 6 10	15 5 11
HARVESTING :—				
Ploughing out ..	0 9 3	0 10 4	0 16 8	0 17 10
Pulling and topping	3 2 6	3 10 2	3 9 3	3 5 8
TRANSPORT :—				
Carting ..	2 7 0	1 16 4	2 4 8	2 7 11
Rail or lorry ..	4 9 0	3 5 6	3 10 8	2 14 10
TOTAL COSTS ..	24 1 10	24 17 2	25 8 1	24 12 2
TOTAL RECEIPTS ..	27 3 10	28 12 3	30 18 7	20 13 4
PROFIT	3 12 0	3 15 1	5 10 6	—
Loss	—	—	—	3 18 10
YIELD OF WASHED BEET	Tons 9.25	Tons 10.73	Tons 9.70	Tons 7.35
SUGAR CONTENT, per cent... ..	18.2	17.1	18.4	16.5

Most of the individual items show remarkably close conformity with those calculated by Bridges and Dixey, as is shown in Table III (see overleaf).

The only marked difference is that very much more appears to have been spent on manures on the farms under consideration, and less has been carried forward as manurial residues.

TABLE III.—COMPARISON OF PRESENT DATA WITH BRIDGES AND DIXEY'S

	Present Data (1) 1924-7	Bridges and Dixey 1925
	£ s. d.	£ s. d.
Overheads, rent, rates and sundries	2 18 4	3 15 3 (2)
Manures (without labour), gross total	6 2 4	4 0 3 (2)
Preparatory cultivations ..	3 6 9	2 18 1 (2)
Horse hoeing	0 11 1	0 11 3 (3)
Singling and hand-hoeing ..	2 12 9	2 5 10 (4)
Ploughing out	0 13 6	0 12 1 (5)
Pulling and Topping	3 6 11	3 6 4 (2)
Carting from field	2 4 0	—
Transport : rail or lorry ..	3 10 0	3 12 9 (2)
Total receipts per acre ..	28 6 11 (6)	28 2 6 (2)
Manurial residues credited	1 10 4	3 0 8 (2)

(1) Average of four annual averages (unweighted for acreage).
 (2) Medium-heavy soils. (3) All farms. (4) Thirty-six farms. (5)
 Nine medium and heavy farms. (6) 1925 only.

It would also appear that the singling and hand-hoeing has not been done as economically as possible—a typical lesson to be learnt from these cost comparisons. Total labour costs compare as follows :—

Year	Present Data	Bridges and Dixey (2)
	£ s. d.	£ s. d.
TOTAL COST OF LABOUR	1924 12 6 7	11 13 10
(including men, horses	1925 13 4 4	12 13 6
and machinery)	1926 14 4 6	—
	1927 14 8 11	—

It appears, then, that on these farms the cost of growing beet for the last four years has averaged round about the following figures :—

	£ s. d.
Preparatory cultivations, rent, rates, manures, overheads and sundries	11 15 0
Work on growing crop	3 5 0
Ploughing out, pulling and topping	4 0 0
Transport from field to factory	5 15 0
Total	£24 15 0

The receipts have averaged £27.

Now the grower has to face, in the present season, a reduction in receipts of 8s. per ton (less any benefit that may accrue to him from the modification in the scale of payment for sugar content). Can we continue to grow the crop at this price ?

On the above figures it looks doubtful, but in interpreting them the following points must be borne in mind:—

- (1) That the soil on many of these farms is by no means ideally suited for the crop.
- (2) That last year was admittedly an exceptionally bad one for the crop. If it is omitted from the above figures, the receipts average £29 per acre instead of £27. The yield of washed beets fell from 9·8 tons in 1926 to 7·35 tons in 1927. The estimated figures for the whole country, as published in the Ministry's Agricultural Market Report for March 16, 1928, were as follows :—

	1926	1927
Yield per acre ..	8½ tons	6½ tons
Sugar content ..	17·33%	16·13%
Dirt tare ..	15 lb. per cwt.	20 lb. per cwt.

In addition to this, the cost of keeping a smaller crop clean was increased by 10s. per acre through the unfavourable weather.

- (3) That the above costs for labour should be capable of reduction.
- (4) That costs for both manuring and transport are higher than would be necessary in many parts of the country.
- (5) That no credit has been taken for the value (feeding or manurial) of the tops and leaves which yield some 5 tons per acre. Bridges and Dixey estimate their value as follows :—
 65s. per acre when carted to stock.
 48s. „ „ fed on the land.
 36s. „ „ ploughed in for manure.

- (6) That the growing of sugar beet is without doubt an admirable preparation for other crops.
- (7) That the value of any crop to the farm as a whole cannot be entirely judged on the costings of that particular crop. Such costings must be compared with the crop for which it has been substituted, and this is most commonly potatoes or mangolds. Potatoes are a speculative and highly variable crop, with which any direct comparison is difficult. Mangolds, however, present many similar features, though by reason of shallower rooting their effect on the land is not quite so advantageous.

Comparison with Mangolds.—With regard to paragraph (7) above, it is possible to compare the cost of sugar beet and mangolds in the same season, and on the same farm, in many of the present cases, and Table IV gives a summary of nine such comparisons. The costings are weighted on an acreage basis. The item termed “harvesting,” in the case of sugar beet, includes pulling, topping and carting from the field to the lorry, farm or station ; in the case of mangolds, it includes pulling, carting to the clamp, making clamp and earthing up. Thus the “total” figures in this table represent on the one hand the sugar beet loaded on lorry or railway truck ready for despatch to factory, and on the other hand the mangolds earthed up in the clamp.

TABLE IV.—COMPARISON OF COSTS OF GROWTH OF SUGAR BEET AND MANGOLDS

<i>Farm and Year</i>	<i>Sugar Beet</i>	<i>Mangolds</i>
LANGFORD : 1925	(10 acres)	(9 acres)
	£ s. d.	£ s. d.
Preparatory cultivations, rent, rates, manures and overheads	13 2 5	13 11 2
Work on growing crop	2 4 1	2 18 9
Harvesting	5 18 1	2 9 3
Total	21 4 4	18 19 2
Yield	9.2 tons	25 tons
LANGFORD : 1926	(8 acres)	(8 acres)
	£ s. d.	£ s. d.
Preparatory cultivations, rent, rates, manures and overheads	12 7 0	13 4 7
Work on growing crop	3 11 9	3 14 10
Harvesting	7 9 8	1 6 6
Total	23 8 5	18 5 11
Yield	7 tons	20 tons
LANGFORD : 1927	(14 acres)	(9 acres)
	£ s. d.	£ s. d.
Preparatory cultivations, rent, rates, manures and overheads	11 16 5	13 14 10
Work on growing crop	4 2 2	3 3 1
Harvesting	6 2 5	3 5 11
Total	22 1 0	20 3 10
Yield	7.65 tons	25 tons
LAVENHAM : 1925	(13 acres)	(12 acres)
	£ s. d.	£ s. d.
Preparatory cultivations, rent, rates, manures and overheads	12 7 1	12 4 9
Work on growing crop	3 11 6	2 2 0
Harvesting	5 15 7	2 13 8
Total	21 14 2	17 0 5
Yield	11.7 tons	19.5 tons
LAVENHAM : 1926	(40 acres)	(38 acres)
	£ s. d.	£ s. d.
Preparatory cultivations, rent, rates, manures and overheads	12 8 2	12 3 11
Work on growing crop	3 2 8	3 13 0
Harvesting	5 9 1	2 9 1
Total	20 19 11	18 6 0
Yield	10.3 tons	25 tons

STOCKS : 1926	(5 acres)	(5½ acres)
	£ s. d.	£ s. d.
Preparatory cultivations, rent, rates, manures and overheads	12 9 0	11 8 2
Work on growing crop	3 15 10	2 18 1
Harvesting	4 8 9	1 18 10
Total	20 13 7	16 5 1
Yield	9.3 tons	17 tons
FARDINGS : 1927	(12 acres)	(14 acres)
	£ s. d.	£ s. d.
Preparatory cultivations, rent, rates, manures and overheads	11 16 4	14 7 0
Work on growing crop	3 12 5	2 7 6
Harvesting	8 8 0	3 15 3
Total	23 16 9	20 9 9
Yield	8.0 tons	17.6 tons
TERLING HALL : 1927	(12 acres)	(11 acres)
	£ s. d.	£ s. d.
Preparatory cultivations, rent, rates, manures and overheads	12 13 7	12 4 8
Work on growing crop	3 16 4	3 5 7
Harvesting	6 7 3	1 10 0
Total	22 17 2	17 0 3
Yield	8.5 tons	22.7 tons
FAIRSTED : 1927	(5 acres)	(15 acres)
	£ s. d.	£ s. d.
Preparatory cultivations, rent, rates, manures and overheads	11 17 3	14 19 1
Work on growing crop	4 7 8	3 6 10
Harvesting	8 11 0	2 4 10
Total	24 15 11	20 10 9
Yield	7.25 tons	22 tons

These comparisons show at a glance that up to the time of harvesting there is little difference in cost between the two crops. Preparatory cultivations, rent, rates, manures and overheads average £12 6s. 4d. for sugar beet and £13 2s. 0d. for mangolds. By the time the roots are ready for lifting the sugar beet crop has cost £15 18s. 0d. per acre, and mangold, £16 3s. 0d.* It is from this time onward that the costs differ so greatly, as is shown in the following table (per ton = per ton *washed* sugar beet) :—

* These figures are a simple average of the costs given in Table IV, and have not been again weighted for acreage.

TABLE V.—COMPARATIVE COSTS OF HARVESTING AND TRANSPORT :
SUGAR BEET AND MANGOLDS

	SUGAR BEET		MANGOLDS	
	Per acre	Per ton	Per acre	Per ton
	£ s. d.	s. d.	£ s. d.	s. d.
Harvesting, i.e., sugar beet to farm, lorry or station, and mangolds to clamp, and clamped	6 10 0	14 9	2 8 2	2 3
Transport to factory by rail or lorry ..	2 19 10	6 10	—	—
Additional cost of sugar beet over mangolds ..	7 1 8	—	—	—

The cost per ton for harvesting sugar beet, which in the above nine cases averages 14s. 9d., shows very great variation. Taking all the fields (see Appendix B, pp. 334-336), it averages 15s. 4d., and ranges from 8s. 0d. to 23s. 7d. per ton, being, of course, correlated to some extent with yield. The distribution is shown in Table VI:—

TABLE VI.—CORRELATION BETWEEN COST OF HARVESTING BEET
(PER TON WASHED BEET) AND YIELD

Yield per acre	No. of cases	5s.-9s.	10s.-14s.	15s.-19s.	20s.-24s.
4.0 tons- 5.9 tons	1	—	—	—	1
6.0 " - 7.9 "	7	—	1	2	4
8.0 " - 9.9 "	12	1	8	2	1
10.0 " -11.9 "	5	1	3	1	—
12.0 " -13.9 "	1	1	—	—	—
	26	3	12	5	6

The yield of washed sugar beet, as compared with mangolds on the same farm and the same season, averages 41 per cent., i.e., mangolds averaged 21.5 tons and sugar beet 8.8 tons per acre. If we take the feeding value of mangolds at 16s. per ton, carted in from the clamp, and the proceeds of sugar beet—looking to the future—at 50s. 8d. (allowing for 17 per cent. sugar-content), we get the following comparison:—

	£	s.	d.
21.5 tons mangolds at 16s. ..	17	4	0
8.8 tons sugar beet at 50s. 8d. ..	22	5	10
Gain on growing sugar beet ..	5	1	10
Additional cost of growing sugar beet ..	7	1	8
Difference in favour of mangolds ..	£1	19	10

This figure is, of course, subject to the general reservations that have already been mentioned, and in the present writers' opinion the direct and indirect benefits, as well as the possibilities of lower costs and higher returns, will more than counterbalance it and justify the continuance of the crop where soil and locality are suitable. It is equally clear, however, that it is only the great national importance of maintaining the industry, combined with the distressing returns obtainable from other crops, that justifies the grower in accepting, for the future, a price that appears to yield a direct profit only under favourable conditions of soil and season.

Summary.—(1) Costs are presented of growing sugar beet on certain farms in East Anglia for the last four years. Results have been as follows:—

1924—Profit £3 12s. 0d. per acre.	Yield 9.25 tons.
1925—Profit £3 12s. 11d. "	Yield 10.61 "
1926—Profit £5 10s. 3d. "	Yield 9.80 "
1927—Loss £4 6s. 5d. "	Yield 7.35 "

(2) It is submitted, however, that the loss sustained last year should not necessarily discourage growers, since it was—on these farms at any rate—exceptional, and entirely due to low yield combined with low sugar content.

(3) A more serious question is the reduction of the basic price by 8s. per ton, a difference which would approximately cancel the profit made in past years.

(4) The costs are presented, in Table I, in the same form as those already published by Bridges and Dixey, and agree very closely with them. A comparison of the figures suggests that further economies, notably in harvesting, should be possible on the farms under review. It must be emphasized, however, that these farms do not by any means represent ideal conditions for growing sugar beet either as regards soil or distance from factory.

(5) In Table II the costs are sub-divided according to operations, and these, in round figures, can be summarized as follows:—

	£	s.	d.
Preparatory cultivations, rent, rates, manures, overheads and sundries ..	11	15	0
Work on growing crop ..	3	5	0
Lifting, pulling and topping ..	4	0	0
Transport from field to factory ..	5	15	0
	£24	15	0

(6) In considering the advisability of growing any crop, it is suggested that the isolated cost cannot be taken alone, but must be considered in conjunction with that of possible alternatives. Nine examples are given of sugar beet and mangolds grown on the same farm in the same years. The weight of washed sugar beet averaged 41 per cent. of the weight of mangolds as carted. Costs were identical up to the time both crops were ready for lifting. Thereafter, the sugar beet cost £7 ls. 8d. per acre more than mangolds. The additional value of sugar beet, taking a 21.5 ton crop of mangolds at 16s. and an 8.8 ton crop of beet at 50s. 8d., was £5 ls. 10d., showing a difference of about £2 per acre in favour of mangolds. Is this difference likely to continue, and likely to have wider applicability?

(7) In considering the question, it must be borne in mind that the figure makes no allowance for the value of tops and leaves or for the benefit that deep cultivation and rooting affords to the subsequent crop. Most important of all, it makes no allowance for the unassessable advantage that accrues from growing a crop that can be marketed direct for prompt cash at a fixed price, instead of one that has first to be converted into meat or milk, with the unavoidable risks attaching to live stock and to fluctuating markets. There is also a small benefit in being able to obtain a certain quantity of dried sugar beet pulp at a low price.

(8) The deductions made for dirt tare have not here been tabulated, but they were exceptionally heavy in 1927. Every grower knows that they aggravate the effect of an unfavourable lifting season, or an unfavourable soil. There seems as yet no practical alternative to the present method of estimation by sampling, but it is to be hoped that the factories will exercise very close supervision over this operation, which is admittedly of variable accuracy.

(9) Finally, it is the opinion of the writers that the costs here shown are capable of reduction. They are by no means put forward as an example of what sugar beet ought to cost; rather, indeed, from the opposite point of view, as illustrating, from personal experience, how easily costs may here and there become exceptionally high. It is hoped at any rate that they will form a small contribution to the common stock of knowledge concerning this new crop and industry, which it is assuredly the duty of all who can to support—since its prosperity or otherwise must necessarily react on many branches of agriculture.

APPENDIX A.—DETAILS UNDER EXPENDITURE HEADINGS

	1924			1925			1926					1927			1928		
	Langford 10 acres	Langford 10 acres	Langford 10 acres	Lavenham 6 acres	Lavenham 7 acres	Fardings 15 acres	Terling Hall 12 acres	Fairsted 6 acres	Stocks 5 acres	Bury 21 acres	Langford 8 acres	Langford 10 acres	Langford 10 acres	Langford 10 acres	Langford 10 acres	Langford 10 acres	Langford 10 acres
Labour: Horses	12½ days £ s. d.	12½ days £ s. d.	12½ days £ s. d.	17 days £ s. d.	16 days £ s. d.	7½ days £ s. d.	12½ days £ s. d.	16 days £ s. d.	14½ days £ s. d.	18 days £ s. d.	13 days £ s. d.	12½ days £ s. d.	12½ days £ s. d.	12½ days £ s. d.	12½ days £ s. d.	12½ days £ s. d.	12½ days £ s. d.
Do. Manual	3 1 10	3 1 10	3 1 10	3 12 7	3 0 4	2 1 1	3 9 4	4 15 1	3 12 5	4 19 5	3 15 9	4 15 1	4 15 1	4 15 1	4 15 1	4 15 1	4 15 1
Do. Machinery	1 10 3	1 10 3	1 10 3	9 18 10	9 14 7	10 18 8	9 9 0	9 13 3	8 14 1	10 11 0	9 18 10	9 13 3	9 13 3	9 13 3	9 13 3	9 13 3	9 13 3
Farmyard manure 'at £s. per load..	12 6 7	13 6 7	13 6 7	13 11 5	12 14 11	15 19 9	14 13 6	15 16 10	12 6 6	17 9 5	15 12 8	12 6 6	15 16 10	15 16 10	15 16 10	15 16 10	15 16 10
Artificial manure	3 18 9	2 12 6	2 12 6	3 3 0	2 12 6	—	3 10 0	5 0 0	2 15 0	4 0 0	3 15 0	5 0 0	2 6 6	2 6 6	2 6 6	2 6 6	2 6 6
Seed ..	2 16 3	3 6 9	3 6 9	3 0 0	3 0 0	3 0 0	3 12 9	2 6 6	3 12 9	3 11 9	3 7 0	3 12 9	2 6 6	2 6 6	2 6 6	2 6 6	2 6 6
Rent and rates	0 8 9	0 8 9	0 8 9	0 7 7	0 7 7	0 7 0	0 6 6	0 7 1	0 7 0	0 7 0	0 8 9	0 7 1	0 7 1	0 7 1	0 7 1	0 7 1	0 7 1
Other expenses	1 13 0	1 13 0	1 13 0	1 19 0	1 19 0	1 2 0	2 6 0	1 11 0	2 2 0	1 2 0	1 13 0	2 2 0	1 11 0	1 11 0	1 11 0	1 11 0	1 11 0
Transport ..	22 5 4	22 9 7	22 9 7	23 3 0	21 16 0	22 12 6	25 10 9	26 3 5	22 5 3	28 8 2	25 18 5	26 3 5	26 3 5	26 3 5	26 3 5	26 3 5	26 3 5
GROSS EXPENSES ..	26 14 4	25 1 0	25 1 0	26 11 9	25 12 5	26 9 0	29 12 10	29 16 8	25 8 9	30 1 6	28 6 3	29 16 8	29 16 8	29 16 8	29 16 8	29 16 8	29 16 8
GROSS RECEIPTS ..	27 13 10	25 2 6	25 2 6	24 5 9	36 8 7	33 12 6	35 9 1	26 14 9	29 3 8	27 1 6	22 13 0	26 14 9	26 14 9	26 14 9	26 14 9	26 14 9	26 14 9
Cash Profit or Loss ..	0 19 6	0 1 6	0 1 6	-2 6 0	10 16 2	7 3 6	5 16 3	-3 1 11	3 14 11	-3 0 0	-5 13 3	3 14 11	3 14 11	3 14 11	3 14 11	3 14 11	3 14 11
Manurial residues	2 12 6	1 4 2	1 4 2	1 0 4	0 9 0	—	2 6 8	3 6 8	1 11 8	1 0 1	2 10 0	3 6 8	3 6 8	3 6 8	3 6 8	3 6 8	3 6 8
Profit ..	3 12 0	1 5 8	1 5 8	—	11 5 2	7 3 6	8 2 11	0 4 9	5 6 7	—	3 3 3	0 4 9	0 4 9	0 4 9	0 4 9	0 4 9	0 4 9
Loss ..	—	—	—	1 5 8	—	—	—	—	—	1 19 11	—	—	—	—	—	—	—
Yield of washed beet..	Tons 9.25	Tons 9.20	Tons 9.20	Tons 9.05	Tons 13.95	Tons 10.5	Tons 11.4	Tons 8.6	Tons 9.3	Tons 8.9	Tons 7.0	Tons 8.6	Tons 8.6	Tons 8.6	Tons 8.6	Tons 8.6	Tons 8.6
Sugar content ..	18.2%	17.8%	17.8%	16.7%	16.7%	19.5%	18.7%	18.5%	18.9%	19.2%	19.2%	18.5%	18.5%	18.5%	18.5%	18.5%	18.5%
Previous crop..	W. oats	Wheat	Wheat	W. oats	Wheat	Wheat	Wheat	Wheat	S. barley	W. oats	W. oats	Wheat	Wheat	Wheat	Wheat	W. oats	W. oats

APPENDIX A (contd.)

1926 (contd.)											1927										
Peppers 6 acres		Peppers 5 acres		Lavenham 13 acres		Lavenham 12 acres		Lavenham 15 acres		Fardings 12 acres		Terling Hall 6 acres		Terling Hall 6 acres		Fairsted 5 acres		Stocks 4 acres			
7 days £ s. d.		18 days £ s. d.		10 days £ s. d.		15½ days £ s. d.		15 days £ s. d.		9½ days £ s. d.		10½ days £ s. d.		14 days £ s. d.		17½ days £ s. d.		19½ days £ s. d.			
Labour : Horses	1 17 5	4 6 0	2 19 1	3 10 0	3 18 2	2 12 11	2 19 3	3 6 9	4 8 1	4 15 2	2 10 0	2 4 0	3 15 0	4 12 6	1 18 0	0 8 2	0 8 2	2 2 0	1 2 0		
Do. Manual	6 17 3	9 1 9	7 16 11	9 5 6	8 0 6	10 5 5	11 7 9	10 12 3	10 6 2	10 5 5	11 7 9	11 13 0	10 12 3	10 6 2	10 6 2	9 18 9	9 18 9	9 18 9	9 18 9		
Do. Machinery	1 4 0	0 8 0	1 0 0	—	—	1 10 0	1 13 0	0 14 0	—	1 10 0	1 13 0	0 14 0	0 14 0	2 8 0	—	—	—	—	—		
Farmyard manure	9 18 8	13 15 9	11 16 0	12 15 6	11 18 8	14 8 4	16 0 0	14 13 0	17 2 3	14 8 4	16 0 0	14 13 0	14 13 0	17 2 3	14 13 11	14 13 11	14 13 11	14 13 11	14 13 11		
Artificial manure	2 10 0	3 0 0	3 0 0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
Seed	2 17 3	2 17 3	4 4 3	4 19 2	4 5 0	4 15 0	2 0 3	2 4 0	4 12 6	4 15 0	2 0 3	2 4 0	2 4 0	4 12 6	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0		
Rent and rates	0 8 7	0 8 9	0 5 5	0 10 10	0 5 5	0 8 1	0 8 2	0 8 2	0 8 2	0 8 1	0 8 2	0 8 2	0 8 2	0 8 2	0 8 2	0 8 2	0 8 2	0 8 2	0 8 2		
Other expenses	1 10 0	1 10 0	1 19 0	1 19 0	1 19 0	2 3 0	2 4 0	2 6 6	1 11 0	2 3 0	2 4 0	2 6 6	2 6 6	1 11 0	2 2 0	2 2 0	2 2 0	2 2 0	2 2 0		
Transport	18 6 6	22 13 9	22 6 8	21 6 6	22 10 1	22 16 5	25 14 5	24 8 8	24 15 11	22 16 5	25 14 5	24 8 8	24 8 8	24 15 11	22 14 1	22 14 1	22 14 1	22 14 1	22 14 1		
Gross EXPENSES	3 11 0	5 4 10	4 2 2	4 1 6	3 1 0	2 19 5	3 2 6	3 8 10	2 11 3	2 19 5	3 2 6	3 8 10	3 8 10	2 11 3	3 1 4	3 1 4	3 1 4	3 1 4	3 1 4		
Gross RECEIPTS	21 17 6	27 18 7	26 8 10	25 8 0	25 11 1	25 15 10	28 16 11	27 17 6	27 7 2	25 15 10	28 16 11	27 17 6	27 17 6	27 7 2	25 15 5	25 15 5	25 15 5	25 15 5	25 15 5		
Cash Profit or Loss	26 0 0	34 10 3	39 6 2	33 14 2	31 19 8	23 2 7	23 2 7	24 15 4	21 2 5	23 2 7	23 2 7	24 15 4	24 15 4	21 2 5	23 3 2	23 3 2	23 3 2	23 3 2	23 3 2		
Manurial residues	4 2 6	6 11 8	12 17 4	8 6 2	6 8 7	-2 13 3	-5 14 4	-3 2 2	-6 4 9	-2 13 3	-5 14 4	-3 2 2	-3 2 2	-6 4 9	-2 12 3	-2 12 3	-2 12 3	-2 12 3	-2 12 3		
Profit	1 13 4	2 0 0	1 11 8	-0 5 5	1 15 8	-1 0 4	1 18 9	2 10 0	—	-1 0 4	1 18 9	2 10 0	2 10 0	—	0 18 2	0 18 2	0 18 2	0 18 2	0 18 2		
Loss	5 15 10	8 11 8	14 9 0	8 0 9	8 4 3	3 13 7	3 15 7	0 12 2	6 4 9	3 13 7	3 15 7	0 12 2	0 12 2	6 4 9	1 14 1	1 14 1	1 14 1	1 14 1	1 14 1		
Yield of washed beet	Tons 8-7	Tons 11-15	Tons 11-7	Tons 10-35	Tons 9-15	Tons 8-0	Tons 8-1	Tons 9-0	Tons 7-25	Tons 8-0	Tons 8-1	Tons 9-0	Tons 9-0	Tons 7-25	Tons 8-2	Tons 8-2	Tons 8-2	Tons 8-2	Tons 8-2		
Sugar content	17-9%					17-4%					17-4%					17-2%					
Previous crop	Wheat					Mangold					W. oats					W. oats					
	Wheat					Wheat					Wheat					Wheat					
	Wheat					Wheat					Wheat					Wheat					
	Wheat					Wheat					Wheat					Wheat					
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APPENDIX B.—ANALYSIS OF COSTS BY OPERATIONS. (SEE TABLE II.)

	1924			1925			1926						
	Langford 10 acres	Langford 10 acres	Langford 10 acres	Lavenham 6 acres	Lavenham 7 acres	Fardings 15 acres	Terling Hall 12 acres	Fairsted 6 acres	Stocks 5 acres	Bury 21 acres	Langford 8 acres		
OVERHEADS :— Rent, rates and overheads ..	£ s. d. 2 15 0	£ s. d. 2 15 0	£ s. d. 2 15 0	£ s. d. 3 1 0	£ s. d. 3 1 0	£ s. d. 3 5 0	£ s. d. 3 8 0	£ s. d. 2 13 0	£ s. d. 3 4 0	£ s. d. 3 0 0	£ s. d. 2 15 0		
MANURES :— One-third of dung, total artificial and labour, + residual values ..	5 2 9	5 15 0	5 18 1	5 17 3	3 3 11	6 6 2	6 6 2	6 4 2	5 16 7	8 8 6	6 6 4		
PREPARATORY CULTI- VATIONS :— Up to and including drilling and seed ..	2 16 10	4 12 5	3 14 10	3 2 11	3 0 1	4 2 8	4 2 8	4 14 6	3 8 5	3 16 9	3 5 8		
GROWTH OF CROP :— Horse-hoeing ..	10 14 7	13 2 5	12 13 11	12 1 2	9 9 0	13 16 10	13 16 10	13 11 8	12 9 0	15 5 3	12 7 0		
Singling and hand- hoeing ..	0 15 3	0 4 0	0 10 3	0 11 8	0 15 2	0 8 4	0 8 4	0 6 5	0 7 11	0 10 10	0 7 2		
Headlands, weeding, etc. ..	2 2 7	2 0 1	2 17 9	2 19 10	2 13 10	2 14 0	2 14 0	2 16 1	3 7 11	2 13 0	3 4 7		
	0 1 8	—	0 1 4	0 2 1	0 0 5	0 2 3	0 2 3	0 1 2	—	0 3 6	—		
HARVESTING :— Ploughing out ..	13 14 1	15 6 6	16 3 3	15 14 9	12 18 5	17 1 5	16 15 4	16 15 4	16 4 10	18 12 7	15 18 9		
Pulling and topping ..	0 9 3	0 12 5	0 11 3	0 7 5	1 10 1	0 12 9	0 12 9	0 11 5	0 12 11	1 11 1	0 12 7		
Carting to farm, lorry or station ..	3 2 6	3 1 10	3 10 0	3 18 7	6 7 2	3 18 1	3 18 1	3 3 8	2 13 4	3 19 0	4 0 10		
	2 7 0	2 4 8	1 18 2	1 6 3	1 16 10	1 11 10	1 11 10	2 6 4	1 2 6	3 5 5	2 16 3		
MARKETING :— Transport by rail or lorry ..	19 12 10	21 5 5	22 2 8	21 7 0	22 12 6	23 4 1	22 16 9	20 13 7	27 8 1	23 8 5	27 10		
	4 9 0	2 11 5	3 8 9	3 16 5	3 16 6	4 2 1	3 13 3	3 3 6	1 13 4	2 7 10	—		
TOTAL COSTS ..	24 1 10	23 16 10	25 11 5	25 3 5	26 9 0	27 6 2	26 10 0	23 17 1	29 1 5	25 16 3	—		
TOTAL RECEIPTS ..	27 13 10	25 2 5	24 5 9	36 8 7	33 12 6	35 9 1	26 14 9	29 3 8	27 1 6	22 13 0	—		
PROFIT ..	3 12 0	1 5 8	—	11 5 2	7 2 6	8 2 11	0 4 9	5 6 7	—	—	—		
LOSS ..	—	—	1 5 8	—	—	—	—	—	—	—	—		
YIELD OF WASHED BEET ..	9.25 tons	9.2 tons	9.05 tons	9.05 tons	9.05 tons	9.05 tons	9.05 tons	9.05 tons	9.05 tons	9.05 tons	9.05 tons		

APPENDIX B—(contd.)

APPENDIX B—(contd.)

	1926 (contd.)				1927					
	Peppers 6 acres	Peppers 5 acres	Lavenham 13 acres	Lavenham 12 acres	Lavenham 15 acres	Fardings 12 acres	Terling Hall 6 acres	Terling Hall 6 acres	Fairsted 5 acres	Stocks 4 acres
OVERHEADS:—	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Rent, rates and overheads ..	2 12 0	2 12 0	3 1 0	3 1 0	3 1 0	3 5 0	3 6 0	3 8 6	2 13 0	3 4 0
MANURES:—										
One-third of dung, total artificial and labour, + residual values ..	4 7 7	4 17 5	6 16 7	5 10 5	6 7 1	5 17 9	6 4 2	5 12 2	4 18 5	4 12 4
PREPARATORY CULTIVATIONS:—										
Up to and including drilling and seed ..	1 13 9	2 8 2	2 13 1	3 10 0	3 3 3	2 13 7	3 11 5	3 4 10	4 5 10	5 1 9
GROWTH OF CROP:—										
Horse-hoeing ..	8 13 4	9 17 7	12 10 8	12 1 5	12 11 4	11 16 4	13 1 7	12 5 6	11 17 3	12 18 1
Singling and hand-hoeing ..	0 10 6	1 1 7	0 9 5	0 6 5	0 8 11	0 7 8	0 6 11	0 11 6	0 17 10	0 8 2
Headlands, weeding, etc. ..	1 15 1	2 13 10	2 9 1	2 10 0	2 10 0	3 1 8	3 8 6	3 1 10	3 5 5	2 18 7
	—	—	0 1 11	0 3 7	0 7 9	0 3 1	0 2 2	0 1 10	0 4 5	0 3 5
HARVESTING:—										
Ploughing out ..	10 18 11	13 13 0	15 11 1	15 1 5	15 18 0	15 8 9	16 19 2	16 0 8	16 4 11	16 8 3
Pulling and topping ..	1 2 11	0 16 5	0 12 3	0 11 5	0 9 11	1 6 5	1 0 8	0 14 10	1 4 2	0 15 4
Carting to farm, lorry or station ..	2 14 2	2 13 6	2 13 3	4 0 0	1 19 2	3 19 9	4 1 3	2 5 2	2 15 0	3 1 7
	1 17 2	3 10 10	1 18 5	1 19 1	2 7 4	3 1 10	1 14 7	2 18 0	4 11 10	1 10 9
MARKETING:—										
Transport by rail or lorry ..	16 13 2	20 13 9	20 15 0	21 11 11	20 14 5	23 16 9	23 15 8	21 18 8	24 15 11	21 15 11
	3 11 0	5 4 10	4 2 2	4 1 6	3 1 0	2 19 5	3 2 6	3 8 10	2 11 3	3 1 4
TOTAL COSTS ..	20 4 2	25 18 7	24 17 2	25 13 5	23 15 5	26 16 2	26 18 2	25 7 6	27 7 2	24 17 3
TOTAL RECEIPTS ..	26 0 0	34 10 3	39 6 2	33 14 2	31 19 8	23 2 7	23 2 7	24 15 4	21 2 5	23 3 2
PROFIT ..	5 15 10	8 11 8	14 9 0	8 0 0	8 4 3	3 13 7	3 15 7	0 12 2	6 4 9	1 14 1
LOSS ..	—	—	—	—	—	—	—	—	—	—
YIELD OF WASHED BEET ..	8.7 tons	11.15 tons	11.7 tons	10.35 tons	9.15 tons	8.0 tons	8.1 tons	9.0 tons	7.25 tons	8.2 tons

of the Institute of Agricultural Engineering. The wheat was cut on August 19, being then quite ripe, and the first samples were taken on the 22nd at 11.30 a.m. when the moisture content was 23.5 per cent. for the stooked grain and 26.15 per cent. for the standing grain. It had rained each day, but the weather had improved on the 21st, and there were 26 hours of sunshine altogether on that and the following two days. Samples taken at 7 p.m. on the 23rd had 20.25 per cent. moisture content in the stooked and 17.3 per cent. in the standing grain.

The following table gives the weather conditions and the moisture content of the standing grain during the period intervening between the cutting and carrying of the bulk of the crop. The weather records were taken by the meteorological observer at the farm.

Date	Rainfall	Hours Sunshine	Wind Strength	Time Sample Taken	Moisture Content
Aug. 19 ..	0.32	2.0	2	—	—
„ 20 ..	0.34	0	2	—	—
„ 21 ..	0.16	7.9	3	—	—
„ 22 ..	0.12	6.4	7	11.30 a.m.	26.1
„ 23 ..	trace	11.7	3	7 p.m.	17.3
„ 24 ..	0.03	4.0	1	5 p.m.	18.3
„ 25 ..	0.26	3.7	2	4.45 p.m.	32.1
„ 26 ..	—	1.4	2	5 p.m.	21.8
„ 27 ..	—	5.0	5	—	—
„ 28 ..	—	0.5	3	—	—
„ 29 ..	—	6.1	1	8 a.m.	18.9
„ 30 ..	0.02	3.1	3	—	—
„ 31 ..	0.01	5.2	1	9.30 a.m.	19.9
Sept. 1 ..	trace	0.7	0	—	—
„ 2 ..	—	1.3	1	12 noon	20.0
„ 3 ..	—	3.4	3	—	—
„ 4 ..	—	0	2	—	—
„ 5 ..	—	0	1	2 p.m.	19.2
„ 6 ..	0.22	0	1	2 p.m.	19.7

Figures for the wheat in the stooks are not given in the above table. There is a difficulty about getting a true sample of stooked wheat, as the moisture content of the outside and inside ears may vary very much, and the proportions of ears on the outside exposed to the weather to ears in the interior of the sheaf or stook will vary from stook to stook, according to the shape of the sheaves and the skill of the stooker. Taking two ears from the outside and two from the inside, as a composite sample, the average moisture content of the stooked wheat came out at 0.9 per cent. less than that of the standing wheat—the difference on the day the wheat was carried being 0.6 per cent. in favour of the stooked wheat.

As wheat can be thrashed when its moisture content is a little above 20 per cent., it will be seen, from the figures given above, that the grain in the wheat left standing was, except directly after rain, dry enough at any time to admit of thrashing, though it would have required drying afterwards if it were to be stored for any time. If dry enough for thrashing in the ordinary way, it was dry enough to be harvested with a combine, so that objections to the use of the combine in this country on the score that English grain cannot be dry enough do not seem to be well founded. There would have been the further advantage that, assuming that arrangements had been made for drying the wheat after harvesting with the combine, the whole crop might have been cut, thrashed and stored at least a week before the date—September 6—on which it was actually carried.

In connexion with the dryness of the grain, it is probable that dead ripe grain, in dry weather, is usually fairly dry. Wheat which thrashes out damp has not necessarily been stacked with the actual grains damp. If it is stacked with the straw damp, either from rain or from its own sap, or with green weeds amongst it, it will “sweat” and the moisture so given off will be partly absorbed by the grain. Frequently, when the crop is carried, the ears of the sheaves are dry and the butts damp. Under such conditions the grain, when in the stack, will absorb moisture from the butts. Dead ripe wheat in a damp season is usually hard and dry enough to thrash well, as is shown by the way it will shed on the binder canvas during any spell of hot sunshine.

For wheat to thrash easily, it must be ripe, and both chaff and grain be dry. It is essential for the chaff to be dry, particularly with tight chaffed varieties. In any dry weather the chaff of ripe standing corn is dry enough for thrashing; it is after it gets into the rick that it runs the risk of becoming “tough.”

Difficulties to be Met.—Size.—There are, however, various objections to the combine, among which must be mentioned its size. The overall width of the smallest machine made, with its cutting table folded, is 11 feet. It is thus unable to get through ordinary gateways, and difficulty would be experienced with bridges.

Disposal of Straw.—The question of the straw is another serious drawback to the use of combines here. In America, as in most wheat-growing countries, straw is reckoned of no account, but here it is a part of the crop and has a consider-

able value. The practice in Morocco, where the straw is required for feeding purposes and where combines are in use, is to furnish the combine with a dumping arrangement, which leaves the straw in cocks about as big as the ordinary stook. This practice is also being introduced into some parts of America, the straw being afterwards collected with hay sweeps and baled in the field. The straw, going as it does ears first into a comparatively small drum, is much broken and could, as a rule, be used only for bedding or for feeding purposes. Another point to be considered is the capacity of the thrashing machinery of the combine. It is obvious that the capacity of a thrashing machine is ruled by the bulk of material which can be put through it, and that, therefore, the amount of straw which goes through the drum is the ruling factor.

Bulky Crops.—With tall strawed crops, or very bulky crops, it may be impossible, in England, to drive the full width of the cutter bar without choking the drum. One make of the combine, however, is capable of dealing with straw up to 4 ft. high, cutting close to the ground, though it will naturally have to be pulled at a slower speed than when it is cutting a shorter strawed crop.

Binders, equally, cannot always in very bulky crops be driven full width, but it should be noted that laid crops, apart from their bulk, do not present the difficulties to combines which they do to binders. A binder only ties good sheaves if the straw is delivered evenly to the knotter platform with the ears all one way. It does not matter much how the straw comes to the drum of the combine, it will be thrashed out equally well.

"Seeds."—Where "seeds" are drilled in the corn crop, it would be impossible to use the combine if the season had been favourable to their growth. In a damp season, clover will grow about 18 in. high before harvest. In such circumstances the use of a combine would be impossible, however dry the actual grain might be. Such crops, however, do not form a large proportion of the total acreage.

Weeds.—Weedy crops are a serious handicap to the combine. In ordinary thrashing from the rick, or from the field, these weeds have dried to hay before they enter the drum. If, however, the standing crop is cut by a combine these weeds enter the drum green and sappy, get broken up, their sap wets the interior of the drum, and dust and dirt adhere until clogging takes place. In such cases a method of using the combine together with binders has been developed.

In this method the knotter is removed from the binder, which then makes a windrow instead of turning out sheaves. The ears mostly lie resting on the straw and the windrow lies loose and in good condition for drying. Where several binders follow each other round a field, conveyor platforms are attached to the rear binders, so that all the machines deliver to one windrow. After two or three days the combine travels along the windrows, picking them up and thrashing out the grain straight away. This method has the advantage of spreading out the possible harvesting time and of allowing weedy crops to be dried off before thrashing, but the English climate is scarcely reliable enough for its adoption.

Saving of the Combine.—If a crop be thrashed direct by a combine, the losses due to each successive handling, binding, stooking and loading are saved. What these losses are it is difficult to say. They might not exceed 2 per cent., but even this figure amounts to more than the cost of the fuel to run the combine. American experience seems to show that the saving amounts to about 1 bus. per acre or 3 to 4 per cent. of the crop. In a laid crop, the saving might be more, but experience will be necessary to decide this.

On the other side must be put the liability to incomplete cleaning of the straw, which may be greater than it is with a crop thrashed from a rick. The necessity for complete maturity of the crop before cutting would minimize this loss.

The combine is able to deal with all kinds of crops, from wheat to linseed or beans, or even clover seed. The British crop to which it seems peculiarly adapted is barley. Barley straw is usually short, it is not specially valuable, and barley is peculiarly liable to damage from weathering. Well-ripened barley, cut with a combine, would necessarily be all of the same colour, and the risk of damage in the stook would be eliminated.

One reason for the popularity of the combine in America would not, in general, apply here. Reading the testimonials published by the manufacturers, it is remarkable how they almost unanimously insist on the great advantage it is to the women-folk on the farm, as, by making harvesting a two or three men job, it saves them the trouble of feeding the harvesting and thrashing crews.

In view of the great possibilities of these machines, a combine is being imported from Canada by the Institute of Agricultural Engineering, and will be tried out next harvest.

PROTEIN AND LIME IN THE RATION OF FATTENING PIGS

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RECENT research work has directed the attention of farmers and others to the very great importance of supplying the pig with a sufficiency of mineral matter and protein in its food. A study of practical conditions, as applied to feeding and management, will, in many cases, reveal to the observer that little or no attention is paid to either of the above factors. In the south-western counties, for instance, the common practice is to give to pigs being fattened indoors a ration consisting entirely of milling offals and barley meal: a ration notably deficient in lime and in protein. There is not the least doubt that, when good prices prevail for bacon and pork, a return can be made, despite the unbalanced nature of the food; and, possibly because of this, the advantages to be obtained from a balanced diet are somewhat obscured. While, in many parts of the country, an extended use is being made of the protein foods now available, there are other parts where their use is still the exception rather than the rule in feeding practice. As for mineral matter, where the results of any deficiency are not at once noticeable, practically no consideration is given to it. To obtain some measure of the results of feeding deficient in these two constituents, a series of trials was commenced in 1926 with pigs intended for the bacon factory. The precise points aimed at in the investigation were: (a) The effect of a marked deficiency of lime, and (b) the effect of a marked deficiency of protein, on the growth, the food requirements, the costs of production, and the carcass of the animal.

Plan of Trials.—Three pens, each of six pigs, were very carefully selected from the progeny of Large Black and Long White Lop-Ear sows sired by a Large White Yorkshire boar. The different litters were equally represented in each pen, and as far as possible the sexes were evenly distributed. To ensure obtaining an even lot of pigs, the heaviest and the lightest of the litters were discarded, and the pen arrangements were such that as nearly equal weights per pen as possible were obtained at the commencement of the trial. The pigs were housed in a range of sties, each having an open yard with feeding accommodation. For the more efficient control of the feeding, the water supply to each sty

was discontinued. The sties were littered regularly with an equal weight of litter to each pen.

The food was weighed daily and soaked 24 hours before feeding. Each pen was fed, up to the limit of appetite, with sufficient meal to allow of consumption within 30 minutes of feeding: any food remaining in the troughs after this time was removed and weighed. Careful attention was paid to the removal of all food from the feeding buckets, so that no waste occurred and the pigs had their full allowances.

Weighing was conducted fortnightly on a fixed day and at a set time, and as the pigs were not fasted before this it was thought advisable to weigh as long after the morning feed as possible: 4 p.m., therefore, was the time selected.

Scheme of Feeding.—The experiments commenced on October 1, 1926, and all pens were on their respective rations for a trial period of two weeks, to accustom them to the feeding and the introduction of new foods. This was particularly necessary, as the pigs were weaned at eight weeks old and taken from the dam straight on to the various rations employed.

The foods used were purchased in sufficient bulk to last throughout the trials, and were:—

	<i>Protein</i> <i>per cent.</i>	<i>CaO</i> <i>per cent.</i>	<i>P₂O₅</i> <i>per cent.</i>
Barley Meal	12.77	.048	1.041
Fine Middlings	16.7	.036	1.618
Meat Meal (from whale flesh) ..	69.2	.155	1.602

The whale meal used was specially prepared for the purposes of the trial, and contained a minimum of mineral matter. The rations were:—

Pen A (Balanced ration)—

1 lb. middlings
1½ lb. barley meal
·15 lb. meat meal
·0251 lb. CaO (11 gms. approx.)

containing .35 lb. protein and .02625 lb. each of CaO and P₂O₅.

Pen B (deficient in lime) was similar to Pen A, but without the addition of the lime. It contained .35 lb. protein and .026 lb. of P₂O₅, but only .0011 lb. CaO.

Pen C (deficient in protein) was similar to Pen A, but without the addition of the meat meal. It contained only .26 lb. protein, but was balanced in lime and phosphoric acid.

As the trial progressed the proportion of barley was increased, the mineral matter being adjusted accordingly.

Results.—The results obtained in the experiment are shown in the accompanying graph; and, for the purpose of comparison, the progress of the pens is set out in two tables, Table I relating to the early and medium stages of fattening, and Table II to the final stages.

TABLE I

	Average live wt. in lb. per pig		Total live wt. increase per pen lb.	Lb. food required to 1 lb. l.w.
	Oct. 1	Feb. 11		
Pen B (Lime deficiency)	26.3	154.7	771	4.1
Pen A (Balanced)	26.0	161.0	810	3.8
Pen C (Protein deficiency)	26.6	134.3	636½	4.7

TABLE II

	Average live wt. in lb.		Total live wt. increase per pen lb.	Lb. food required to 1 lb. l.w.
	Feb. 11	Final date		
Pen B (Lime deficiency)	154.7	210	327	6.6
Pen A (Balanced)	161.0	212	276½	5.4
Pen C (Protein deficiency)	134.3	214	325½	5.0

N.B. The first date varied with each pen, as indicated in Table III.

It will be seen that, compared with the animals on the complete ration (Pen A), those receiving a ration deficient in lime (Pen B) had much smaller increases in weight from the age of 18-20 weeks onwards. During the eleventh week of the trial, one of the pigs went off its legs and another became lame. The former was temporarily removed from the pen and lime added to its ration, after which it slowly recovered and was returned to the pen. Later the four remaining pigs all went lame, although they did not actually go off their legs. Their appetite was poor and their food consumption per 1 lb. live-weight increase became greater. Fig. 1 gives some idea of the state of the pigs in this pen. It will be seen that the fore-legs in this case are rachitic.

It is of interest to note that, from the tenth week onwards, the pigs on this lime-deficient ration removed considerable quantities of mortar from the walls of the sty. This, however, did not occur in any of the other pens. These conditions are very similar to those found by Elliott, Crichton, and Orr at the Rowett Institute ("Rickets in Pigs," *Brit. Jour. Exper. Pathol.*, 1922, 3, 1).

Animals on the protein-deficient ration (Pen C) made small increases in growth up to the age of 24 weeks, with a high food consumption, after which they grew rapidly and more economically. Fig. 2 shows the differences in development of pigs in Pens A and C during the earlier stages of

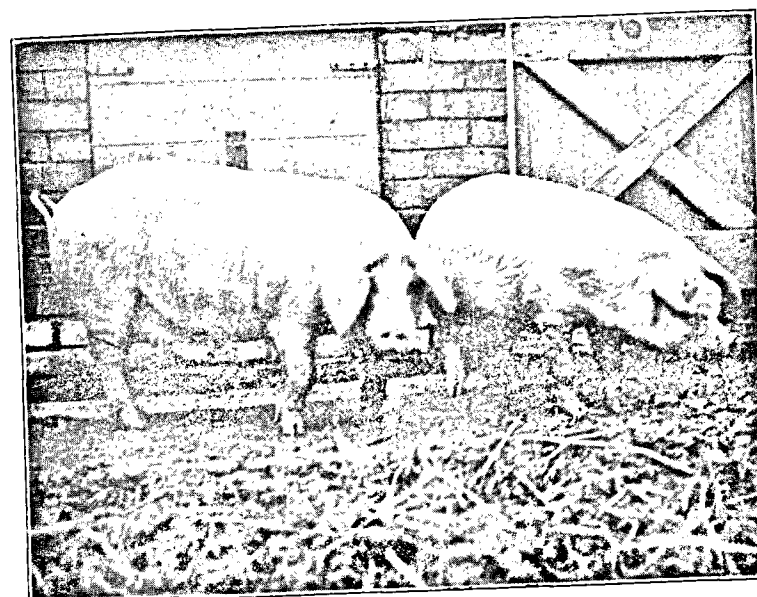


FIG. 1.—Typical Pigs, Pen B, showing rachitic condition of legs.

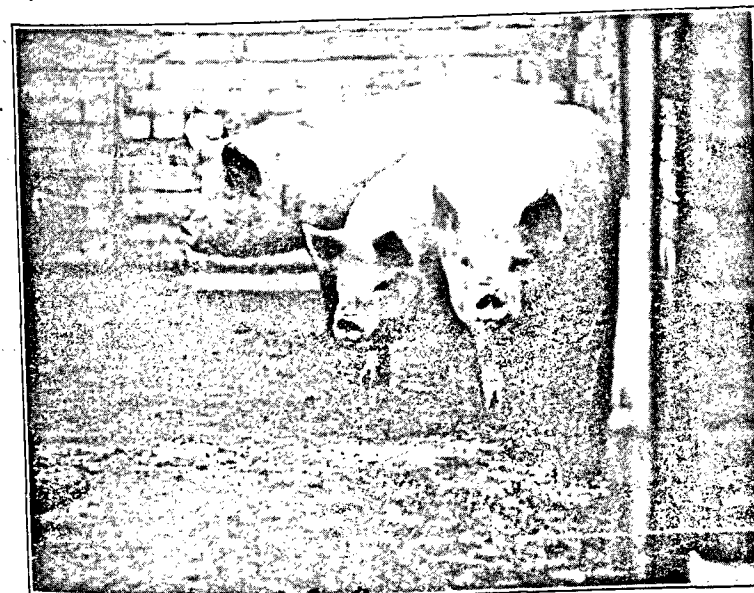


FIG. 2.—Selected Pigs from Pens A, C, A respectively, showing dwarfed growth condition, typical of Pen C, compared with Pen A.

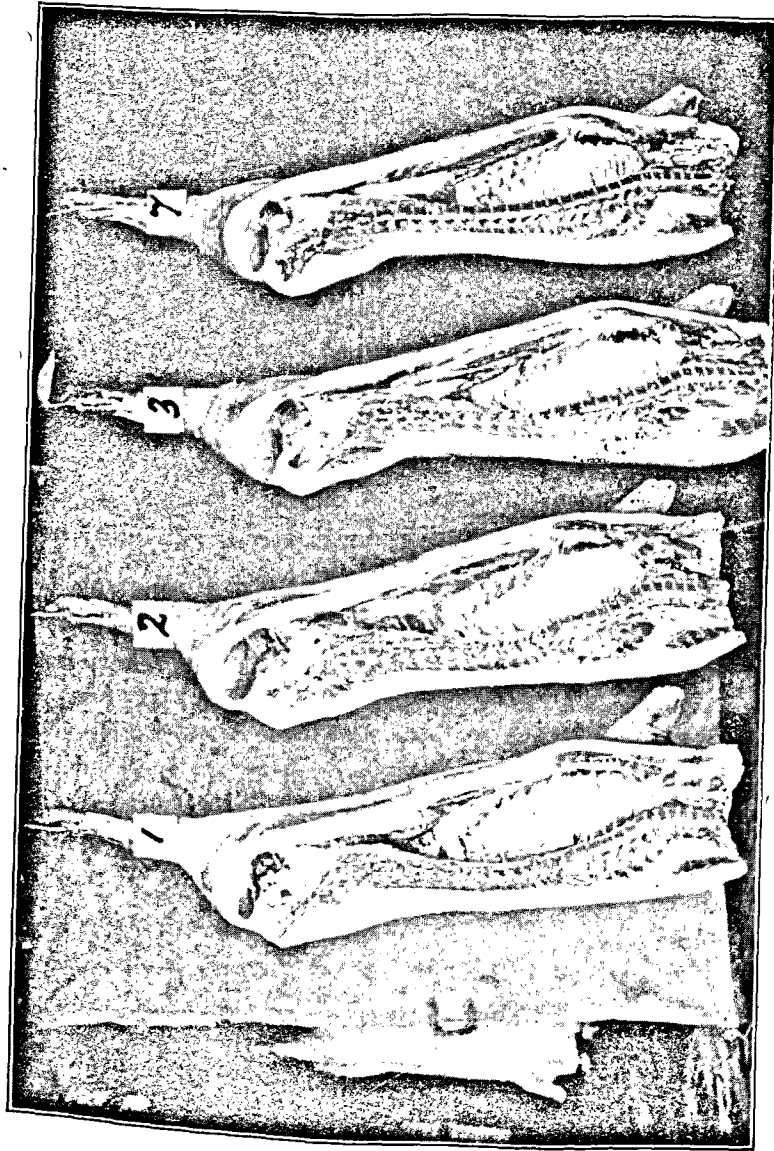
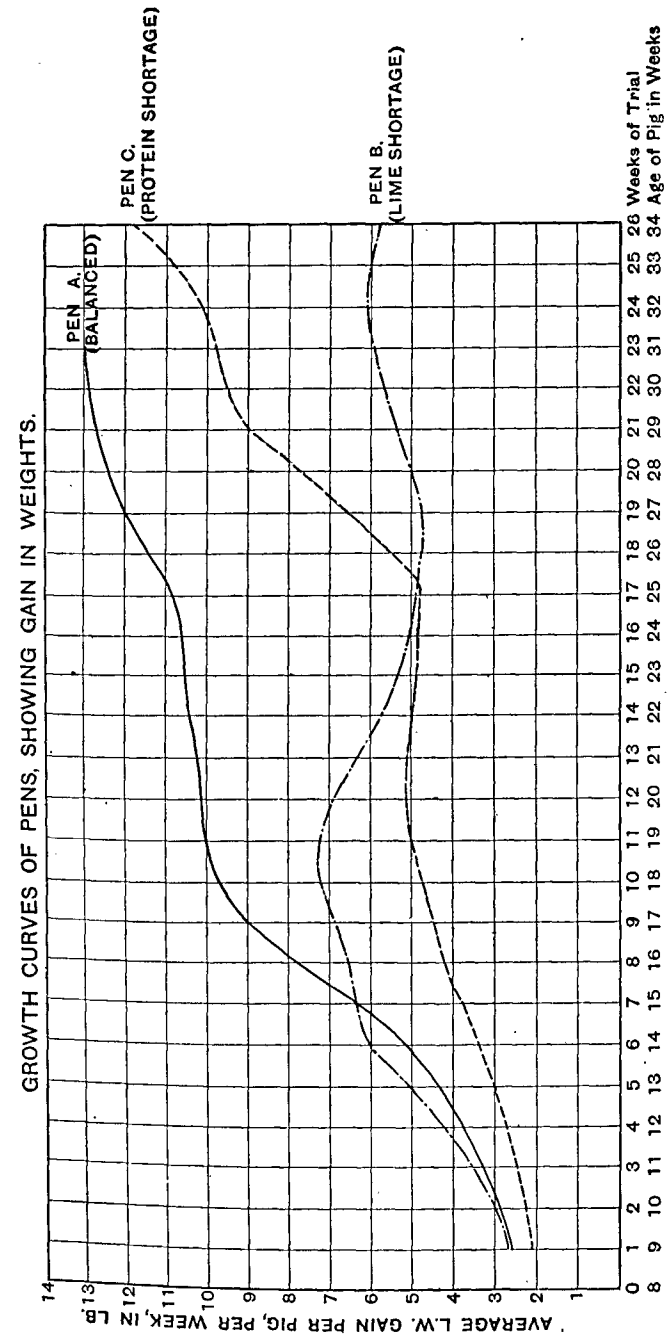


FIG. 3.—Sides of Bacon, showing excess of fat in those from Pen C (Nos. 1 and 7) compared with those from Pen A (Nos. 2 and 3).



feeding. This result illustrates the principle that a higher proportion of protein is required in the early stages of growth than in the later, and confirms the practice of widening the nutritive ratio with increase in age.

In Table III is a summary of the whole period over which the trial extended :—

TABLE III

	Pen A	Pen B	Pen C
Average weight at commencement of trial. October 1 (lb.) ..	26.0	26.3	26.6
Average weight at end of trial (lb.) ..	212	210	214
Average number of days taken to attain final weights (lb.) ..	154½	191½	168
Average live-weight gain per day (lb.)	1.2	0.95	1.1
Meal consumed per 1 lb. live-weight increase (lb.) ..	4.2	4.85	4.6

In considering the progress of the three pens during the whole trial it is important to note the various times taken to attain maturity. On an average, the pigs of Pen B (lime deficiency) were 37 days longer and Pen C (protein deficiency) 14 days longer in attaining bacon weights than were the pigs of Pen A on the balanced food. This factor affected, to a very noticeable extent, the meal consumption per 1 lb. live-weight increase; and consequently the total costs of production. A summary of the costs is set out in Table IV :—

TABLE IV

	Pen A			Pen B			Pen C		
	£	s.	d.	£	s.	d.	£	s.	d.
Average cost of store ..	1	10	0	1	10	0	1	10	0
Average price received per score, dead weight ..	18	6		18	6		18	0	
Average selling price per pig ..	7	3	4	7	1	6	7	2	2
Cost of meal per pig ..	3	13	10	4	3	11	4	1	9
Average return per pig ..	1	19	6	1	7	7	1	10	5

A lower price per score was received for the pigs of Pen C, their sides being rather fatter than those of Pens A and B. In Fig. 3 a comparison is made of average sides of Pen C (1 and 7) and Pen A (2 and 3).

A full costing of the trial would have still further emphasized the differences in return of the respective pens, because labour and incidental charges for Pens B and C would be greater than in Pen A owing to the longer time taken in bringing these pens to maturity.

Conclusions.—The following conclusions may be drawn :—

- (1) That a deficiency of lime such as is common to many farm rations has serious effects on the growth and health of the pig. The results obtained from Pen B, showing loss of appetite, general slowing down of growth, onset of lameness and in some cases rickets, due to this deficiency, confirm what has already been found by the workers at the Rowett Institute.

- (2) In the cases where the shortage of lime did not produce the obvious signs of rickets, it resulted in a slow rate of growth and an increased amount of food required to produce 1 lb. gain in weight.
- (3) That the physiological effects of lime deficiency bear closely on the costs of production. In this series of trials the shortage of lime alone has resulted in a lower net return per pig of approximately 12s. as compared with Pen A.
- (4) A marked shortage of protein, as might be expected, limits growth very appreciably during the earlier stages of fattening, but has little or no effect during the final feeding period. It would seem that, given a correct balance and ample supply of mineral matter, the effects of a protein shortage are to some extent mitigated.

In the application of the above results to feeding practice, it must be remembered that the meat meal used throughout the trials was a special product, very short of mineral matter. This class of protein food as available on the market has for the most part sufficient mineral content to meet the needs of the fattening pig, and a ration balanced in protein would in all probability be supplying adequate mineral matter. It is nevertheless important in the purchase of this class of food to pay some attention to its lime and phosphate content, though with careful selection of the protein food it should be unnecessary to consider the feeding of minerals as a separate part of the ration.

The writer records his thanks to Mr. D. R. Edwardes-Ker, the Principal of the College, for facilities provided; and acknowledges the very considerate help given by Dr. Orr, both in the planning of the trial and in the compiling of this report. The writer's thanks are also due to Mr. Blenkinsop, the Advisory Chemist, and to his colleagues on the Agricultural Staff at the Seale-Hayne College, for the interest they have taken in the experiments.

* * * * *

FERTILIZERS AND FEEDING STUFFS

THE Fertilizers and Feeding Stuffs Act, 1926, comes into operation on July 1, 1928. Its provisions are based upon the recommendations of two Committees which sat during 1923-25, the first of which suggested the general lines of the Act, while the second prepared the Schedules of articles coming within its scope. Although the Act received the Royal Assent in December, 1926, it has not been practicable to bring it into operation until the Regulations governing such matters as methods of sampling and analysis, methods of marking parcels and limits of variation, have been prepared and published.

These Regulations were published in draft form in February, 1928, and in their final form during June.

The general purpose of the Act, like that of the Act of 1906 which it repeals, is to provide civil remedies in cases of misdescription of, and to prevent fraud in, fertilizers and feeding stuffs. Its scope is defined by means of Schedules which may be extended or varied, whenever the need arises, by Regulations.

One of the principal objects in replacing the Act of 1906 by new legislation was to separate, as far as possible, civil proceedings and criminal proceedings, in order to encourage farmers to exercise their civil rights without involving their supplies in police court proceedings.

Civil Provisions.—The “civil provisions” of the Act are those which enact that buyers of the fertilizers and feeding stuffs in common use shall be furnished with a warranty covering certain important points, and which, further, afford them the means of testing those warranties with the object of formulating a claim where they are not fulfilled. These provisions are, therefore, of immediate interest to the farming community.

Statutory Statements.—The first requirement of the Act is that every person who sells for use as a fertilizer or as a feeding stuff for cattle (including sheep, pigs and goats) or poultry any article included in either the First or the Second Schedule to the Act shall give the purchaser a written statement (called the “statutory statement”) showing:—

- (i) the name under which the article is sold;
- (ii) certain particulars, which are prescribed, in respect of each article, in the Schedules, and which relate principally to the percentages of valuable constituents contained in it; and
- (iii) in the case of feeding stuffs, the presence of any ingredient mentioned in the Third Schedule.

This statutory statement has effect as a warranty.

Defined Names.—In the case of those commonly used names of fertilizers and feeding stuffs which are defined in the Fourth Schedule to the Act, the use of the name in the statutory statement constitutes a warranty that the article accords with the definition.

Analytical Particulars.—The analytical particulars to be given in respect of each article have been fixed having regard to the needs of each individual case. Under the previous Act, only the percentages of oil and albuminoids were required

to be declared in respect of feeding stuffs. The new Act requires, in certain instances, that particulars shall be given as to the percentages of fibre, sugar, and phosphoric acid. Fertilizers are dealt with similarly, the particulars required including the amount of free acid in sulphate of ammonia, and in the cases of basic slag and ground phosphate rock, the percentages which will pass through a prescribed sieve.

Suitability of Feeding Stuff.—On the sale, as a feeding stuff, of any scheduled article, there is an implied warranty that the article is suitable for use as such and, further, that none of the ingredients included in the Third Schedule, unless mentioned in the statutory statement, is present.

Voluntary Warranties.—In addition to the warranties mentioned above, which are of a compulsory character, any written statement as to the amount of chemical or other ingredients or as to the fineness of grinding of a fertilizer, or as to the amount of the nutritive or other ingredients of a feeding stuff has effect as a warranty.

Limits of Variation.—The warranties implied by statements of percentages of constituents are not absolute. In order to provide against small natural variations between the results of analyzing different samples, a scale indicates the latitude allowable in respect of each scheduled article. These “limits of variation,” as they are called, are set out in the Regulations made under the Act. If the percentages found on analysis of a sample do not differ from the warranty by more than the appropriate limit of variation, no action can lie for breach of warranty; but if the difference is to the prejudice of the buyer and is greater than the limit of variation, he is entitled to claim in respect of the full difference between the percentage warranted and that found. Thus, if superphosphate is warranted to contain 14 per cent. of phosphoric acid and is found to contain 13.6 per cent., as the limit of variation is 0.5 per cent., there is no breach of warranty; but if it contains only 13.2 per cent., a claim can be made in respect of the full difference of 0.8 per cent.

Testing Warranties.—Under the Act of 1906, the purchaser was entitled to take samples himself and submit them for analysis. Samples taken for civil purposes (*i.e.*, for testing the warranty) under the Act of 1926, can be taken *only by official samplers*. If a breach of warranty is disclosed by the analysis of such a sample, a claim can be made by the purchaser but no criminal proceedings in respect of the false warranty can follow. Every County Council and County Borough

Council in England and Wales is required to appoint one or more official samplers. The name and address of the nearest one can be obtained from the Clerk to the local authority, who will also be able to furnish particulars of the fees payable. Samples must be taken within fourteen days of delivery of the consignment or receipt of the invoice, whichever is the later, so that no time should be lost before calling in the official sampler where it is desired to make use of the Act. Copies of the certificate of analysis are sent to both the buyer and the seller.

Criminal Provisions.—The “criminal provisions” of the Act are those which are designed, (1) to ensure that the warranties required by the Act are given, and, (2) to give that measure of official control which is necessary to prevent misrepresentation.

The work of administration is mainly in the hands of County and County Borough Councils, though the consent of the Ministry of Agriculture and Fisheries is necessary before proceedings for certain of the offences against the Act can be instituted. These local authorities are required to appoint inspectors and agricultural analysts for the purpose of carrying the Act into effect.

Failure to give Statutory Statement.—It is an offence to fail to give, within a reasonable time the statutory statement (which constitutes a warranty) required by the Act. Prosecutions for this offence may be undertaken by local authorities without reference to the Minister.

Every parcel of an article included in the First Schedule to the Act (but not the Second) is required to be marked; when prepared for sale or consignment and while on the premises of the seller, in such a way as to indicate to an inspector the particulars which have to be given in the statutory statement. Failure to mark parcels and false marks are two of the most important of the offences against the Act. The mark may be either a plain statement of the particulars comprising the statutory statement or a symbol, such as “X” or “O.O.,” the meaning of which is entered in a register and kept available to inspectors. These marks need not remain on parcels after consignment. They are not intended to fulfil any purpose as far as the buyer is concerned, but merely form part of the method of official inspection. Where symbols are used to denote particulars, a copy of the symbol must appear on the statutory statement. Inspectors who are able to obtain these statutory statements from purchasers will be able to check that the particulars given

to buyers coincide with those marked on the parcels before consignment.

Power of Entry.—In order to permit of the taking of samples and the examination of documents, inspectors are empowered to enter, at all reasonable times, any premises where there are scheduled fertilizers and feeding stuffs which have been prepared for sale or consignment.

Deleterious Ingredients of Feeding Stuff.—It is an offence to sell, offer, or expose for sale as a feeding stuff any article containing a deleterious ingredient. Deleterious ingredients are not defined, but it is provided that substances included in the Fifth Schedule shall be deemed to be deleterious unless the contrary is proved.

Copies of the Act and Regulations can be obtained through any bookseller or directly from His Majesty's Stationery Office (Astrakal House, Kingsway, London, W.C. 2; and branches). The Act is published at 9d. per copy, and the Fertilizers and Feeding Stuff Regulations, 1928, at 9d. per copy, not including postage.

REPORT OF PROCEEDINGS UNDER THE TITHE ACTS

The following Report deals with the business transacted in the Ministry under the Tithe Acts during the year 1927.

Total Amount of Tithe Rentcharge.—The total amount of tithe rentcharge charged on lands in England and Wales by the Tithe Acts, 1836, and the amending Acts, was £4,054,405. It is estimated that, by the end of the year 1927, this sum had been reduced by redemption, merger and other means to about £3,235,000. In previous reports it was only possible to estimate the amount of tithe rentcharge payable to the different classes of tithe-owners, but as the Tithe Act, 1925, transferred, to Queen Anne's Bounty, tithe rentcharge attached to benefices and ecclesiastical corporations, more precise information has now been made available. The particulars supplied by the Bounty indicate that at the end of 1927 approximately £2,026,000 tithe rentcharge was vested in them in trust for benefices, and £98,000 for ecclesiastical corporations. Information supplied by the Ecclesiastical Commission and Welsh Church Commissioners shows that £280,000 and £207,000 respectively was owned by these bodies. The balance of the estimated sum of £3,235,000 above referred to, namely £624,000, or such portion of it as is still payable, is held by various schools, colleges, charities and individual lay owners.

APPENDIX II
TITHE ACTS, 1836 TO 1925
TRANSACTIONS COMPLETED UNDER THE TITHE ACTS, 1836 TO 1925, AND CERTAIN OTHER ACTS

Period	Tithe Rentcharge						Extraordinary Tithe Rentcharge				Corn Rents						Number of Awards of Exchange of Glebe lands, etc.	Redemptions under the Vicar's Rate in Halifax Act, 1877		Redemptions of Tithe Rate under London (City) Tithe Acts		Period														
	Redemptions			Mergers			Altered Apportionments	Redemptions		Exonerations		Redemptions		Conversions		Altered Apportionments		No.	Amount of Rate	No.	Amount of Tithe Rate															
	No.	Amount of Rentcharge			No.	Amount of Rentcharge			No.	Area exonerated		No.	Amount of Rentcharge		No.								Amount of Rentcharge													
		£	s.	d.		£		s.		d.	a.		r.	p.									£	s.	d.	£	s.	d.								
1838 to 1914	19,641	69,470	6	11	17,790	151,433	5	10½	12,205	376	1,535	7	9	5	145	3	8	393	1,638	7	5½	24	6,921	10	5	85	1,543	289	142	3	10½	139	1,491	1	4½	1838 to 1914
1915	255	831	18	2½	90	3,022	15	1	282	4	4	4	10	—	—	—	—	7	19	16	9½	—	—	—	—	6	5	1	0	6	10	3	9	7	9	1915
1916	257	1,158	7	7	62	1,271	16	9½	212	4	2	5	2	1	3	1	17	10	79	16	5½	—	—	—	2	4	3	7	14	9½	5	52	2	2	1916	
1917	157	1,053	4	11½	89	1,138	11	2½	135	2	0	11	5	—	—	—	—	3	1	1	2½	—	—	—	—	1	3	2	3	5	7	29	13	2	1917	
1918	213	1,065	16	7½	131	3,463	13	8	119	7	18	6	4	—	—	—	—	6	50	1	5½	—	—	—	1	2	—	—	—	1	1	19	0	1918		
1919	744	8,442	4	0½	262	4,268	12	6½	208	9	40	7	3	—	—	—	—	13	332	18	7½	2	1,150	13	2	2	4	1	0	6	4½	—	—	—	1919	
1920	2,213	41,344	0	4	367	4,967	7	3½	771	30	53	12	7	—	—	—	—	16	220	1	4	5	1,298	5	5½	3	4	—	—	—	12	43	15	11½	1920	
1921	4,151	96,195	2	4½	270	4,625	10	7½	575	39	79	18	11	—	—	—	—	17	314	13	9	2	810	2	2	1	5	4	1	5	9	1	29	3	1½	1921
1922	4,466	125,260	1	10½	167	3,210	3	1	679	24	68	15	2	—	—	—	—	40	1,324	5	7½	2	373	3	8	3	3	5	2	4	3½	4	14	14	9	1922
1923	2,990	64,788	4	9	252	5,523	7	8½	746	14	24	14	9	—	—	—	—	18	353	19	6	—	—	—	11	1	2	0	10	2½	7	96	14	0	1923	
1924	2,208	27,130	16	8½	156	4,851	10	8½	607	15	59	4	3	—	—	—	—	52	450	15	9½	—	—	—	3	2	3	0	15	0	7	62	2	7	1924	
1925	1,854	18,007	14	2	158	4,121	10	6½	561	14	51	5	2	—	—	—	—	42	287	14	2	—	—	—	7	2	2	1	10	7½	7	108	2	4	1925	
1926	1,795	12,424	0	9½	177	3,589	12	1½	527	18	43	0	0	—	—	—	—	36	403	14	11½	—	—	—	3	2	1	0	3	3	8	104	4	2	1926	
1927	1,795	9,990	10	7½	150	4,051	11	5½	573	24	64	0	3	—	—	—	—	27	144	18	8½	3	498	3	10	3	—	—	—	—	7	193	0	2	1927	
Totals	42,739	477,162	10	0½*	20,121	199,539	8	8†	18,200	580	2,045	13	10	6	149	0	25	680	5,622	5	9½	38	11,051	18	8½	130	1,578	314	159	4	4½	208	2,236	0	6½	Totals

* This sum includes £667 15s. 10½d. unapportioned rentcharge and £476,494 14s. 2½d. apportioned rentcharge.
† This sum includes £46,559 0s. 4½d. unapportioned rentcharge and £152,980 8s. 3½d. apportioned rentcharge.

Redemption of Tithe Rentcharge.—The number of redemption cases completed in 1927 was 1,795, of which 297 were "compulsory" and 1,498 "voluntary," but in several cases rentcharges owned by two or more different tithe-owners were separately redeemed by these proceedings, and the total number of separate redemptions effected was 2,189.

At the end of the year 1927, the number of compulsory redemptions in progress was 611, comprising areas owned by many thousands of small property owners.

The total amount of consideration money and expenses collected by the Ministry in connexion with compulsory redemptions in 1927, was £70,186, and the number of property owners affected by these proceedings was 26,692.

Altered Apportionment of Tithe Rentcharge.—The number of cases completed during the year was 573, of which 441 were voluntary and 132 compulsory. In the latter cases, tithe rentcharges amounting to £5,875 and charged on 28,810 acres, were re-apportioned among 838 landowners. The total

APPENDIX I
SUMMARY OF TITHE RENTCHARGE REDEMPTION PROCEEDINGS COMPLETED DURING 1927

Tithe Rentcharges payable to	Number of separate redemptions completed	Amount of Tithe Rentcharge redeemed			Consideration money for redemption			Redemption Annuities imposed	
		Compulsorily by cash payment	Voluntarily by cash payment	Voluntarily by annuity	Total	Paid in cash	Being paid by Annuity	Number	Total Amount
		£	£	£	£	£	£		£
*Incumbents of Benefices or Queen Anne's Bounty	1,462	1,061	4,314	237	5,612	111,728	5,354	2	294
*Ecclesiastical Corporations or Queen Anne's Bounty	44	39	100	—	139	2,440	—	—	—
Ecclesiastical Commissioners	159	155	594	135	884	12,817	2,532	1	142
Welsh Church Commissioners	32	43	252	—	295	5,424	—	—	—
Other owners	492	370	2,202	488	3,060	43,685	7,948	10	479
TOTAL	2,189	1,668	7,462	860	9,990	176,094	15,834	13	915

* Under the provisions of the Tithe Act, 1925, Tithe Rentcharge attached to benefices and ecclesiastical corporations became, as from March 31, 1927, vested in Queen Anne's Bounty.

of the expenses assessed upon these landowners was £2,226, the average cost being 1s. 6d. per acre, £2 13s. 1d. per landowner, and £16 17s. 3d. per case.

Merger of Tithe Rentcharge.—The total number of declarations confirmed by the Minister during 1927 was 150, and the amount of tithe rentcharge thus extinguished was £4,051 11s. 5½d.

Corn Rents.—During the past year, redemptions of corn rents, rentcharges, and money payments payable out of, or charged on lands in lieu of tithes, by virtue of any local Inclosure Act or other local Act of Parliament, amounting to £144 18s. 8½d. were completed, all of which were redeemed by cash payments. The total consideration of these redemptions was £2,590 6s. 2d. Last year three altered apportionments of corn rents were completed.

Other Transactions.—Other transactions effected during the year 1927, under the Tithe Act and other Acts affecting tithe payments, included 24 redemptions and 20 altered apportionments of extraordinary rentcharge and 7 cases of redemption under the London (City) Tithe Act, 1879, of tithe rate payable in the City of London. The number of cases of apportionment of annuities completed during the year under the Tithe Annuities Apportionment Act, 1921, was 26, and 2 cases under Section 191 of the Law of Property Act, 1925.

During the year, the tithes in the Parish of St. Helens, Bishopsgate, were commuted into tithe rentcharge, and by an instrument confirmed on March 30, 1927, the amount awarded was apportioned amongst the properties liable.

The fees and charges paid to the Ministry during the year ended December 31, 1927, in connexion with the work under the Tithe Acts and other business referred to above were as follows :—

	£	s.	d.
Office fees	19,544	17	6
Inspection fees	644	15	0
Search charges	280	4	0
Charges for copies of, or extracts from, documents and tracings from the relative maps	1,301	1	11
	£21,770	18	5

* * * * *

WEEDS OF ARABLE LAND—IV*

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(With Drawings by BERTHA REID.)

Creeping Buttercup (*Ranunculus repens* L.) must be classed as one of the worst weeds of arable land, particularly on damp, heavy soils. It is a hairy perennial. (Fig. 1.)

In the earliest stage the seedlings have a long, whitish root, which quickly branches; the hypocotyl is smooth, whitish and mostly below the surface of the soil; the cotyledons or seed-leaves are oval, $\frac{3}{10}$ in. to $\frac{1}{2}$ in. long by $\frac{1}{5}$ in. broad, dark green, smooth, and have stalks about $\frac{1}{8}$ in. long. The first leaves are radical, lobed and toothed, dark green, smooth, with a long stalk which is deeply channelled above and bears a few fine hairs. The growing seedling quickly begins to throw out fresh rootlets, in accordance with the perennial habit of the plant, the leaves become more deeply lobed and cut, and develop hairs at the margins, above and below, and on the leaf stalk. Growth is very rapid and the plants throw out runners. The writer has found in cultivated garden soil over 650 seedlings of this weed in a square yard.

In the mature plant the leaves are divided into three segments, the segments also being lobed and toothed; the stems are 1 ft. to 2 ft. high and bear yellow flowers nearly 1 in. in diameter; and the extensive runners root at the nodes, and may quickly cover the ground with a network of the weed (Fig. 3). The flowers appear between May and August. If the weed is not attacked in good time seeds are plentifully produced and grow freely, the weed soon completely over-running the land. The roots are much divided, long and stout.

This pest must be attacked by means of vigorous and frequent cultivation in hot weather, and the loosened plants should, if possible, be collected and burnt. Fallow crops will be most useful, and if the weed be very plentiful, two root crops may be taken in succession with the object of reducing it. If they are deeply ploughed under many of the plants may be destroyed, but they are likely to recover unless buried more than six inches. The weed occurs most freely in damp land, and draining is found to reduce it. In garden cultivation deep trenching will destroy the growing plants, but unless this work be done thoroughly it will be better to fork out the weeds and burn

* See this JOURNAL for April, p. 50, May, p. 147, and June, p. 246, for the first, second and third articles. This series embodies material from certain leaflets issued by the Ministry.

them. Frequent hoeing in hot weather in spring and summer will destroy thousands of the young plants.

Bladder Campion (*Silene vulgaris* Garcke) is one of the commonest weeds of cornfields, and grows on many kinds of soil (Fig. 2).

Seeds sown in May yielded seedlings in a fortnight. The youngest seedlings have a thread-like root; the hypocotyl is thick and fleshy, smooth, white below but slightly tinged green above, a little swollen at the base of the cotyledons; the cotyledons are fleshy, spear-head shaped to nearly spatulate, smooth, light green, with a short and broad stalk—nearly sessile. The total length of the cotyledon is about $\frac{1}{2}$ in. and the breadth $\frac{1}{8}$ in. to $\frac{1}{10}$ in. The cotyledons are semi-erect to nearly horizontal.

In the slightly older seedling the cotyledons may be $\frac{3}{4}$ in. in length and $\frac{1}{4}$ in. broad. The first leaves are on the growing stem, opposite in pairs, resembling the cotyledons, lanceolate to broadly-lanceolate, narrowing to a broad stalk, sparsely downy.

Later the leaves are larger and broader, and may be smooth, sparsely downy, or quite hairy. The seedling now begins to branch from below.

The mature plant is a smooth, shiny perennial, 1 ft. to 2 ft. high, with ovate or oblong pointed leaves and drooping white flowers $\frac{3}{4}$ in. in diameter, appearing from June to August. The calyx is inflated and bladder-like, sometimes with violet veins, and is often picked by children to "pop" by hitting the open end against the hand. The capsule is globose.

Red Campion (*Lychnis dioica* L.) is a softly hairy, viscid perennial, 1 ft. to 3 ft. high, with slender, branched rootstock. The leaves are ovate, and the flowers, which appear in June and July, have reddish-pink lobed petals.

White Campion, Evening Campion (*Lychnis alba* Mill.). much resembles *L. diurna*, but the flowers are white, and fragrant at night. Flowering occurs between June and September. This plant is perhaps most common on light, sandy soils (Fig. 4).

These three species are all common enough in cornfields, leys, and clover crops. Their seeds are often found as impurities in seed samples. Wherever the plants are met with an endeavour should be made to prevent seeding by hand pulling, hoeing, etc. Only pure seed samples should be sown.

Mouse-Ear Chickweed (*Cerastium vulgatum* L.) may sometimes be very troublesome in arable land, while a closely allied

species, *C. arvense* L., may also occur in quantity on light, sandy soils.

Seedlings of *C. vulgatum* were raised from seed in 16 days. The seedling in the youngest stage is very small, with thread-like root; hypocotyl smooth, colourless below to light green above; the cotyledons are ovate-lanceolate to lanceolate, vivid light green, arranged nearly horizontally, narrowing to a short broad petiole, the base of the petioles being slightly bulged. The total length of the cotyledon, including petiole, is about $\frac{1}{3}$ in. and the breadth $\frac{1}{15}$ in.

In the rather larger seedling the stem is light green and smooth; the leaves are stalked, cauline and placed opposite in pairs, closely resembling the cotyledons, but larger and hairy. The seedling soon begins to branch from the base. The stem is tinged reddish.

The plant (Fig. 5) is usually perennial, slender, straggling, procumbent, and downy, with small oblong-lanceolate leaves placed opposite in pairs on the stem; its clusters of small white flowers are arranged on short stalks and appear from April to August. The seeds may occur in poor samples of clover and grass seed, and unless care be exercised may thus find their way to arable land.

C. arvense is perennial; it has a hairy stem, linear-lanceolate leaves somewhat crowded at the base of the shoots, and clusters (cymes) of many small white flowers.

These two species are frequently kept down by the earlier-sown cereals, which soon over-top the low-growing weeds. They are harmful, however, owing to their habit of growing closely around the base of the stems of corn and root crops. Thorough cultivation, and deep ploughing with the use of the skim coulter, keep them in check.

Chickweed (*Stellaria media* L.) is a weed which is ubiquitous on moist arable soils, especially in gardens and on rich, well-tilled land.

From seed sown on May 8 the three stages of seedling illustrated (Fig. 6) were available by June 12. At the outset the root is long and slender; the hypocotyl slender, smooth, crimson from below upwards; and the cotyledons lanceolate, shortly stalked, smooth, light green, tinged crimson at the base, $\frac{3}{10}$ in. total length by $\frac{1}{10}$ in. broad.

The cotyledons grow with the seedling, eventually attaining about $\frac{3}{8}$ in. in length, about one-half of this being the length of the stalk, at the base of which appear a few hairs. The first leaves are opposite in pairs on the stem, are ovate-lanceolate and shortly stalked.

At a later stage the seedling commences to branch from the base; the leaves themselves are smooth, but the petioles and stems bear hairs, a line of hairs running up the stem and crossing over to the other side after passing a node. Branching takes place at the leaf-axils. The stems are tinged with red.

The mature plant is low, prostrate, much branched, and easily distinguished by the line of hair on the stem already noted. "Water poured on the plant runs down these, and Stahl explains them as adaptations similar to drip-tips (cf. *Ficus*) for drying the plant after rain; Lindman thinks they convey the water to the leaf-axils, where it is absorbed by the plant."* The leaves are ovate, the lower ones being stalked and the upper sessile. Large numbers of small white flowers in lax clusters are produced from early spring to late autumn, and the plant exhausts itself in seed production.

Chickweed is a lowly weed which hugs the soil closely, wrapping the ground in a mantle of green. It grows and matures so rapidly, and sheds such an abundant supply of seeds, that a close watch must be kept upon it.

To keep down chickweed a continual use of the hoe in hot dry weather is necessary. In damp weather, especially in garden cultivation, the hoed-out weeds may with advantage be raked off and placed on the compost heap or smother fire, or be deeply buried in the rubbish trench for the growth of marrows. On the farm, surface cultivation to encourage the germination of the seeds, followed by harrowing in hot weather, will destroy large numbers of the seedlings. Deep ploughing, with the use of the skim coulter, will also destroy this weed. In root crops, where the weed presses closely around the base of the plants, especially on the tops of potato-drills, the hand and horse hoe must be used freely and frequently.

Silver-Weed or Goose Grass (*Potentilla anserina* L.) is a perennial weed of prostrate habit, very common by roadsides; it is occasionally a serious pest on arable land, growing well on almost all soils, especially when these are damp.

The seedlings (Fig. 7) are small, with a thread-like fibrous root, dirty white in colour; the hypocotyl is rather stouter than the root, smooth and tinged reddish above; the cotyledons are oval, smooth, dark green, with a short flattish petiole tinged with red, the blade being $\frac{1}{10}$ in. to $\frac{1}{8}$ in. long and $\frac{1}{15}$ in. to $\frac{1}{12}$ in. broad, the length inclusive of petiole being about $\frac{1}{4}$ in. As the seedling grows and leaves appear, the cotyledons become brown or yellow and may fall. The first leaves are

* J. C. Willis, *Flowering Plants and Ferns*.

simple, petiolate, and radical, the petiole being tinged with red, channelled above, and smooth. The leaf blade is dark green above, lighter below, smooth, roundish to semi-circular, but deeply cut or toothed. Subsequent leaves may be trifid to pinnate.

The root is now much divided, long (4 in. to 5 in.), and fibrous. The leaves are radical, the component leaflets being oblong or oval, deeply toothed, dark green with a few short whitish hairs above, but very light green to silvery below, owing to the presence of a white silky down.* The leaf-stalk is slightly channelled above, and tinged with red on the lower portion.

The mature plant (Fig. 7 and 8) is glossy, its silky, silvery-white pinnate leaves, bright yellow flowers, and long runners making it a conspicuous object in the summer months.

Silver-weed is not easily eradicated, as the runners are readily broken, and, as they root at the nodes, small pieces form new plants. Where the weed is a pest it should be given no rest during which it can re-establish itself. Extra deep ploughing, with the use of a skim coulter, will kill much of it, and in ordinary tillage operations much may be gathered and burnt after harrowing. Two fallow crops, such as potatoes and mangolds, may also be taken in succession, so as to afford an opportunity for continual cultivating and hoeing.

It has been recorded† by Mr. W. K. E. de Winton Pembroke that wood-pigeons are at certain times partial to the "sweet and succulent root of the Silver-weed," while pheasants also eat it. Some pigeons, indeed, "seemed to prefer an exclusive diet of this root."

Corn Chamomile (*Anthemis arvensis* L.) is an annual common on arable land, especially in cornfields on the lighter classes of soils.

The root of the early seedling is fibrous, and whitish; the hypocotyl whitish or slightly pinkish; the cotyledons broadly oval, about $\frac{1}{8}$ in. long by $\frac{1}{10}$ in. broad, light green above and beneath, rather joined together at the base, somewhat curved to enclose the central bud. By the time the first leaves appear the cotyledons may attain $\frac{3}{10}$ in. in length and $\frac{1}{8}$ in. in breadth; the first leaves are deeply cut and lobed, the terminal lobe being the largest. The petiole is broad, and about equal in length to the rest of the leaf.

* The var. *servicea* Hayne, with leaves white silky on both surfaces is very common in this country.

† *Jour. Bd. Agric.*, Feb., 1908, p. 686.

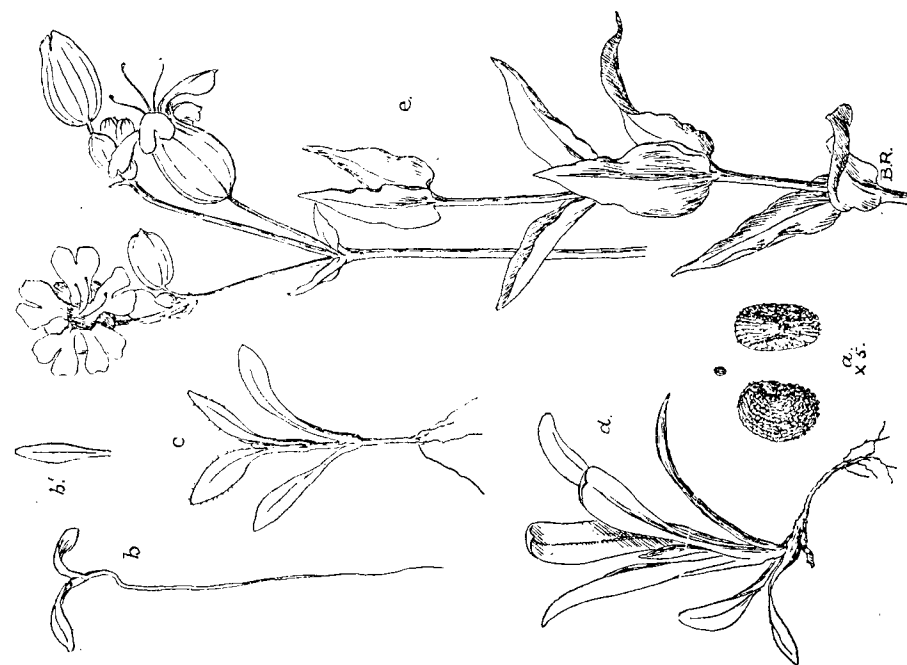


FIG. 3.—Bladder Campion (*Silene vulgaris* Garche). a. Seed, nat. size, and $\times 5$; b, c and d. Three stages of the seedling, $\times 1$; e. Parts of stem showing leaves and flowers, nat. size.



FIG. 1.—Creeping Buttercup (*Ranunculus repens* L.). a. Fruit or "seed," nat. size, and $\times 4$; b, c and d. Progressive stages of the seedling, $\times 1$; e. Flowering stem $\times \frac{1}{2}$.

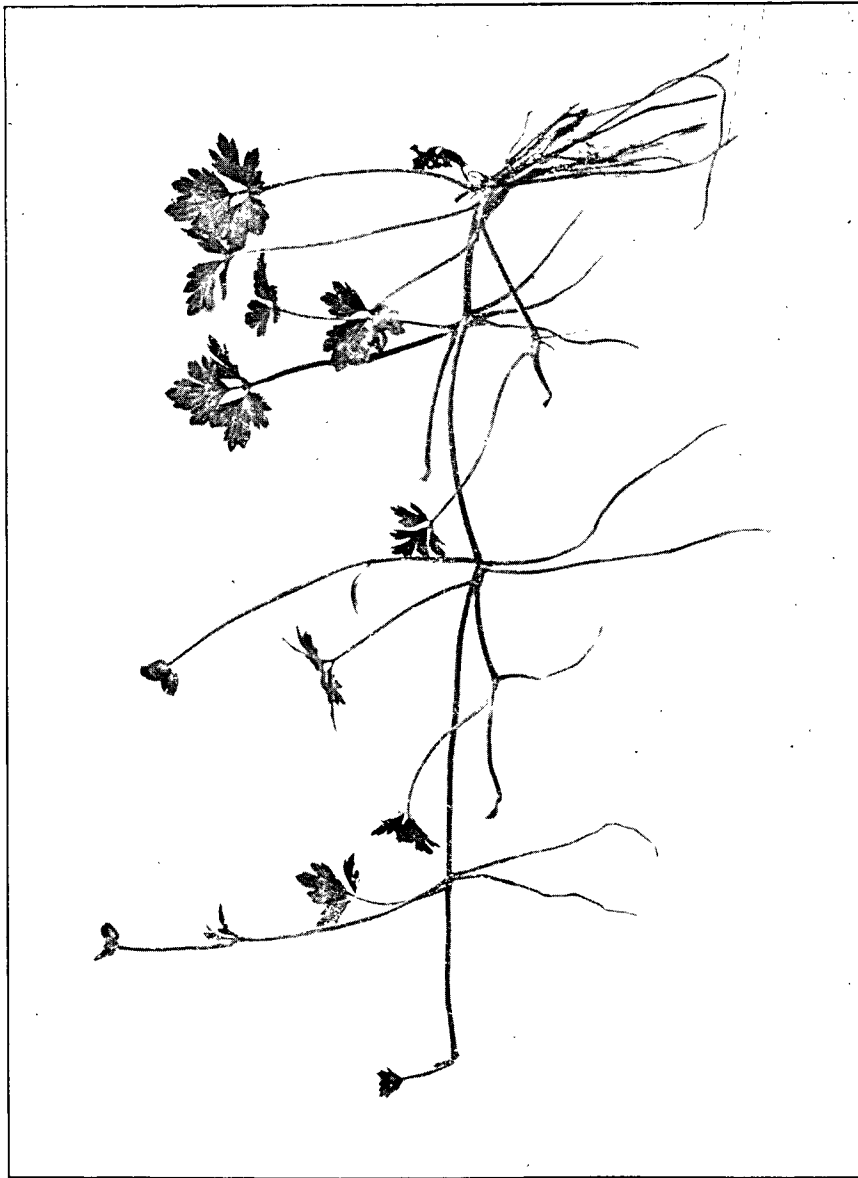


FIG. 2.—Creeping Buttercup (*Ranunculus repens* L.), showing a runner rooting and branching at the nodes.

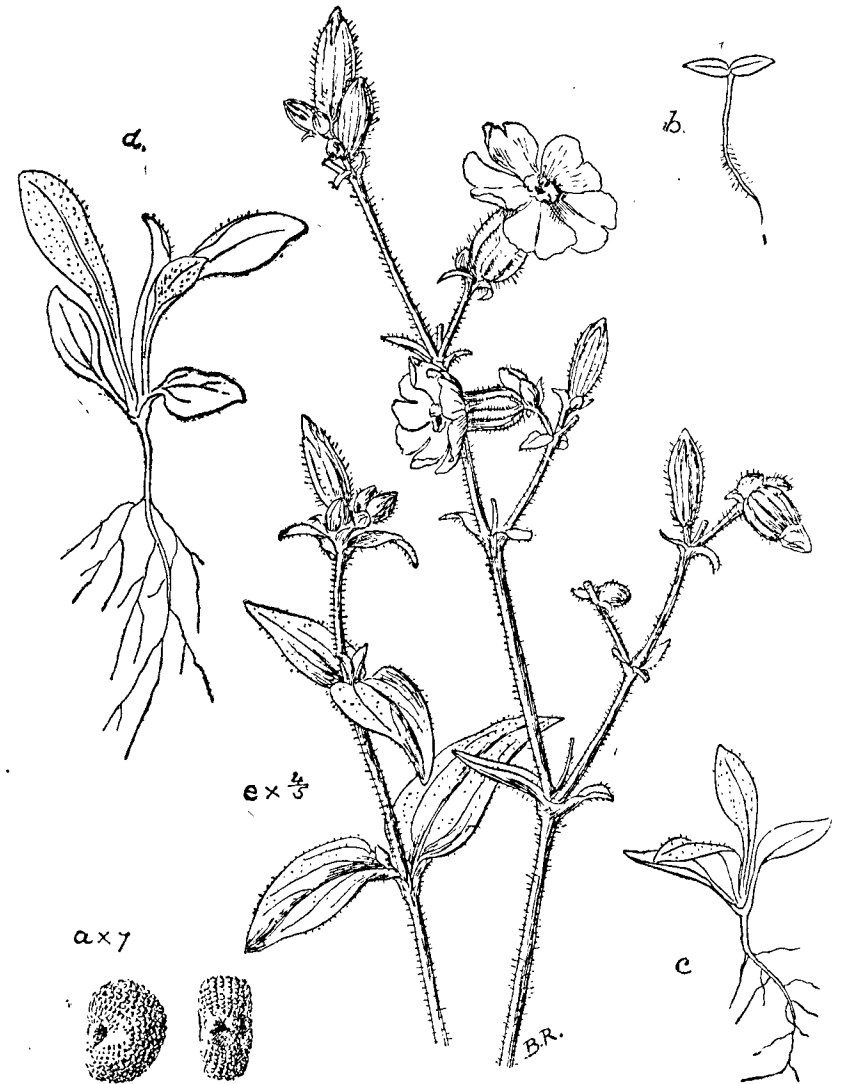


FIG. 4.—White Campion (*Lychnis Alba* Mill.). *a*. Seed, nat. size, and $\times 7$; *b*, *c* and *d*. Three stages of the seedling, $\times 1$; *e*. Flowering stem, $\times \frac{1}{5}$.



FIG. 5.—Mouse-ear Chickweed (*Cerastium vulgatum* L.). *a*. Seed, nat. size, and $\times 15$; *b'*. Cotyledon, $\times 2$; *b*, *c* and *d*. Three stages of the seedling, $\times 1$; *e*. Flowering stem, nat. size.

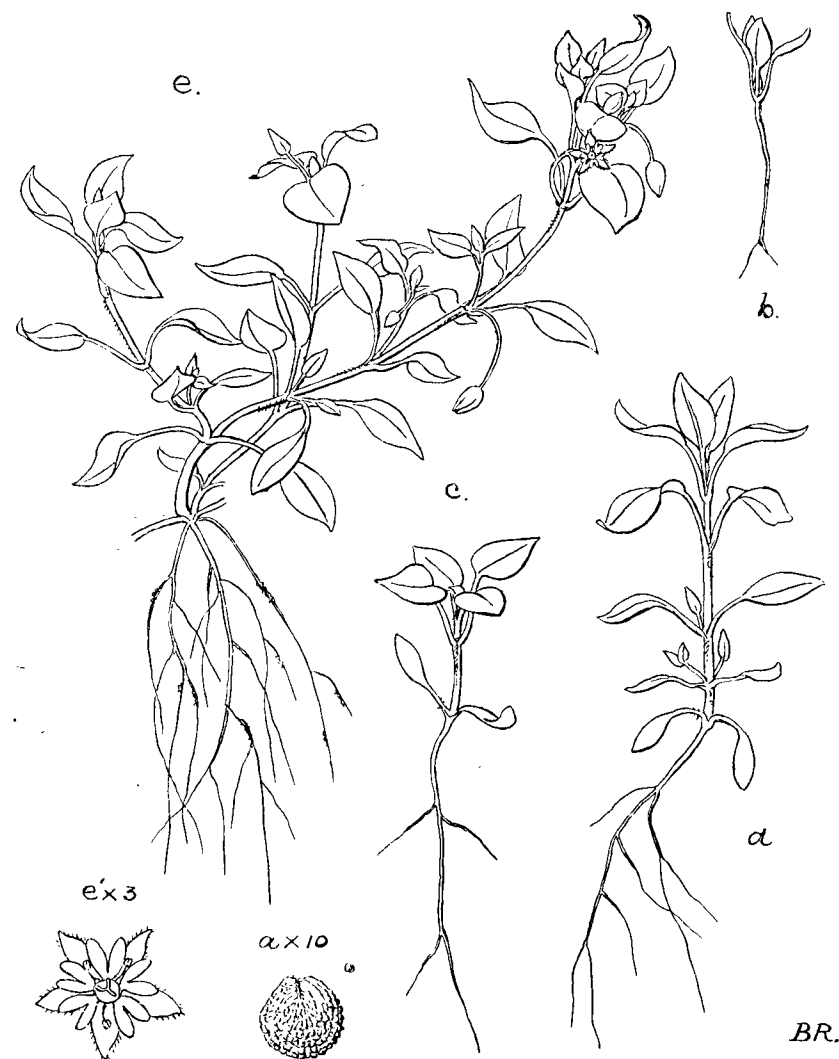
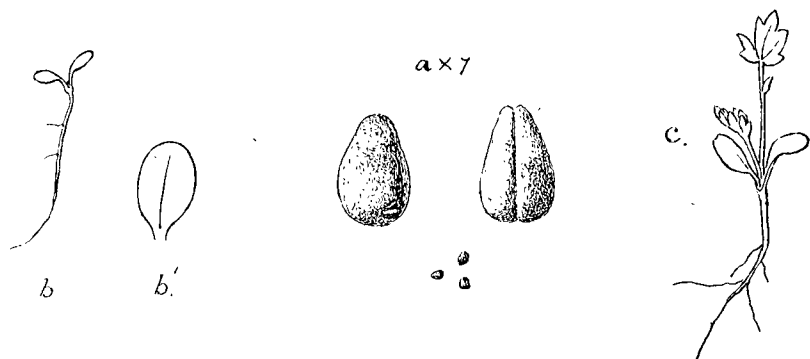


FIG. 6.—Chickweed (*Stellaria media* L.). *a*. Seed, nat. size, and $\times 10$; *b*, *c* and *d*. Three stages of the seedling, $\times 1$; *e*. Young flowering plant, $\times 1$; *e'*. Flower, $\times 3$.



e

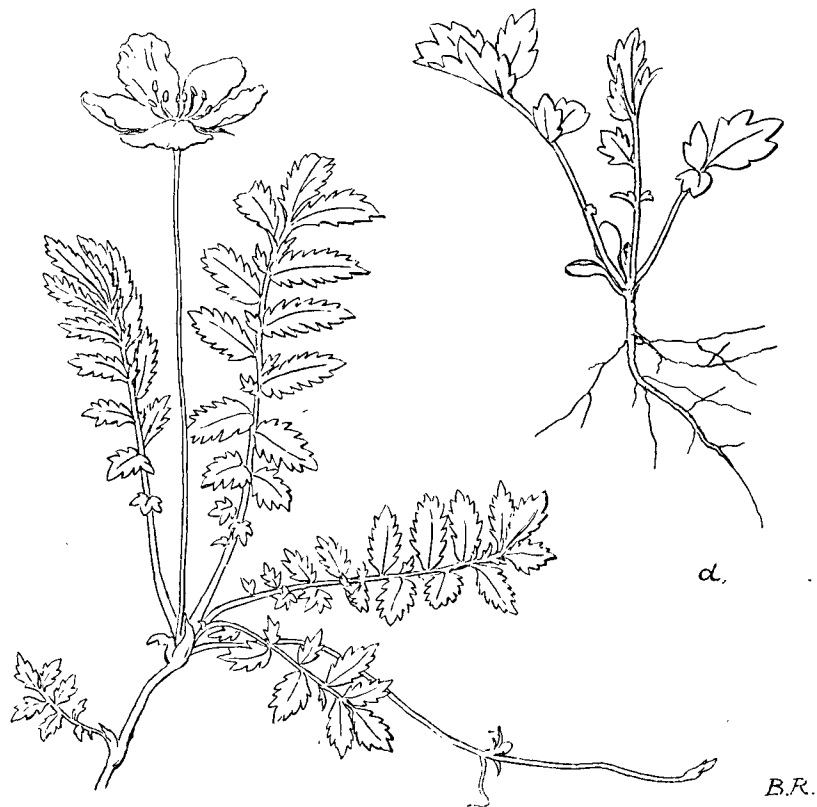
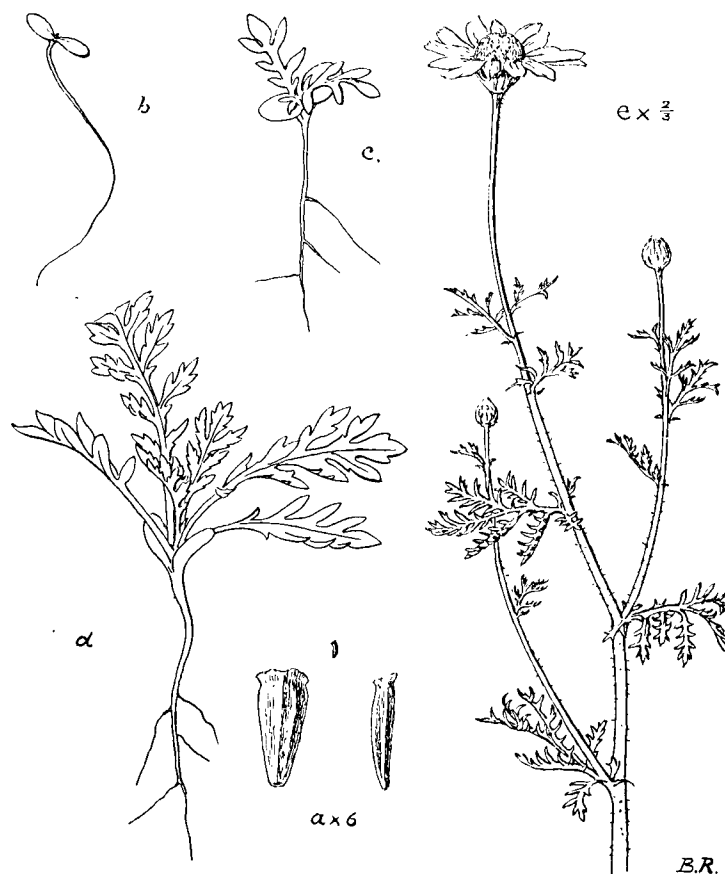


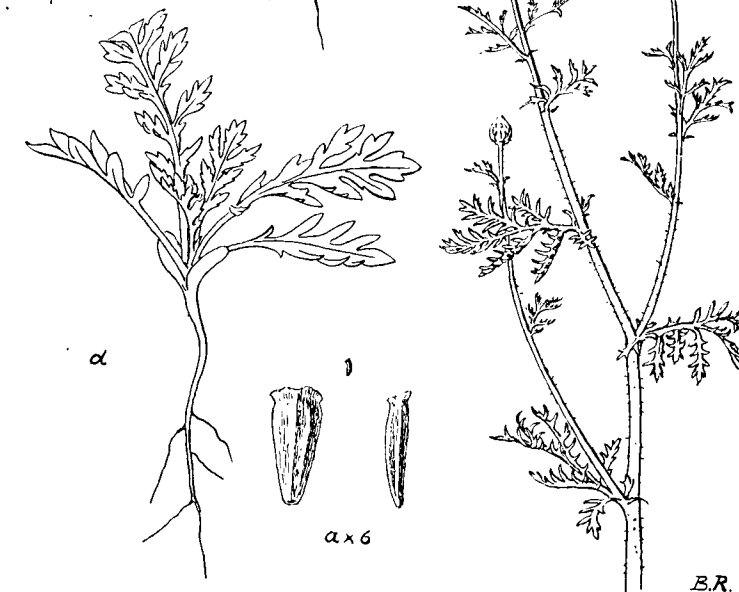
FIG. 7.—Silver-Weed (*Potentilla anserina* L.). a. Seed, nat. size, and $\times 7$; b'. Cotyledon, enlarged; b, c and d. Three stages of the seedling, $\times 1$; e. Flowering branch, nat. size.



FIG. 8.—Silver-Weed (*Potentilla anserina* L.)



e $\times \frac{2}{3}$



B.R.

FIG. 9.—Corn Chamomile (*Anthemis arvensis* L.). a. Fruit or "seed," nat. size, and $\times 6$; b, c and d. Three stages of the seedling, $\times 1$; e. Flowering branch, $\times \frac{2}{3}$.

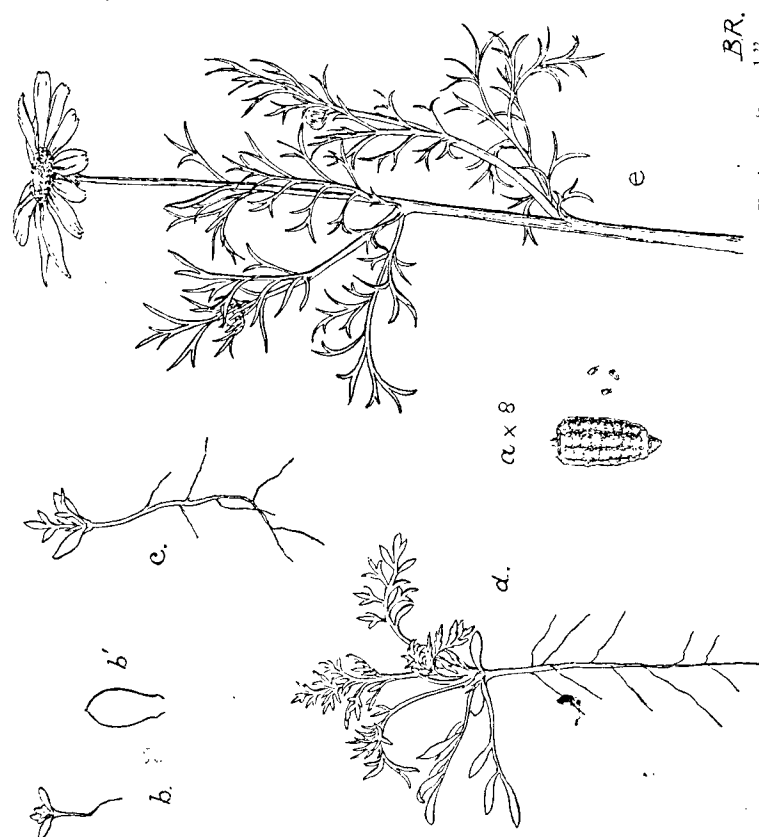


Fig. 10.—Stinking Mayweed (*Anthemis cotula* L.). *a*. Fruit or "seed," nat. size, and $\times 8$; *b*, *b'*. Outline of cotyledon, $\times 1$; *c* and *d*. Three stages of the seedling, $\times 1$; *e*. Flowering branch, nat. size.

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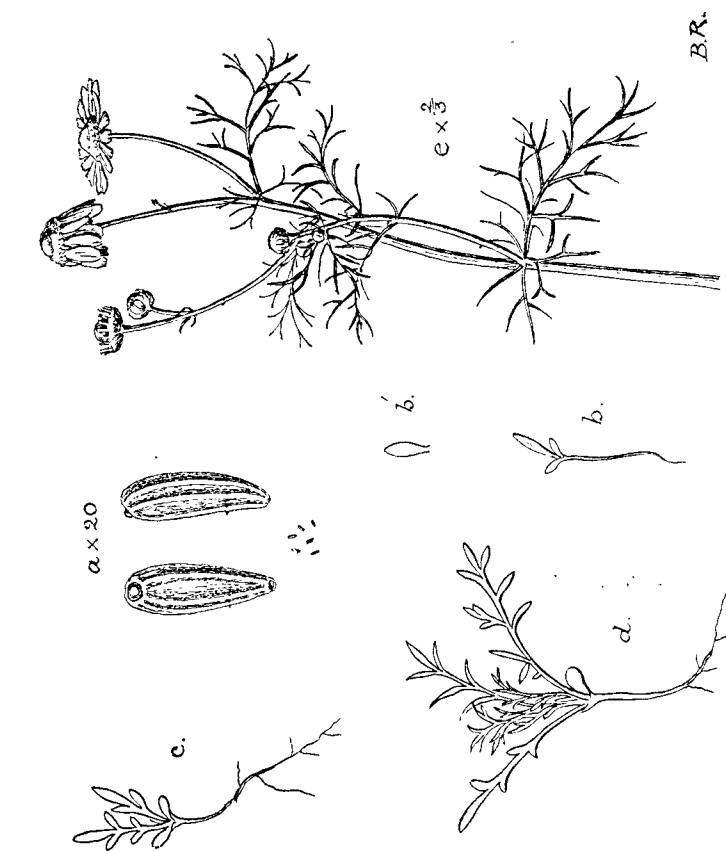


Fig. 11.—Wild Chamomile (*Matricaria chamomilla* L.). *a*. Fruit or "seed," nat. size, and $\times 20$; *b*, *b'*. Outline of cotyledon, $\times 2$; *c* and *d*. Three stages of the seedling, $\times 1$; *e*. Flowering branch, $\times \frac{2}{3}$.

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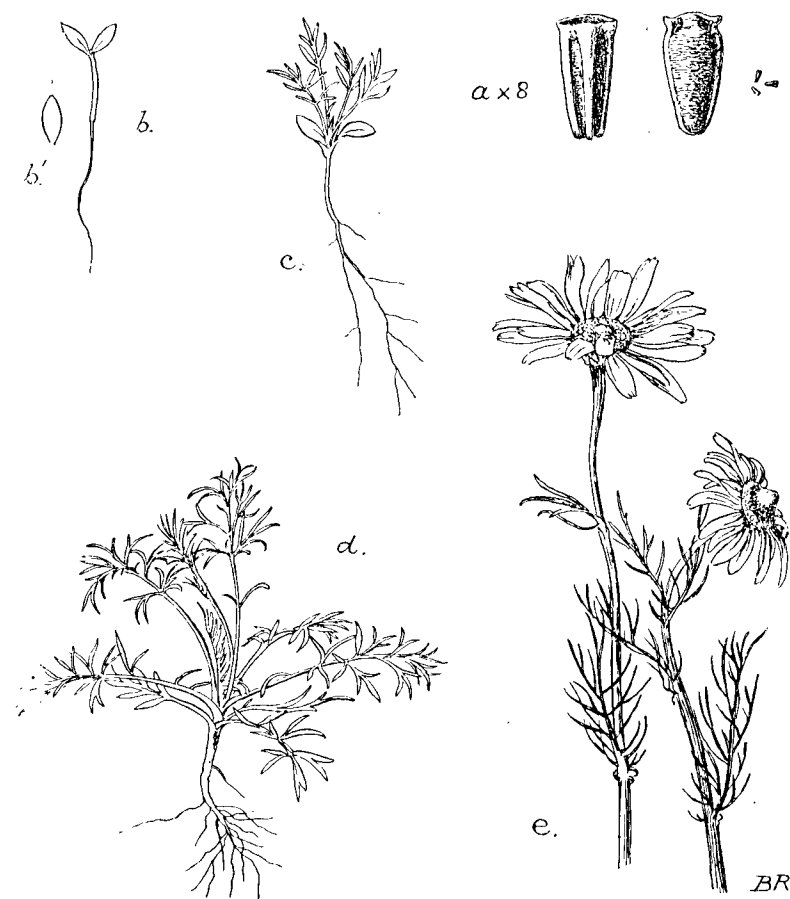


Fig. 12.—Scentless Mayweed (*Matricaria inodora* L.). *a*. Fruit or "seed," nat. size, and $\times 8$; *b*, *b'*. Outline of cotyledon, $\times 1$; *c* and *d*. Three stages of the seedling, $\times 1$; *e*. Flower heads, nat. size.

B.R.

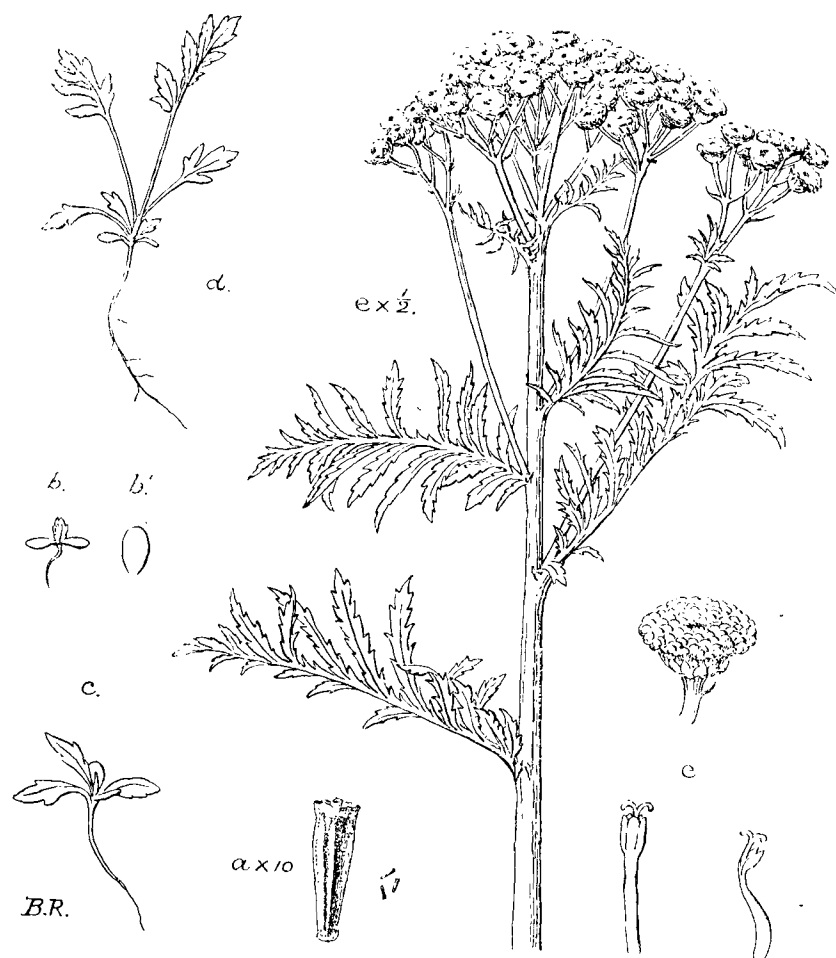


FIG. 13.—Tansy (*Tanacetum vulgare* L.). *a*. Fruit or "seed," nat. size, and $\times 10$; *b'*. Outline of cotyledon, $\times 2$; *b*, *c* and *d*. Three stages of the seedling, $\times 1$; *e*. Flowering branch, $\times \frac{1}{2}$, and (on right) flower head $\times 2$, with florets enlarged.

At a still later stage the leaves are deeply cut into narrow segments which are themselves cut and toothed, the later leaves being progressively more finely divided than the earlier ones; they are light green in colour, hairy, with a strong and not unpleasant odour when crushed.

The mature corn chamomile (Fig. 9) is 1 ft. to 2 ft. high, "usually erect from a decumbent base," and much branched. The leaves are much divided into short linear segments, almost hair-like; and the flower heads are on long stalks, the outer florets being white, and the central or disk florets yellow. Flowering takes place between June and August.

Stinking Mayweed or Stinking Chamomile (*Anthemis cotula* L.) is an annual which is often troublesome on arable land, particularly in cornfields on the heavier soils.

From seeds sown in the first half of May, seedlings were well up in just over a fortnight. At this stage the root is branched and fibrous; the hypocotyl short, thickening above, greenish white; the cotyledons oval to nearly round, but narrowing below, fleshy and brittle, smooth, dark green, joined together at the base, about $\frac{1}{8}$ in. long by $\frac{1}{10}$ in. broad.

The first leaves are light green, slightly hairy, cut and lobed, the terminal lobe being the longer, as in *A. arvensis*.

In the rather more advanced seedling the cotyledon may have attained to $\frac{3}{8}$ in. long by $\frac{1}{4}$ in. broad. The leaves are deeply lobed and cut, fleshy, hairy, light green.

The mature plant (Fig. 10) may be 1 ft. to 2 ft. in height, with a stout branched stem; the leaves are cut into hair-like segments and dotted with glands; and the plant has a strong fetid odour. The white ray florets are usually barren. The flower heads resemble those of *A. arvensis*. It is an acrid weed, the crushed foliage often blistering the hands of those who gather it. Flowering takes place between June and September.

Wild Chamomile (*Matricaria chamomilla* L.) is also a common weed of cornfields on a variety of soils (Fig. 11).

The early stage seedling is minute, the root threadlike, the hypocotyl very slender, whitish and smooth. The cotyledons are nearly oval, but narrowing towards the base, about $\frac{1}{10}$ in. in length, smooth, fleshy, light green.

With the growth of the seedling the cotyledons may attain $\frac{1}{8}$ in. in length. The first leaves are radical, narrow-linear, entire, fleshy, smooth, light green, rather broader towards the apex, where some are slightly indented.

As the seedling increases in size the leaves become deeply lobed and cut, the lobes being narrow-linear, and the one at the apex the largest, as in the case of *Anthemis* spp.

The mature plant is much branched, and in general appearance resembles *A. arvensis* and *M. inodora*, but is smooth. The leaves are bipinnate, and divided into narrow hair-like segments; the flower heads, in corymbose clusters, are only $\frac{1}{2}$ in. to $\frac{3}{4}$ in. in diameter, with an outer row of white florets and a central yellow disk. Flowering takes place from June to August.

Scentless Mayweed (*Matricaria inodora* L.), also called corn feverfew and horse daisy, is a common annual or biennial weed of arable land and waste ground on all soils (Fig. 12).

Seedlings appeared in a fortnight from seed sown in May. The root is short, simple, tapering; the hypocotyl slender, whitish, smooth; the cotyledons oval, tapering below, fleshy, light green, $\frac{1}{10}$ in. to $\frac{1}{8}$ in. long and $\frac{1}{20}$ in. to $\frac{1}{15}$ in. broad.

At a later stage the cotyledons may attain $\frac{1}{5}$ in. to $\frac{1}{4}$ in. in length. The first leaves are radical, very small, smooth, light green, showing little sign of lobes. At a later stage the leaves are still smooth, fleshy, light green, stalked and deeply lobed, the lower lobes being the finest and the upper the largest.

In the mature plant the stem is branched and angular; the leaves are much cut and hair-like; and the flower heads are solitary, and larger than in *M. chamomilla*, being nearly 2 in. in diameter. The whole plant is odourless, or nearly so. Flowering lasts from June to October.

These four weeds may all prove troublesome if allowed to seed, and, as all are annual or biennial, the chief method of reducing them consists in preventing seeding. This may be done by hoeing and surface cultivation in spring, by pulling up the growing plants as long as practicable in standing corn, and by the growth and thorough cultivation of root crops—two in succession, if necessary.

Tansy (*Tanacetum vulgare* L.) is a perennial which may be troublesome on various soils.

In the early stage seedling, the root is long and threadlike— $\frac{1}{2}$ in. to 2 in. long. The hypocotyl is slender, smooth, light green; the cotyledons minute at first but enlarging to $\frac{1}{8}$ in. to $\frac{1}{6}$ in. long, nearly oval, sessile, smooth, light green.

The first leaves are apparently radical, light green, minutely hairy, nearly entire, but slightly lobed and irregular, stalked.

At a later stage the leaves are seen to be cauline, alternate, very light green, apparently smooth, but clearly showing with the aid of a small pocket lens numerous fine hairs, deeply lobed, each lobe being itself lobed and cut. The crushed seedling emits a strong herby smell.

In the flowering stage the tansy is a strong-scented, shrubby plant 2 ft. to 3 ft. high (Fig. 13). The leaves are alternate on the stem and much divided, the segments being toothed; the lower leaves are stalked, but the upper clasp the stem. The flower heads are small, $1\frac{1}{2}$ in. in diameter, dull yellow in colour, and arranged in corymbose clusters. They have been described as button-like, and appear in August and September.

In arable land this weed may usually be kept within bounds by thorough and "clean" cultivation.

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THE COUNCIL OF AGRICULTURE FOR ENGLAND

THE twenty-seventh meeting of the Council of Agriculture for England was held at the Middlesex Guildhall, Westminster, on June 14. Mr. R. G. Patterson (Staffs) was elected to be chairman for 1928. A vote of thanks to the retiring chairman, Mr. W. R. Smith, for his services during the past year was unanimously passed, and Mr. Smith was elected a member of the Standing Committee.

Marketing of Fresh Milk.—Mr. Denton Woodhead, Vice-Chairman of the Standing Committee of the Council, moved the adoption of the Standing Committee's Report on the Marketing of Fresh Milk. He emphasized the fact that it was necessary for the farmers to organize to deal with the surplus milk problem. The producer and consumer should be brought more closely together so that the producer would get fair payment for his goods and the consumer would not be called upon to pay an unreasonable price. The Industrial Co-operative Societies had, in the matter of milk, in some parts of the country been of as much if not more help to the producer than any other group of distributors. Milk had much improved in quality and there was plenty of room for an improvement in the consumption of it.

Mr. Charles Roberts (Cumberland) said that the Council should be grateful to the Committee for this report, though he thought that it represented the matter as being more easy to deal with than it really was. It was not easy to organize co-operative institutions. Money would be required and he did not quite know how the new Agricultural Credits Bill was going to work. He also thought that the report should have dealt more closely with the question of grades of milk. The Ministry of Health fee of five guineas charged to the producers of certified milk was a positive discouragement, and the grading in the Ministry of Health's regulations was, in his

view, weak. Milk was certainly improving in quality, but there was still possibility of improvement and graded milk was still a virtual necessity. As to grading, "Grade A" was not the first but the third grade: this was wrong. "Grade A" could as a matter of fact be produced with little trouble from a herd of cows that had failed to pass the tuberculin test. He thought there should be only two grades of milk, *i.e.*, milk, and "Grade A" milk.

The report was received and adopted by the Council. A copy of the report follows this article.

Marketing of Potatoes.—*Mr. Woodhead* moved the adoption of a report on this subject, which suggested (1) the better storing and grading of ware potatoes and their sale according to grades and standards recognized throughout the country, (2) the organization of the export trade in seed potatoes, including prohibition of export of any consignment which had not been inspected and certified by the Ministry, and (3) that the surplus of "ware" potatoes in seasons of plenty should be dealt with by export, by drying and preserving as food for men and animals, and for manufacture into what are known as "potato crisps."

Mr. Walter Smith said that the Council could hardly expect the Standing Committee, in these Reports, to do more than define certain general principles which were sound in themselves for application to a particular commodity. The Committee could not lay down cut and dried schemes for adoption. As regards the export of seed potatoes, it was necessary to safeguard the exporter against the type of person who is simply out for himself and not for the industry. *Mr. Cecil Robinson* (Holland Division) said that as a grower and exporter of seed potatoes he would like to congratulate the Standing Committee on the report. He felt sure that it was a step in the right direction, and, if growers were careful what they grew, the export trade in seed potatoes would go up by leaps and bounds. *Mr. J. Hamilton* (Lancs) said that he hoped the Ministry would take immediate action on the lines recommended in the report. *Mr. R. L. Walker* (West Riding) said that, whilst appreciating the report, he did not think it went far enough. There was the question of growing certain common kinds of potatoes and passing them on to the consumer as some other variety. This did harm to the potato trade. The common varieties should be reduced as much as possible, and only the best kinds grown. The National Farmers' Union might help in this matter.

Lord Stradbroke, Parliamentary Secretary to the Ministry, said that the Ministry was very much alive to the importance of the potato industry and would do all it could to protect it and to see that the export trade was encouraged in every way.

The Report was received and adopted by the Council.

Wheat Marketing.—*Mr. Woodhead* moved the adoption of the Standing Committee's interim report on Wheat Marketing, which stated that after exhaustive inquiry into the question of a Wheat Imports Board, the Committee considered that such advantages might accrue to the farmer, if the Board carried out what is claimed for it, that the suggestion was worthy of serious consideration by the Government. In recommending the Report, *Mr. Woodhead* said that the quantity of wheat imported was so large compared with the quantity of home-grown, and the margin between the prices of flour for bread making and the price of wheat was so small, that the question became surrounded with difficulty. Under present conditions, farmers were compelled to throw a large quantity of wheat on the market soon after it had been harvested. In consequence the price went down and by the time it rose to its highest, farmers had little left to sell. The suggestion was that an Imports Board for buying all overseas wheat and flour would stabilize the price. At the recent conference of the International Wheat Pool at Regina, the president of the Alberta Pool had declared that the future lay in overthrowing competition and substituting co-operation. How was co-operation possible unless a pool was formed on this side? The Minister of Agriculture might now think it well to appoint a larger and more influential body to consider the whole question. The position of the arable farmer to-day was very bad, and if the establishment of a Wheat Imports Board was going to help, it should be set up. *Mr. W. B. Taylor* (Norfolk) considered the Report to be a very practical one. It displayed a degree of courage which in his view had not hitherto been apparent in reports on the vital questions of prices associated with the industry.

Mr. Christopher Turnor disagreed with the view that the Board suggested was desirable; it could not escape being a Government Board, and could not possibly be satisfactory from the farmers' point of view. He thought a Corn Growers' Association was required. The British Empire was growing more and more wheat and was becoming more and more in a position to control prices. Organizations of farmers existed

in the Dominions and should exist here, and stabilization of prices could be better effected in this way than by Government interference. *Mr. George Rea* (Northumberland) said he did not consider the suggested Board practical. There was the difficulty of storage of imports and cost of storage. The Government might again consider the question of putting a duty on imported flour; it would keep no essential foodstuffs out of the country nor would it raise the price of bread to the consumer; it would give the British farmer the use of more offals from imported wheats; and would assist in increasing the proportion of British wheat in the manufacture of bread. *Mr. John Beard* thought that the creation of so many boards would lead to contention amongst them and that in time they would be superseded. If the Government decided that wheat was required to be grown, wheat growers would have to be paid for it if ordinary production proved uneconomic. *Major S. V. Hotchkin* (Lindsey) said that it was certainly very bad for all concerned to have violent fluctuations in price. The farmer was usually entirely at the mercy of foreign producers, not only of corn but of bacon, meat, etc., and the public was in a similar position. It was, therefore, in the public's interest to work with the farmer and help him to get stabilized prices. The Board, however, should not, he thought, necessarily buy commodities; it should be in a position to negotiate on friendly terms with producers in the Colonies and other countries as regards the amount of any commodity allowed to come into this country at any one time. No hardship would be done either to the overseas supplier or to the consumer, and prices would be stabilized. *Mr. George Dallas* pointed out that the Standing Committee was not asking the Council to pledge itself definitely to the establishment of a Wheat Imports Board. The report that the Government should consider the suggestion was unanimous from the Standing Committee. It was important that no avenue should be closed which might assist the industry and benefit the country. He recommended a Government Committee to explore the whole situation. The Prime Minister of Australia at the Imperial Economic Conference had suggested that an organization for bulk buying of wheat should be set up to stabilize the price of wheat in this country and in the Dominions. It had been objected that the Board would be a Government Department. Those who had examined the question longest did not visualize it as a Government Department. It would rather correspond to the British Broadcasting Corporation. It would

be composed of experts representing the producers and traders, who would be responsible under the Minister or Parliamentary Secretary to make an annual report, but would be free to carry out the details of their own business policy. The tax on flour proposed by *Mr. Rae* was impossible. On the point of storage, it was for the Board to say whether they desired to store or not. There was no suggestion at present that the Board would buy large quantities ahead of requirements, though they might contract to buy. The Corn Production Act had been of no assistance to agriculture and was immediately abolished when it came into operation. It would be a great thing for the country if the price of bread could be stabilized and this might be done through the suggestion now put forward. *Mr. H. W. Thomas* (Hants) welcomed the report. It went in the direction of his own suggestion to the Council about two and a-half years ago, as to which he had spoken in the Council several times since. Eighteen months ago wheat was worth 60s. a quarter. Last autumn it sold for 40s. to 42s. It had risen two months ago, but there was now a set-back, largely owing, he was told, to operations abroad. There were large tracts of land in the southern counties capable of keeping sheep and growing corn. They were not suitable for sugar beet or pasture. In his view, there was nothing that would maintain the cultivation of that land so surely as a fair and suitable price for wheat.

Sir Merrik Burrell (West Sussex) said that the report would have been stronger had it not been for the doubt as to whether the Board might not eventually stabilize the price of wheat at a lower figure than it was to-day. The buyers of the Board could not work in the open market, so that the Board would have to buy on the basis of an agreed price with the big wheat pools, who would, if the scheme were to be practicable, have to agree to work with the Board. The result of such co-operation would probably be that the price would go up in the first instance. If it did, then more land all over the world would be put under wheat, and the extra supply might bring the price down lower than ever. It might be possible to create machinery to restrict undue increase of wheat growing over the world. At the same time, the suggestion was one which should not be thrown away, and ought to be examined by the Government. From the farmers' point of view the Board would be of no use unless it kept the price of wheat up, and there was the question whether the Board would act for the farmer, or with the object of supplying the people with a loaf at the lowest possible price.

Mr. Walter Smith said he thought it only fair to say that the expert evidence before the Committee was that the action of the proposed Board would almost inevitably raise prices, and their fears were, therefore, in the opposite direction to those of *Sir Merrik Burrell*. The Corn Production Act methods had been mentioned and comments made in the sense that the abolition of it was the fault of the Government. The abolition had a particular bearing on the matter of organizations of farmers, when it was remembered that it was with the consent of the farmers' organization in this country. Their attitude was one of complete surrender. *Mr. Christopher Turnor* had suggested an organization of growers. One very excellent witness before the Committee had expressed the gravest doubts as to whether it was possible ever to get the producers of this country to organize. That was the difficulty of the situation. Organization provided the opportunity for the producer to secure power and authority over his product. A scheme was, therefore, wanted which forced organization. One essential condition to successful agriculture was to continue the policy of the plough, and you could not dissociate from that policy the growing of wheat. Two alternative means presented themselves. First, that which *Mr. Rea* had touched on, *viz.*, Protection, which was impracticable. Second, there was Organization. Voluntary organization was impracticable, and the State must come in and do something to secure stability and the confidence that followed stability.

Lord Stradbroke, on behalf of the Ministry, said that he was very glad to be present at this discussion. The whole question had been carefully gone into by the Royal Commission on Food Prices in 1925, and also at a recent Imperial Conference. The Government had then decided against the institution of an Imports Board, and were still of that opinion. As was well-known, the Ministry was assisting the marketing of agricultural commodities, including wheat, in other directions. He hoped that the Credits Bill would assist farmers who had to sell corn immediately after harvest to realize money. It was certainly true that if big purchasers on behalf of the British Government went on the market, they could not help but run up prices.

Mr. Denton Woodhead expressed regret that the Government did not see its way to adopt the proposal. *The Chairman* pointed out that the Council, if it adopted this Report, would not be committing itself to a definite approval of an Imports Board, though, notwithstanding what the Parliamentary

Secretary had said, it would still hope that the Government would consider it. The Report was then put to the Meeting, and received and adopted.

Report on Pork and Bacon Trades.—*Mr. Denton Woodhead* moved the adoption of a Report from the Standing Committee recommending the Ministry's Report (No. 17, Economic Series) on the Pork and Bacon Trades in England and Wales to the members of the Council. *Mr. McCracken* (Cheshire) spoke on the subject and the Report was put to the Meeting and adopted.

Agricultural Credits Bill.—*Mr. Woodhead* also moved the adoption of the Report from the Standing Committee explaining the provisions of the Agricultural Credits Bill now before Parliament. *Mr. Charles Roberts*, *Major Hotchkiss* and *Lord Stradbroke* spoke to the Report, which was put to the Council and adopted.

Registration of Bulls.—*Sir Merrik Burrell, Bart.* (West Sussex) on behalf of the Standing Committee, moved :—

"That the Council reaffirms the Resolution in favour of the elimination of Scrub Bulls which was passed at the Nineteenth Meeting of the Council on December 10, 1925, as follows :—

'That the Ministry of Agriculture be urged to proceed with a draft Bill for the Compulsory Registration of Bulls on the lines of the scheme which has been placed by the Ministry before the Agricultural Advisory Committee for England and Wales. The Council understands that a somewhat similar scheme has been in operation in Northern Ireland under the Livestock Breeding Act (Northern Ireland), 1922, since January 1, 1924, and that it is successfully achieving its purpose. The Council recommends that a suitable time (at least two years) should be allowed to elapse between the passing of the Act and the date of its enforcement, widespread notice of the effect of the Act being given in the meantime.'

"The Council understands that a draft Bill was prepared, but that it was thought advisable not to proceed with it at that time. The Council considers, however, that the time is now ripe for the advance that was then suggested, and it requests the Ministry, in view of the real importance of the subject, to give early consideration to the question."

In the course of his speech, *Sir Merrik* said that he had been content to wait and see how the Irish scheme went, and to profit by their experience. The scheme had been successful in Ireland, and the Standing Committee, agreeing with him, had asked him to bring this motion forward to-day. He suggested that the Minister might now produce a draft Bill and submit it to his Advisory Committee, with two or three representatives of the National Farmers' Union in conference with that Committee. *Major Hotchkiss* seconded the motion, which was also spoken to by *Mr. J. Hamilton* (Lancs), and

Lord Stradbroke, agreeing with the suggestion, outlined what the Ministry's proposals would be, viz :—

- (1) Every bull whether pedigree or non-pedigree would have to be licensed on reaching the prescribed age, about ten months.
- (2) A licensed bull would not have to be examined a second time.
- (3) Bulls would be examined by the Minister's live stock officers, and uniformity of inspection and selection could therefore be secured.
- (4) Appeals to referees from panels nominated by suitable bodies, such as County Agricultural Committees, would be allowed.
- (5) The charge for licence would probably be about five shillings, as is the case in Ireland.
- (6) Any Act of Parliament dealing with this matter would probably not operate until two years after it was passed, and would then only affect young bulls reaching the prescribed age limit.

He said that the Minister would have a draft Bill prepared which he would introduce, provided its provisions carried out the wish of the agricultural community.

The resolution was put to the Meeting and carried unanimously.

Introduction of Foot-and-Mouth Disease.—*Sir Merrik Burrell* (on behalf of the Standing Committee) moved the following resolution :—

"That this Council, in view of the grave danger of outbreaks of Foot-and-Mouth disease being caused by the importation of meat from foreign countries where that disease is endemic, urges the Minister of Agriculture to take all possible steps to ascertain how long the virus may remain active in any portion of the carcass, with the view to taking whatever steps may be found to be the best to limit, or, if possible, eliminate, the risk of the disease being introduced through this source."

Sir Merrik outlined the position in regard to certain scientific inquiries, and stated the length of time in which the virus of Foot-and-Mouth disease had been found to remain active in experimental cases. He thought it was important that these inquiries should be continued with a view to finding the limit of time in which the virus could live under the conditions of the imported meat trade. If it should be proved that the virus did not die out in all parts of frozen and chilled carcasses within a fairly reasonable length of time, he would suggest in all seriousness that all the chilled and frozen meat that comes into this country should be quarantined until such time as the virus is dead. A carcass should not be treated more leniently than a live animal if it were a carrier of disease. *Mr. Gibbons* (Gloucestershire) in seconding the resolution, asked whether there had been an outbreak of Foot-and-Mouth disease during the war. He suggested that the examination of the problem might be narrowed down if we considered the incidence of the disease in connexion with the special

conditions of the war period. *Lord Stradbroke* said that the resolution went right to the heart of the question of protecting this country from the introduction of disease in meat or animal products. The Ministry had started an inquiry to estimate the risk of infection in imported meat and that inquiry at Pirbright Experimental Station had to be interrupted. Pirbright had now been refitted and the work was in progress once more. He hoped that the experiments would show which were the dangerous parts of the carcass, and also that a method might be evolved of treating the carcasses so as to render them innocuous. The reports from the Ministry's Veterinary Inspectors stationed in Argentina showed that the Government there was doing all it could to prevent the exportation of diseased carcasses and were administering their laws with great firmness and showing no favour.

The motion was then put to the Meeting and carried.

Farm Rating Relief.—*Mr. W. B. Taylor* (Norfolk) moved the following resolution :—

"That this Council welcomes the Government's Budget proposals for farm rating relief, but regrets that they will not be operative until October, 1929. In the present circumstances of the Industry, the Council urges the Government to expedite this reform so that it may come into force, if possible, in October of this year."

This resolution was duly seconded and put to the Meeting and carried. The proceedings then terminated.

REPORT FROM THE STANDING COMMITTEE ON THE QUESTION OF THE MARKETING OF FRESH MILK

(1) At its meeting in January last, we reported to the Council upon the question of improving the marketing of the chief agricultural products. In furtherance of the wish of the Council that we should continue our inquiries and make specific reports on individual commodities, we have given close attention to the whole position, having held 15 meetings since January, and at them conferred with a number of men of experience in agricultural production and marketing, some 18 in all.

(2) We have selected fresh milk to be the subject of our first report, as it appears to be the product in which early action of the right kind is likely to be most profitable for farmers. Certain opportunities for improvement present themselves at the present time which, if allowed to slide, may not recur. We, therefore, feel it to be our duty to point out certain essential facts, and to suggest certain courses of immediate action.

(3) To state briefly the present position: the country is practically self-supplying in fresh milk. The farmer has a virtual monopoly of the market. Fresh milk is an indispensable food and has no strong competitor. In such a case, it would seem that the farmer could, if he pleased, control the market and decide the price. As a matter of fact, he is not in a position to do either. On both points, he is beaten through

the presence on the market of milk which is surplus to normal requirements. In other words, he suffers from a curious kind of over-production of his own commodity which need not occur if the industry is organized. At present, the public demand for milk in summer is, on the whole, greater than it is in the winter, and this coincides with the natural seasonal increase in production. Nevertheless, there is much more milk on the market in spring and summer than the market will take as liquid milk. Distributors, however, usually buy it, but at a considerably lower price. In these seasons of surplus they do not reduce the price of all milk to the public and so give this extra milk a chance of ordinary consumption. That would be the course normally dictated by the laws of supply and demand. No doubt they argue that their heavy overhead expenses make it impossible for milk to be dealt in on a smaller distributors' margin than is given by the regular price. So they take the surplus from the farmer more or less as a favour and use it for various purposes, including manufacture into cheese and butter. The farmer does not know what is the amount of the milk paid for at surplus prices for the whole or any of the chief districts. He only knows what his own amounts are. His contract is for so much milk at full price and the rest at surplus price.

(4) Without further elaboration, this statement reveals the essential weakness of the farmer's position. Instead of strength, there is weakness, and it must continue and in time grow into fixity unless action is promptly taken.

(5) The action we suggest is that production should be organized more on the basis of farmers controlling their own commodity up to the time of handing it on to the wholesaler for distribution to the public. That is to say, we suggest that producers should, wherever possible, deal with the whole of their milk at depôts owned by themselves, cooling it, treating it in any way desirable for its proper preservation themselves, and controlling the quality themselves, calling their own members to book for inferior consignments or paying extra for high quality milk. This could be done in some parts of the country now with only a small adjustment of existing organization. In Scotland, in the Glasgow area, a scheme like it is already in operation. By it, producers would be put in a proper position of controlling their commodity, would be able to provide means for dealing with surpluses, and would certainly know what these were, so that the bogey which at present really frightens the producers' market would disappear. They would then be in a position to bargain with power and knowledge with the different distributing organizations as to contracts for supplies. There would no doubt be conferences with representatives of distributors' organizations, both centrally and in the six large consuming areas of Tyneside, Lancashire, Yorks (West Riding), Birmingham and the Midlands, South Wales, and London, and scales of prices would be fixed as at present.

(6) The establishment of a central authority for fixing prices of milk throughout the year has been suggested and we gave it serious consideration in view of the existing inequality in bargaining power through lack of proper organization amongst producers. We think it would inevitably lead to difficulties and to a demand for legal effect to be given to awards which would create a position that would be contrary to the spirit of business in this country. We do not, therefore, recommend it. It is, in our view, much better for the present that each district should have its price fixed for it by organized producers and distributors meeting in conference, with public opinion on the lookout, as it is at present, that unreasonable prices are not charged. We think it well here to state our view that the public has a real interest in price fixing between producers and distributors, not only to see that they are in the end not

charged too much for their milk, but also to see that the producer gets a fair price for his services which are given under conditions which include a variety of new sanitary and other precautions involving expense. In other words, the public require the conditions under which milk is produced to be up to a certain standard and naturally should be interested in seeing that the producer is properly paid for his trouble.

(7) In this way, and provided the system became general, as we think it would, the public would, in time, have a guarantee that milk as it left the producers' hands was sound and of high quality and that the producer was being paid a fair price for his services. No doubt, distribution could be organized in such a way as to ensure that all liquid milk was kept from contamination in the short time in which it was passing through the distributor's hands, and that the least delay possible took place in this operation. The public could then be sure that the milk came to them daily in an absolutely fresh condition, and this confidence, which it should be the aim of all concerned to establish, would be certain to have the effect of increasing consumption and so, as we think, improving the health of the Nation.

(8) In connexion with the question of the treatment of milk by heat, pasteurization, or other heating process to preserve its keeping quality, we look forward to the time when it may be possible to avoid this to a great extent. In present conditions, where the milk is so treated, it is usually done by distributors' organizations. We do not desire to dogmatize on the rightness or wrongness of pasteurization. We think, however, that both scientific and technical inquiries should be pressed forward upon that subject so that the public could know definitely whether pasteurized milk is or is not of as sound a food value for old and young as fresh milk. Personally, we doubt if it is, but have not found sufficient evidence to establish the precise facts or to be satisfied under what circumstances and for what part of our national milk consumption pasteurization is justified. At present, it provides a means to give an assurance of harmlessness of the supply in cases where the operation can be properly performed with the best pasteurizing plant under scientific control. At the same time, it provides a means whereby unsold milk and milk which would otherwise become stale can be sold as freshly pasteurized milk. In other words, milk can be passed through a pasteurization process more than once, and ultimately be sold as ordinary milk without detection. In our view, this should not be done, nor should it be necessary to pasteurize or otherwise treat milk with heat for the purpose of killing bacteria at all. It should be of pure quality when it leaves the farm, cooled to preserve it, bottled, and sold with all its excellent natural properties unimpaired to the consumer as early as possible. Carrying the point one step further outside our province, the consumer should, as a matter of common but vital education, be made aware of the need for keeping milk in absolutely clean receptacles in a cool, fresh position at home in which it is unlikely to become tainted by flies or through proximity to noxious odours or refuse.

(9) In concluding our remarks on this section of our Report, we should like to acknowledge the fact that several Medical Officers of Health have in recent years testified to the greater purity of the milk supply, and have drawn attention to the fact that the number of cases of disease attributable to milk has very much decreased. Some also, while expressing confidence in the cleanness of milk when it leaves the distributors, have felt doubts about the conditions under which the householder keeps it before consumption. Tribute by Medical Officers of Health to cleanly production if it could be general over the country—as we think it would be, were the producers' depôt system which we

advocate generally adopted—would be of the greatest value in strengthening the public's confidence in the purity of its milk supply.

(10) As to the provision of means for the establishment of depots in the various districts, or for existing ones to be acquired from distributive organizations, these might be provided to associated producers under the Government's schemes for the provision of agricultural credit.

(11) The foregoing contains the main suggestions which we have to offer. In this next section we propose to deal more closely with the question of price, which we think can be stabilized for the producer and reduced to the consumer to the benefit of all principal interests concerned. The usual systems are annual contracts based to some extent on the annual agreed prices of the National Federation of Dairymen and the National Farmers' Union, varying winter and summer; but there are also flat rate contracts for the year and others for short periods. The influence of the National Farmers' Union agreements varies considerably over the country; and this is bound to be so with so large a variation of local conditions. The agreements would be likely to be more generally followed if made separately for each of the six big consuming areas, and if the arguments in support of changes in price were based on exact and agreed statistics of rises or declines in prices of dairy farmers' requirements and labour, or on ascertained changes in other related directions. We do not suggest that prices to farmers should necessarily always be the same over the same period for delivered milk in these districts, but we do wish to advocate a scheme which will ensure that a farmer will get the full price for the quality of the milk which he produces, having regard to the accessibility of his farms from the consuming centre.

(12) There should be no question of a smaller price to a farmer because he can for any reason produce milk cheaper than his fellows. That is an advantage which he should enjoy in the same way as another farmer enjoys the advantages of proximity to a centre of consumption, and it should not be taken from him because farmers are badly organized in his particular district.

(13) We stated earlier our view that the price of milk to the consumer could be reduced. It may assist, then, the consideration of this and other relevant questions if we consider the special position of certain groups of producers in the country which have organizations of a particular character, the details of which are known to us. Take first, the Scottish Milk Agency, Ltd., operating in South Scotland and familiarly known as the Glasgow Milk Pool. The Agency is registered under the Industrial and Provident Societies Acts and started operations only on November 1, 1927. It is a producers' organization and owns no depots or factories. Its producer members number about 1,200, besides 14 creameries with a membership of over 600. Contracts have been signed by each member that all the milk he sells in three years from November 1, 1927, shall be sold to the Agency. The contract refers to a definite number of gallons each month, on which the producer is allowed a 10 per cent. variation either way. The prices paid are 1s. 3d. per gallon for every month except May, June and July, when 11d. is the rate. From these prices has to be deducted 1d. a gallon from individual members' milk and $\frac{1}{2}$ d. a gallon for creamery milk, to cover the cost of the Agency in carrying unsold milk, for working expenses, and for a necessary reserve fund. This deduction applies to all milk sold in liquid form. This is merely an expense charge and need not necessarily be the same in later years when the scheme is better established and the Agency is better able to adjust its business. The scheme supplies 70 to 75 per cent. of the milk consumed in Glasgow.

(14) There are besides certain differences in price in individual cases as follows :—

- (a) An added 1d. per gallon for certain milk delivered to the dairyman's premises before 6.30 a.m.
- (b) A deduction of 1d. to 1½d. per gallon in cases where the purchaser lifts the milk within 30 miles of Glasgow.
- (c) Special rates for brine-cooled, pasteurized and accommodation milk.
- (d) Special rates for high quality, such as butter fat content.

(15) It will be noted that members are paid full price for the whole of their contract supplies within a 10 per cent. variation. The question of surplus does not worry the individual. That is a matter which the Agency deals with. The idea behind the formation of the Agency was that it was necessary for the producers to obtain control of the bulk of the supplies in the district. It was realized that before they had done so they could not effectively treat with distributing organizations. It is of interest to note that the retail price of milk per gallon is 2s. in all months except May, June and July, when it is 1s. 8d., prices which are somewhat lower for ordinary milk than those current in many parts of England and Wales. There is a certain amount of milk produced which is in excess of contract quantities. This is sold to the Agency at a manufacturing price fixed by it, which is understood to correspond with the price of Scottish cheese per lb. less a deduction for the estimated cost of manufacture. Thus, the Agency deals with the question of surplus on behalf of its members.

(16) Those are the general outlines of the scheme. It is early yet to say that they are ideal. Certainly, the farmers get for nearly all their milk, prices which are substantially higher than they got before. They control the whole of their supplies, and the milk is sold to the public at lower prices than are current in many industrial districts. Through such a scheme, moreover, all kinds of anomalies are prevented, such as a number of individual producer-retailers retailing milk at a lower, and, to the main body of producers, an uneconomic price, and so, as it were, puncturing the market.

(17) Another instance is that provided by the farmers in a considerable district in Buckinghamshire who have supplied the London Industrial Co-operative Society with increasing quantities of milk over a period of eight years. It appears to owe its success mainly to local organization and to the enlightened and sympathetic understanding of the managers of the London Society. 35,000 gallons of milk per week are now being sent to the London Society's creamery in the district, where it is cleaned and cooled, and sent to London in glass-lined tanks. The Society buys the whole of the output of its contracting farmers' milk at full prices, whilst the local organization deals directly with any cases of inferior quality or unevenness of supply. In this case, the question of surplus does not arise, as the London Society is able to take increasing quantities of milk and the suppliers are limited in number to the needs of the organization. It is understood that there is a waiting list of farmers in the district anxious to join the associated producers.

(18) As to the price paid to the farmer; bringing into the calculation that there is no surplus at a reduced price, the farmer receives 1½d. to 2d. a gallon more than the price otherwise received by dairy farmers in the county for the same quality milk. We were informed that the organization work for the scheme in any district which could link up with a similar distributing organization would be covered by a levy of about $\frac{1}{2}$ d. a gallon. As to price to the public, it is understood that the members of the London Industrial Co-operative Society pay the same price as other consumers in London (2s. 4d. per gallon from October

to March and 2s. per gallon from April to September), but the profits on the milk come back to them in dividends. Three points of interest arise in this connexion: first, the Society pays the farmers more than do other buyers of milk; second, it sells at the same price as other sellers; third, as milk is one of the most profitable articles in co-operative trading, there is a presumption that other sellers could afford to retail it at lower prices than they do at present.

(19) A third instance of successful organization amongst farmers is to be found in the supply of milk to the Belfast Industrial Co-operative Society. There the organization appears to be more the work of the Industrial Co-operative Society than in the last case. It is, anyhow, directed on a broad and generous policy that the best interests of the farmers are also the best interests of the Society; the policy is to encourage farmers to produce good milk and pay them fairly for it. 55,000 gallons of milk a week are dealt with under the scheme and the Society makes no charge for collection within 15 miles of headquarters. All milk is tested and farmers who supply milk with a butterfat content of more than 3·6 per cent. are given $\frac{1}{4}$ d. a gallon more for each decimal point that milk is above that figure, though they must take $\frac{1}{4}$ d. a gallon less for each decimal point it is below. High quality milk from a dozen or so selected farms where "Grade A" requirements are fulfilled is called "baby" milk and paid for at a rate of 3d. per gallon above ordinary milk. The average price for ordinary milk for the year paid to the farmer is 12·24d. per gallon and the average selling price for the year is 22d.—less than 10d., margin for distribution. All milk is filtered, pasteurized, and bottled by the Industrial Society. In addition to these and other works of organization, the Society helps the associated farmers in the provision of feeding stuffs at wholesale prices and milk cans are supplied at cost price, plus carriage. Surplus milk is bought at prevailing manufacturing prices for making into cheese, butter, and lactone.

(20) Generally speaking, the Committee was much impressed by the possibilities of successful union between groups of associated producers and industrial co-operative societies. The producers could as individuals get back a share of the profits of distribution by joining the society as members, and, if the society were big enough, it could doubtless arrange for associated producers to obtain a considerable proportion of their business requirements at wholesale rates. A further advantage is the considerable one of having full particulars of the retailing societies' current costs and profits on milk before a conference when it comes to the question of price-fixing—an advantage which would usually be lacking when the distributors were a combine or amalgamation of limited liability companies.

(21) There are said to be now no less than 440 industrial co-operative societies over the country which are engaged in milk distribution and that they retail about $4\frac{1}{2}$ million gallons of milk a week to about 4 million households. A still further advantage of associated farmers linking up with these societies is that it opens up a channel for the profitable sale of other graded farm produce, *e.g.*, meat, eggs, fruit, and market garden produce.

(22) That sums up the position in favour of organization by farmers. Instances have been collected and no doubt others could be found in which producers of milk are obtaining better prices and conditions of contract where they act together than where they act singly. United, and having in their own hands the power of controlling the major proportion of the district's milk supply, and taking steps to become acquainted with the quantities wanted by distributing firms for liquid consumption, they can secure proper prices for their commodity and be sure that the surplus milk position is not ~~used~~ to their undoing. The

issue to which we are calling attention is, therefore, in essence, a simple one. The National Farmers' Union, which has performed a useful service to the industry in arranging annual milk prices with distributors, is doubtless well aware of the very useful purpose that would be served by the extended association of milk producers as we suggest.

(23) We now go further and suggest that some organization, preferably that of the National Farmers' Union Branches, should take on the work of establishing local agencies on the lines of the Glasgow Milk Pool for arranging contracts, for dealing with surplus milk by the manufacture of cheese, etc., and for dealing with whey and whey products. It would be the duty of any such organization to see to it that it stands independently with the various distributing organizations, not tying itself too closely to any organization but retaining complete freedom to dispose of its milk to the best advantage. At the same time, we regard a system of definite contracts between individual farmers and the Agency to send all the milk they sell through the one channel as a matter of the first importance. To set such a scheme going it may be necessary for farmers to contract for lengthy periods, but, whatever time is agreed upon, it is essential that farmers should stick closely to the terms of their contracts, no matter what better prices they may be offered for their milk by other bodies, and so loyally support their own organization.

(24) Not till some such position is achieved can it be said that the dairy farmer is established in his industry and is making the most of his bargaining power so as to enable him to obtain a full and fair return for services rendered.

(25) We have not thought it necessary in this report to deal with the complication of the varying grades of milk. Broadly speaking, the common milk supply of the country should be so good that there is no great need for higher standards. Nevertheless, it is part of our conception of the proper future of the industry that milk should be paid for according to quality, *i.e.*, percentage of butter fat, and we, therefore, agree that grades will, for this and, under present conditions, for other purposes, still be necessary. But we would recommend that they be as few as possible and that distinction between them be made as simple as possible. In paying more, the public should know exactly what it is buying and should be told it by the simplest of definitions of the article. All milk, at least all that for consumption in centres of population, should be retailed in bottles properly capsuled and labelled with the designation of the milk, pasteurized or otherwise, etc., and, where possible, with the name of the district in which it was produced.

(26) In conclusion, we may say that if the changes which we have suggested in the organization of the milk industry could be made, we are certain that economies in the production and distribution of milk would follow so that the retail price would be able to be reduced. In our view, such reduction, coupled with the increased realization by the public of the importance of milk as a complete and cheap food substance, would lead to much greater consumption, which, in its turn, through the lowering of proportionate overhead charges, might bring a still further reduction in price and improved prospects to the industry.

June 1, 1928.

JULY ON THE FARM

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Seasonal Notes.—At the time of writing, growth is rather backward for the time of the year. The cold, dry weather of May delayed the germination and seedling growth of root crops, so that in Midland districts the singling stage was not generally reached until near the middle of June. The side hoeing and singling of beet and mangolds would, therefore, have seriously clashed with hay-making, but for the fact that, at the usual time for beginning to mow seeds crops, growth was incomplete and the common intention was to await the result of the belated rains that had fallen on June 7 and following days. Pastures showed perhaps the most pronounced effects of unusual weather conditions, keep having become definitely short by the end of May. Owing to lack of indoor fodder the stock had to be turned out to grass before the desirable length of growth had been attained, and this probably aggravated the effect of the cold, dry weather. The prevalence of buttercups and daisies in pastures this year has been very noticeable.

Corn crops are generally not unsatisfactory in the Eastern Midlands and some fields are very promising. Barley in particular looks well, although it is expected to be somewhat late in reaching the shooting stage. The dry weather, however, certainly favoured the cleaning of bare fallows, and steam tackle proprietors have had a busy time. Probably many farmers will endeavour to take advantage of the success of the cleaning operations by devoting a portion of the fallow area to the production of autumn or winter keep. July is not too late for yellow turnips or even for certain varieties of swedes. Apart from the production of forage, there is reason to believe that wheat suffers less from the bulb fly where some crop has been sown on the fallowed land than where the soil has been left bare throughout the summer. In connexion with fallows, attention may be drawn to the practice of sowing rye grass in or immediately after the corn crop preceding the bare-fallow year. The rye-grass (Italian) provides valuable feed for ewes and lambs in spring before the land is broken up. Such keep has been very useful during the past spring; and there is no doubt that, with the aid of a little nitrogenous top dressing, even more and earlier forage could be so provided. Those who have not sown the grass seed may find an opportunity of doing so in August or September.

Hoeing Sugar Beet.—The side-hoeing and singling of the sugar beet crop is usually carried out in the early part of June; further hoeings are given during the second half of the month; and, if weather conditions have not prevented weed destruction, the drills and interspaces are fairly clean when July arrives. During July the crop receives further hoeings, differing in depth and frequency according to circumstances and opinions, but towards the end of the month the foliage begins to extend across the spaces between the rows and inter-cultivation must then cease.

Some farmers believe that the efficiency of the hoeing operation is proportional to the depth stirred; others hold the view that there is no advantage in penetrating more deeply than is requisite to destroy weeds and to freshen the soil surface. The latter view has on previous occasions been advocated in these pages, and the results of last year's experiments in Yorkshire and in Kesteven support it. In five trials carried out in the first mentioned County, four gave results in favour of the shallower work; and in the three Kesteven experiments, two favoured shallow hoeing. The chief objection to deep hoeing, however, rests on the risk of destroying root fibres when the operation is carried out after the crop has reached the stage of rapid growth in mid-July.

As regards the frequency of hoeing in the months of June and July, experiments carried out by the Irish Department in 1925 and 1926 show that good cultivation is remunerative. The omission of hoeing before singling reduced the yield by a ton or more per acre: this would seem to support ridge cultivation as a safeguard in seasons such as the present year, when sugar beet seedlings have come through very slowly. In the Irish trials also, serious depressions in yields resulted from any reduction of the after-cultivations below three horse- and two hand-hoeings or weedings—all completed before the end of July; the advantage gained from further workings, however, was relatively small. Possibly the crop will usually pay for four horse-hoeings during June and July; under special conditions an additional hoeing may be required to break a crust or to lift up the soil after it has been beaten down by a rain storm.

The value of the multiple hoe is obvious, and shares are obtainable to adapt the implement to various conditions. For the third and fourth operations, the trailing blades used in the earlier hoeings should be replaced by A shares. These are obtainable in widths up to 12 in. and are suitable for stirring the interspaces without injury to the plants. The

afternoon is a better time for horse-hoeing than the morning, as the leaves of the crop are then less turgid and brittle. In this matter, however, hay-making and root-hoeing are not very compatible.

Mowing of Pastures.—There is often a remarkable difference between the condition of the sward of meadows and that of pasture fields, especially where the latter are not heavily stocked. In particular, meadows show little tendency to become "matted," whereas pastures which are not especially cared for are inclined to get in this condition. Shortage of lime is often blamed for the accumulation of "mat"; and in most if not all cases, matted turf is associated with soil that shows a lime requirement. Adjoining a matted pasture, however, there may be a meadow which, though it has not been limed, is yet free from "mat" or "skin," indicating that lime is not the only factor to be considered.

Closely grazed pastures remain clean in the sward, even on sour soils. This fact suggests that the reason for meadows also remaining clean, while adjoining pastures become rough, is because the fibrous stalky matter is mown and removed; and the aftermath, being leafy and sweet, is generally grazed off evenly. Nothing is left, therefore, to accumulate on the surface and bring about or aggravate the sour conditions that cause stock to reject the herbage on the places affected.

In recent years many progressive farmers have re-discovered the value of the mowing machine as an aid to pasture management. It is difficult to adjust the number of stock precisely to the total acreage of pasture, the size, water supply, etc., of the different fields, and the varying conditions affecting the growth of grass. By timely mowing of such parts of the fields as tend to become rough, however, the palatability of these portions is improved and they are better grazed in the following year. Mowing reduces their tendency to become matted and ultimately to need liming or breaking up. Early use of the machine is desirable to ensure the best results.

Water.—A reliable supply of good water in every pasture field is an ideal found on only a small minority of farms. Systematic grazing, not to mention intensive management, is impossible, however, without satisfactory watering arrangements. Where water can conveniently be led to a suitable point in a pasture not at present supplied, the cost of providing the requisite concrete trough, ball tap and piping may be small in comparison with the value of the improvement. The cost, generally less than £10 per watering, may in some cases

be justified wholly on the grounds of the better segregation of the different classes of stock.

Pond or "mere" waterings are generally subject to serious contamination, and may sometimes lead to ill-health and the spread of disease in cattle. Abortion, Johne's disease, garget and ropy milk are some of the troubles which may be associated with water supplies to which cattle have improper access, although contaminated pastures and byres may be equally responsible. Such waterings should be fenced off, so that the animals cannot contaminate them, and the water led to a suitable trough. Sometimes the water may be led in a pipe from the pond to a trough placed at a lower level in the field; the supply may then be regulated by a ball tap. A cheaper arrangement is merely to sink a trough to the level of the pond overflow, then dig out and otherwise prepare a suitable approach. An old bath may be used for the trough, the water being led into it through the waste aperture.

Waterings in streams should likewise be fenced off where this is practicable. The introduction of weirs is objectionable from the point of view of arterial drainage.

Live Stock.—Cows due to calve in October are dry or yielding little milk in July; and with the modern tendency to increase the proportion of autumn calvers in herds, the output of milk begins to fall to a low level towards the end of the month. For this reason it is convenient to arrange for the heifers to calve down for the first time about this time of the year; and this affords an opportunity to give the young cow the desirable long rest after her first lactation period. Newly calved heifers on July grass may require rather liberal assistance with concentrated foods, to keep up their yield and extend their lactation well into the winter: otherwise July is not a good month for calving, where good milk records are desired.

It is not unlikely that many cows that are dry or going dry in this month will still be in rather poor condition as a result of the bad winter and the poor spring grazing conditions. To bring these cows into satisfactory form for winter milk production, therefore, supplementary feeding may have to be commenced rather earlier than usual. On farms where contagious mammitis occurs, dry and drying-off cows are often affected in July. A sharp lookout should, therefore, be kept in order to observe and isolate the first cases before they have spread the disease to other members of the herd. The part played by contaminated waterings in this connexion has already been mentioned.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

Description	Average price per ton during week ending June 13				
	Bristol	Hull	L'pool	London	Cost per unit at London
Nitrate of soda (N. 15½%) ..	£ s. 11 15	£ s. 11 0	£ s. 10 10	£ s. 10 7	s. d. 13 5
" " line (N. 13%) ..	..	..	..	11 7½	17 6
Nitro-chalk (N. 10%) ..	7 0f	7 0f	7 0f	7 0f	14 0
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%)	11 19g	11 3h	..	..	..
Sulphate of ammonia :—					
Neutral (N. 20.6%) ..	10 13*	10 13*	10 13*	10 13*	10 4
Calcium cyanamide (N. 19%) ..	9 0†	9 0†	9 0†	9 0†	9 6
Kainit (Pot. 14%) ..	3 7	2 17	2 18	3 1	4 4
Potash salts (Pot. 30%) ..	5 2	..	..	4 19	3 4
" (Pot. 20%) ..	3 17	3 5	3 10	3 10	3 6
Muriate of potash (Pot. 50-53½%)	9 10	9 0	9 9	10 0	3 9
Sulphate " (Pot. 48-51½%)	11 10	11 0	11 14	12 2	4 9
Basic Slag (T.P. 31%) ..	3 1§	2 8§	2 9§	..	..
" (T.P. 32%) ..	2 19§	2 6§	2 7§	..	..
" (T.P. 30%) ..	2 16§	2 3§	2 4§	2 2e	1 5
" (T.P. 24%) ..	2 7§	1 18§	1 19§	..	..
Ground rock phosphate (T.P. 58%)					
Very fine grade ¶	2 15	..	..	2 2d	0 9
Fine grade ||	2 10	2 8	..	2 0d	0 10
Superphosphate (S.P. 35%) ..	3 0	..	3 1	3 0	1 8
" (S.P. 33%) ..	..	..	2 19	..	..
" (S.P. 30%) ..	2 15	2 10	2 15	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 12	8 2	..
Steamed bone flour (N. ½%, T.P. 60-65%)	5 17†	6 2†	6 5	5 15	..

Abbreviations: N.—Nitrogen; S.P.—Soluble Phosphate; T.P.—Total Phosphate; Pot.—Potash.

* Delivered in 6-ton lots at purchaser's nearest railway station. 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.

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

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

§ Prices for 6-ton lots delivered to purchaser's nearest railway station in neighbourhood of town mentioned above.

¶ Fineness 80% through standard screen of 14,400 holes to the square inch (120 mesh sieve).

|| Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London stations the cost to purchasers is 2s. 6d. per ton extra.

e F.o.r. Northern rails; 3s. 6d. per ton extra on Southern rails.

f Delivered in 6-ton lots at purchaser's nearest railway station.

g F.o.r. Gloucester.

h F.o.r. Gooles.

NOTES ON FEEDING STUFFS FOR JULY

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The Vitamins in the Ration.—Much has been heard of the subject of vitamins during the last two decades. Not since Darwin's time have the results of biological inquiry taken such hold of the popular imagination. Nevertheless, the discerning farmer is frequently at a loss to understand why these much-talked-of discoveries have exerted such a minor influence on the recognized methods of feeding farm stock. It is from this point of view, therefore, that the writer wishes to deal with the subject.

Before discussing the significance of vitamins in the feeding of farm animals, we may usefully consider how the discoveries in this branch of the science of nutrition arose. By the end of the first decade of the present century, it was well recognized, as a result of the painstaking investigations of the chemist, that the essential constituents of feeding stuffs were moisture, protein, fat, carbohydrates (including fibre) and minerals. The conclusion was naturally drawn that, if the diet of an animal contained all these ingredients in suitable amount and proportion, then the animal was receiving everything necessary to maintain it in satisfactory condition and health, and, in the case of a young animal, to enable it to grow and develop normally.

The final proof of this hypothesis, however, could only be obtained by ascertaining whether it was possible to bring up young animals to maturity on an artificial diet made up by mixing together the requisite organic and inorganic constituents. In the year 1912, Professor Hopkins (now Sir F. G. Hopkins), of the Biochemical School at Cambridge, decided to test this theory of the nature of feeding stuffs, and to the results of his cleverly devised experiments we owe the discovery of vitamins.

The ration which he employed in his tests was prepared by mixing together highly purified casein (protein from milk), starch (carbohydrate), lard (fat) and inorganic salts similar to those existing naturally in milk. Suitable amounts of this diet were fed over long periods to laboratory-bred rats. It is important to remember that all the early work on vitamins was carried out on small animals like rats and guinea pigs. The rate of growth of such young rats receiving this artificial ration was compared with that of rats receiving a ration composed of

natural food. The animals on the natural ration grew very quickly during the early days of the experiment and, later, their rate of growth gradually slowed up, until, finally, they attained to mature size, at which stage their weight remained roughly constant. Such behaviour, of course, represented normal development.

The rats receiving the artificial ration, however, displayed very different behaviour. They grew fairly satisfactory in the first part of the experiment; but growth soon ceased, and this was followed by gradual decline in weight and ultimate death. These symptoms of malnutrition were in no way connected with a deficiency of nutrient matter in the artificial diet, the latter, from the energy point of view, being just as rich as the natural diet supplied to the control set of experimental rats.

It was at this point that Professor Hopkins made the critical discovery. He found that if to the artificial diet of the rats suffering from nutritional disorders he added a few drops of fresh milk daily, then such sick rats began to show quick signs of recovery, putting on weight again and subsequently growing quite satisfactorily to adult size. To what property of milk was this remarkable effect to be attributed? Obviously, it could not be ascribed to any increase in the amount of nutriment (protein, carbohydrate, etc.) brought about by the addition of such small amounts of milk, since clearly such increase was almost negligible. Professor Hopkins concluded that there were present in milk some substances, in extremely minute amount, which were absolutely essential to the health and well-being of the animal organism, especially that of the young growing animal. He further concluded that very small amounts of such substances were sufficient to maintain normal health in animals. These newly-discovered factors in animal nutrition were termed by Professor Hopkins accessory food factors; they are now better known under the name of vitamins.

During the last decade and a-half, bio-chemists in all parts of the world have been engaged in an intensive search for vitamins in all the available feeding stuffs. The existence of five such vitamins is now definitely recognized.

(1) *Vitamin A*.—The absence of this vitamin from the diet causes retardation of growth in young animals, and, in the case of adult animals, appears to lower the resistance of the organism to infectious disease. It is present in milk, butter and egg yolk. Cod liver oil is a specially rich source of vitamin A,

while recent research has shown that sheep's liver oil is even richer. The farmer should bear in mind that green plants are the primary source of this accessory food factor. If it is not present in the diet of the dairy cow, then it will be absent from the milk of the animal. It has even been found possible to trace back the vitamin A, stored in the liver of the cod, to the agency of green plants. A unicellular marine plant, the diatom *Nitzschia closterium*, synthesizes, or builds up, after the manner of terrestrial green plants, vitamin A from inorganic materials. Such plants are consumed by innumerable species of small marine animals, plankton, which secure in this way their supplies of the vitamin. Again, the plankton are devoured by larger species, such as squid, small fish, etc., which in turn constitute the food of larger fish, such as the cod. It follows that the vitamin A stored together with the oil in the liver of the cod has for the most part passed through several organisms since it was originally manufactured in the marine plant. The green plant, therefore, is to be regarded as the sole elaborator of vitamin A.

(2) *Vitamin B*.—Continuous deficiency of this vitamin in the diet of animals gives rise to acute nervous disorders. The eastern disease of beri-beri is due to the exclusive feeding on rice which has had the pericarp and most of the underlying layer removed in the process of polishing. Fowls fed on polished rice develop a polyneuritis similar to that occurring in beri-beri. The diseased condition disappears when the rice polishings, which contain the vitamin B, are added to the deficient diet.

Vitamin B is contained in milk, rice bran, yeast, wheat bran and germ. Ordinary white flour is deficient in this food factor, since the object of modern milling is to remove the bran and embryo as completely as possible. Where bread forms the staple food of human beings, therefore, it would seem advisable to use whole-meal instead of white flour. With the ordinary varied human dietary, however, this is largely a matter of indifference, since the minute amounts of this vitamin which are necessary for the maintenance of health, even though absent in the bread, will readily be secured from other sources.

(3) *Vitamin C*.—The long absence of this vitamin from the diet leads to the condition known as scurvy. Guinea pigs fed on a mixture of oats and bran show, at the end of about three weeks, symptoms closely resembling those of human scurvy. This condition can be cured by giving them small amounts of fresh fruit and vegetables, or extracts prepared from such

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materials. Vitamin C is also present in relatively large amount in fresh green plant tissues. It is not present in dried seeds, but is produced during their germination, a fact which was successfully made use of during the war in coping with an outbreak of scurvy in the Near East.

(4) *Vitamin D*.—This vitamin occurs in association with vitamin A in milk and cod liver oil. It plays an essential role in the normal processes of bone and teeth formation. It was noted some years ago that rickets in its early stages could

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	11 2
Maize	81	6.8	10 10
Decorticated ground nut cake	73	41.0	13 5
" cotton cake	71	34.0	12 0

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

The cost per unit starch equivalent works out at 2.84 shillings, and per unit protein equivalent, 1.54 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 1927, 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	10 19
Oats	60	7.6	9 2
Barley	71	6.2	10 11
Potatoes	18	0.6	2 12
Swedes	7	0.7	1 1
Mangolds	7	0.4	1 0
Beans	66	20.0	10 18
Good meadow hay	31	4.6	4 15
Good oat straw	17	0.9	2 10
Good clover hay	32	7.0	5 2
Vetch and oat silage	13	1.6	1 19
Barley straw	19	0.7	2 15
Wheat straw	11	0.1	1 11
Bean straw	19	1.7	2 17

DESCRIPTION	Price per qr.		Price per ton £ s.	Manu- rial 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.	Pro- tein equiv. %
	s. d.	lb.							
Wheat, British	—	—	11 15	0 13	11 2	72	3 1	1.65	9.6
Barley, British feeding	—	—	10 5	0 10	9 15	71	2 9	1.47	6.2
" Canadian No. 3 Western	41 6	400	11 12	0 10	11 2	71	3 2	1.70	6.2
" Danubian	39 3	"	11 0*	0 10	10 10	71	2 11	1.56	6.2
" Karachi	39 3	"	11 0†	0 10	10 10	71	2 11	1.56	6.2
" Chilian	39 9	"	11 3‡	0 10	10 13	71	3 0	1.61	6.2
" Persian	39 0	"	10 18	0 10	10 8	71	2 11	1.56	6.2
Oats, English, white	—	—	13 13	0 11	13 2	60	4 4	2.32	7.6
" " black and grey	—	—	12 10*	0 11	11 19	60	4 0	2.14	7.6
" Canadian No. 2 Western	40 0	320	14 0	0 11	13 9	60	4 6	2.41	7.6
" " " 3	38 9	"	13 12	0 11	13 1	60	4 4	2.32	7.6
" " feed	35 0	"	12 5	0 11	11 14	60	3 11	2.10	7.6
" Argentine	35 6	"	12 8	0 11	11 17	60	3 11	2.10	7.6
Maize, American	44 9	480	10 8	0 11	9 17	81	2 5	1.29	6.8
" Argentine	45 6	"	10 12	0 11	10 1	81	2 6	1.34	6.8
Beans, English, winter	—	—	10 7†	1 6	9 1	66	2 9	1.47	20
Peas, Indian	—	—	11 10†	1 3	10 7	69	3 0	1.61	18
" Japanese	—	—	26 0‡	1 3	24 17	69	7 2	3.84	18
Dari	—	—	10 5	0 13	9 12	74	2 7	1.38	7.2
Millers' offals—	—	—	—	—	—	—	—	—	—
Bran, British	—	—	8 5	1 3	7 2	42	3 5	1.83	10
" broad	—	—	9 2	1 3	7 19	42	3 9	2.01	10
Middlings, fine, imported	—	—	9 16	0 18	8 18	69	2 7	1.38	12
" coarse, British	—	—	8 15	0 18	7 17	58	2 8	1.43	11
Pollards, imported	—	—	8 5	1 3	7 2	60	2 4	1.25	11
Meal, barley	—	—	12 7	0 10	11 17	71	3 4	1.78	6.2
" maize	—	—	11 10	0 11	10 19	81	2 8	1.43	6.8
" " S. African	—	—	10 0	0 11	9 9	81	2 4	1.25	6.8
" " germ	—	—	10 0	0 16	9 4	85	2 2	1.16	10
" " gluten feed	—	—	9 10	1 1	8 9	76	2 3	1.20	19
" locust bean	—	—	10 0	0 8	9 12	71	2 8	1.43	3.6
" bean	—	—	12 17	1 6	11 11	66	3 6	1.87	20
" fish	—	—	21 10	3 10	18 0	53	6 10	3.66	48
Maize, cooked flaked	—	—	13 0	0 11	12 9	85	2 11	1.56	8.6
Linseed—	—	—	—	—	—	—	—	—	—
" cake, English 12% oil	—	—	13 2	1 11	11 11	74	3 1	1.65	25
" " " 10% "	—	—	12 12	1 11	11 1	74	3 0	1.61	25
" " " 9% "	—	—	12 7	1 11	10 16	74	2 11	1.56	25
" " " 6% "	—	—	11 10	2 4	9 6	69	2 8	1.43	36
Cottonseed cake English—	—	—	—	—	—	—	—	—	—
" Egyptian 5½% "	—	—	8 15	1 10	7 5	42	3 5	1.83	17
" " Egyptian 5½% "	—	—	8 7	1 10	6 17	42	3 3	1.74	17
Decorticated cottonseed cake,	—	—	12 0	2 5	9 15	74	2 8	1.43	35
" 8% oil	—	—	—	—	—	—	—	—	—
" meal, 8% oil	—	—	12 0	2 5	9 15	74	2 8	1.43	35
Coconut cake, 6% oil	—	—	11 10	1 6	10 4	79	2 7	1.38	16
Ground nut cake 7% oil	—	—	12 10	1 7	11 3	57	3 11	2.10	27
Decorticated ground-nut cake,	—	—	13 5*	2 5	11 0	73	3 0	1.61	41
" 7% oil	—	—	—	—	—	—	—	—	—
Palm kernel cake, 6% oil	—	—	9 10‡	0 19	8 11	75	2 3	1.20	17
" " meal, 6% oil	—	—	10 15†	0 19	9 16	75	2 7	1.38	17
" " meal 2% "	—	—	9 10†	1 0	8 10	71	2 5	1.29	17
Feeding treacle	—	—	6 5	0 9	5 16	51	2 3	1.20	2.7
Brewers' grains, Dried ale	—	—	8 12	1 0	7 12	49	3 1	1.65	13
" " " porter	—	—	8 2	1 0	7 2	49	2 11	1.56	13
Malt culms	—	—	6 10	1 9	5 1	43	2 4	1.25	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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. 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 1.29d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.29d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 11d.; P₂O₅, 3s. 10d.; K₂O, 3s. 3d.

often be cured by the administration of suitable doses of cream or cod liver oil. Later it was discovered that rickets in children could also be cured by exposing their skin to sunlight, or to the rays of a lamp producing "artificial sunlight."

The connexion between these two curative methods became clear when it was shown that rickets is caused by a deficiency of vitamin D in the body, and that this vitamin can be prepared by exposing a substance called ergosterol to the action of sunlight ("irradiated ergosterol"). Ergosterol is present in the skin of animals. By exposing the skin to sunlight, the ergosterol is transformed into vitamin D for use in the organism. It is similarly manufactured in the skin of the cow, from whence it finds its way into the milk secretion.

Vitamin D can now be prepared artificially by extracting ergosterol from yeast and exposing it to "artificial sunlight." It is said that the addition of 1/250,000 grm. of such "irradiated ergosterol" to the daily diet of children will usually cure early rickets.

(5) *Vitamin E*.—This vitamin appears to be concerned in the normal processes of reproduction, and is therefore essential to fertility in the animal. Its prolonged absence from the diet has been shown to be the cause of sterility in rats. Red meat and wheat germ oil are rich in this food factor, though the average human diet would appear to contain a sufficiency. As the discovery of this vitamin is but recent, full information concerning its nature and mode of action is not as yet available.

In the Notes for next month, the writer proposes to deal with the subject of vitamins from the standpoint of the stockfeeder.

* * * * *

MISCELLANEOUS NOTES

AN interesting announcement is that the Cambridge University Agricultural Society has arranged to keep July 13 as a re-union day for old students of the

A Re-Union Day School of Agriculture. It is hoped that
at Cambridge as many past students as possible will go to Cambridge on that day. Special

arrangements have been made for most of the staff of the School of Agriculture to be in attendance from 11 a.m. to 12.30 p.m. to meet the visitors and discuss any problems in which they are individually interested—rationing, breeding, manuring, economics, plant and animal diseases. After a joint lunch in the town at 12.45, the visitors will proceed to

the University Farm for a tour of inspection and to see a series of demonstrations. Tea will follow at the Farm, this terminating the organized part of the re-union.

It is requested that intending visitors will communicate with the Hon. Secretary, Cambridge University Agricultural Society, School of Agriculture, Cambridge, and say if they will require char-a-banc accommodation from the town to the University Farm. Visitors defray their own expenses, with the exception that tea is provided at the University Farm by the Department of Agriculture.

* * * * *

IN connexion with the scheme of egg marketing reform recently recommended by the Minister's Poultry Advisory Committee, it may be recalled that a decision as to the grades to be recommended for ducks' eggs was deferred for further consideration. At a meeting on Thursday, May 24, the Poultry Advisory Committee considered the following grades—which had been suggested by the Ministry and had already received the approval of the Utility Duck Club—and provisionally approved them for reference to the National Farmers' Union, the National Poultry Council and other national bodies concerned :—

The Proposed Grades.

<i>Extra Duck</i>	..	Eggs of " <i>First Quality</i> " weighing 21 lb. or more per 120 eggs, no 12 eggs to weigh less than 33 oz.
<i>Standard Duck</i>	..	Eggs of " <i>First Quality</i> " weighing 19 lb. per 120 eggs, no 12 eggs to weigh less than 28½ oz.
<i>Medium Duck</i>	..	Eggs of " <i>First Quality</i> " weighing 17 lb. per 120, no 12 eggs to weigh less than 26½ oz.
<i>Small Duck</i>	..	Ungraded eggs of " <i>First Quality</i> " weighing less than 26½ oz. per dozen.

The weight-grade of *Extras* when 22 lb. or more per 120 eggs to be marked on the case.

The colour, e.g. white, green or mixed colour, to be marked on the case.

The definition of "*First Quality*" to be as follows :—

Shell : Clean and sound.

Yolk : Visible but not dense, moving slowly.

White : Translucent and firm.

Explanatory Note.—Considerable attention has been given during recent years to the production of ducks' eggs; prolific laying types of ducks have been developed and taken up by

general farmers and others to whom duck keeping is, in some instances, more suited than the keeping of laying hens.

The production of ducks' eggs on the farm is, to some extent, more specialized than the production of hens' eggs, since, if large numbers of ducks are kept for the purpose of egg production, greater attention must be given to the eggs in order that they may be marketable. When ducks are kept only in small flocks, as on many general farms, a substantial proportion of the eggs is utilized for hatching and rearing ducks for table, but, in the aggregate, the surplus from such farms constitutes an important part of the total supplies marketed for food. There are thus two classes of ducks' eggs on the market—(1) the egg duck class, (2) the table duck class—and, as they are produced by ducks of different types, so the eggs of each class are, to some extent, distinctive in size, appearance and quality.

Eggs in class (1) are generally less strong in flavour than those in class (2), and are consequently more palatable to the majority of consumers. The shells are, for the most part, white; only a very limited proportion have coloured shells. The eggs are generally smaller in size than those in class (2) and range from $2\frac{1}{4}$ oz. to $2\frac{3}{4}$ oz. in weight, or 17 lb. to $20\frac{1}{4}$ lb. per 120. Eggs in class (2) are, however, of more distinctive flavour and, as a rule, a considerable proportion have green shells. The range in weight is considerable, from $2\frac{1}{2}$ to $3\frac{1}{2}$ oz., with an average which exceeds $2\frac{3}{4}$ oz. or $20\frac{3}{4}$ lb. per 120.

The supplies of (1) are frequently produced in large units whereas eggs of (2) are usually produced in small units scattered over all parts of the country.

The definition of grades for ducks' eggs presents some difficulty owing, on the one hand, to the wide range in individual egg weight which, to ensure uniform grading, calls for a number of grades, and, on the other hand, to the limited quantity of ducks' eggs available which makes it difficult to pack to various grades in wholesale quantities. It is nevertheless important that well-defined grades should be fixed in order to put the trade on a proper basis, to encourage producers in areas where production is already general, and to encourage development elsewhere.

Inquiries made from producers and wholesale buyers in various parts of the country confirm the wide range in weight, returns showing weights of $15\frac{1}{2}$ lb. up to 24 lb. per 120 eggs. From inquiries on the London markets, English eggs are generally considered to weigh 17-18 lb. per 120.

The weight fixed for *Standards* will cover the greater part of the supplies of eggs of both class (1) and (2), and provides for an egg of reasonable size, the encouragement of which is desirable in the best interests of production. The *Medium* grade will meet the remainder of the eggs produced by ducks of class (1) and the *Extra* grade the remainder of those produced by ducks of class (2).

With grading on a voluntary basis, it is not considered that insistence on three grades will prove irksome to packers. When supplies are short, it will always be open to them to market the eggs ungraded; on the other hand, there are substantial advantages in continuity of supply once the market has been established, and this is likely to make them keener buyers than hitherto.

The minimum tolerance per 12 eggs has been fixed with due regard to the desirability, consistent with uniform grading, of including a large proportion of eggs in the *Standard* grade, the permissive range in weight between the grades being as follows :—

				Range per 120	
				Below grade	Above grade
				weight	weight
				120	
Extra	..	..	21 lb.	6 oz.	No limit
Standard	..	..	19 lb.	19 oz.	26 oz.
Medium	..	..	17 lb.	7 oz.	13 oz.

This allows a reasonable margin on either side for packing to the grade weight; it also encourages the production of eggs of *Standard* grade.

As the shells of ducks' eggs, of class (1) in particular, are generally less resistant than those of hens' eggs, and having regard also to their larger size, the use of fillers and flats for packing is not considered desirable. It is recommended that flat cases, with wood-wool packing, should generally be used, but that an exception should be made in regard to eggs of the "*Small Duck*" grade which should be packed in filler and flat cases of the size specified for "*Special*" grade hens' eggs as recommended in Marketing Leaflet 5, in order to meet the preference of some retailers for this type of package.

The eggs should be packed in quantities of 5 long hundred (600 eggs) in divisible cases of $2\frac{1}{2}$ long hundred in quarter cases, in three layers. This conforms with present trade practice.

THE National Institute of Agricultural Botany has extended to parties of farmers, potato growers and merchants, and agricultural advisory and administrative officers, an invitation to visit the Ormskirk Potato Trials, 1928 : Potato Testing Station, Ormskirk, singly or in parties, on August 10, 1928. If this date is inconvenient the visit may be made on any week-day between July 30 and August 11.

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 of a number of varieties to leaf-roll, and the possibility of growing in England seed potatoes free from virus diseases. These trials, together with plots illustrating typical forms of virus disease, will be open to the inspection of visitors. In addition, visitors will be able to see the Lord Derby Gold Medal trials—there are nine entries this year—and yield and maturity trials of leading immune main crop potatoes. There are also many demonstration plots of the chief varieties of British and foreign potatoes, including the varieties certified as immune in 1926 and 1927. Those who are interested in the oat crop will find on the farm large observation plots of over 30 of the more important varieties of oats.

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, too, 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 Liverpool or Preston.

IN view of the importance of increasing the efficiency of farm labour at the present time, and of the fact that a demand exists for more definite instruction in the training of young men in the use of farm implements, etc., Mr. W. J. Malden, at the invitation of the Ministry, has given three series of demonstrations at specially selected centres so as to bring his methods directly to the notice of teachers and students of agriculture. For many years past Mr. Malden has studied the whole question of economy of effort and expenditure in farm work, and has had experience

and success in teaching his principles. Three centres were selected, viz., the South-Eastern Agricultural College, Wye; Reading University; and the Hertfordshire Farm Institute, Oaklands. Preliminary class-room instruction, followed by demonstrations in the field, have been given to the students at each centre. The students subsequently carried out the operations under the direction of Mr. Malden. The staffs of the institutions and instructors from the county and neighbouring counties were also present in order that they could study the system, and, if possible, encourage training, on the lines demonstrated by Mr. Malden, among the young men in their respective counties. The demonstrations have been a great success, and were much appreciated by the Principals of the Institutions, the students being very enthusiastic and very ready to adopt the methods suggested.

* * * * *

VOLUME XI of the Ministry's Register of Dairy Cattle was published on June 14, and contains particulars of 7,500 cows selected on their milk yields during the year ended October 1, 1927. The qualification necessary for a cow to be eligible for entry in the Register was that its milk yield was not 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 is restricted to 7,500, which allowed only for the inclusion of 48 per cent. of the total number of cows eligible. Of these cows, 45 gave between 8,000 and 9,000 lb. of milk during the year; 434 between 9,000 and 10,000 lb.; 3,041 between 10,000 and 11,000 lb.; 1,878 between 11,000 and 12,000 lb.; 1,135 between 12,000 and 13,000 lb.; 501 between 13,000 and 14,000 lb.; 241 between 14,000 and 15,000 lb.; 210 between 15,000 and 20,000 lb.; and 15 over 20,000 lb. Nineteen recognized breeds or types are represented in the volume, 61 per cent. being of the Shorthorn type; 20 per cent. Friesian; and 4 per cent. Guernsey. A statement is included 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 each breed.

A list of 266 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, 1927, 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 also 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 99 bulls are given in the volume, 63 of which qualified under condition (a) and 36 under condition (b).

An up-to-date list of the Milk Recording Societies in England and Wales is also included in the Register, giving particulars of each Society and the name and address of the Secretary.

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.

* * * * *

At a conference of representatives of potato growers, wholesalers and retailers which was convened by the Ministry on May 2, the suggested standard grades for ware potatoes which were demonstrated at several agricultural shows last year under the auspices of the Ministry were reviewed and amended, having in view further demonstrations this year. The grade names used last year were also revised. The grades now proposed are:—

Special	minimum size (diameter)	2 inches
Selected	"	1½ "
Standard	"	1½ "

All grades should be clean, healthy, true to type and free from serious defects within the following limits:—

Grade	(a) Under Size	(b) Soft Rot, Wireworm, etc.	(c) Other Disease or Damage	Maximum Total Defects (a), (b), (c)
	per cent.	per cent.	per cent.	per cent.
Special	2	1	2	4
Selected	3	2	3	5
Standard	3	3	3	6

Earth and other extraneous matter should be less than 4 per cent. in potatoes loaded before November 1 each year and under 2 per cent. thereafter.

These grades were demonstrated at the Cambridge and Isle of Ely Agricultural Society's Show at March on June 12, and at the Lincolnshire Agricultural Society's Show at Scunthorpe on June 27 to 29, and are to be demonstrated also at the Great Yorkshire Show at Halifax on July 18 to 20, and at the Royal Lancashire Show at Oldham on August 2 to 6.

* * * * *

THE index of prices of agricultural produce for May was three points higher than in April and at 54 per cent. above the level of the base years 1911-13, it

The Agricultural Index Number was twelve and four points higher than in May, 1927 and 1926 respectively. The increase as compared with April was due

to the continued advance in the prices of fat cattle, wheat, oats and potatoes.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923:—

		Percentage increase compared with the average of the corresponding month in 1911-13						
Month		1923	1924	1925	1926	1927	1928	
January	.. ..	67	60	71	58	49	45	
February	.. ..	63	61	69	53	45	43	
March	.. ..	59	57	66	49	43	45	
April	.. ..	54	53	59	52	43	51	
May	.. ..	54	57	57	50	42	54	
June	.. ..	49	56	53	48	41	—	
July	.. ..	50	53	49	48	42	—	
August	.. ..	52	57	54	49	42	—	
September	.. ..	52	61	55	55	43	—	
October	.. ..	50	66	53	48	40	—	
November	.. ..	51	66	54	48	37	—	
December	.. ..	55	65	54	46	38	—	

Grain.—Wheat was 11d. per cwt. dearer on the month at an average of 11s. 1d. per cwt. and 40 per cent. above pre-war, as

compared with an average of 12s. 1d. per cwt. and 53 per cent. a year ago. Barley was unaltered during May at 10s. 10d. per cwt. and 41 per cent. above 1911-13, whereas in the corresponding period of 1927, prices rose by 4d. per cwt. and the index number was five points higher. The increase of 1s. 4d. per cwt. in the average price of oats which occurred during the month under review brought this cereal to the very high level of 74 per cent. above pre-war, a rise of ten points on the month and 47 points on the index figure recorded a year previously.

Live Stock.—The advance in the price of fat cattle which has been noticeable in the past few months continued during May and second quality cattle at an average of approximately 55s. per live cwt. were 2s. 8d. per cwt. dearer than in April, and 9s. per cwt. dearer than in May, 1927. Fat cattle are now 48 per cent. above pre-war as against an average of 27 per cent. for the whole of the year 1927. Fat sheep during May were about the same price as in April, but as a fall in prices is customary at this season the index number rose by 12 points to 90 cent. above 1911-13. It is noticeable that fat sheep have sold at appreciably higher prices since Christmas, the lowest index number recorded this year, *viz.*, 56 per cent. above pre-war in February, being six points higher than the average for the whole of last year. Store cattle and sheep have also sold at advanced prices, the index numbers for both classes being 4 points higher on the month at 26 and 50 per cent. respectively above the level of May, 1911-13. Dairy cows were slightly cheaper at 33 per cent. Both fat and store pigs showed a reduction in price, in accordance with the usual tendency at this period of the year, baconers declining one point, porkers five points and store pigs nine points to 42, 40 and 26 per cent. above the pre-war level.

Dairy and Poultry Produce.—The customary reduction in butter prices occurred in May, but, although the index number fell three points on the month, the level of prices at 52 per cent. above 1911-13 was ten points higher than that of May, 1927. Cheese prices also continued high, Cheddar selling at about 85 per cent. more than pre-war as compared with 46 per cent. a year ago. Milk declined from 63 per cent. to 53 per cent. above the base years, the average contract price being affected by an appreciable reduction in the Manchester area, the decline being similar to that experienced in May, 1927. Egg prices advanced a little during the month under review, but not to the same extent as usual and the index number was two points lower at 35 per cent. above pre-war, while poultry, which continued to sell at

somewhat higher prices than last year, were ten points higher at 51 per cent. above 1911-13.

Other Commodities.—Potatoes sold at considerably higher prices in May following upon sharp advances in April, and the index number for May at 120 per cent. above pre-war marks the highest level recorded since May, 1925, when the index number stood at 124 per cent. above the base years. In May, 1926, potatoes were 15 per cent. and in May, 1927, they were 74 per cent. dearer than in 1911-13. Vegetables also were dearer in May than in the previous month, and hay at 14 per cent. above pre-war was three points higher than in April. Wool was one point higher at 72 per cent. above the 1911-13 level.

Index numbers of different commodities during recent months and in May, 1926 and 1927, are shown below:—

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

Commodity	1926	1927	1928			
	May	May	Feb.	Mar.	Apl.	May
Wheat	67	53	29	30	34	40
Barley	22	46	34	36	41	41
Oats	30	27	42	49	64	74
Fat cattle ..	43	24	32	38	43	48
Fat sheep ..	67	63	56	61	78	90
Bacon pigs ..	88	58	38	40	43	42
Pork pigs ..	90	66	42	45	45	40
Dairy cows ..	36	24	29	31	34	33
Store cattle ..	29	23	25	23	22	26
Store sheep ..	55	38	44	47	46	50
Store pigs ..	122	99	41	35	35	26
Eggs	38	28	33	26	37	35
Poultry	61	41	39	40	41	51
Milk	60	53	66	56	63	53
Butter	52	42	47	47	55	52
Cheese	83	46	59	65	78	85
Potatoes	15	74	71	82	94	120
Hay	9	2	12	12	11	14
Wool	29	31	62	70	71	72

* * * * *

THE Fream Memorial Prize, which is annually awarded by the Ministry to the candidate who obtains the highest marks in the examination for the

The Fream National Diploma in Agriculture, has been won this year by Mr. Charles Turner, a student of the West of Scotland Agricultural College, Glasgow. The value of the prize this year is about £7, which is to be devoted to the purchase of books.

Demonstrations in Marketing Home Produce DURING the present season the Ministry has continued to demonstrate better marketing methods at agricultural shows. The marketing of eggs and poultry has been demonstrated at the following shows up to the middle of June :—

Wharfedale Show at Otley	May 11-12
Bath and West and Southern Counties Show at Dorchester	May 22-26
Devon County Show at Exeter	May 30-June 1
Staffordshire Show at West Bromwich	June 12-13

Fruit marketing has been demonstrated twice :—

Essex Show at Chelmsford	May 23-24
Devon County Show at Exeter	May 30-June 1

An exhibit of fruit packages etc., was also given at the East Malling Research Station on the Associate Members' Day (May 15).

With the approval of the Pig Industry Council, four demonstrations of the marketing of pigs and pig products have been given at the following shows :—

Wiltshire Show at Salisbury	May 15-16
Devon County Show at Exeter	May 30-June 1
Suffolk Show at Bury St. Edmund's	June 7-8
Royal Cornwall Show at Bodmin	June 13-14

The first potato marketing demonstration of the year was given at the Cambridge and Isle of Ely Show at March on June 12.

A further step forward was taken at the Royal Norfolk Show at Norwich (June 27-28) when the demonstrations covered not only eggs and poultry, fruit, pigs and pig products, but, in addition, cattle. The cattle demonstration, which thus made its maiden appearance, related to fat cattle and calves, and included a display of sides of beef, illustrative of suggested standards and of present-day market requirements, a demonstration by means of joints and cuts of beef of desirable and undesirable features; displays of veal, showing the requirements of the trade; and of beef products, hides, etc.

The following demonstrations are to be given during July and the early part of August :—

July 10-14	Royal Show at Nottingham	Eggs and poultry, fruit, pigs, potatoes, cattle
" 18-20	Great Yorkshire Show at Halifax	Potatoes
" 25-26	Tunbridge Wells Show at Tunbridge Wells	Eggs and poultry, cattle

August 2-6	Royal Lancashire Show at Oldham	Pigs, potatoes
" 8-9	Taunton Deane Horticultural Show at Taunton	Fruit
" 8-10	Royal Welsh Show at Wrexham	Eggs and poultry, cattle

A potato marketing demonstration will also be given at Sandy, Bedfordshire, on August 30.

* * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on May 23, at 7 Whitehall Place, S.W.1, the Chairman, Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from the Hertfordshire Agricultural Wages Committee of decisions fixing special overtime rates of wages for male and female workers employed on the hay harvest in 1928, and special minimum rates of wages for male and female workers employed on the corn harvest in 1928, and made Orders carrying the decisions into effect as from May 28. The overtime rates fixed in respect of the hay harvest are, for male workers of 21 years of age and over, 10d. per hour, and for female workers of 19 years of age and over, 7½d. per hour. In the case of the corn harvest the minimum rates fixed are, for male workers of 21 years of age and over, 10½d. per hour, and for female workers of the same age, 7½d. per hour.

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

* * * * *

Special Minimum Rates of Wages for the Corn Harvest.—Special rates of wages for employment on the corn harvest in 1928 have been fixed by the following Agricultural Wages Committees: Devonshire, Dorset, Hertfordshire, Norfolk, Somerset, Wiltshire, and the East Riding of Yorkshire, whilst in the following areas notices of proposal to fix such rates have been issued, viz., Cambridgeshire and Isle of Ely, Essex, Hampshire and Isle of Wight, and Suffolk. In each case similar rates were fixed last year.

Except in the cases of Cambridgeshire, Essex, Hertfordshire, and the East Riding of Yorkshire the rates which have been, or are proposed to be, fixed, apply to male workers only. In certain areas the rates take the form of special differential rates for overtime employment on the corn harvest, the rate for male workers of 21 years of age and over being 10d. per hour in Devonshire, Dorset, and Somerset, and 9d. per hour in Hants and Isle of Wight and Wiltshire. In the East Riding of Yorkshire the special overtime rates are, for male workers of 21 years of age and over who are not boarded and lodged by their employer, 1s. 3d. per hour, and for workers who are boarded and lodged by their employer: foremen, beastmen, shepherds and waggoners 1s. per hour; third and fourth lads 9d. per hour; and other beginners 7d. per hour; whilst in the case of female workers of 16 years of age and over, the special overtime rate is 11d. per hour.

In Cambridgeshire and Isle of Ely special minimum rates are proposed, the rate in the case of male workers of 21 years of age and over being £11 for a period of 4 weeks of 64 hours per week. Employment on Sundays or in excess of 64 hours per week is to be paid for at the rate of 11d. per hour. The special minimum rate for female workers of 18 years of age and over is 8d. per hour.

In Essex it is proposed to fix special minimum rates of wages. In the case of male workers on farms of over 60 acres of corn the special rate takes the form of a bonus of £5 5s. for the harvest period, this bonus being payable in addition to the ordinary weekly minimum

wage and in lieu of overtime rates. On farms of 60 acres of corn and under, the special minimum rate for the harvest period is 10½d. per hour for male workers of 21 years of age and over. In the case of female workers of 21 years of age and over on all farms the special minimum rate is 7½d. per hour.

Special hourly minimum rates of wages have been fixed in Hertfordshire, the rate in the case of male workers of 21 years of age and over being 10½d. per hour, and in the case of female workers of the same age, 7½d. per hour.

In Norfolk, special minimum and overtime rates of wages have been fixed, those in the case of male workers of 21 years of age and over being £11 for the full month of 24 consecutive working days (excluding Sundays) or for the harvest period as the case may be. In the case of workers who do not work the full period, special differential rates are payable for overtime employment on harvest work, the rate in the case of male workers of 21 years of age and over being 9½d. per hour.

In Suffolk the special minimum rates proposed are, for male workers of 21 years of age and over on farms of at least 60 acres of corn, £5 payable in addition to the ordinary minimum wage and in lieu of overtime rates, the hours of work being not more than 12 while the crops are being carted, and 11 while other harvest work is in progress but so that the total hours shall not exceed 70 in any one week. On farms of less than 60 acres of corn the special minimum rate for male workers of 21 years of age and over is 10d. per hour.

In all cases, lesser rates are proposed or have been fixed for younger workers.

Copies of the Orders in full may be obtained free of charge, on application to the Secretary, Agricultural Wages Board, 7 Whitehall Place, London, S.W. 1.

In areas where the Agricultural Wages Committees have not fixed any special rates for the corn harvest, employment on such work must, of course, be paid for at not less than the ordinary minimum and overtime rates.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending June 15, legal proceedings were instituted against four employers for failure to pay minimum and overtime 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 con- cerned.
		£	s.	d.	£	s.	d.	£	s.	d.	
Gloucester	Thornbury .	4	0	0	1	1	0	19	16	1	1
Hereford .	Leominster .	10	0	0	—			22	1	10	2
Lancs ..	Garstang ..	3	0	0	3	7	6	45	4	3	3
Lincoln ..	Lindsey ..	1	0	0	0	17	6	1	9	4	1
		£18	0	0	£5	6	0	£88	11	6	7

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Foot-and-Mouth Disease.—Since the report in last month's issue of this JOURNAL no outbreak of foot-and-mouth disease has been confirmed in Great Britain. The last outbreak was confirmed at Sandon, near Stafford, on May 20.

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NOTES FOR THE MONTH

THE Rt. Hon. Walter Guinness, D.S.O., M.P., Minister of Agriculture and Fisheries, speaking at Elveden on July 7, said that the Government scheme for rating relief would be of great assistance in maintaining and increasing employment by removing a millstone from the neck of productive industry and so enabling many producers, who were now working at a loss, again to conduct their industries on a profitable basis. The scheme would bring about a much fairer distribution of local expenditure in rural areas and between the rural areas and the towns.

In many rural districts the de-rating of agricultural land and buildings would involve the loss of one-half of the present rateable value, and the resulting loss in rate income would be made up by Exchequer grants greater in amount than the rates which they would replace. The present system of Exchequer grants would be transferred, and the result would be of great advantage to those areas of dense population on the one hand, with their problems of poverty and their small resources, and to those areas of sparse population on the other hand, where the cost of necessary local services per head of population was high. These anomalies would be removed by an ingeniously devised formula under which in future Exchequer grants would be adjusted according to the needs of the locality.

Even under the new scheme, however, fluctuations would take place in the cost of Local Government, and the Central Government must provide against the effect of such fluctuations. They should remember that if one-half of the rateable value of a rural district were to be wiped out owing to the de-rating of agricultural land and buildings, a shilling rate would in future be required to bring in the same sum which formerly accrued from a rate of 6d. The only way to avoid

this fluctuation was to widen the area of charge both for Poor Law and road services, and this the Government proposed to do.

In rural areas the work of the Boards of Guardians had been admirable, but the system was no longer in accordance with modern requirements, and the smallness of the areas involved overlapping of services which could now be more efficiently administered on a county basis. It was to be hoped that many of the rural guardians would, as members of the new Poor Law Sub-Committees, continue to give their personal services in the work which they had done so well in the past.

It had been universally admitted that the growing cost of road expenditure threw an unfair burden on the rural ratepayer. The upkeep of main roads had been charged to the county, but the District Councils had had to pay for the subsidiary roads. In the days of horse traffic and early motoring this classification bore some relation to the origin and benefit of the traffic carried. Now, however, commercial traffic and heavy pleasure traffic from the towns caused heavy wear and tear on the by-roads, and the cost of bringing these smaller roads up to modern requirements for this traffic was far beyond the resources of the rural communities. In this case it would be to the great financial benefit of the rural areas that the more generous State grants which the Government now proposed should be accompanied by an equalization of burden over the whole county, so as to make the richer areas, from which the motor traffic originated, contribute for the first time fairly towards the expenditure which they now threw on to the rural ratepayer.

Rural District Councils had done their best to administer a system which had become unsuitable to modern needs, but the public must not allow appreciation of their admirable work to stand in the way of a great reform designed for the benefit of the overburdened ratepayer.

* * * * *

THE following account shows how an exceptional smallholder became the owner of his statutory holding, and records what is, in many respects, the most

Small Holdings : remarkable achievement of its kind that
A Successful has been reported to the Ministry within
Owner-Occupier recent years.

The holder is a married man with four children. Before the War he was employed as a cowman, and out of his wages managed to put aside a small amount

regularly for the object he had in view. He served in the Army, and on his return to civilian life took a situation as dairyman on another farm. In 1920 he applied to his County Council for a small holding ; and in 1921 was granted the tenancy of a holding which comprises a double bungalow with two annexes (converted Army huts), and a long range of corrugated iron shedding, together with about 34 acres of poor down land. The area consisted of 25 acres of pasture, 4 acres of cultivated land, and 5 acres occupied by buildings, yards, road and waste. This holding formed part of a farm, consisting of rough arable and pasture, which had been used by the Army during the War, and numerous Army huts and rough iron sheds were scattered over the land.

The tenant first paid a rent of about £68 per annum, but this was subsequently reduced to £56. His capital, on entry, amounted to £300, and this was expended on the purchase of four good dairy cows, two heavy horses and the necessary implements. His former employer gave him an old farm wagon and a set of harrows. He commenced to retail milk on a small scale, delivering daily to a suburb of a neighbouring town. As his round increased, he borrowed £25 with which he purchased a donkey, cart, harness, milk churn and the necessary utensils for delivering the milk.

In 1925 he accepted an offer from the County Council to sell him his holding for £1,025. He paid down £370—the whole of his available capital—and took up a mortgage of £655, to be repaid over a period of 20 years with interest at the rate of 5 per cent. The crowning achievement of the family consists in the fact that the whole of the £655 was paid off by April, 1928, this sum having been saved during a period of about two and a half years. Apart from the profits derived from the holding, the only income has been 10s. per week, representing the rent of part of the double bungalow which was sub-let.

The stock kept by this smallholder includes 16 cows, (3 with calves at side), 2 good working horses and 2 ponies ; no poultry or pigs are kept, simply because he has no time to look after small stock. His arable land (about four acres) is reported to be in a splendid state of cultivation and is growing one of the best crops of wheat that the Ministry's District Commissioner has seen. In addition to the statutory holding, 12 acres of rough grass have been rented and 40 acres of good grassland taken over until the end of the year.

There is no doubt that the holder and his family have

suffered hardships and have exercised considerable self-denial to achieve the object they had in view. His wife and eldest boy have ably assisted him in his undertaking. All their energies and spare cash have been devoted to the improvement of the land and stock, and the family are justly proud of their splendid achievement.

* * * * *

THE Pig Industry Council was appointed by the Minister of Agriculture in March last 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 of pork and bacon.

Under its chairman, Mr. E. R. Debenham, the Council has held a number of meetings which have been devoted to preparing a programme of work. As a result of these preliminary meetings, five sub-committees of the Council have been constituted to deal with the following subjects:—

- (a) Breeds, Breeding and Recording.
- (b) Feeding.
- (c) Veterinary.
- (d) Pig Management.
- (e) Marketing.

The chairmen of these Committees are respectively: (a) Viscount Folkestone, (b) Mr. Leopold C. Paget, (c) Captain the Hon. Godfrey Phillimore, (d) Mr. Theo. A. Stephens and (e) Mr. H. German.

In accordance with the principle adopted by the Minister in his appointment of the Council, the interests of breeders, feeders and distributors are represented on each sub-committee.

The questions which have been referred by the Council to its Sub-Committees for consideration are summarized below.

(a) The suitability of the breeding stock of the country for the requirements of the pork and bacon markets is to be considered, and, taking into account, from the point of view of the producer, the prolificacy, early maturity and cost of feeding of the various breeds and crosses, a breeding policy will be drawn up to meet commercial requirements; pig-recording schemes will be investigated, and means will be considered whereby commercial pig classes at agricultural shows can be encouraged.

(b) The food requirements for pigs at various ages, the methods and costs of feeding, and the suitability of cereals,

grass, and other foods as to growth and quality of flesh, are among the questions set down for consideration by the Feeding Sub-Committee.

(c) The Veterinary Sub-Committee will consider the various diseases affecting pigs, the conditions favourable to the spread of the diseases, and the practical safeguards and precautions which should be taken to prevent disease.

(d) The Pig Management Sub-Committee will investigate the various methods of pig-keeping, and will report on the most satisfactory and most economical methods of housing and general handling of pigs destined for the pork and bacon markets.

(e) The existing methods of marketing live pigs and pig products will be fully explored by the Marketing Sub-Committee. With a view to considering what means can be adopted to put the suggestions into practical use, this Committee will also examine the various suggestions for the improvement of the marketing side of the industry put forward in the two reports recently published by the Ministry on the Marketing of Pigs and the Pork and Bacon Trades.

The Council realizes that the programme of work which it has so far drawn up does not cover all the subjects which will require its consideration; other matters affecting the industry will, however, be fully investigated by the Council in due course.

The Secretary of the Council is Mr. J. B. Baber, M.C., 10 Whitehall Place, London, S.W. 1, to whom all communications should be addressed.

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SUBSEQUENT to the note which appeared in the July issue of the JOURNAL it has been suggested that the grades for ware potatoes should be as follows:—

Suggested Standard Grades for Ware Potatoes	Grade	Min. Size
	"Selected"	1 ³ / ₄ in.
	"Standard"	1 ⁵ / ₈ in.
	"Medium"	1 ¹ / ₂ in.

It is further proposed that there should be a standard specification, with tolerances for defects, applicable to all grades by way of defining a marketable sample, as follows:—

Specification (All Grades).—Standard ware potatoes of all grades shall be reasonably clean, healthy, free from serious defect and suitable for human consumption.

When the variety and/or type of soil on which potatoes have been grown are specified at the time of sale, standard ware potatoes

of all grades must conform to the description given to the extent of at least 95 per cent. by count.

Unsoundly and large, oversize potatoes shall be picked out before offering standard ware potatoes of any grade for sale (any potato which exceeds $3\frac{1}{4}$ in. in its smallest diameter shall be deemed oversize), and potatoes smaller than the minimum size specified for the grade shall be dressed out, but otherwise, as far as size is concerned, standard ware potatoes shall be packed and sold as grown.

Tolerances for Defects: (a) *Undersize.*—In all grades, the quantity of potatoes present which, in the normal way of dressing, will pass through a riddle having a mesh of the minimum size specified for the grade, must not amount to more than 3 per cent. of the total weight, and, of this, not more than 0.5 per cent. shall pass through a riddle having a 1 in. mesh.

(b) *Disease or Damage.*—The quantity of potatoes present which are appreciably diseased and/or damaged must not exceed 3 per cent. of the total weight; and, included in this amount, the part consisting of potatoes obviously affected with soft rot must not exceed 0.25 per cent. by weight of the total.

(Notes:—

(i) Any disease or defect the presence of which may be established by cutting open the potato shall be taken into account.

(ii) A potato shall only be regarded as being obviously affected with soft rot if, at the time of inspection, it is squashy and/or the surface is at some part distinctly broken or wet owing to disease.)

(iii) Potatoes suffering from superficial disease or damage, including damage by worms or slugs, which affect the skin only, shall not be reckoned as diseased or damaged unless more than one tenth ($\frac{1}{10}$) of the surface is affected. Potatoes having worm or slug holes penetrating into the flesh shall be regarded as damaged.

(c) *Earth, etc.*—The amount of earth and/or extraneous matter present must not exceed 4 per cent. in potatoes loaded up to November 1 in the year of harvesting, and 2 per cent. after November 1; the percentage to be calculated on the net weight of screened potatoes.

(d) *The maximum aggregate defect* on account of all undersized, diseased and damaged potatoes, earth, etc., in a consignment shall not exceed 5 per cent. by weight of the total at any time.

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THE Ministry's Annual Report on the prices and supplies of agricultural produce and requirements in 1927-28 will shortly be issued. This report discusses

Agricultural Statistics, 1927-8, Part II the movements in prices of the different commodities during 1927, and price changes are compared over a series of years by means of index numbers. The

Report shows that, during the cereal year 1926-27, prices of agricultural produce averaged 47 per cent. above 1911-13, as compared with 53 per cent. in the previous cereal year, while in the seven months September, 1927, to March, 1928, the

index number declined further to 42 per cent. above pre-war. Prices of feeding stuffs advanced from 28 per cent. in 1925-26 to 33 per cent. in 1926-27, and for the seven months September, 1927, to March, 1928, they averaged 48 per cent. above 1911-13. Fertilizers averaged only 3 per cent. above pre-war in the period September, 1927, to March, 1928 as against 13 per cent. in the cereal years 1926-27 and 1925-26.

The Report also contains references to agricultural wages, the prices of seeds and machinery, and the progress made under the Markets and Fairs (Weighing of Cattle) Act of 1926.

Tables are appended to the Report showing the monthly average prices in 1927 of most agricultural commodities, together with figures of the imports of live stock into Great Britain from Ireland and of imports into the United Kingdom of all the chief classes of agricultural commodities.

The Report, which forms Part II of the Agricultural Statistics, will be obtainable through any bookseller or direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2.

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APPROXIMATELY 1,700 delegates registered as members of the World's Dairy Congress, which opened at the Central Hall, Westminster, on Tuesday, June 26, and concluded on Thursday, July 12. This number included upwards of 150 official delegates, representing 42 nations participating in the Congress.

Many papers, dealing with the leading problems concerning milk and milk products, were read at the conferences which were held at the Central Hall on the mornings of the first three days of the Congress. These conferences were well attended and provoked useful discussion. Papers were also read at Reading on July 2 and 3, and at Edinburgh on July 6.

In addition to the paper-reading conferences, four scientific discussions were held, dealing respectively with animal physiology in reference to milk production, veterinary medicine in reference to dairy cows, dairy bacteriological technique, and dairy chemical technique.

It is understood that all the papers read at the Congress, with a verbatim note of the discussions which ensued, will be published in the Proceedings of the Congress, to be issued as soon as practicable.

On July 2 and 3 the headquarters of the Congress were changed from London to Reading, and delegates were given an opportunity of visiting the University, the Research Institute and the British Dairy Institute, as well as various farms and dairies in the neighbourhood. From July 5 to 8 the Congress was held in Scotland, where delegates were received officially by the Corporations of Edinburgh and Glasgow, and from July 10 until the closing date on July 12 the headquarters were at the Royal Agricultural Show, Nottingham, where a very large and representative collection of dairy machinery and equipment was staged under the direction of the Congress Committee. H.M. the King visited this exhibit on July 11, and the Chairmen of the various committees of the Congress, together with some of the official delegates, were presented to him. At the conclusion of the Congress proper, a tour was arranged throughout Northern Ireland and the Irish Free State.

H.M. Government held an official reception of all delegates at Lancaster House on the evening of Tuesday, June 26. On Wednesday the City Corporation held a reception in their honour at the Guildhall, and on Thursday the Congress Committee welcomed them officially at the Crystal Palace. On Friday H.M. Government gave a dinner to a selected number of official delegates at the Hotel Metropole.

The general impression gained during the Congress is that the bringing together of delegates from many nations, and the mutual discussion and interchange of ideas which ensued, cannot fail to have been greatly to the advantage of the dairy industry in the different countries, and particularly to the home industry. Prominence has been given to the high value of milk as a food, and it is felt that the action of the milk industry in carrying the Congress through to a successful conclusion will, by its evidence that the industry is taking active steps to develop a safe and clean milk supply, serve to stimulate public interest in the question of an increased milk consumption, which in turn should react to the advantage of the industry itself. The smoothness with which the arrangements were carried through reflects credit on the organizers of the movement; and the dairy industry as a whole, which conducted the Congress on its own responsibility without active help from the State, is to be congratulated on having brought about a meeting which is generally considered to have reached a higher standard of efficiency than any of those so far held under the auspices of the International Dairy Federation.

SUBSTITUTES FOR FISH MEAL IN THE RATIONS OF FATTENING PIGS

Report on an investigation carried out under the direction of Professor T. B. Wood, Animal Nutrition Research Institute, Cambridge; Dr. J. B. Orr, Rowett Research Institute, Aberdeen; and Dr. C. Crowther, Harper Adams Agricultural College, Newport, Salop.

Edited by H. R. DAVIDSON, M.A., Dip. Agric.,
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Research Institute, Cambridge.

As a feeding stuff for animals, fish meal appears to have been first used in Norway, where, in 1892, the Government carried out feeding experiments, the successful results of which led to the use of fish meal on the Continent on a large scale. In spite of the importance of the fishing industry in this country, however, it was not until 1905 that fish meal, as distinct from fish manure, was manufactured in appreciable quantities; but, even then, it was nearly all exported to Germany and other continental countries. Not until 1916, when war conditions interfered very seriously with the normal supply of concentrated feeding stuffs, did its use in this country become at all common. Feeding trials, carried out by teaching and research authorities, soon demonstrated its very great value, especially for young growing animals, milk cows and poultry; and the subsequent general experience of farmers has entirely supported the results of such trials.

As a result of the increased demand for fish meal, however, two problems have arisen. In the first place, the large and increasing demand is almost greater than the available supply, with the result that the price is higher than many farmers feel justified in paying. The second difficulty, which is the very serious opposition by pork butchers and bacon curers to its use, even in small quantities, is partly due to the varying quantity and quality of the fish oil in the meal, and partly to the tendency to use unnecessarily large quantities of fish meal.

There is considerable evidence to show that, when it is properly used, fish meal of good quality does not materially affect the quality of bacon or pork. Owing, however, to its cost and to the very general objection to its use, on the part of curers, it was thought to be desirable to investigate possible substitutes for fish meal to which the objections would not apply.

As previous experiments had shown considerable and confusing variation in results, it was decided to carry out a

co-operative investigation by the two institutes for research in animal nutrition at Cambridge and Aberdeen, and by other centres engaged in work of a similar nature. By carrying out exactly the same experiment, with feeding stuffs from the same source, but with different lots of pigs and under different control, an attempt has been made to obtain a reliable check on all results and to arrive at conclusions which can safely be applied in practice.

Experimental Plan : (a) *The Important Constituents of Fish Meal.*—The value of fish meal lies in the fact that, when used as a supplement to cereals, it supplies what is lacking in them from the point of view of the growing animal. An animal making rapid growth, or maintaining a high production either of milk or eggs, necessarily requires in its food a high proportion of protein and of mineral salts. Further, it is important that these constituents should exist in the food in a highly digestible condition, because, in the young animal, the organs of digestion are as yet only partly developed, and in the case of the cow and the hen the individual is producing very much above the limit which would be expected of her in natural conditions. Finally, much recent research has shown that, in many animals, rapid and healthy development is conditional upon the presence in the food of some constituents not yet isolated and which are variously known as vitamins or accessory food factors. The vitamin connected with growth is closely associated with certain oils and fats; hence it has been assumed that, as cereals are in general deficient in protein, mineral salts and vitamin-rich oils, it is the presence of these three constituents in fish meal which gives it its value, and for which substitutes would have to be found.

In the case of the fattening pig, however, the value of fish oil has been shown to be very doubtful. Orr and Crichton¹ * have shown that pigs fed on a diet to which linseed oil, containing no growth-assisting vitamin, was added grew just as well as others receiving cod-liver oil. Drummond, Zilva and Golding² also carried out experiments with results which indicated that the requirements of the pig for the fat-soluble vitamin A were not of a high order. Crowther³ has also shown that cod-liver oil had practically no effect on growth when added by itself to a cereal mixture, and his results were confirmed by White and Roberts,⁴ who found that pigs on a vitamin-poor ration made as good gains in

* For references see p. 422.

weight and were in as good general condition as those getting vitamin-rich green food in addition. Finally Paterson⁵ has shown that $\frac{1}{2}$ oz. of cod-liver oil per pig per day not only gave no appreciable difference in live-weight increase, but actually depressed the carcass weight.

This and other similar evidence—including unpublished results, showing that fish meal, from which all the oil has been extracted, produces more rapid growth than ordinary high-class fish meal, containing 4–6 per cent. of oil—indicates that, in attempting to find a substitute for fish meal, the question of oil may be ignored. It would, therefore, appear that the problem resolves itself into finding substitutes for the highly digestible protein and for the mineral matter represented by the bones and salt which are found in fish meal. The details of the successive experiments carried out to this end are reported under “Experimental Data.”

(b) *Pigs Used.*—At the two institutes for research in animal nutrition, only pure-bred Large Whites were employed. In the Harper Adams experiments, cross-bred pigs out of Large White $\times$ Essex sows, and all by the same Large White boar, were used. Care was taken that the pens should be comparable as regards weight, sex and, where possible, breeding. In most cases the risk of variation in growth due to worm infection was obviated by treating the pigs shortly after weaning. In view of the rigorous selection made to ensure uniformity the number of pigs available did not usually allow of more than seven or eight pigs per pen.

(c) *Feeding.*—With one exception “wet” feeding was employed throughout the investigation. Normally three feeds per day were given while the pigs were small, but for the greater part of the time a morning and an evening feed were the rule. All pens were given as much food as they would clean up. Free access to drinking water was given at some centres, but not at others.

(d) *Housing.*—All pigs were housed in similar pens with concrete floors and with the same exposure.

(e) *Weighing.*—The method of weighing varied with local circumstances, but in the later experiments all animals were weighed on three consecutive days both at the beginning and at the end, the average being taken as the weight on the middle day in each case. During the rest of the period, weighing was carried out, usually weekly, and in no case did the interval between weighings exceed 10 days. Weighing was invariably

done before the morning feed, when the pigs were in a semi-fasted condition.

Experimental Data.—As it proceeded, the investigation fell naturally into three main groups. The first of these aimed mainly at making a preliminary survey of the problem by determining the relative values of the protein and of the mineral fractions of fish meal. This having been ascertained, the next move was to test the value of several of the available vegetable and animal proteins in conjunction with the necessary minerals. During this part of the investigation the substitutes, although giving nearly as good growth results as fish meal, appeared to be responsible for a rheumatic or “crampy” condition, which was particularly noticeable with some kinds of bean meal.

The third group of experiments was therefore concerned with determining the best kind of bean meal to use, and with making further alterations in the mineral mixtures used so as to get each ration balanced by its own particular mineral supplement. As the “crampy” condition was eliminated, and as the best of the substitutes actually gave better results than fish meal, it was felt that a résumé of the results so far obtained might now be given.

First Group of Experiments : Value of Mineral Fraction.—

A preliminary communication dealing with one experiment in this group was made in 1925,⁶ and it will be useful to repeat some of the findings here. The plan of the experiment included five pens all receiving the same basal ration and four out of the five receiving supplements in addition. The composition of the rations used is given in Table I.

TABLE I.—COMPOSITION OF RATIONS IN PRELIMINARY INVESTIGATION.

Ingredients	Pen 1. Cereals		Pen 2. Cereals + minerals		Pen 3. Cereals + bean meal		Pen 4. Cereals + bean meal + minerals		Pen 5. Cereals + fish meal	
	Parts	Per cent.	Parts	Per cent.	Parts	Per cent.	Parts	Per cent.	Parts	Per cent.
Barley meal ..	60	33.3	60	32.8	60	26.1	60	25.9	60	30.0
Coarse sharps (middlings)	80	44.4	80	43.7	80	34.8	80	34.5	80	40.0
Maize meal ..	40	22.2	40	21.8	40	17.4	40	17.2	40	20.0
Fish meal ..	—	—	—	—	—	—	—	—	20	10.0
Bean meal ..	—	—	—	—	50	21.7	50	21.4	—	—
Mineral mixture ..	—	—	3	1.64	—	—	3	1.06	—	—

The mineral mixture had the following composition :—

Ground chalk	..	..	..	..	300 parts.
Common salt	..	..	..	..	300 "
Iron oxide (Fe ₂ O ₃)	..	..	..	..	30 "
Potassium iodide	..	..	..	..	1 part.

By comparing the growth of Pens 2–5 with Pen 1, it was possible to find out the increase in gain due to the different supplements. The difference in gain, for example, between Pen 5, on cereals plus fish meal, and Pen 1, getting cereals only, showed the gain due to fish meal. Similarly, a comparison of Pen 1, on cereals only, and Pen 2, on cereals plus minerals, showed the increase due to the mineral portion of fish meal; the other pens supplied information of the same kind on the relative effects of bean meal added by itself to cereals and also when accompanied by minerals.

One of the first results of this, as of other experiments in the same group, was that both the pens receiving bean meal developed a serious loss in condition, and had to be withdrawn from the experiment. The principal symptom was a form of arthritis or “crampiness” which, as it became more acute, resulted in the pigs being unable to get up and feed normally. Further, the condition of the skin was typical of unthrifty animals, being scurfy and without the brightness associated with normal health. This condition was investigated later, in the second group of experiments, and it need only be repeated here that of the two pens, No. 4, receiving minerals in addition to the bean meal, was the healthier.

The second result was the complete collapse of Pen 1, which received no supplement to the basal ration of cereals. The pigs in this pen were behind all the other pens in growth, and at the end of the seventh week half of them had to be removed. When the experiment terminated at the end of 14 weeks, only two pigs were left in this pen, and an estimate, based on these two, of what the average growth of the pen might have been, indicates that it would have been less than half that of the pen receiving fish meal. While they were under experiment, the pigs in this pen showed many signs of deficient nutrition. Much of their time was spent in licking the whitewashed walls of the sty, and this craving was so intense that the walls became flecked with the froth produced by the continual licking carried on all the time that the animals were not eating. Dirty skins and crampiness were even more evident than in the case of the pigs getting bean meal.

The third point of interest was that Pen 2, receiving only minerals along with the basal cereals, remained healthy throughout the experiment, and showed a very marked increase in growth over the pigs receiving cereals alone. As was to be expected, the lack of protein reduced growth in the first half of the experiment, as is clearly seen from Table II, but during the latter half the increase was as great as in the case of the pigs getting fish meal.

TABLE II.

	Pen 1. Cereals Lb.	Pen 2. Cereals+ minerals Lb.	Pen 5. Cereals+ fish meal Lb.
Average gain per pig during first six weeks	27.50	33.96	49.23
Average gain per pig during last six weeks	35.50 (estimated)	69.22	71.00
Average gain per pig in 84 days	63.00	103.18	120.23
Average gain in weight per pig per day	0.75	1.23	1.43

This result, demonstrating the value which must be ascribed to the mineral portion of fish meal, is confirmed by two other experiments.

In one of these, two pens, of five pigs each, were given the following basal ration of cereals:—

Fine sharps	3 parts.
Coarse sharps (middlings)	1 part.
Barley dust	3 parts.
Rice meal	1 part.
Maize meal	2 parts.

Pen 1 received, in addition to the basal ration, a free choice mineral mixture consisting of steamed bone flour, chalk, salt and ferric oxide.

Pen 2 received, in addition to the basal ration, 1 part (9.1 per cent.) of fish meal. Table III shows the results.

TABLE III.

	Pen 1. Cereals+ minerals <i>ad lib.</i> Lb.	Pen 2. Cereals+ fish meal Lb.
Average initial weight per pig	52.5	53.1
Average final weight per pig	119.7	132.9
Average gain per pig in 70 days	67.2	79.8
Average gain in weight per pig per day ..	0.96	1.14

In the second of these two confirmatory experiments, two pens were fed a basal ration of maize meal, oatmeal, coarse sharps (middlings) and potatoes, to which were added marmite

and swede turnip juice. Pen 1 received the basal ration only and Pen 2 had a mixture of calcium-rich salts added. The results are shown in Table IV.

TABLE IV.

	Pen 1. Cereals only Lb.	Pen 2. Cereals+ minerals Lb.
Average initial weight per pig	31.5	31.0
Average final weight per pig	98.0	163.5
Average gain per pig in 119 days	66.5	132.5
Average gain in weight per pig per day ..	0.56	1.11

In view of the fact that these three sets of results were obtained independently at two separate stations, the similarity of the results is significant. If the figures are examined, it will be found that cereals plus minerals gave respectively 84 per cent. and 86 per cent. of the live-weight gain made on cereals plus fish meal.* On the other hand, cereals only gave 50 per cent. and 61 per cent. of the gain made on cereals plus minerals, or approximately 42.5 per cent. and 52 per cent. of the gain on cereals plus fish meal. That young pigs from shortly after weaning until they reach a weight rather under bacon weight (*i.e.* during the period of most rapid growth) should only make 40 per cent. to 50 per cent. of normal growth when fed on cereals only confirms how very deficient such foods are for pigs. That exactly similar pigs should make 80 per cent. to 85 per cent. of normal growth when only minerals and no extra protein are added, proves what a very important part is played by the minerals supplied in fish meal.

Second Group of Experiments: Suitability or otherwise of Bean Meal and other Protein Supplements.—The first group of experiments having demonstrated the relative importance of the mineral and protein fractions, the second part of the investigation was devoted to examining the injurious effect of bean meal, especially when fed without a mineral supplement. The general observation on the effect of bean meal was that although, when combined with a mineral supplement, it led, at first, to nearly as good growth as fish meal, it produced a "crampy" or rachitic condition, which eventually became acute, and interfered with the amount of food consumed and so, indirectly, with growth.

Table V, based on one of the earliest experiments, indicates this more clearly, the average gain per day showing the

* In a third comparison made subsequently at another centre, the proportion of 79½ per cent. was found.

relative position of the bean meal pen during the first and second months.

TABLE V.

	Pen 2. Cereals+ minerals	Pen 4. Cereals+ bean meal +minerals	Pen 5. Cereals+ fish meal
	Lb.	Lb.	Lb.
Average initial weight per pig	74.43	74.57	72.57
Average weight after 28 days	98.64	105.59	108.07
Average gain in 28 days ..	24.21	31.02	35.50
Average gain per day ..	0.87	1.11	1.27
Average weight after 56 days	138.63	127.90	156.51
Average gain in 28 days ..	39.99	22.31	48.44
Average gain per day ...	1.43	0.80	1.73

In view of the importance, already established, of the mineral portion of the ration, it was considered possible that the unthrifty symptoms observed in the bean meal plus mineral pens, as compared with the healthier condition of the pigs on cereals plus minerals only, might be due to defective mineral balance in the whole ration. It was, therefore, decided to add, in the second group of experiments, a pen which would get cereals plus bean meal plus minerals *ad lib.* The results confirmed the belief that the mineral balance on previous occasions had been wrong, as will be seen from Table VI.

TABLE VI.

	Pen 1. Cereals+ mineral mixture	Pen 2. Cereals+ soya bean meal+ minerals <i>ad lib.</i>	Pen 3. Cereals+ soya bean meal+ mineral mixture	Pen 4. Cereals+ fish meal
	Lb.	Lb.	Lb.	Lb.
Average initial weight per pig	46.0	46.0	46.0	46.0
Average weight after 83 days	100.1	127.7	116.1	125.0
Average gain in 83 days ..	54.1	81.7	70.1	79.0
Average gain per day ..	0.65	0.98	0.84	0.95

In this case, the growth due to soya bean meal plus minerals *ad lib.* was, if anything, slightly greater than in the case of fish meal, whereas, when the minerals were added as a definite part of the ration, the daily gain was only 0.84 lb. as compared with 0.95 lb. with fish meal. In addition to this, the pigs receiving minerals *ad lib.* were carried on along with those receiving fish meal almost to bacon weight, whereas those receiving the mineral mixture in their food had to be withdrawn at the end of 83 days.

Two Further Protein Substitutes.—This information led on to the third group of experiments, in which it was found

possible to obtain results equal to those from fish meal; but, before describing these, the effect of two other protein substitutes should be reported. Arising out of the discussion on the value of fish meal, considerable stress has been laid on the animal origin of protein for pig feeding. In this country, the most readily available animal protein feed is meat meal, and this was compared, in one experiment, with fish meal, and also with bean meal plus a mineral mixture. The results of feeding meat meal, however, must, for the present, be inconclusive owing to the great variation which exists in the proportion of bone which is present in the meal. "Rations for Live Stock,"⁷ containing the most reliable averages for British feeding stuffs, gives the ash content of meat meal as 3.8 per cent. The ash in the case of the meat meal used on this occasion amounted to 18.3 per cent., and the American figures given in Henry and Morrison's "Feeds and Feeding" show that in different samples the ash may vary from 15.3 per cent. to 45.8 per cent. Such wide variations not only produce great differences in the total amounts of protein and of the important minerals present, but also interfere seriously with the relative proportions.

Pea meal was another possible substitute which was tested, because of the good results which are known to follow feeding whole peas to young, newly-weaned pigs. Neither meat meal nor pea meal, however, gave as good results as fish meal, whereas in this particular experiment bean meal plus a mineral mixture actually did as well as fish meal, though most of the pigs were beginning to develop "crampy" symptoms just before slaughter. The actual results are given in Table VII.

TABLE VII.

	Pen 1. Cereals+ fish meal	Pen 2. Cereals+ meat meal	Pen 3. Cereals+ bean meal +mineral mixture	Pen 4. Cereals+ pea meal +mineral mixture
	Lb.	Lb.	Lb.	Lb.
Average initial weight per pig	44.62	44.87	44.60	44.25
Average weight after 103 days	183.12	175.30	182.00	157.12
Average gain in 103 days	138.50	130.43	137.40	112.87
Average gain per day ..	1.34	1.27	1.34	1.10

In this case both the meat meal and the pea meal led to a dry and dirty condition of the skin, and in addition a certain amount of "crampiness" developed in the pea meal pen.

Third Group of Experiments: Successful Substitutes.—Having determined that oil had little special value for growth, that the mineral part of the supplement was of very

considerable importance, and that, under certain conditions of mineral balance, the vegetable proteins gave satisfactory results as regards live-weight increase, the last part of the investigation was devoted to testing two or three supplements which there was reason to believe would be successful. Both English bean meal and extracted soya bean meal had already proved of value, and results obtained by Paterson⁵ and Rayns⁹ indicated that decorticated ground-nut meal was to be considered in the same category.

The final set of experiments was therefore based on the following feeding plan. Five pens were fed on the same basal ration of cereals which altered in proportion according to age as follows :—

Live weight	Coarse sharps (middlings)	Barley
30-70 lb.	45 parts	45 parts
70-140 "	30 "	60 "
140-210 "	15 "	75 "

The five pens were then fed as shown in Table VIII.

TABLE VIII.—COMPOSITION OF RATIONS IN FINAL GROUP OF THE INVESTIGATION

	Pen 1. Fish meal		Pen 2. Bean meal		Pen 3. Soya bean meal		Pen 4. Dec. earth-nut meal		Pen 5. Soya Bean meal + Dec. earth-nut meal	
	Parts	Per cent.	Parts	Per cent.	Parts	Per cent.	Parts	Per cent.	Parts	Per cent.
Basal ration ..	90	90	90	75.9	90	84.5	90	86.0	90	85.2
White fish meal	10	10	—	—	—	—	—	—	—	—
English bean meal ..	—	—	25	21.0	—	—	—	—	—	—
Ex. soya bean meal ..	—	—	—	—	13.3	12.5	—	—	6.65	6.3
Dec. earth-nut meal ..	—	—	—	—	—	—	11.4	11.0	5.70	5.4
Mineral Mixture A ..	—	—	3.63	3.1	3.25	3.0	—	—	—	—
Mineral Mixture B ..	—	—	—	—	—	—	3.15	3.0	—	—
Mineral Mixture C ..	—	—	—	—	—	—	—	—	3.25	3.1

The composition of the mineral mixtures was as follows :—

	A	B	C
Ground limestone ..	1.5 parts	1.3 parts	1.3 parts
Steamed bone flour ..	1.25 "	1.5 "	1.5 "
Common salt ..	0.25 "	0.1 "	0.2 "
Ferric oxide ..	0.25 "	0.25 "	0.25 "
Potassium iodide ..	0.0004 "	0.0004 "	0.0004 "

From this it will be seen that different mixtures of minerals were used according to the variations in the mineral content

of the different supplements in order to bring all the supplemented rations to the same mineral balance.

Only two stations were actually able to take part in this experiment, but the results obtained were in very close agreement, as will be seen from the first part of Table IX. From this it will be seen that, on live-weight increase, the only outstanding pen was the soya meal pen (Lot 3), the rest being equal within the probable range of normal variations. The other results are equally similar and only the averages for the two stations are given.

TABLE IX.—RESULTS OF FINAL EXPERIMENTS.

Pen	Live weight gain in lb. per day				Meal con- sumed per 1 lb. gain	Cost per 1 lb. of food	Cost per 1 lb. gain	Health and con- dition
	I	II	Av.	Fish meal = 100				
(1) Fish meal ..	1.33	1.26	1.30	100	4.00	1.16	4.64	Very good
(2) Bean meal ..	1.38	1.28	1.33	103	4.00	1.12	4.48	Very good
(3) Soya meal ..	1.48	1.31	1.40	108	3.81	1.06	4.04	Very good; skin poor
(4) Earth-nut meal ..	1.39	1.23	1.31	101	4.10	1.11	4.55	Fair; skin excellent
(5) Soya, plus earth-nut meal.	1.34	1.24	1.29	99	3.98	1.11	4.41	Fair; skin fair

In both cases, the pen on extracted soya bean meal was outstanding, being the best as regards appetite and growth, whereas the pen getting decorticated earth-nut meal was less satisfactory in these respects, possibly owing to the fact that the meal used contained 7 per cent. of oil. In both cases, too, pen 5, receiving both decorticated earth-nut meal and extracted soya bean meal, while coming midway between Pens 3 and 4 in most characteristics, showed results which approximated much more closely to those from extracted soya bean meal than from earth-nut meal. There is reason to believe that, at one centre, the growth of the fish meal pen was not as good as is usually obtained, so that the relative superiority of the extracted soya bean meal pen may not be quite so great as represented by the figures.

While the live-weight growth, however, was distinctly the best in the case of extracted soya bean meal, it was observed that the condition of the skin was the poorest of the five pens, and the tendency was for the carcass percentage to be the lowest as well. Examination of the fat, after killing and curing, also showed that the soya bean meal had a tendency to produce

rather soft tissue, although this is not to be interpreted as meaning an oily or tainted fat. There was considerable variation between the carcasses of individual pigs from all the pens, and no single ration gave uniformly firm fat in all cases.

A more detailed examination of the physical and chemical characters of samples of fat, taken from some of the Harper Adams' pigs, was made by Mr. F. W. Jackson, B.Sc., A.I.C., Chief Chemist to Messrs. Marsh and Baxter, Ltd., the results of which will be published elsewhere. It will suffice here to indicate that the conclusions were substantially in accordance with the ordinary grading of the carcasses, in which the bean meal lot were placed first, followed by the soya bean lot classed as "soft."

Discussion of Results.—All the large pig-producing areas of the world, with the exception of the corn belt of the United States, which mostly produces lard pigs, have in the past found it necessary to supplement the supply of cereals with milk or one of its by-products. In Great Britain, however, the demand by the large industrial population for liquid milk has made it too valuable to be used for pig feeding, and fish meal has largely taken its place. The experiments just described indicate wherein the value of fish meal lies, and how it can be replaced by cheaper and equally satisfactory ingredients.

In discussing the results which have been obtained, one of the most interesting is the effect which oil has upon the pig. Contrary to the opinion originally held, oil does not increase the rate of growth of fattening pigs, but is inclined to depress it slightly. On the other hand, the condition of the skin is much improved and there is some indication that the carcass is more compact and forms a higher percentage of the live weight, although this may be a secondary effect due to slower growth. There is, too, a very marked similarity between pigs receiving a fairly high proportion of oil, in an otherwise balanced ration, and those getting minerals only in addition to cereals. Oil *per se* is known to assist the ingestion of mineral salts,⁸ and there would appear to be a close connexion between mineral balance and skin condition.

This is borne out by the fact that, where minerals only are added to cereals, the health and general condition are always good, although the growth is below normal on account of deficiency of protein. On the other hand, if protein-rich feeds (pure protein alone was not used in this investigation), such as bean meal, are added without balancing up with minerals, fairly normal growth is obtained for a time only, to be followed fairly soon by a more or less serious breakdown in health.

When fed in conjunction with minerals, vegetable proteins give varying results which appear to depend partly on the amount of oil associated with them and partly on the amounts and nature of the minerals already in the protein feed. This would appear to apply particularly to decorticated earth-nut cake meal which is obtainable either with the ordinary amount of about 7 per cent. of oil, or in the extracted condition in which the oil is normally reduced to below 2 per cent. The meal used in these experiments had an oil content of 7.17 per cent., and, both when it was used alone or formed one-half of the protein supplement along with extracted soya bean meal, the results were disappointing. Further confirmation of this was obtained by Rayns⁹ at the Norfolk Experimental Station. The live-weight increase of the fish meal pen was 1.59 lb. per pig per day as against 1.51 lb. where fish meal was replaced by equal parts of unextracted decorticated earth-nut meal and extracted soya bean meal. If the gain of the fish meal pen is taken as 100, then the increase of the substitute pen is 95. The results obtained by Paterson,⁵ who found decorticated earth-nut meal as good as fish meal, suggest that the extracted meal was used by him, although this is not stated.

The results from the final series of experiments indicate that by properly balancing vegetable protein feeds and a combination of minerals it is possible to rely upon obtaining as rapid growth as when fish meal is employed, and to maintain the pigs in excellent health throughout the feeding period. It has to be observed in this connexion, however, that neither with fish meal, nor with the best growth-promoting protein and mineral substitutes, can one rely upon obtaining as good carcass results as with some of the other supplements, which, while maintaining a healthy condition, do not produce such rapid growth. The fat from pigs fed on extracted soya bean meal was softer than is desirable for bacon-curing, although it was neither oily nor tainted in any way; and, in the case of fish meal, many of the carcasses were also not quite so firm, as, for example, when only cereals and minerals were fed. Associated with this, it was observed that the skins were dirty and harsh in many instances. Under other conditions of feeding, notably where boiled potatoes are used, the most rapidly-growing pigs produce the firmest fat, and the highest carcass percentage. The factors which lead to most rapid growth are not, therefore, always the same as those which produce the best carcass; and further research is necessary to determine the relationships of these causes and effects.

Practical Conclusions.—(1) The value of fish meal for feeding to pigs, as a supplement to a basal ration of cereals, has been investigated and found to be associated with the protein and, particularly, with the amount and proportions of the mineral ingredients.

(2) The oil in fish meal not only appears to be of no special value for growth, but to have a slight depressing effect on live-weight increase.

(3) Vegetable proteins, when used in the proper proportions, and when carefully supplemented by mineral mixtures, give as good results as the animal protein in fish meal. In neither case, however, was a carcass of first-class quality obtained.

(4) Of the various vegetable proteins used in the investigation, extracted soya bean meal has given the best results.

(5) Minerals may be supplied separately, from the rest of the ration, either in the form of a simple mixture in one box, or individually in a box containing four or five compartments. Reference is made in the Transactions of the Highland and Agricultural Society¹⁰ to the following mixture: salt, 20 parts; ground limestone, 40 parts; bone meal, 40 parts; potassium iodide, 0.04 part.

If supplied individually, compartments should be provided for (1) ground limestone, slaked lime, or chalk; (2) bone meal; (3) common salt; and (4) a mixture of coal and wood ashes.

(6) The quality of the fat, and the conformation of the carcass, are not always the best in the case of pigs with the greatest live-weight increase.

We would express our acknowledgments for valuable assistance rendered by Messrs. Marsh and Baxter, Ltd., in the grading and examination of carcasses from the Harper Adams experiment, and by the St. Edmundsbury Co-operative Bacon Factory, Ltd., in connexion with the pigs from the Cambridge experiments.

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THE DISEASES OF ANIMALS ACTS, 1894 TO 1927

THE suppression of contagious and infectious diseases in animals is of primary importance to the agricultural industry of every country, and practically every country in the world has adopted measures of some kind for that purpose.

Records exist of serious loss suffered for several centuries past from animal epidemics, but no organized attempt at control was made in Great Britain until 1848, when the prevalence of sheep-pox, introduced from the Continent, led to the passing of two Acts of Parliament under which that disease and the cattle-plague outbreaks of 1865 were dealt with. These Acts proved insufficient to prevent the spread of cattle plague throughout the country until the Cattle Diseases Prevention Act, 1866, was passed; this required the compulsory slaughter, with compensation, of all affected animals, and empowered the slaughter of animals in contact therewith. This measure succeeded in eradicating the disease by September, 1867, and the experience of these two diseases led to the passing of the Contagious Diseases (Animals) Act, 1869, which conferred extensive powers upon the Privy Council and Local Authorities to deal with animal diseases, including pleuro-pneumonia and foot-and-mouth disease, as well as cattle-plague and sheep-pox. The Act of 1869 also imposed the first effective restrictions on the importation of animals from certain foreign countries where disease was prevalent. Agricultural opinion was not, however, favourable to the full exercise of the powers conferred by the Act of 1869, and the country had to experience two more outbreaks of cattle-plague (1872 and 1877), and very extensive outbreaks of foot-and-mouth disease and contagious pleuro-pneumonia of cattle, before the Act of 1869 was revised by the Contagious Diseases (Animals) Act, 1878, which laid the foundation for the methods now in force. The Act of 1878 and its subsequent amendments were consolidated by the Diseases of Animals Act, 1894, which, with its nine amending Acts of 1896 to 1927, confers the powers upon which State action at the present time is based.

Main Objects of the Acts: Central and Local Organization.—

Generally speaking, the Acts impose upon the Minister of Agriculture and Fisheries, as the central authority, the duty of devising and putting into operation measures for the control and eradication of contagious diseases amongst

animals in England, Wales and Scotland. They confer upon the Minister wide powers to make Orders for these and other specified purposes, including :—

- (a) The declaration of infected places and areas ;
- (b) The prohibition or regulation of the movement of animals into, out of, or within such places and areas, and of the exposure of animals at markets, sales and exhibitions ;
- (c) The control of the importation of foreign animals, carcasses, fodder, etc., for the purpose of preventing the introduction of disease from without ;
- (d) The muzzling and control of dogs ; and
- (e) The protection of animals and poultry from unnecessary suffering during transit by land or sea.

Thus, while indicating the general lines of the procedure to be adopted, the Acts empower the Minister to prescribe the details by administrative Orders which have the full force of an Act of Parliament.

For the discharge of these duties the Minister has established the Diseases of Animals Division of the Ministry, under the direction of the Chief Veterinary Officer, assisted by a professional staff consisting of a Deputy Chief Veterinary Officer, 9 Superintending Inspectors, 32 Divisional Inspectors and 63 Inspectors, and also by a lay administrative and clerical staff numbering 40. The professional staff is distributed between the head office, general field work, inspection of animals at ports and the Ministry's Laboratory. Two of the senior Inspectors are stationed in South America.

With certain exceptions, the Acts require the Local Authorities and the police generally to execute and enforce the provisions of the Acts, and of the Orders of the Minister thereunder. The Local Authorities constituted for the purposes of these Acts number 332, and comprise the County Councils, the County Borough Councils and the Councils of certain other boroughs and burghs. All these Authorities are required to appoint their own veterinary and other inspectors to carry out the duties imposed upon them, and the expenses of the Local Authorities, with certain exceptions, have to be defrayed out of the local rate. In most of the counties the police have been appointed as Inspectors. An Inspector of the Ministry or of a Local Authority has special powers of entry upon any premises or on any vessel on which he has reason to believe that disease exists, or that the Acts or Orders of the Minister or Regulations of a Local Authority are being infringed. In addition, an Inspector of the Ministry may enter any premises to ascertain whether pleuro-pneumonia, foot-and-mouth disease or swine fever exists thereon.

Diseases dealt with under the Acts.—The Acts and Orders of the Minister at the present time require the notification of cases or suspected cases of the following twelve diseases : cattle plague, contagious pleuro-pneumonia of cattle, foot-and-mouth disease, sheep-pox, swine fever, sheep scab, anthrax, rabies, glanders, epizootic lymphangitis, parasitic mange in horses, asses or mules, and certain forms of bovine tuberculosis. These may be divided into two classes :—

- (1) Those in which the diagnosis is in the hands of the Ministry's officers, *i.e.*, cattle-plague, pleuro-pneumonia, foot-and-mouth disease, sheep-pox and swine fever ; and
- (2) Those in which the diagnosis is carried out primarily by officers of the local authorities, *i.e.*, anthrax, sheep scab, glanders, rabies, epizootic lymphangitis, parasitic mange of equines and bovine tuberculosis. In anthrax and rabies, however, the diagnosis is subject to confirmation by the Ministry, and in sheep scab, glanders and tuberculosis the owner has a right of appeal to the Ministry against the diagnosis.

Of the above diseases, no outbreaks have occurred in Great Britain of cattle plague since 1877, pleuro-pneumonia since 1898, sheep-pox since 1850, epizootic lymphangitis since 1906, or of rabies since 1922. The efforts of the Authorities are therefore directed mainly against other diseases.

Responsibilities of Stock Owners and Veterinary Practitioners : Reporting of Disease and Separation of Affected Animals.—Every person having in his possession or under his charge an animal or carcass affected with or suspected of any of the notifiable diseases above-named is required :

- (a) As far as practicable to keep that animal or carcass separate from animals not so affected ; and
- (b) With all practicable speed to give notice, to a police constable, of the fact that the animal or carcass is so affected or suspected.

Section 57 (1) of the Act of 1894 provides that the owner or person in charge of an animal, charged with an offence against the Act relative to disease, shall be presumed to have known of the existence of the disease or illness, unless and until he shows to the satisfaction of the Court that he had not knowledge thereof, and could not with reasonable diligence have obtained that knowledge.

Any veterinary surgeon who finds any notifiable disease is likewise required to report such cases to the Local Authority.

An important provision contained in the Orders of the Minister dealing with the specified diseases is the prohibition

of the exposure of any affected or suspected animal in a market, fairground, saleyard or place of exhibition, and of the movement or grazing of such an animal on a highway, road or lane, or on common or unenclosed land, or of its movement by rail or water.

The Acts and Orders impose upon stockowners and the public generally an obligation to afford inspectors and police all necessary facilities for the performance of their duties, and any obstruction is an indictable offence. Persons guilty of an offence in respect of these or other matters referred to in the Acts and Orders are liable to a penalty of £50, or £5 in respect of each animal where more than 10 animals are concerned, and in certain cases to imprisonment.

Slaughter and Compensation : Remedial Treatment.—In cattle plague and pleuro-pneumonia the Acts render it obligatory upon the Ministry to slaughter all affected animals, with payment of compensation. In the case of sheep-pox slaughter by the Local Authority is compulsory.

In foot-and-mouth disease slaughter is not obligatory, but may be carried out at the discretion either of the Ministry or of the Local Authority. In practice, in cases of foot-and-mouth disease, slaughter of affected and in-contact animals, accompanied by stringent restrictions on movement of animals in infected areas, is adopted by the Ministry as being the most effective and economical method of maintaining the comparative freedom of this country from the disease, regard being had to present pathological knowledge. This disease is the subject of investigation by a Scientific Research Committee appointed by the Minister of Agriculture.

In the case of swine fever also, slaughter is within the discretion of the Ministry. As a "stamping out" policy, slaughter in swine fever was given a prolonged trial over many years at considerable public expense, but without success. The attempt to stamp it out was abandoned in 1915 in favour of control by isolation of infected herds, and slaughter is now carried out only where necessary to provide a means of diagnosis by post-mortem examination.

Of the other notifiable diseases slaughter of affected animals is obligatory upon the Local Authority in cases of glanders and certain forms of bovine tuberculosis, with compensation to the owners; and also of dogs and cats (but without compensation) found to be affected with rabies, or known to have been bitten by a rabid dog or cat.

Cases of sheep scab and parasitic mange in equines are dealt with by the application of remedial measures; sheep scab by the dipping of the affected sheep twice with a short interval (not less than 7 days and not more than 14 days) between the two dippings; and mange by a dressing or other remedy approved by a veterinary surgeon. Anthrax in animals is nearly always fatal, and slaughter is expressly avoided, as the spilling of the blood, which swarms with anthrax bacilli, is attended with great danger both to other animals and to human beings. All stockowners and butchers are cautioned against the cutting of the carcasses of animals which have died of anthrax or suspected anthrax. Cremation is the usual method of destruction of the carcasses.

The above measures are accompanied in every case by restrictions on the movement of the animals on the infected premises, with the object of preventing the spread of infection to other stock.

Principles of Compensation.—The amount of compensation payable for animals slaughtered by the Ministry or Local Authority varies with the disease and according to whether the animal is diseased or not. The object of the provision made in the Act of 1894 for the payment of compensation is frequently misinterpreted. Compensation is not provided for the purpose of reimbursing an owner for losses incurred through outbreaks of disease amongst his stock; such losses are ordinary trade risks connected with the live stock industry, and are to some extent insurable. Compensation is provided to enable the Ministry or Local Authority compulsorily to acquire the ownership of any animals which it considers should be slaughtered in the public interest. These animals become the property of the Ministry or Local Authority, and the owner is paid compensation according to a prescribed scale based upon the market value of the animals when slaughtered. The Ministry and the Local Authority have power, however, to withhold compensation, either wholly or partially, in respect of an animal slaughtered under the Acts and Orders where the owner or person in charge of the animal has, in the judgment of the Ministry or the Local Authority, as the case may be, been guilty, in relation to the animal, of any offence against the Diseases of Animals Acts or Orders made thereunder. This power to withhold compensation is sometimes exercised, more particularly in cases in which the owner or person in charge has been convicted for the very serious offence of failing to report disease.

Other Diseases : Provision for Research.—The Act of 1894 empowers the Minister, by Order, to add other diseases to the list of those to be dealt with by State action. Some of the more serious diseases in animals, such as contagious abortion in cattle, Johne's disease, etc., are not suitable for addition to the list of notifiable diseases, either because the nature of the disease renders this impracticable, or because the imposition of such measures of control as would be necessary would interfere unduly with the industry and thus make the remedy worse than the disease. Such diseases, therefore, are not notifiable, but the more important are dealt with in leaflets of advice which are available for the use of farmers.

In addition, scientific research is conducted into various contagious and infectious diseases of animals, including foot-and-mouth disease, contagious abortion in cattle, mares and ewes, various sheep diseases such as louping ill and scrapie, tuberculosis, Johne's disease, mastitis in cows, quarter evil in cattle, etc. These researches are conducted either at the Ministry's Veterinary Laboratory (New Haw, Weybridge, Surrey) or at various institutes aided by Government grants.

Measures for Preventing Introduction of Infection from Abroad.—One of the most important aspects of the problem of keeping Great Britain free from disease is the prevention of the introduction of disease from abroad. Our insular position gives us special advantages in this respect, but these are limited by the fact that we are not self-supporting either in regard to foodstuffs or various raw materials for manufacture, etc. Without undue interference with these necessities, it has been possible to provide a considerable measure of protection against the introduction of infection by live animals, carcasses, hay, straw, packing materials and animal foodstuffs by the following action :—

- (i) Prohibition of landing of live animals from abroad, except—
 - (a) From Ireland, the Channel Islands and the Isle of Man, subject to certain conditions ;
 - (b) Canadian store cattle for feeding purposes, subject to the provisions of the Act of 1922, and
 - (c) Fat cattle or sheep from Canada, the United States, the Union of South Africa (including the Mandated Territory of South West Africa), Southern Rhodesia, Iceland and the Faroe Islands, subject to slaughter at an imported animals' wharf at the port of landing within 10 days after landing.
- (ii) Prohibition of the landing of fresh carcasses and animal products from the Continent of Europe, with certain minor exceptions.

- (iii) Prohibition of landing of hay and straw from countries infected with foot-and-mouth disease.
- (iv) Requirement that packing materials used for goods and meat, whether imported or not, shall not be brought into contact with animals and shall be destroyed when their use as packing material is finished.
- (v) Requirement that all waste animal foodstuffs or swill containing animal matter, whether of foreign or home origin, shall be boiled before being fed to or brought into contact with animals.
- (vi) Prohibition of landing of dogs and other canine animals from abroad, except by licence from the Ministry and subject to six months' quarantine on approved premises, as a protection against rabies.
- (vii) Control of importation of horses, asses and mules, which are required to be accompanied by a veterinary certificate in specified terms, as a protection against glanders, epizootic lymphangitis, dourine, and certain other diseases of equines.

Protection of Animals and Poultry from Avoidable Suffering during Transit.—In addition to the measures above described for the suppression and prevention of animal diseases, the Ministry is charged under the Diseases of Animals Acts with the duty of making such regulations as may be considered necessary for protecting animals and poultry from avoidable suffering during transit on land or by sea, and for securing to them a proper supply of food and water. Orders with this object in view have been made as follows :—

- (a) Transit of Animals Order of 1927, dealing with the carriage of animals between ports in Great Britain and between Great Britain and Ireland, the Channel Islands and the Isle of Man, and also the carriage of animals by rail in Great Britain. This Order includes requirements as to the nature of the fittings for vessels engaged in the trade, and also the method of construction of railway vehicles carrying animals by railway.
- (b) Conveyance of Live Poultry Order of 1919, to protect live poultry during transit by sea, road or rail, or during exposure for sale, from exposure to bad weather or excessive heat, and to prevent overcrowding or the use of unsuitable receptacles.
- (c) The Exportation and Transit of Horses Order of 1921, which regulates the traffic in horses exported to the Continent or elsewhere, prevents the export of decrepit horses, i.e., horses unfit to travel or work, lays down stringent provisions as to the construction of the stalls in which the horses are to travel, and requires the provision of an adequate supply of food and water at all stages of the journey.

The Dogs Act, 1906.—Section 2 of the Act of 1906 is the only part of the Act with which the Ministry is directly concerned as the administering authority. That section adds to the purposes for which the Ministry may make Orders under the Diseases of Animals Act, 1894, the following :—

- (a) For prescribing the wearing by dogs, whilst in a highway or place of public resort, of collars bearing the name and address of the owners ; and

(b) For preventing dogs from straying during the hours of darkness, the object being to prevent the worrying of cattle and sheep.

Collar Regulations are now in force throughout Great Britain, and Local Authorities are empowered to make regulations requiring dogs to be kept under adequate control during the hours of darkness. These powers have been exercised in nearly every county in Great Britain.

* * * * *

CULTURE OF CHICORY (WITLOOF) IN BELGIUM

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CHICORY (*Cichorium intybus*) is a biennial indigenous plant cultivated largely for the roots, which, dried, roasted and ground, are admixed with coffee. The two varieties used are "Chicory of Brunswick," which forms thick roots and has horizontally extending leaves with a denticulate margin and red median veins; and "Chicory of Magdebourg," characterized by erect entire leaves with white midribs. By constant and rigorous selection, a special strain, suitable for culture as a vegetable, has been produced from the "Chicory of Magdebourg." This is the chicory "Witloof," i.e., white leaf. When the roots are stimulated, the central bud, as a rule, alone develops, and its leaves, when grown in the dark, are largely used in salads, being sold under the name of Barbe de Capucin (Monk's Beard). When the leaves of this central bud are forced through a layer of soil, they are pressed tightly together, forming a very compact head, and this head, detached from its root, is called a "chicon," a vegetable that is becoming increasingly common in English markets. This article deals only with the culture of chicory witloof for the production of the chicons.

Uses of Chicory.—Chicory witloof, as a vegetable, was first produced in Belgium. It possesses many medicinal qualities: it is a mild aperient and stimulates the appetite; it is recommended in cases of constipation, liver trouble and gallstones; moreover, being very light and agreeable to the palate, it is considered an excellent vegetable for invalids, convalescents and old people. It is now grown in Belgium and, to a lesser extent, in France and Holland. That grown in Belgium is of a high standard, and is exported in quantity to the British Isles and to France, Germany, Switzerland, Holland and America.

Sowing.—Seed (from a strain of first quality) should be sown between May 10 and 20. If earlier sowing is made, "bolters" may appear. The soil must be light, fertile, and contain an abundance of well-decomposed manure, i.e., manure which has been applied for previous crops, and it must not be too retentive of moisture. Roots obtained in soil which is too light or too rich in nitrogenous manures produce loose chicons of poor flavour and no crispness. The yard manure given is about 20 tons per acre, and is supplemented by about 4 cwt. per acre of basic slag and $3\frac{1}{4}$ cwt. of kainit, incorporated in the soil in the autumn; or by $3\frac{1}{2}$ to 5 cwt. of superphosphate and $1\frac{3}{4}$ cwt. of kainit in the spring. Before sowing, the soil must be well cultivated to a good tilth.

The seed is sown in rows 12 in. apart and $\frac{1}{2}$ in. deep, a hand drill of the "Planet Junior" type being used for sowing and covering. As soon as the seedlings are seen in the rows, the soil is loosened between the rows with the hand cultivator to keep down weeds and conserve moisture. The first thinning takes place from five to six weeks after sowing and is done during dull weather, the soil being loosened again after the operation. A second thinning is done three weeks later and the plants are then left at about 6 in. apart in the rows. The plants will satisfactorily transplant to fill up blanks, a spade being used for the purpose, and the leaves are then slightly reduced. During the summer, the weeds are kept down and all bolters are removed. Where growth is insufficient, watering with liquid manure is carried out in the evening, or a little nitrate of soda is broadcast at the rate of 3 to $3\frac{1}{2}$ cwt. per acre.

Some growers cut the leaves for stock feeding purposes during the summer, but this is highly detrimental to the formation of good root stocks.

Lifting and Storing the Roots.—The roots are lifted just before the first frost appears, from about the end of September to November 15, being raised by means of spade, fork or plough. When immediate forcing under glass is to be done, as in the Ghent district, the leaves are cut off one inch above the crown, and the roots are laid in shallow piles exposed to the air to dry and become thoroughly dormant; but, when they are to be kept for later forcing, the roots are allowed to retain their leaves and pass the winter in the open. They are bunched up close together, upright on the surface of the soil, to form a circular clamp about $6\frac{1}{2}$ ft. diameter; soil is piled up around the plants and, in frosty weather, they are covered with leaves, reed mattresses, flax waste, etc. As

required, the clamps are opened, the leaves cut and the roots brought in for forcing. When forcing in wide trenches out of doors, by means of manure or hot water heating, is practised, as around Brussels and Louvain, the roots, after lifting, have their leaves removed up to 1 in. from the collar, which must not be injured, for in the heart of this is the central bud which will produce the chicon. After a few days' exposure to the air, the roots are buried in trenches on the ground where they are to be forced. The trenches are 3 ft. to 3 ft. 6 in. wide and about 33 ft. long, and are established in a dry situation in the garden. After marking out the beds, the soil is dug 10 in. deep and broken up finely, all weeds, stones and rubbish being carefully removed. Digging is done in such fashion as to have, at one end of the bed, a trench 3 ft. 4 in. wide by 10 in. deep, and into this trench the first roots are introduced.

The roots, the small ones being removed, are trimmed and placed in the trenches upright and close together, generally all the crowns being level and in line with the normal soil level; in very dry soil, however, they are planted a little deeper. Roots which are too long are broken to even them up. A small sprinkling of soil is introduced between the roots so that they do not actually touch one another. A little nitrogenous fertilizer is added to the soil; excess of nitrogen, however, must be avoided, or Sclerotinia disease will result. Once in position, a heavy watering is applied to the roots unless the soil is already very wet or heavy, when the roots are covered with a light layer of loose, open and dry soil to a depth of 3 in. to 10 in. When setting is completed, lights or large wooden lids are placed over them to protect the soil from rain.

Forcing may be commenced as soon as the little rootlets appear. During frost, the beds are protected with straw or loose manure. The heat for forcing is obtained by the use of manure, hot air or hot water.

Forcing Out of Doors : (1) *Manure Heating.*—On the soil covering the roots, horse or sheep manure is placed in a layer 1 ft. 3 in. to 2 ft. 6 in. thick, according to the weather; the manure must extend 1 ft. 3 in. to 2 ft. 6 in. beyond the limits of the beds, which are about 4 ft. wide. If the manure generates too much heat, it must be pulled open or the crowns may be damaged. The bed is then covered with wooden blinds or straw mats, arranged to form a ridge to keep in the heat and throw off the rain. In the soil, a temperature of 20° C. to 25° C. must be obtained; this causes good growth and ensures a production of good chicons in 18 days. Heat

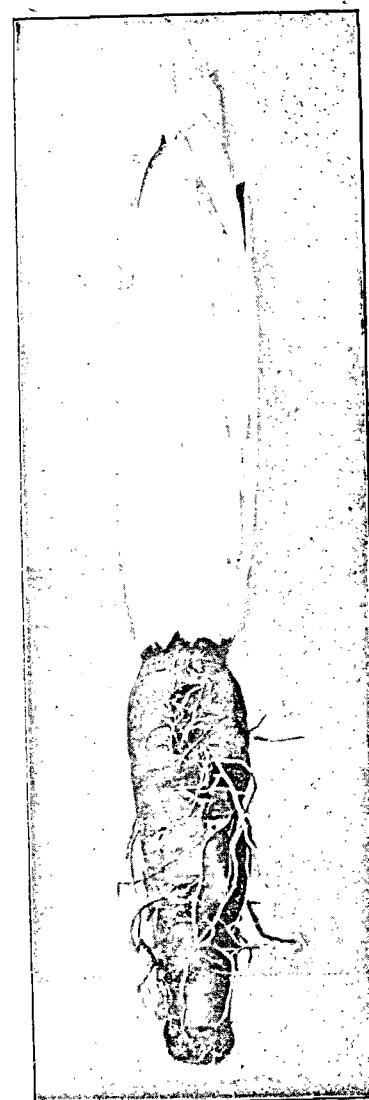


FIG. 1.—Chicory root with Chicon.

[Illustration by the
Belgian Ministry]

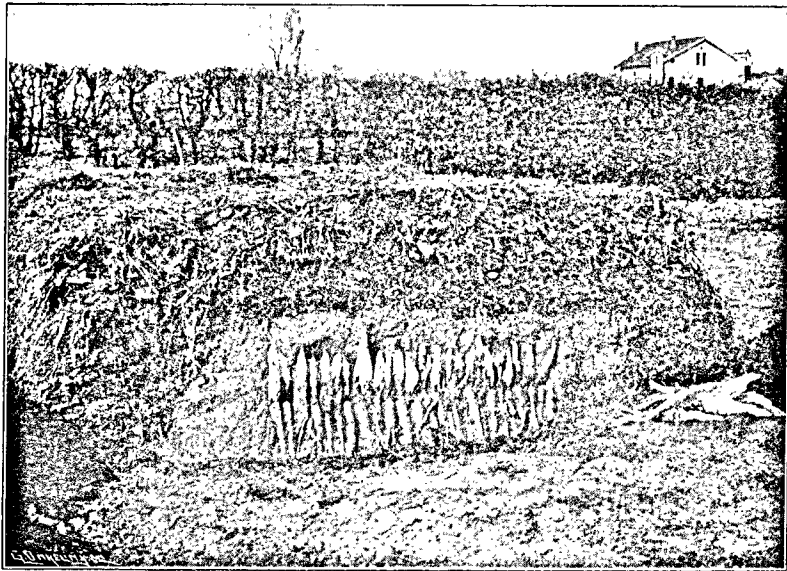


FIG. 2.—Chicory bed, showing Chicons produced by forcing with manure.

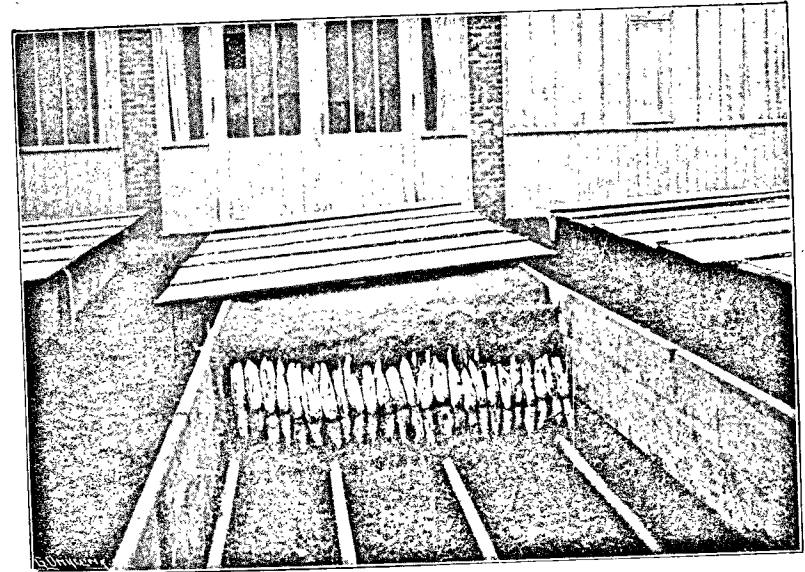


FIG. 6.—Chicory forced in frames by hot-water system with pipes placed beneath the roots.

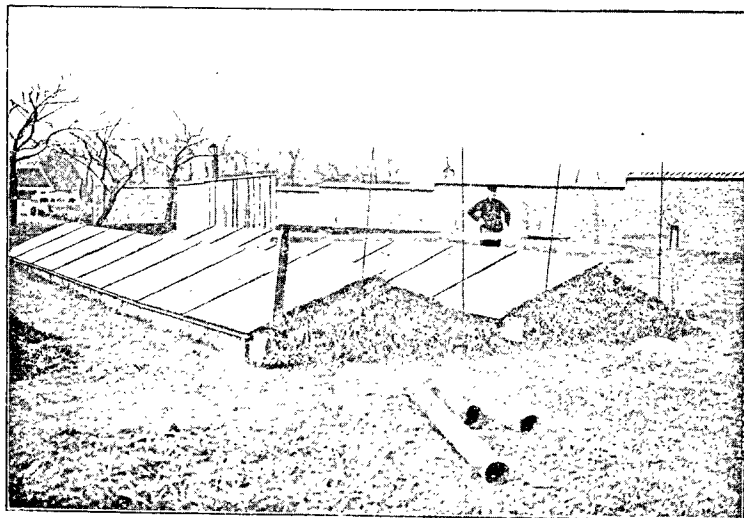


FIG. 3.—Chicory beds, sheltered by wooden lights, with hot-water system for forcing Chicons.

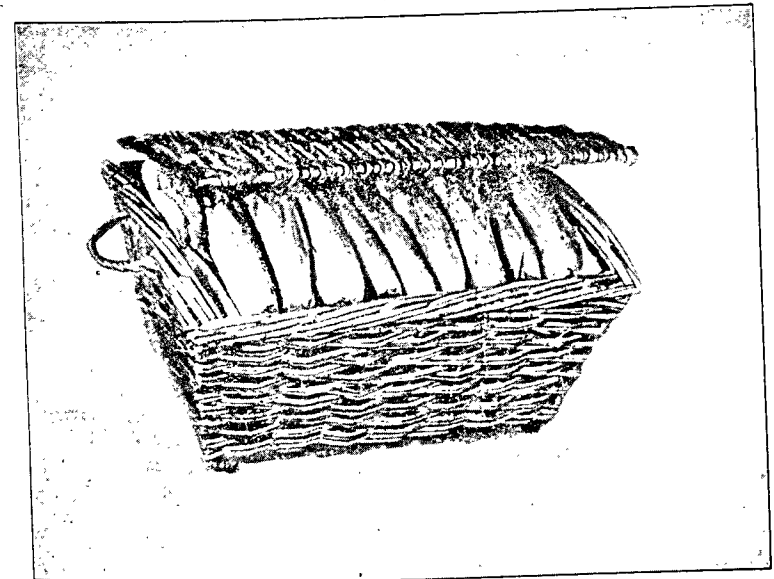


FIG. 8.—Chicons packed ready for market.

[Illustrations by the courtesy of the
Belgian Ministry of Agriculture.

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Belgian Ministry of Agriculture.

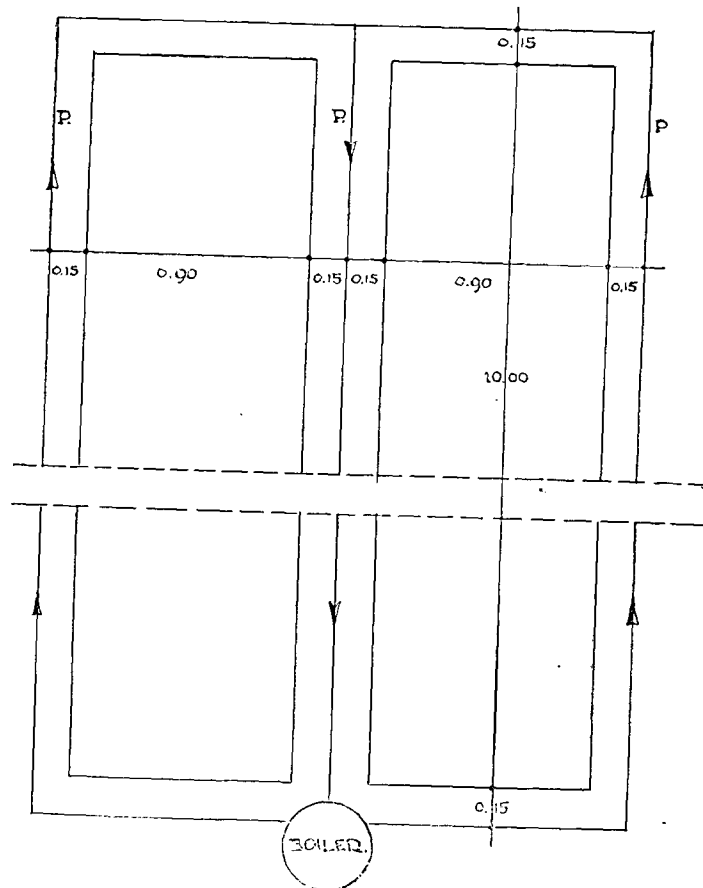


FIG. 5.—Plan of Fig. 4, showing direction of pipes and position of boiler.

regulation is tested by means of thermometers placed about in suitable positions in the beds.

(2) *Hot Air: Flue System.*—Between the beds, at a depth of 6 in., earthenware piles are buried, and through these is passed the smoke of a fire lighted at one end of the path, and low enough to give a good draught. This system has now been practically abandoned in favour of the hot-water system.

(3a) *Hot-Water System: Pipes above the Roots.*—For this, a light portable boiler and pipes, about 3 in. in diameter, which can be taken down easily, are used. The pipes are connected together and placed on the path 6 in. from the roots. Each boiler, or each valve in the case of large systems, is sheltered by a wooden hut and heats two beds 1.33 ft. in width (Fig. 4) separated by a path 1 ft. wide, the two flows being on the outer edges of the path, with a single return in the centre of the path between the beds (Fig. 5). Where two systems adjoin, the path is 3 ft. 4 in. wide to allow the pipes to be 6 in. from the roots.

The level of the pipes should be slightly below the collars of the plants. When the heating apparatus is *in situ* and the fires lighted, the beds receive an additional layer of soil, so that the final thickness is about 10 in. of soil above the roots, and this layer extends about 9 in. beyond the limits of the beds. The beds are covered with hay or straw, as previously described for manure forcing, and are protected by a wooden roof composed of two large boards, the one on the west side projecting well beyond the easterly one to give greater stability against the prevailing westerly winds (Fig. 4). Forcing should not commence until about a fortnight after planting, to allow the formation of young rootlets. By keeping a temperature of 15° C. to 20° C. in the soil, the chicons are produced in 18 to 21 days. For this a fire is necessary only every second or third day, although more firing is required at the beginning in order to raise the soil temperature to the required heat. With the approach of warmer weather, less heat is required and, in March, excellent chicons can be obtained without any heating. This system enables the grower to have a sequence of beds, because, as the plants reach maturity, the heating apparatus is dismantled and removed to other beds.

(3b) *Hot-Water System: Pipes under the Roots.*—Certain growers think that the pipes should be placed in the soil directly beneath the beds, leaving approximately 4 in. of soil between the pipes and the roots (Fig. 6). In this way, the heat is better utilized. Much care must be exercised, however, if this system

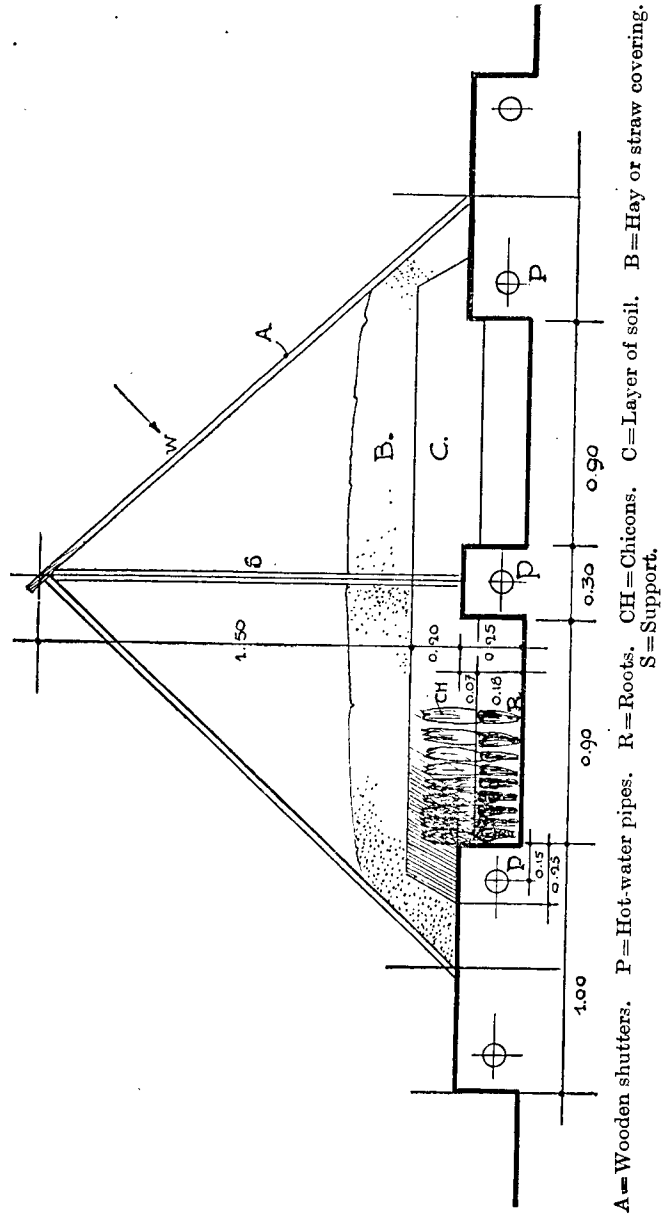


FIG. 4.—Section of Chieffy Beds showing arrangement of wooden shelters and pipes above the roots for forcing.
(Measurements in metres)

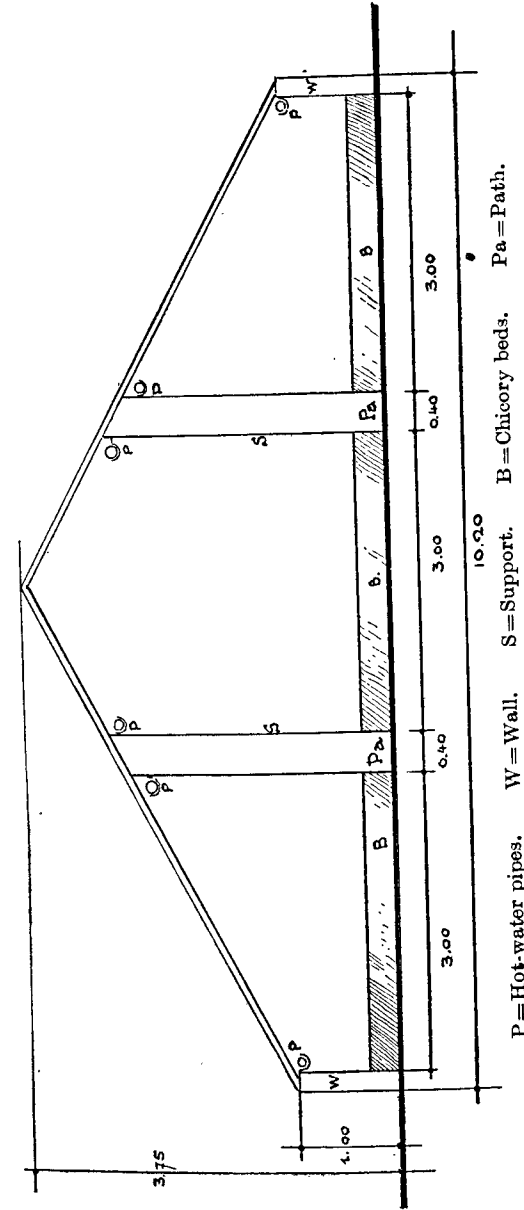


FIG. 7.—Type of modern greenhouse used in the culture of the chicory in the Ghent district.

is adopted, for too much heat may result in scorching of the roots. Two flows and two returns per bed are necessary; the beds are larger than with other systems, measuring 8 ft. to 9 ft. wide, with a path 3 ft. 4 in. between the beds. The heating of each separate bed is regulated by means of valves.

Forcing in Greenhouses (Ghent System).—The most modern houses (Fig. 7) are about 33 ft. wide and 82 ft. long. Trenches of about 10 ft. wide are made, separated by paths 1 ft. 4 in. wide. Heating is done by hot-water pipes. The roots are set in trenches as before and covered by a layer of 10 in. of old flax waste (paillettes de lin) which is used for hot beds for palms, etc. Forcing begins in October, and six crops of forced chicons are obtained in the same greenhouse from October to March. When witloof is finished, melons and tomatoes are grown in the houses. The hot-water pipes are placed in an overhead position with the lowest pipe 3 ft. 4 in. from the soil-level, and heat is supplied until a temperature of 20° C. is obtained in the soil. When it is freezing, 5° C. to 6° C. should be maintained in the houses. Some growers do not have special houses for witloof and bury the chicory roots in the soil under stages on which palms, aspidistras, etc., are grown. Forcing may also be carried out in shallow frames with pipes below, as used for the culture of geraniums, fuchsias, etc.

Harvesting the Chicons.—When the chicons are mature, they are about 6 in. long, and are then ready for lifting. The roots are removed from the soil by means of a fork, starting where the planting finished; very gently by hand, the chicon is twisted off at the base. The outside leaves which are discoloured or dirty are carefully removed and any other leaves which do not adhere closely to the chicon. The chicons are never washed or cleaned by wiping with a cloth.

Selection, Grading and Packing.—Chicons are graded into "Firsts" and "Seconds." First quality chicons are large, firm and shapely. The selected chicons are carefully packed in flat baskets (Fig. 8) provided with a lid, or, more rarely, in shallow lattice boxes. The inside measurements of the baskets are as follows:—

A.—Consignments for Belgium and France (by rail):—

Basket of 15 kilogrammes (33 lb.) capacity: Size at top (under the lid)—length, 41 cm. (16 in.); width, 33 cm. (13 in.). Size at bottom—length, 32 cm. (13 in.); width, 20 cm. (8 in.). Depth, 21 cm. (8 in.).

Basket of 10 kilogrammes (22 lb.) capacity: Size at top—length, 35 cm. (14 in.); width, 25 cm. (10 in.). Size at bottom—length, 27 cm. (11 in.); width, 18 cm. (7 in.). Depth, 20 cm. (8 in.).

B.—For shipment to America the baskets are made rectangular so that no room be lost when packed one on top of the other in the ship's hold. The freight is charged according to weight and measurements: length 34 cm. (13 in.); width 22 cm. (8½ in.); height 16 cm. (6 in.).

The bottom and sides are lined first with blue and then with greaseproof paper, and the chicons are placed head inward, the basket accommodating just two rows horizontally, and several deep; white paper is placed between each layer of chicons. When the basket is filled, the ends of the paper are folded over the chicons and before the lid is closed a little straw is packed between the lid and paper. The lid is fastened by strings tied crossways over the basket. For long-distance export to America, only first quality produce is used, and more durable packing and paper are employed.

Stock Plants for Seed.—When the chicons are being gathered for market, the best specimens are kept for stock. These are selected for the following characteristics: smooth root of medium size with small collar and carrying an ideal and shapely chicon. The chicon must be rather conical with strong base and narrow collar; colour white, with as little yellow pigment on the leaves as possible. Even in summer, in the field, good vigorous plants with entire, upright, and closely packed leaves having a large and white midrib may be marked as likely to be suitable for stock purposes.

The chicons are removed and the roots are planted in the open air 1 ft. 8 in. apart, so that the collar is 2 in. beneath the soil. If the weather is unsuitable, the roots are stored in a shed. Each root produces several shoots of which the best one to three or four are retained; each of these is pinched at 2 ft., the lateral at 1 ft. 8 in., and each main stem is staked. The harvesting of the seeds takes place in October before the seeds begin to drop. Soil for seed raising must be rich, deeply cultivated, well drained, and contain a good supply of phosphates and potash manures. The stock plants must, of course, be isolated from other fields of chicory.

Diseases.—(1) *Puccinia hieracii*: This rust attacks the leaves of chicory, the sori appearing in summer. The usual treatment is wide rotation, roguing, burning diseased plants, and spraying with Bordeaux mixture.

(2) *Sclerotinia* sp.: This is a serious disease causing rapid rotting of the roots near the collar during forcing. In the attacked tissue, black hard sclerotia, typical of this type of fungus, are formed. Treatment consists of avoiding infested soil and nitrogenous manures, and removal and destruction by fire of infested roots. The soil should be sterilized with formaldehyde (2 per cent.) and trenched to a depth of 2 ft. after sterilizing.

(3) *Pleospora albicans*: Produces white spots on the stems of stock plants and is treated with Bordeaux mixture.

Pests: Beetles.—Seedlings are sometimes attacked by carabid beetles during dry weather; they are usually trapped by means of heaps of weeds, under which numbers collect. Dusting with powder containing lead arsenate has been found effective. Another method, met with in America, is to trap them by means of the trench and jar system.

Culinary Uses and Recipes.—The bleached and uncooked leaves are often chopped or broken into salads as with corn salad, lettuce, endive and beetroot. Cooked chicory is a very appetising dish and the following recipes may be of interest:—

Chicons au Jus.—Boil the chicons in water for half an hour with a little salt, strain and cook until brown in a pan of boiling butter. Serve with a little of the gravy poured over the chicons.

Chicons à la Crème.—Boil in the same way and cook with butter as above, but instead of gravy serve with dressing of cream or sauce made with milk and yolk of eggs. Many cooks add a little lemon juice.

Chicons Farcis.—Select chicons of good size and first quality. Scoop out the interior at the base and fill the cavity with stuffing of minced meat and cook as for stuffed vegetables.

Chicons au Four.—Boil and strain the chicons and place them on a plate. Add salt and pepper and a thin layer of breadcrumbs on which a little butter is placed; cook in the oven for 10 minutes.

Chicons au Jambon au Gratin.—Boil and strain as before. Each chicon is then wrapped in a slice of cooked ham and cooked in the oven in a vessel in which they can be served. A layer of grated cheese is added and over this a layer of white sauce; on this comes another layer of grated cheese, with small pieces of butter here and there; the whole is cooked for 25 minutes in the oven.

BOTANICAL NOTES FROM THE SOUTH-WEST OF ENGLAND

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THE following notes were made during the summer and autumn of 1927, while the writer was still on the Staff of Seale-Hayne Agricultural College. As the information affects other parts of the country it was thought it might be of interest to readers of this JOURNAL.

Broomrape.—During the year there was an appreciable amount of broomrape present both in hay and in fields laid up for seed. Once again these cases fall under two types: the irregular areas of heavily infested clover, and the evenly distributed single parasitic plant, evidently following the lines of the drills. The latter type was found in many fields for the first time this year. The view that certain years are "broomrape years" does not seem to conform to conditions in the south-west area. There is not much fluctuation from year to year. The most noticeable feature is its periodic appearance and disappearance in many fields, extending over a wide area.

Field Thistles.—Thistles were not so much in evidence in the summer of 1927. There are still too many cases of neglect to eradicate thistles, and the amount of seed that is scattered over the countryside is, in some areas, enormous. One old farmer in East Devon gave as his method of destroying field thistles in pastures: Leave them to grow up, flower and seed, let the stems die, then cut down the remains! They will not re-appear, or, if so, much reduced! Even assuming (for the sake of argument) the success of his seed production and exhaustion theory, is the doubtful gain greater than the certain loss entailed by those plants which arise from the broadcasting of the seed?

Corn Sow Thistle.—This weed is still slowly penetrating to many new places. Its presence was noted, by the writer, previously in this JOURNAL (Vol. XXXIII, No. 11, February, 1927), but in 1927 it was evident in several mangold fields in Cornwall and Devon. Among cereals it was not quite so common.

Hawksbeard.—The steady increase in the amount of this weed is giving real concern to many farmers in Devon and Cornwall. It was a disagreeable surprise to notice the weed as almost dominant in many hayfields in Cornwall. The fact

that it was evenly distributed suggested sowing with the seed. In remoter districts this is highly probable, since a considerable amount of exchange in seeds takes place. In some cases one could, with little difficulty, trace where the seeds had been blown into the field, by the presence of the weed only in certain areas. Considering that this weed is of very recent economic importance (see this JOURNAL, Vol. XXXII, No. 7, 1925), it may yet become a very serious proposition, unless vigorous means of eradication are prosecuted.

Soft Knotted Trefoil.—This plant was first experienced as a weed in 1923. It is common on many of the sandy banks, and even inland near the coastal line where the sand contains an appreciable amount of lime (see this JOURNAL, Vol. XXXII, No. 7, 1925). In 1927 it was found as the chief weed in a lucerne field near Harlyn Bay, Cornwall. In one or two patches, it has seriously competed with the lucerne. It can either spread prostrate over the ground, or, if growing with tall herbage, shoot upwards to a height of 2 ft. Should this plant become a weed in lucerne fields, it would be extremely difficult to hold in check.

Rayless Mayweed.—So far, this weed has been an occasional trouble in arable fields (see this JOURNAL, Vol. XXXII, No. 7, 1925). In 1927 for the first time it was found as a weed in pastures. In many instances it had spread in beyond the area near the entrance gate. In some fields it had spread irregularly across almost half the field. As far as it was possible to glean information, and by an examination of the plants, it seems that stock are not willing to graze it. In one small field in South Devon, part of which had been used for fowl runs, the latter were covered with this plant and hardly a blade of grass was to be seen. Not only so, but it had spread far beyond into the field. In fact matters were so bad that ploughing up was the only method of eradication that could be adopted.

Lucerne.—This plant has received neither the attention nor the extended trial which it deserves in the south-west of England. There are many districts where it should do well and give good yields. In Devon, it has been met with occasionally in hayfields, and in grasslands which seem to be cut and then grazed later in the year. In both cases it is very persistent. In 1927, one case was noted in South Devon in which an oat crop had been choked out by lucerne growing through it. Evidently the field had previously been in grass and the cultivation had not been sufficient to kill the roots of the

lucerne. In every instance in Devon, the plant was growing in the limestone areas.

In Cornwall, two very interesting fields were examined. One, already mentioned above under the heading soft knotted trefoil, was practically pure sea sand containing a certain amount of lime. The field was about 150 to 200 yards from the sea. The lucerne plants were, except in one or two patches, good and vigorous. A fair amount of fodder was available, and it held much hope for the future of this plant in that district. In another field in the same district, there was a really good and even crop. A cutting in the field revealed the fact that the soil was of an average depth of 6 in., and below this was a mass of solid shale (shillet). In the cutting the roots of the lucerne had penetrated deep into the layers of the shale and it was impossible to pull up all the roots. In neither of these cases had there been any inoculation. It seems, from such cases, that the prospects of lucerne growing in many parts of Cornwall are quite good.

In the last few years, lucerne has been successfully grown in small plots of the Botanical Department at Seale-Hayne Agricultural College. The soil is a medium loam, fairly deep where the plots are, but beyond a light dressing of lime no other manurial treatment was given and no inoculation. Two, and sometimes three, cuts a year were obtained. In one plot not cut, good seed was obtained. The growing of this plant and the production of seed in the drier parts of the south-west is well worth a trial.

There is a point of considerable interest regarding the success of lucerne when inoculated. The particular "strain" of bacteria which infects the roots of lucerne, and causes the well-known nodules, is the same as that which is found in the root nodules of Black Medick (*Medicago lupulina*) and incidentally of the genus *Melilotus*. In the south-west of England black medick is indigenous to the soil in many districts. In such areas, therefore, inoculation of lucerne should be unnecessary. Observation and trial confirm this point, which seems to have been rather neglected. It is certainly an important matter which should receive further and immediate attention.

Sainfoin.—This most useful plant is practically unknown in the south-west. In the small plots of the Botanical Department at Seale-Hayne Agricultural College it has been carefully tried out, both by itself and with other grasses and clovers. It gave a vigorous growth and is holding its own after severe competition with other plants. In competition with the clovers

and lucerne it was the most persistent, and almost the only survivor. In a doormat pasture plot it showed the same capacity to hold its own, the same persistence and the same steady yield of fodder. Grown alone it gave good yields and, on one occasion, two cuts in one year. There was no difficulty in obtaining good seed. Taking these circumstances into account, sainfoin is, like lucerne, worth a good trial, not merely for the fodder it supplies but also for seed production. In the drier districts of the south-west there should be no difficulty in obtaining good seed. Home-grown seed from such a plant should be a profitable undertaking.

Fenugreek.—This plant was successfully grown in small plots. It matured, and seed was obtained. Whether the growing of it for seed in the south-west would be a commercial proposition is open to doubt; much would depend on the demand and price. Being a leguminous plant it would, of course, enrich the soil, and it might be considered for further trial, on a small scale, before being risked for crop purposes.

Rye-Grass and Wild White Clover.—As pointed out in the Ministry's Miscellaneous Publication No. 29, there is a great field in the south-west for the harvesting of the seed of rye-grass, known locally as Eaver, and also for wild white clover. The outstanding feature of the grasslands of the south-west is the remarkably high proportion of the ground held by wild white clover. In most parts of Devon, and many parts of Cornwall, many pastures in summer are a sheet of white with the flower heads of clover, while the scent is almost overpowering. It seems a pity with such excellent material that no serious attempt is made to harvest seed. The chief trouble is lack of machinery for thrashing and cleaning the seed. If that could be overcome, all serious difficulty is removed. Even at its present price there should be an ample margin of profit for the producer.

Rye-grass seed was produced in considerable quantities some years ago. It seems, according to some accounts, that many of the best pastures from which such seed was obtained were ploughed up during the war. The same explanation is given for the disappearance of the seed of local strains of red clover, which must have been not unlike Cornish Marl. Yet in spite of this there are fields which have been down for many years from which it would be worth attempting to obtain seed. One field in Cornwall, from which very fine seed of perennial rye (Eaver) is obtained, has been down for at least 80 years.

As with clover, so with rye-grass seeds, the chief difficulty is cleaning the seed. If this difficulty were removed, there should be quite a good side-line for some farmers.

The importance of good local seed from permanent pastures need not be stressed. Perhaps ways and means may be forthcoming to give stimulus and help to this useful and most valuable source of seed production. The successful growing, harvesting, and marketing of Cornish marl clover (late-flowering red clover) by the Cornish Marl Seed Growers' Association shows what can be done in spite of great difficulties.

* * * * *

WEEDS OF ARABLE LAND.—V

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Ministry of Agriculture and Fisheries.

(With Drawings by BERTHA REID.)

Field Bindweed (*Convolvulus arvensis* L.), known also as small bindweed, bearbine, or bethbine, is a beautiful but very harmful perennial weed, occurring in cornfields and waste places on almost all soils, especially those of a medium or sandy nature. This weed (Fig. 1 and 2) trails along the ground over and among low-growing crops, robbing them of food, moisture, light and air, or climbs among corn and other tall crops, pulling them down, preventing the ripening of corn, and causing a reduced yield. It hampers harvesting operations, and in unsettled weather may cause much loss in view of the fact that stacking cannot take place until the weed is sufficiently dried in the sheaf.

The seeds germinate freely. In the early stage seedling the root is long, stout, fibrous; the hypocotyl is stout, smooth, whitish below, tinged with red above; the cotyledons are almost rectangular, with an indentation at the apex, smooth, dark green, $\frac{1}{4}$ in. to $\frac{1}{3}$ in. long and $\frac{1}{4}$ in. broad, petiolate. The petiole is smooth, tinged reddish, deeply channelled above, convex below. With further growth the cotyledons may attain a total length of $\frac{2}{3}$ in. to $\frac{3}{4}$ in. and a breadth of $\frac{3}{8}$ in. to $\frac{1}{2}$ in.

The first leaves are small, smooth, dark green, cauline, alternate, petiolate, nearly arrowhead-shaped, the petiole nearly equal in length to the blade and deeply channelled above.

A little later the seedling has a rapidly lengthening stem, the hypocotyl and base of stem may be purplish in colour, and there are signs of branching from the base. The leaves are still small, but the rootstock is enlarging very much and beginning to branch underground.

In the mature plant the stem is slender, twining, and leafy, the leaves being rather variable, but always more or less arrowhead-shaped; the large, handsome and fragrant flowers are solitary or two to three together, 1 in. in diameter, funnel-shaped, usually pink or whitish-pink, rarely white; the roundish capsules are two-celled, each cell containing two seeds. The rootstock is slender and brittle, and creeps extensively and deeply underground, sometimes to an almost incredible degree, and in enormous masses. This weed must be combated as in the case of *C. sepium* (see below).

Great Bindweed or Bearbine (*Convolvulus sepium* L.), is somewhat similar to the last species, but the climbing stems are much longer and stouter, frequently overtopping hedges. This bindweed (Fig. 3) or convolvulus is not so much a pest of the farm as of the garden, and while its chaste beauty is deserving of a place in the "wild garden," it is most harmful in hedges and among garden crops, among which it climbs, strangling and starving them by the sheer vigour of its growth. Bush fruit trees, peas, broad beans, and similar crops may be covered with it, and hedges may be almost hidden and much damaged by the foliage and climbing stems of the weed.

In the freshly grown seedling the root is long, slender, thicker above, with horizontal fibrous roots; the hypocotyl is very thick and short, smooth, whitish-green below, tinged reddish or red brown above; the cotyledons are larger, unequal in size (in specimens selected one cotyledon was $\frac{3}{8}$ in. by $\frac{3}{8}$ in. and the other $\frac{1}{2}$ in. by $\frac{1}{2}$ in.), inclined to be rectangular, but wider and somewhat auricled at the base, the sides inclined to be once waved, the end blunt and distinctly waved, smooth, medium dark green, sometimes with a tinge of purple or red beneath, and having a distinct branched veining arising from the petiole. The petiole may be $\frac{2}{5}$ in. long, and is smooth, stout, tinged reddish, and deeply channelled above.

As the seedling grows the roots extend rapidly and may be 3 in. to 4 in. long within three weeks of germination. The cotyledons may attain $\frac{5}{8}$ in. long by $\frac{5}{8}$ in. broad. A central and somewhat reddish stem soon arises, bearing small alternate leaves somewhat arrowhead-shaped, light green in colour, with well-marked midrib and branched veins, petiolate. With continued growth the root becomes very much extended and densely fibrous, the stem is beginning to branch from the base, and the arrowhead-shaped leaves are larger. The plant gradually develops an extensively creeping rootstock which is stout, fleshy and brittle,

In the mature plant the leaves are 3 in. to 5 in. long, arrowhead-shaped or heart-shaped, with lobes at the base, and the large bell or funnel-shaped flowers, 2 in. in diameter, are usually white and solitary. The seed capsules resemble those of *C. arvensis*, but are larger. The flowers open in fine weather from June or July to October, chiefly in the earlier part of the day; with other species this weed is in North America aptly named "Morning Glory."

The rootstocks of these two pests run deeply in the soil, spreading in all directions, and breaking easily, each small piece soon becoming a fresh plant. It is only by the exhaustion or removal of the rootstocks that the weeds can be eradicated, and this necessitates much care, patience, and expense. In field cultivation the best means of destroying *C. arvensis* lie in short rotations with extra root crops, and persistent thorough hoeing to exhaust the root system of its food reserves and prevent seeding. During tillage operations, with deep ploughing and cultivating, many of the rootstocks can be collected by the harrow or by hand, after which they should be burnt. Small patches may be dug out with the fork; no small pieces should be left. The more the rootstocks can be turned up and sun-dried by fallowing in summer, the more likely will the pest be reduced.

In regard to garden cultivation, it is advisable to remove all the rootstocks of *C. sepium* that can be found every time the garden is dug. Thorough and frequent hoeing should be practised, and if the weed succeeds in getting large enough to twine round and climb among bush fruit trees and tall plants it should be promptly cut off below before flowering is accomplished and seeds are shed. The rootstocks may then be carefully removed.

Persicaria, Redshank (*Polygonum persicaria* L.) is a tall-growing annual, often very troublesome in gardens and among cultivated field crops. It occurs on most soils, especially those which are fairly moist and in good condition, and on acid peaty loams.

Redshank (Fig. 4) is 1 ft. to 2 ft. in height, smooth and shiny, branched, and has much swollen nodes, the stem being reddish above. The leaves are lanceolate, almost sessile on the stem, and commonly have a black blotch in the centre. The very small reddish or white flowers are in dense clusters or spikes $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. long, and appear between July and October. The weed seeds freely. Individual plants are often very bushy and rank in growth.

In garden cultivation this weed must be kept under by the use of the hoe, and by hand-pulling any tall plants which may escape by growing amongst potatoes and similar crops. The chief thing is to prevent seeding. In field cultivation, well-hoed root crops, surface cultivation in spring and early summer, combined with hand-pulling where necessary, will quickly materially reduce persicaria. Care should be taken that the seeds are not introduced in dung. The seeds need little moisture to enable them to germinate. Persicaria is regarded by some people as a nutritious plant, and has been given to horses and cattle as a green food.

It may be noted that experiment has shown that persicaria may be destroyed by spraying with a 4 per cent. solution of copper sulphate.

Knotgrass (*Polygonum aviculare* L.), or knotweed, is frequently extremely troublesome among both corn and root crops on practically all soils. On some of the light, sandy soils it is often found in almost incredible quantity, while it also occurs in great abundance on soils highly manured by sheep,* clearly implying the lighter soils.

Knotgrass (Fig. 5) is also known to farmers as surface twitch, red robin, or hogweed. It is a smooth, prostrate annual, much branched from the base, the branches sometimes reaching 3 ft. or so in length. The leaves are $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. long, more or less lanceolate or oval, sessile or shortly stalked, with silvery, chaffy stipules at the base. Flowering continues from May to October, the flowers being minute, white, greenish, pink or crimson, and clustered in the axils of the leaves almost the whole length of the reddish stems. Seeds are produced in abundance, and unless seeding be prevented it will be impossible to eradicate the weed. Where this weed is very plentiful a short rotation may be adopted, more frequent root or hoed crops affording an opportunity to prevent seeding. Two fallow crops in succession will be even better, and late turnips, or maize in the south, will especially allow of surface cultivation in the spring months to encourage the seeds to germinate for destruction with the harrows. Owing to the prostrate habit of the weed, hand-pulling in corn is difficult or impossible after the month of May.

Black Bindweed, or Climbing Buckwheat (*Polygonum convolvulus* L.), is a very troublesome annual which is somewhat similar in habit to field bindweed, both species twining round the stems of cereals and other plants, dragging them down and

* Complete Grazier.

choking them (Fig. 6). In root crops, also, both may be very troublesome. (Field bindweed, however, is perennial, has creeping rootstocks, and bell-shaped flowers, see p. 443.)

The slender-twining, angular stems are 1 ft. to 4 ft. long; the leaves are somewhat heart- or arrowhead-shaped, 1 in. to 4 in. long, and shortly stalked, with two thin stipules where the stalk joins the stem; and the flowers, appearing from July to September, are very small, greenish-white, in four- to ten-flowered loose terminal or axillary clusters, each flower being on a very short, slender stalk, and giving rise to a rough, black, triangular fruit or "seed." The seeds are too frequently found in samples of cereal grain, and as many of them ripen long before harvest they are also plentifully shed in the field and reproduce the weed in another year. The seeds have considerable value as feed for stock, for which reason screenings containing these and other weed seeds are often carried back from the elevators by farmers and fed without grinding or scalding, which is a dangerous practice.

Black bindweed may be combated in several ways: (1) By surface cultivation as long as possible in spring; (2) by the destruction of seed shaken out in carts at harvest time and by the thrashing machine later; (3) by harrowing the stubble immediately after harvest, some time before ploughing, in order to encourage the seeds to germinate, when the young seedlings may be destroyed; (4) by a short rotation, the hoeing of root crops destroying large quantities of the weed; and (5) by ensuring a pure seed supply.

Crow Garlic, or Wild Onion (*Allium vineale* L.) is an exceedingly troublesome weed in certain districts, not only on arable but on grassland. It does not seem to be too particular as to soil, since it occurs both on sandy and clay soils, as well as on calcareous soils and soils poor in lime. It may be found in plenty on the Wiltshire uplands in heavy land overlying the chalk, while it is also very plentiful in Essex and Eastern Herts, in parts of Northamptonshire and elsewhere. According to Hooker's flora it occurs locally in England, Scotland and Ireland, and is found over the greater part of Europe.

The wild onion (Fig. 7, 8 and 9) is not only very troublesome as a weed in the ordinary sense of occupying space required for the cultivated crop, but, owing to one of its methods of reproduction (by means of small bulbils about the size of grains of wheat), and to the fact that it ripens about harvest-time, the bulbils are liable to be included in considerable quantity with the thrashed wheat. For this latter reason wheat may be

greatly depreciated in value, and may even be refused for milling for bread-making purposes owing to the great difficulty of separating out the bulbils. It is also unfortunately the case that when eaten by stock both meat and milk may be so very badly tainted with a garlicky flavour as to be utterly unfit for human consumption, so that meat has had to be destroyed by butchers, and dairy cows have had to be removed from infested pastures.

Description.—In the young stage, from early winter until late spring, the wild onion closely resembles a young onion. At this time it may often be found in plenty in winter corn, and may readily be recognized by the round, hollow, pointed leaves, which are then from 3 in. to 6 in. high. It may sometimes occur in immense quantity, and scores of bulbs may be lifted on a trowel. With the advent of spring the bulbs will send up a flowering stem, which may attain 2 ft. or more in height. These stems give rise during the summer to globose heads of reddish flowers. These flowers may produce a certain amount of seed, but it is believed that in this country seed production is very rare. The flowerheads, on the other hand, produce an abundance of "bulbils" or "bulblets," to the number of perhaps 25 to 100 in a head. The bulbils are small, fleshy, whitish to light yellow in colour, and very closely approximate in size to plump grains of wheat. When ripe they are scattered in the soil and serve to propagate the weed. At the same time the bulbs themselves give rise to new bulbs in much the same manner as onions. The distribution of the weed, therefore, takes place very readily. The bulbs are found in the soil at a depth of round about 6 in., and there may be two to six when newly formed, one of them being generally larger than the others, with tender delicate white skin, while the remainder have a hard brownish shell. Growth appears to be very irregular and the generations overlap; the plants continue growth during autumn and the new bulbils appear to start growth after that time. It will be seen, therefore, that there is good reason for the extraordinary persistence of the weed, which has great powers of resistance to conditions of moisture and drought.

In certain English districts the bulbils constitute one of the principal impurities in locally grown wheat, and Dr. A. E. Humphries has stated that in his experience the wheat grown in a certain parish invariably contained an appreciable quantity of the bulbils. Not only is there the danger of the odour and taste of garlic passing into the flour produced, if the bulbils

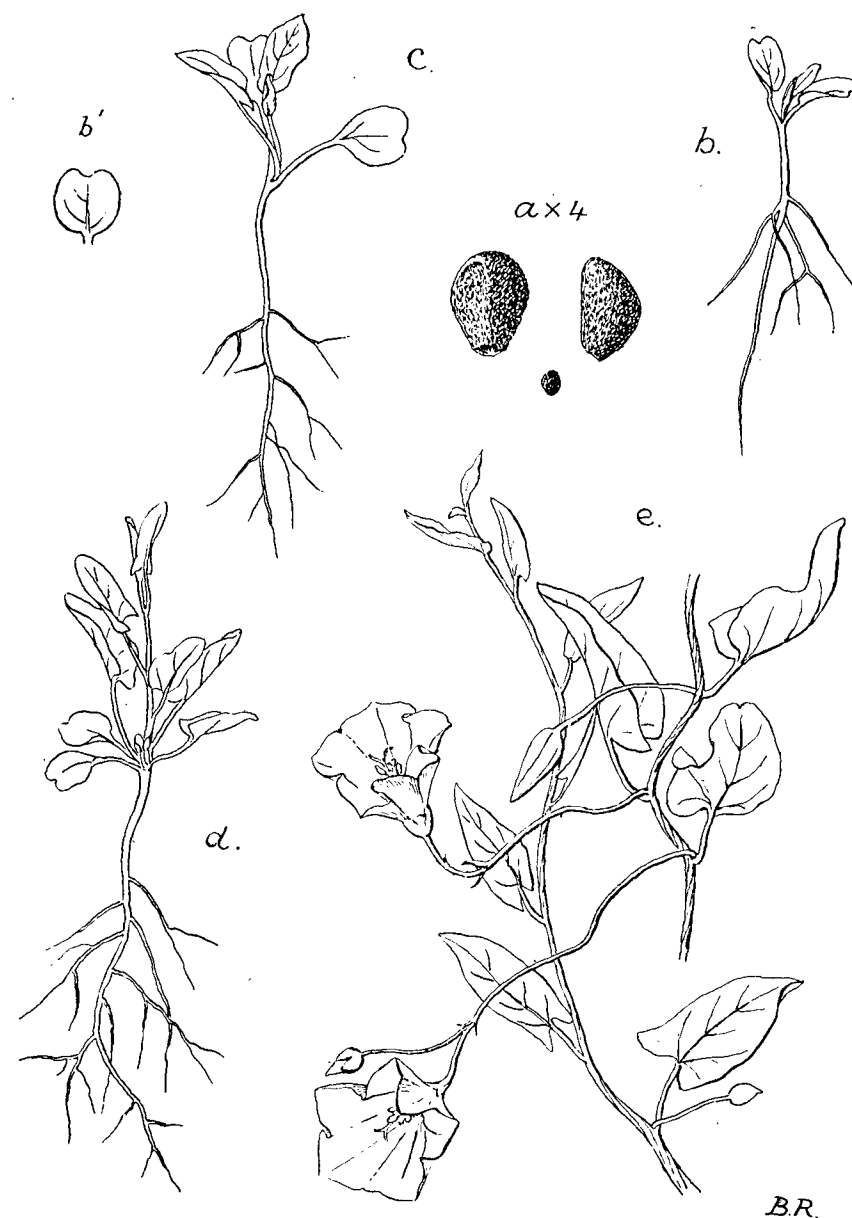


FIG. 1.—Bindweed (*Convolvulus arvensis* L.). a. Seed, nat. size, and $\times 4$; b'. Cotyledon, $\times 1$; b, c and d. Three stages of the seedling, $\times 1$; e. Part of flowering stem, $\times 1$.



FIG. 2.—Field Bindweed (*Convolvulus arvensis* L.), showing the twining character of the plant.



FIG. 3.—Greater Bindweed (*Convolvulus sepium* L.). a. Seed, nat. size, and $\times 2\frac{1}{2}$; b, c and d. Three stages of the seedling, 1; e. Portion of flowering and climbing stem, $\times \frac{2}{3}$.



FIG. 4.—Persicaria (*Polygonum persicaria* L.). *a. a.* "Seeds," nat. size, and $\times 5$; *b'*. Cotyledon, $\times 1$; *b, c* and *d.* Three stages of the seedling, $\times 1$; *e.* Portion of flowering stem, $\times 1$.



FIG. 5.—Knotweed (*Polygonum aviculare* L.). *a.* "Seed," nat. size and $\times 4$; *b, c* and *d.* Three stages of the seedling, $\times 1$; *e.* Portion of flowering stem, $\times 1$; *e'*. Flower, mag.



FIG. 6.—Black Bindweed (*Polygonum convolvulus* L.). a. "Seeds," nat. size, and $\times 3$; b, c and d. Three stages of the seedling, $\times 1$; e. Portion of flowering stem, $\times 1$; e'. Flower, enlarged.

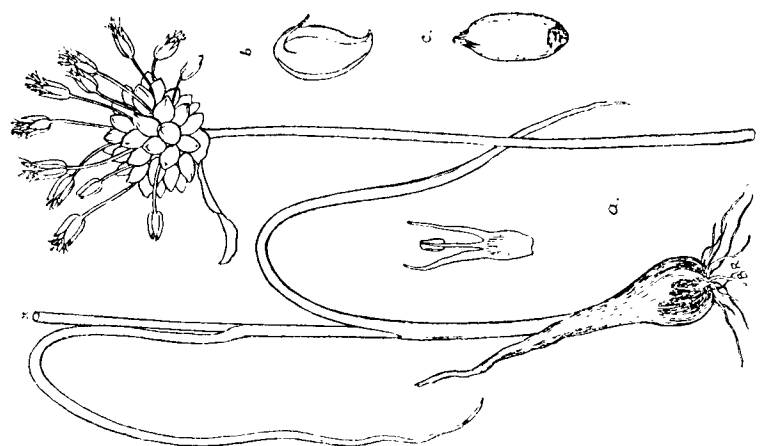


FIG. 8.—Wild Onion (*Allium vineale* L.). a. Bulb and flowering stem (reduced); b. Aerial bulblet, and c. Wheat grain, both slightly, and e. equally, enlarged.

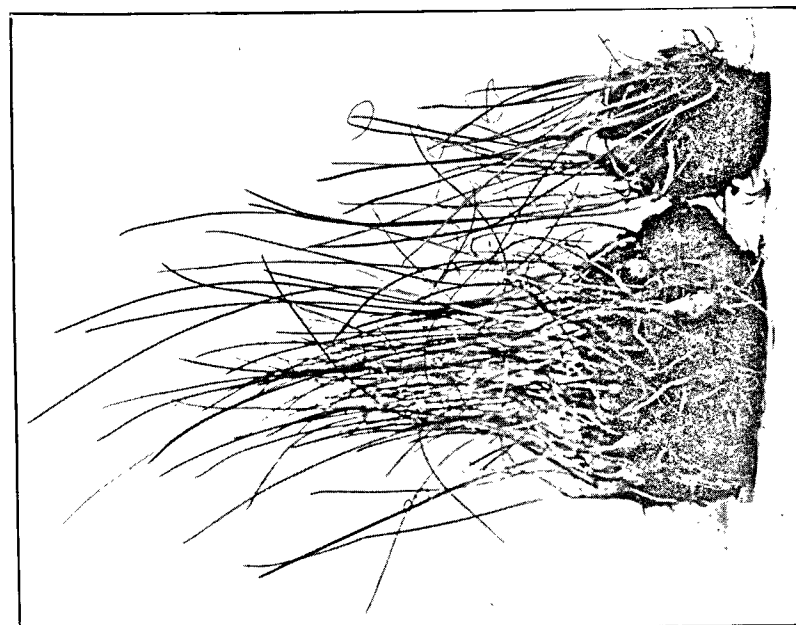


FIG. 7.—Wild Onion (*Allium vineale* L.), in young state, winter and early spring.

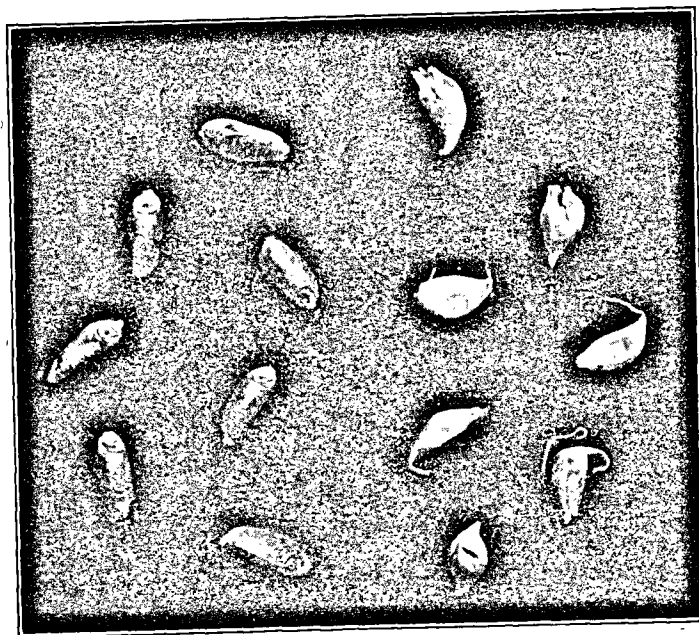


FIG. 9.—*Left*, wheat grains; *Right*, aerial bulblets of wild onion—both slightly enlarged, and indicating approximate equality in size.

are not removed, but a very serious matter is the fact that the bulbils blind or gum the grinding surfaces of the rollers or stones, which become clogged and sticky, so that frequent washing is necessary. As in some cases this may be required every two or three hours, and some time is needed for each set of rollers, the presence of the bulbils may cause considerable expense; the trouble may be even worse where stones are concerned, as redressing may be necessary much more often than is usual. Various methods have been adopted for the purpose of removing the bulbils from wheat, with more or less success. It is difficult to determine the difference in price between clean and garlicky wheat in this country, but it is well known that in the United States the depreciation in the price of garlicky wheat may be from 20 to 40 per cent.

Eradication.—There does not seem to be any certain means of eradicating this very troublesome weed, various authorities differing widely in the advice which local experience has suggested. The following is a summary of what may be regarded as practicable and useful suggestions directed to combat the weed* :—

- (1) When a small area only is involved, or the infestation is not severe, the bulbs should be dug out by hand as carefully and completely as possible, and burnt. If new plants appear, the process should be repeated as fast as they show. Mr. J. Hunter-Smith (Herts Institute of Agriculture) informed the writer of a case in which digging-out exterminated the wild onion in one field. The large and soft white bulbs may readily be removed in this way, but the smaller, hard, brownones are not so readily seen and picked out, while it has been noted in America, and remarked also by Mr. Hunter-Smith, that it is uncertain how long these hard, brown bulbs and the aerial bulbils may remain dormant in the soil.
- (2) Apart from grassland, wild onion seems to be most troublesome in wheat—probably because of the long period during which it remains comparatively undisturbed. This suggests that cultivation restricts its growth. Two root crops in succession, with repeated hoeings to chop down and wear out the bulbs as fast as they throw new shoots, and with both deep and shallow ploughing in the intervals between crops, will give little or no rest for the weed and should go far to reduce it.
- (3) If a good stand of vetches or maize could follow the two root crops, either might be successful in reducing the weed by acting as a smother crop.
- (4) Experiments at Woburn indicated that the best method of control amongst the methods tried was to sow down with a heavy grass mixture on the "Elliot" system, this taking about six years to smother the weed.
- (5) The Woburn experiments also showed that spraying arable land infested with the weed with a 5 per cent. solution of pure

* Reproduced, with amendments, by courtesy of the Editor, from an article contributed by the writer to *Milling*, December 22, 1923.

carbolic acid at any rate largely reduced the weed without injury to the soil for a subsequent corn crop.

- (6) On grassland in which the weed is strongly established, it may be necessary to plough up and, after taking root crops, re-sow with an "Elliot" mixture as mentioned in (4) above.
- (7) Repeated and persistent hand-pulling on grassland in early spring, in June and in autumn, with cutting of flowering stems in between, should greatly reduce the weed.
- (8) If in excessive quantity on a small area only, paring and burning might be worth while.
- (9) Some authorities claim that alternate freezing and thawing of the bulbs, following shallow ploughing in autumn to bring them to the surface, will account for many of them, but others (e.g. Bornemann) state that this method is useless.
- (10) Cultivated crops are aided in crowding out the weed if the soil is in a high state of fertility and has been limed.
- (11) In connexion with (10), care should be taken that the land is well drained: it has been observed that in some districts the weed appears to be worst on heavy land which is not too well drained.
- (12) Garlic-infested seed wheat should on no account be sown.
- (13) A United States' suggestion (a) is that ploughing deeply under in autumn all plants which have made 12 in. to 15 in. growth, by which time most of the food in the bulb is transferred to the leaves, will dispose of such plants and prevent the formation of new bulbs. This should be followed in spring by cutting off the tops of all bulbs which grow, to prevent further growth. This is best done by taking a cultivated crop. "This spring and early summer work is to kill the plants that come up from the hard-shelled bulbs. If it is well done, most of the onions will have disappeared by the end of summer." It may be necessary to repeat the process, but "in two years this treatment is almost sure death to all the wild onions in the land, and the work can be carried out with but little extra labour and expense."
- (14) According to another authority, (b) wild garlic can scarcely be "smothered out" or "cultivated out" of a field. It can be eradicated, however, by spraying with orchard heating oil (a by-product of the fractional distillation of rock oil) in the absence of a growing crop, supplemented by cultivation in autumn to make the bulbs sprout and be ready for spraying in spring before they begin to form heads. It is doubtful if this plan is now recommended; methods of cultivation are probably superior.
- (15) Care should be taken that bulblets are not introduced to a farm by thrashing machines.
- (16) Bornemann's investigations (c) showed that bulbs seated very shallowly in the soil grew weakly, and that those lying very deeply failed to sprout. He concluded that there was an optimum depth at which they grew best, and found that this depth varied according to district (soil, climate, and moisture content) between 14 and 22 centimetres ($5\frac{1}{2}$ in. and $8\frac{1}{2}$ in.). He therefore tried a new method of combating the weed, and found it successful in three cases. The optimum depth was first

(a) *Farmer's Bulletin* No. 610, "Bul. of Plant Indus.," U.S. Dept. Agric, 1914.

(b) Purdue Univ. Agric. Exp. Station, Bul. No. 176, 1914.

(c) Bornemann, F., *Die Wichtigsten Landwirtschaftlichen Unkräute*, 1920.

ascertained by digging up the strongest plants and carefully determining the depth at which they lay. The field was then ploughed in the autumn to the *greatest* depth at which bulbs were found, to bring them nearer the surface. Harrowing and rolling followed in spring, and after three weeks, and shortly before sowing, an old horse-hoe was used to cultivate it, the sharpened knives being so fixed that one covered the other, the object being to cut the plants to pieces. Sowing of early corn followed (oats and barley mixed), in which in two cases lucerne was sown, to be kept down six or seven years. After the spring treatment, wild onion was not to be found on the fields, which were previously badly infested. In the third case, the spring corn was followed by leguminosæ on a shallow fallow; this crop was hayed or fed off, followed by early oats after a shallow ploughing, and then by potatoes. Before each sowing the horse-hoeing treatment was practised. The potato crop was free from wild onion.

Briefly, this treatment consists in bringing the bulk of the bulbs into a shallow soil unfavourable for their development, keeping them there and regularly cutting off the growth, and growing such crops as cover the ground quickly and thickly and are harvested so early that such plants as appear cannot form seed or aerial bulblets. Winter wheat must be avoided.

- (17) A farmer who can hold over his wheat until late in the year after production, or even until the spring, may find that the aerial bulblets of wild onion have dried sufficiently to enable them to be blown out, the effect somewhat resembling commercial drying.
- (18) If an infested crop is required for seed, the flowering plants of the wild onion should be hand-pulled before harvesting.

* * * * *

LIVE STOCK IMPROVEMENT SCHEME REPORT FOR THE YEAR ENDING MARCH 31, 1928

It is pleasing to note that, in spite of the further decline in the general level of prices of agricultural produce during the year under review, steady progress is apparent in practically all sections of the Live Stock Improvement Scheme. This affords further evidence, if more is needed, that the object which the Scheme is designed to achieve, *viz.* improvement in the quality of the ordinary farm live stock of the country, is becoming increasingly recognized as advantageous by individual farmers. The present shortage of capital has, however, presented some difficulties in the working of the Scheme. Owners of premium bulls and boars have often found it far from easy to provide the money necessary to purchase animals of sufficient merit; but in spite of this it is satisfactory to record that the standard of the sires approved for use under the Scheme has been maintained and that their numbers have been increased. The need for economy on the part of farmers has, however, checked the increase, previously recorded, in the membership of Milk Recording Societies.

The general standard of live stock, in districts where the Scheme has been in operation for some time, is evidence of the good results derived from the use of the premium sires. In this connexion, the following resolution passed by the Nottinghamshire County Agricultural Committee, when asking for additional grants, may be quoted: "The Committee are of opinion that in all cases where Premium Bull and Boar Societies have been in existence for any length of time in the County, a marked improvement has resulted in the general standard of the Live Stock of the district." It may also be mentioned that, in the report of the Judges of the 68 small holdings entered for the competition held by the Hampshire County Council for the best-managed small holdings on their estate, attention was called to the beneficial effect which the Ministry's Live Stock Scheme is having on the quality of the stock kept on the holdings.

Reports received by the Ministry indicate that, in some districts, when stock sired by premium bulls and boars is placed on the market, the animals are sought after by buyers who have had experience in rearing stock produced by these sires. Similarly, the announcement at a sale that a calf is by a premium bull usually enhances its price, as rearers are keen to purchase, and, in some cases, such calves have realized £2 to £3 per head above usual market prices. A farmer in Kent stated, at a meeting of the local Farmers' Union, that his heifers, got by a premium bull, made £3 per head more than heifers he had bought in as calves and reared in the same way. Similarly with pigs; litters, the progeny of premium boars, find a ready market, as these pigs are known to mature and fatten more quickly than those sired by nondescript boars. The educative value of such results can be realized, and goes far to explain the increasing interest shown in the provision of premium bulls and boars.

As regards the heavy horse section of the Scheme, the more hopeful feeling respecting heavy horse breeding, occasioned by the better demand and higher prices now ruling for good geldings, has occasioned increased enthusiasm. Additional societies have been formed in several areas and the financial position of many of the older societies has improved.

Bulls.—The number of bulls available for service under the Scheme during the year ended March 31, 1928 (*i.e.*, continued from the previous year with renewed grants, or provided for fresh districts during the year) was 1,372, or 85 more than in the preceding year, and the average number of cows served by a premium bull was 65.

BULL SCHEME.

NUMBER OF BULLS SUBSIDIZED EACH YEAR SINCE THE COMMENCEMENT OF THE SCHEME.

Year (April 1-March 31)	No. of Bulls	Year (April 1-March 31)	No. of Bulls
1914-15*	497	1921-22	847
1915-16	633	1922-23	947
1916-17	659	1923-24	978
1917-18	710	1924-25	1,069
1918-19	721	1925-26	1,175
1919-20	675	1926-27	1,287
1920-21	668	1927-28	1,372

* Including the period February 1, 1914, to March 31, 1914.

It will be noticed that the number of premium bulls has been doubled in the seven years since 1920-21. The efforts made by Live Stock Officers to interest farmers in the Scheme meet, however, with very varying results in different districts. In some areas, the improvement in the quality of the stock, which is achieved by the use of good class pedigree bulls, is appreciated by small farmers, and, in such districts, the formation of a Society for the provision of a bull under the Scheme does not present any very serious difficulty. In other areas, and more particularly in dairying districts, comparatively little interest is taken in the class of bull used, so that the efforts of the Live Stock Officer meet with little success. On the whole, however, the increased value of the cattle reared by farmers who are making use of premium bulls is becoming more widely appreciated, and Societies are being formed in areas where, up to the present, the Scheme has not been taken up. An instance, with the possibilities of good results for an area in the Eastern Counties, may be quoted. A smallholder found that a heifer which he had purchased turned out remarkably well. On inquiry he discovered that this heifer had been sired by a premium bull, and he is now endeavouring to form a Society in his own district.

It was mentioned, in last year's Report, that the high cost of carriage militated against the location of sires in some districts. In order to meet this difficulty, the Ministry decided, in October 1927, that the cost of railway carriage, if £2 or over, may be considered as part of the purchase price for the purpose of assessing grants in cases where bulls are purchased at the important bull sales at which special arrangements are made for the attendance of Live Stock Officers, or where Live Stock Officers, by arrangement, purchase bulls privately for Societies. The maximum grant of £20 per annum is, however, still retained.

Reference has already been made to the educative value of the higher prices realized by stock sired by premium bulls, and the successes of such bulls and their progeny at shows is also of effect in this direction. The number of such successes last year was again considerable, not only at local and county shows but at the most important shows in the country. A bull, sired by a premium bull, obtained a first prize at the Royal Show and a second prize at the London Dairy Show; and the best dairy bull in the open class at the Shropshire and West Midland Show was a premium bull. Successes at shows, such as these, are evidences of the outstanding merits of some of the bulls which are available at a low service fee to small farmers under the Scheme; while the classes for premium animals and their progeny, which are a feature of many local shows, arouse interest in the Scheme and keep it well advertised.

Although a great deal has been done by the Scheme in demonstrating the good results accruing from the use of good bulls, and in effecting improvement, in many areas, in the quality of the cattle, considerable scope still remains for the improvement of the cattle kept by a large number of small farmers. There are still far too many farmers who keep a cheap, nondescript bull, or use the cheapest bull available in the neighbourhood without regard to its suitability for getting good stock. It is not, however, only the small farmers who use inferior bulls: many of the larger farmers are equally careless and negligent. This applies particularly to farmers whose sole object in keeping cows is the production of milk; many of them merely keep a bull to get their cows in calf without any regard to its suitability, with the result that calves are produced which are never likely to grow into satisfactory stock. Dairy farmers of this class usually have herds of good cows, and it is a distinct loss to the country that such cows should not be given a chance of producing progeny that is fit to rear. It costs no more to feed and bring up a good bred calf than it does a badly bred one. Badly bred calves, purchased for rearing, are a source of disappointment and a loss to their purchasers. This state of affairs is not likely to be remedied until legislative action is taken to prevent the use of really bad bulls. Ireland has shown the way in this direction, and, although many breeders and feeders are in favour of similar action in this country, there does not appear to be sufficient agricultural support at present for the necessary steps to be taken. The position is, however, kept under constant review by the Ministry.

Breeds and Prices.—The following table shows the number and prices of premium bulls according to breeds. Bulls were a little cheaper last year, and the average of the prices of the bulls located under the Scheme on March 31, 1928, was £48 10s. The relative numbers of the different breeds show little change. The Shorthorn easily maintains its premier position, and the Lincoln Red shows the comparatively large addition of 17 per cent. against the average increase of 7 per cent.

NUMBERS AND AVERAGE PRICES OF BULLS OF EACH BREED.

Breed	1914-15		1926-27		1927-28	
	No.	Average cost	No.	Average cost	No.	Average cost
		£ s. d.		£ s. d.		£ s. d.
Aberdeen Angus	—	—	3	48 3 4	6	47 1 8
British Friesian ..	—	—	2	58 12 6	2	58 12 6
Devon ..	16	40 17 6	136	54 6 4	146	51 9 0
Galloway ..	—	—	1	19 19 0	1	19 19 0
Guernsey ..	—	—	12	43 19 11	16	41 5 3
Hereford ..	63	33 7 6	142	48 4 1	150	47 9 9
Lincoln Red ..	33	31 10 0	141	48 3 10	165	47 15 6
Shorthorn ..	337	37 17 0	716	52 6 3	752	49 15 1
South Devon ..	6	36 11 6	14	43 2 8	12	46 19 4
Sussex ..	—	—	—	—	3	35 7 0
Welsh Black ..	35	29 9 0	69	45 1 6	69	35 8 5
All breeds ..	497 *	36 0 0	1,236	50 19 6	1,322 †	48 10 4

* Including seven "other breeds" not specified.

† 1,372 bulls were located, but grants in respect of 50 were in suspense at the end of the year.

Service Fees.—The service fees charged for the use of premium bulls again ranged from 2s. 6d. to 10s. 6d. but, as shown in the following table, the small number of fees exceeding 7s. 6d. was reduced from 31 to 23. The increase in the number of fees shown for 1927-28, as a result of the larger number of bulls located, is concentrated at fees of from 4s. to 5s. 6d., and those at 5s. now account for 58 per cent. of the total against 56 per cent. in 1926-27.

Year	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	6/6
1914-15 ..	265	57	41	42	3	88	—	—	—
1926-27 ..	67	52	34	78	13	691	7	108	3
1927-28 ..	68	51	34	89	12	768	14	108	4

Year	7/-	7/6	8/-	8/6	9/-	9/6	10/-	10/6
1914-15 ..	—	1	—	—	—	—	—	—
1926-27 ..	12	140	—	4	1	—	17	3
1927-28 ..	13	138	6	2	—	—	13	2

Boars.—The number of boars provided for service under the Scheme during the year ended March 31, 1928 (*i.e.*, continued from previous year with renewed grants or located in fresh districts during the year), was 907, an increase of 63 over the preceding year.

BOAR SCHEME.

NUMBER OF BOARS SUBSIDIZED EACH YEAR SINCE THE COMMENCEMENT OF THE SCHEME.

Year (April 1 to March 31)	Societies	Individuals	Total number of Boars
1914-15* ..	115	—	115
1915-16 ..	180	—	193
1916-17 ..	186	15	216
1917-18 ..	172	92	264
1918-19 ..	156	167	350
1919-20 ..	120	225	399
1920-21 ..	135	285	441
1921-22 ..	113	416	550
1922-23 ..	93	451	569
1923-24 ..	78	541	638
1924-25 ..	59	574	655
1925-26 ..	52	629	710
1926-27 ..	46	781	844
1927-28 ..	30	850	907

* Including the period February 1, 1914, to March 31, 1914.

In April, 1927, very fair prices were being realized for pigs, but the decline which had set in in the latter half of 1926 continued until the end of 1927, so that, for the greater part of the year under review, pig prices were low. As in previous years, these depressing influences caused a number of pig keepers to sell off their breeding sows, but it is satisfactory to note that there was a demand for a largely increased number of good class sires to be provided under the Scheme. In addition, the average number of services per boar was 62 against 56 in the previous year.

Representations have, from time to time, been made to the Ministry that the minimum age of six months, at which boars might be located under the Scheme, was too low. It was maintained that only poor results could be expected from the services of boars of six months of age, and that the useful life of a boar, if used at such an early age, was likely to be reduced. This matter was considered by the Live Stock Advisory Committee and, on their advice, the Ministry, as from January 1, 1928, raised the minimum age at which boars might be approved for premiums to eight months.

Breeds and Prices.—The following table shows the number and average prices of boars of each breed located on March 31, 1928. The average price per boar was £13 3s. 4d., a slight reduction on the previous year.

The increasing popularity of the Large White breed is evidenced by the large addition to the number of boars of this breed located. The total number of premium boars on March 31, 1928, exceeded that of a year earlier by 58, but the addition in the case of Large White boars alone was 70. Boars of this breed accounted for 61 per cent. of the total number of premium boars, whereas two years ago they represented only 47 per cent.

NUMBERS AND AVERAGE PRICES OF BOARS OF EACH BREED.

Breed	1914-15		1926-27		1927-28	
	No.	Average price	No.	Average price	No.	Average price
		£ s. d.		£ s. d.		£ s. d.
Berkshire ..	10	8 0 0	17	15 9 8	16	14 14 8
Cumberland ..	—	—	48	12 5 6	54	12 2 11
Essex ..	—	—	2	12 2 6	2	12 2 6
Glos. Old Spots ..	7	7 1 0	7	12 3 5	7	12 3 5
Large Black ..	18	7 5 6	65	11 10 7	57	11 14 11
Large White ..	64	7 3 0	462	13 16 1	532	13 14 11
Lincoln Curly						
Coated ..	4	8 4 6	29	11 9 5	29	10 9 3
Middle White ..	12	6 17 0	108	12 15 5	105	12 5 7
Large White Ulster	—	—	5	14 17 0	7	15 6 3
Tamworth ..	—	—	1	14 14 0	—	—
Wessex Saddleback	—	—	16	12 10 11	9	13 9 9
Welsh ..	—	—	48	12 6 1	60	12 12 3
Long White Lop-eared ..	—	—	12	14 1 8		
All breeds ..	115	7 5 3	820	13 4 8	878*	13 3 4

* 907 boars were located, but grants in respect of 29 were in suspense at the end of the year.

Service Fees.—The service fees again ranged between 2s. 6d. and 10s., but there is further evidence of the tendency noted in previous years for service fees to become standardized at 5s. as shown below. In 1927-28 rather over 70 per cent. of the premium boars were serving at a fee of 5s.:—

Year	2/-	2/6	3/-	3/6	4/-	4/6	5/-	5/6
1914-15 ..	21	62	10	5	6	—	2	—
1926-27 ..	—	6	11	21	57	5	543	1
1927-28 ..	—	4	14	17	49	3	623	1

Year	6/-	6/6	7/-	7/6	8/-	8/6	10/-
1914-15 ..	—	—	—	—	—	—	—
1926-27 ..	70	4	5	91	—	1	5
1927-28 ..	68	2	6	88	—	—	3

Horse Breeding.—*Heavy Horses.*—Greater interest than has been shown in recent years is now being taken by farmers

in the breeding of heavy horses, as a result of the improvement in prices occasioned by the keener demand. The very sharp decline in breeding from 1919 to 1926 has consequently been arrested; the Annual Agricultural Returns furnished to the Ministry in 1927 showed that the number of foals of heavy breeds in that year was only 100 less than in 1926. The operation of the Ministry's Heavy Horse Breeding Scheme may be responsible for this to some extent; and, but for the encouragement afforded to breeders by the Scheme, the shortage of heavy horses, which is now beginning to show itself, might have been even more disturbing. The figures given in the table below show that not only was there an increase in the number of stallions in respect of which grants were paid in 1927, but there was, also, a small increase in the average number of mares served per stallion.

It is of interest to note that the number of assisted nominations, which are issued to farmers whose holdings either do not exceed 100 acres, or, if exceeding 100 acres, are of an annual value for income tax purposes of not more than £100, was larger than in any previous year.

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

* No grant was made by the Ministry for assisted nominations (except to the Cumberland Society) for the service season 1924.

The above figures do not include those relating to the Cumberland and Westmorland Society, which was formed for the purpose of awarding assisted nominations to selected stallions travelled by their owners in these counties. It was again possible in 1927 to award an increased grant to this Society so that more assisted nominations could be issued.

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	1921 ..	255
1916 ..	394	1924 ..	121
1917 ..	328	1925 ..	197
1918 ..	321	1926 ..	220
1919 ..	264	1927 ..	247
1920 ..	254		

The regulations relating to the award of grants to Heavy Horse Societies have recently been revised with a view to facilitating the future working of the Scheme by the Societies. No change has been made, however, in the requirement that stallions must be hired and not owned by Societies, and the maximum hiring fee of 300 guineas, and maximum service fee of £3 3s. for stallions in respect of which grants are made, have been retained.

Horse Breeding Act, 1918.—The number of stallions licensed under the Horse Breeding Act, 1918, has declined each year since 1921, but the reduction in 1927 was much smaller than in any previous year. In the licensing year ended October 31, 1927, licences were issued in respect of 1,537 stallions, a reduction of only 71 on the year, as compared with a decrease of 241 in 1926.

Since the Act came into force, there has been a steady decline in the number of cases in which licences have been refused, an indication that the Act has been largely instrumental in eliminating the unsound travelling stallion. In 1927, licences were refused in respect of only 37 stallions, or less than $2\frac{1}{2}$ per cent. of the applications, against 56 refusals, or nearly $3\frac{1}{2}$ per cent. of the applications in 1926; whilst in 1920, the first year in which the Act was in force, there were 404 refusals, or practically 10 per cent.

Year (ending October 31)	Number of applications for licences	Number of licences issued	Number 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

The table below shows for the 1927 service season the

distribution of the stallions according to breed or type, both as regards the number licensed and the number rejected :—

		NUMBER OF STALLIONS LICENSED OR REFUSED.			
		Pedigree		Non-Pedigree*	
		Licensed	Refused	Licensed	Refused
HEAVY—					
Shire		732	19	40	1
Clydesdale		110	—	11	—
Suffolk		139	4	—	—
Percheron		41	1	1	—
Others		—	—	26	3
Total Heavy ..	1,022	24	78	4	
LIGHT—					
Thoroughbred	150	4	3	—	
Hackney	81	2	16	1	
Arab	12	—	5	—	
Hunter	4	—	2	—	
Cleveland Bay	5	—	—	—	
Yorkshire Coach	2	—	—	—	
Welsh Roadster	1	—	1	—	
Others	—	—	1	—	
Ponies (including Welsh Cobs)	129	—	25	2	
Total Light ..	384	6	53	3	
Grand Total ..	1,406	30	131	7	

* Non-pedigree stallions are arranged as far as possible under types.

The number of heavy stallions licensed was 53 less than in 1926, while light stallions declined by 18, the percentage decrease being much the same in each case. The whole of the reduction in heavy stallions occurred in Shires, other heavy breeds showing practically no change on the year. Among light stallions, Arabs, Hackneys and Ponies showed appreciable decreases, but Thoroughbreds increased by 15.

The number of stallions rejected for each of the prescribed diseases and defects was as follows :—

Roaring ..	6	Cataract	7
Whistling ..	14	Defective Genital Organs ..	1
Sidebone ..	5	Bone Spavin	1
Ringbone ..	1	Stringhalt	2

In six cases, appeals were made against refusals of licences and three of these appeals were successful.

The number of cases of infringement of the Horse Breeding Act reported during the year was 18. Only one unlicensed stallion was found travelling for service; and, in two cases, unlicensed stallions were reported as being exhibited for service on premises not in the occupation of the stallion

owners: Proceedings were taken in one case and a conviction obtained. Nine stallions, in respect of which licences had been issued, were being travelled unaccompanied by the licences; and six owners failed to notify changes of ownership of stallions.

Rams.—The financial assistance provided by the Ministry towards the improvement of Welsh Mountain sheep again allowed for the provision of 25 rams by Societies in Wales. The total number of ewes served by these rams was 1,492, an average of practically 60 per ram; and the service fees, which varied from 1s. to 3s. 4d. per ewe, averaged 1s. 7d. The hiring fees of the rams ranged from £6 to £13 13s., this latter figure being paid for the ram which secured first prize at the Royal Show, the Royal Welsh Show and the annual show and sale of the Welsh Mountain Sheep Society at Aberystwyth. Interest continues to be taken in the work of these Societies, and, in districts where the Scheme has been in operation for some years, the mountain flocks are said to show improvement.

Milk Recording.—The returns furnished by Milk Recording Societies show that the steady progress, until 1925–26, in the membership of such Societies suffered a check last year, when the number of new members did no more than balance the resignations. The following table gives the total membership in each year since official recording was commenced in 1914–15, together with the number of herds and cows recorded :—

	Year*	Societies	Members	Herds	Cows
April 1 to March 31	1914-15	16	264	306	7,331
	1915-16	20	350	398	9,811
	1916-17	22	441	495	12,950
	1917-18	25	503	555	14,404
October 1 to September 30	1917-18	27	639	708	19,793
	1918-19	38	1,191	1,332	37,880
	1919-20	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

* Before October 1, 1917, there was no uniform year for Societies.

† The decrease in the number of Societies was due to amalgamation.

‡ The increase in the number of Societies is due to the dividing of one Society covering three counties into separate Societies for each county.

§ Including 35 members recording goat herds only.

In considering these figures, it should be borne in mind that many farmers, who are no longer members of Milk Recording

Societies, are recording the milk yields of their cows privately. As a result of the depression in agriculture, many members have felt compelled to resign in order to reduce their expenditure, and in such cases it is usual for them to continue recording privately. That this is so shows that the main object of the Ministry's scheme, which is to encourage farmers to undertake recording and so learn the benefits to be derived therefrom, has been achieved so far as these farmers are concerned.

It is still true, however, that much the larger proportion of the cow owners of this country have not yet commenced to keep milk records, and a wide field therefore remains in which Milk Recording Societies can push their propaganda and seek for new members. There can be no doubt that there would be increased economy in the production of the country's milk supply if recording were more widespread. The economy which can be effected where records are kept, by conducting the breeding, selection and feeding of cows according to their milk-yielding capacity, and by the increased interest in their work on the part of stockmen, much more than counterbalances the cost of accurate recording of the yields of the cows.

Average Yield of Recorded Herds.—Of the 156,847 cows and heifers recorded under the Scheme, 81,749, i.e. 52 per cent. (as compared with 53 per cent. in the previous year), were cows which had been retained for the full 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 fixed:—

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	Aver- age yield *	No. of cows	Per- centage of total cows and heifers	Total yield	Aver- age 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

* Before 1924-25 the average yield was calculated at the equivalent of 10½ lb. to a gallon and subsequently at 10¼ lb.

The average yield of the full-year cows was 7,037.7 lb. (681 gal.), showing a small reduction on the average of the previous year. A decrease of less than one per cent. is, however, insignificant, and in this connexion it should be remembered that milk yields were adversely affected by the shortage of grass in the spring of 1927, when cold, dry weather prevailed from about the middle of April to the middle of June. Changes in the average yields varied considerably in the different Societies, rather more than one-half showing decreases. Six Societies—Norfolk, Derby and District, Staffordshire, Durham, Suffolk and Essex—had average yields per cow of more than 7,500 lb. (726 gal.), Norfolk heading the list with 7,684 lb. (744 gal.).

Turning to the results in individual herds, it is found that of the 5,018 herds which were recorded for the full year, 1,135 had average yields for full-year cows of 8,000 lb. or over; and, in 151 herds, average yields of 10,000 lb. or over were obtained. Some examples of the increases which have been effected in the average yields of individual herds, since recording was begun, are shown in the following table, in

Herd	No. of years during which records were taken	Aver- age yield per cow in first year	Aver- age yield per cow in last year	In- crease 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
A. (Pedigree Friesian)	7	Gal. 848	Gal. 1,087	Gal. 239	35	£ s. 11 19	£ s. 418 5
B. (Pedigree Guernsey)	5	650	1,015	365	13	18 5	237 5
C. (Pedigree Jersey)	7	549	943	394	10	19 14	197 0
D. (Non- Pedigree Shorthorn)	6	563	1,194	631	8	31 11	252 8
E. (Non- Pedigree Shorthorn)	4	751	881	130	18	6 10	117 0
F. (Non- Pedigree Shorthorn)	6	653	821	168	14	8 8	117 12

which an indication of the cash values of the increases is also given. With such examples before them, it is surprising that so many farmers have not yet taken up milk recording.

The annual returns have again been tabulated so as to provide information regarding the number and average yield of milk of recorded cows of the different breeds. These figures are given in the following table, but details are not included in respect of those breeds of which less than 500 cows were recorded for the full year. These latter are omitted, as any information based on the records of only a very small number of cows can be of little practical value and may be misleading.

The decrease, to which reference has been made previously, in the average yield over all cows recorded, was shared by most of the different breeds, only four, Blue Albion, Jersey, Lincoln Red Shorthorn and Welsh Black, showing increases on the year.

Statement showing the total number of Cows and Heifers of certain breeds recorded in England and Wales during the year ended October 1, 1927, and the number and average yield of Cows recorded for the full year, together with the percentage of full-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 ..	2,022	893	44.2	6,251,793	7,001
Blue Albion ..	1,544	957	62.0	7,219,460	7,544
Devon ..	1,588	849	53.5	4,729,982	5,571
Friesian ..	22,428	12,183	54.3	99,552,771	8,171
Guernsey ..	6,498	3,106	47.8	19,619,925	6,317
Jersey ..	4,814	2,356	48.9	14,527,207	6,166
Lincoln Red ..	3,042	1,681	55.3	11,929,963	7,097
Red Poll ..	4,681	2,706	57.8	18,349,476	6,781
Shorthorn ..	102,130	52,945	51.8	368,285,068	6,956
South Devon ..	2,694	1,295	48.1	7,962,002	6,148
Welsh Black ..	1,147	695	60.6	4,124,353	5,934

Issue of Certificates.—Certificates of Merit were issued for 266 cows as compared with 276 in the previous year. These certificates are issued in respect of cows which have calved not less than three times during a period of three consecutive milk recording years, and which have given, during those years,

not less than the yields of milk prescribed for their breeds. The value of this certificate is that it affords proof not only of the cow's good milking capacity over an extended period, but also of its ability to breed regularly, and it is satisfactory to record that the increased number of these certificates issued last year has been practically maintained.

Of the 266 Certificates of Merit issued for the period ending October 1, 1927, 128 were in respect of cows which yielded 30,000 lb. or over of milk during the three-year period. This number includes 60 Shorthorns, 29 Friesians, 14 Red Polls and 14 Guernseys. The highest yield certified was 66,481½ lb. given by a pedigree Friesian in the three years, this being followed by a non-pedigree Shorthorn with a yield of 50,645½ lb. and another pedigree Friesian with a yield of 48,221½ lb. in the three years.

The number of applications for milk record certificates, in respect of the milk yield of a cow during a single year, showed a further falling off, only 121 certificates being issued for the year ending October 1, 1927, against 206 in the previous year.

Register of Dairy Cattle.—The number of cows which qualified in the milk recording year ending October 1, 1927, for entry in Vol. XI of the Ministry's Annual Register of Dairy Cattle was practically the same as in the previous year, being 15,558 against 15,577. Shorthorns again accounted for over 60 per cent. of the total, but the number of Shorthorn cows which reached or exceeded the qualifying standard of this breed, viz., 9,000 lb. of milk in the year, declined from 9,987 in 1925-26 to 9,559 in 1926-27. Fully one half of the qualified cows of the remaining breeds or types were Friesians, of which 3,067 gave yields of 10,000 lb. or over against 2,727 in 1925-26. Of the total number of cows which qualified for entry, 8,731, or 56 per cent., gave yields of 10,000 lb. or over during the year. The number of entries in the Register was, however, again limited to 7,500 cows, so that it was possible to include in Vol. XI only about 48 per cent. of the qualified cows of each breed. Of the 7,500 cows entered, 7,021 yielded 10,000 lb. or over, while 2,102 yielded 12,000 lb. or over, of which 210 gave between 15,000 and 20,000 lb. and 15 gave over 20,000 lb. of milk in the year.

In a separate section of the Register particulars are given of the 266 cows in respect of which Certificates of Merit were awarded.

The number of bulls entered in this Volume shows a further increase, there being lists comprising 99 bulls against 66 in

Volume X. Of the 33 bulls which are entered for the first time, 15 qualified under the requirement that their dams and sire's dams have given not less than the standard yield prescribed for their breed or type during a milk recording year; and 18 are entered as having two or more daughters which have given the prescribed yield. The total number of bulls entered by reason of the milk records of their dams and sire's dams is 63, while 36 are entered on the records of their progeny.

Rationing.—Reports received from Live Stock Officers indicate that members of Milk Recording Societies are realizing, in increasing numbers, the benefits which accrue from careful attention to the rationing of their cows. In all parts of the country more farmers are reported to be taking steps to see that they are feeding properly balanced rations, and that the quantity of fodder supplied to individual animals is in accordance with their milk yields, with the result that the management of the dairy herds is carried out on more economical lines. Advice on rationing is readily obtainable by members of Milk Recording Societies from County Agricultural Organizers, many of whom administer a scheme of rationing advice on the lines of the standard scheme recommended by the Departmental Committee on the Rationing of Dairy Cows.

Testing for Butter Fat.—The number of samples of milk taken by Recorders and tested for butter fat showed a further increase in the year ending October 1, 1927, the total number of samples being 112,176, as compared with 108,335 in the previous year. Nearly 92,000 of the samples were taken from the milk of individual cows. The cost to members of Societies for butter fat testing is usually from 3d. to 6d. per sample, the samples being taken by the Recorders and the testing done in some counties by the Recorders or Secretaries of the Societies, and in other counties by arrangement with the Agricultural Colleges or Institutes.

Further representations have been made during the past year that the Ministry should lay down some definite system for testing butter fat, but this has not been found practicable, as up to the present no reliable and workable scheme has been devised.

Calf and Bull Marking.—The number of calves marked in 1926–27 under the Ministry's scheme for the registration and marking of calves of milk-recorded cows was 15,947, or 970 less than in the previous year, but still some 531 more than

in 1924–25. The number of bulls marked was exactly the same as in the preceding year, viz. 81.

Cost of Milk Recording.—The average cost of recording per cow over the whole country was practically the same as in the preceding year, viz. 4s. 4d. to the member and 6s. 3d. to the Society. In most cases, where any changes were made in the levies in 1926–27, these were in a downward direction, and the highest average cost per cow to the member in any Society was reduced to 6s. 6d. In 24 of the 51 Societies, the average cost to members was from 4s. to 5s. per cow, while in 14 Societies it exceeded 5s., and in 13 it was less than 4s., the lowest being 2s. 1d.

MILK RECORDING SOCIETIES.

STATEMENT GIVING PARTICULARS OF 51 MILK RECORDING SOCIETIES OPERATING DURING THE YEAR ENDED OCTOBER 1, 1927.
(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
Essex County..	235	271	10,497	5,282	Lb. 7,507
Somerset and North Dorset ..	275	316	9,546	5,389	6,697
Hampshire ..	250	274	9,062	4,901	6,735
North Wiltshire ..	134	162	7,441	4,062	6,576
Norfolk County ..	228	253	6,869	4,147	7,684
Berkshire ..	159	190	6,772	3,689	6,849
East Sussex ..	199	229	6,651	3,696	6,877
Suffolk ..	220	243	5,966	3,523	7,534
Hertfordshire ..	162	191	5,555	2,556	7,164
West Sussex ..	140	163	5,358	2,542	7,063
Kent ..	163	182	5,166	2,588	6,940
Dorset ..	89	116	5,059	3,021	6,415
Surrey ..	160	169	4,342	2,187	6,949
Warwickshire ..	155	160	4,029	1,968	7,248
Oxfordshire ..	118	123	3,767	1,880	7,234
South Wiltshire ..	61	81	3,574	2,151	7,392
Leicester and Rutland ..	129	135	3,473	1,689	6,884
Lancashire County ..	105	113	3,231	1,223	7,272
Gloucestershire ..	103	113	2,951	1,672	7,137
Shropshire ..	78	84	2,864	1,478	7,408
Staffordshire ..	92	94	2,643	1,350	7,569
Cheshire County ..	72	76	2,553	1,186	7,151
South Devon and District ..	109	114	2,514	1,170	6,112
Yorkshire ..	126	134	2,434	1,167	7,282

* Goat herds are not included.

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.
Buckinghamshire ..	91	98	2,420	1,195	7,053
Bristol and North Somerset	105	108	2,418	1,367	6,849
Northamptonshire ..	94	102	2,376	1,152	6,780
Cambridgeshire ..	84	90	2,321	1,362	7,328
Derby and District ..	62	67	2,243	1,056	7,619
Cumberland & North Westmorland ..	121	122	2,085	841	5,987
Worcestershire ..	87	90	1,869	1,044	7,105
Nottinghamshire ..	60	61	1,805	714	7,330
Bedfordshire ..	50	53	1,500	760	7,289
Peak (Derby) ..	69	70	1,499	719	7,310
East Devon ..	85	85	1,438	752	6,741
Northumberland ..	59	60	1,357	656	7,043
Lincolnshire ..	47	51	1,331	703	7,464
Denbighshire and Flintshire ..	56	60	1,211	696	7,303
Cornwall ..	65	66	1,103	594	6,338
Kendal and South Westmorland ..	51	52	1,098	441	5,972
Durham County ..	42	46	1,039	377	7,566
Monmouthshire ..	46	48	1,002	428	6,730
Herefordshire ..	38	38	855	423	7,487
Anglesey and Caernarvonshire ..	64	64	738	418	5,964
Campden, Moreton and District ..	36	37	729	397	7,154
Glamorgan ..	50	50	616	296	7,369
Cardiganshire ..	40	41	479	262	6,316
Carmarthenshire ..	19	19	395	209	7,166
Montgomeryshire ..	22	23	327	187	6,649
Pembrokeshire ..	12	12	169	111	6,319
Merionethshire ..	14	15	107	72	5,789
TOTALS ..	5,131	5,614	156,847	81,749	7,038

* Goat herds are not included.

Export of Live Stock to Countries Abroad.—The foreign Regulations governing the export of live stock abroad are constantly being revised, and the Ministry has made arrangements with the representatives of foreign Governments to be furnished from time to time with the latest regulations governing the import of stock into countries abroad. Summaries of the regulations are prepared, and intending exporters may obtain copies on application to the Ministry. No less than 126 summaries, each dealing with the regulations of a different country, are available.

There are very few countries into which live stock may now be imported without a certificate as to the health of the animals, or as to the freedom from certain diseases of the places from which they come. In recent years, countries abroad have shown a tendency to revise their import regulations with a view to obtaining greater protection against the introduction of animal diseases. One result of this movement is that the certificates of health are more commonly required to be signed by officials of the central Government of the country of origin, and, consequently, the Ministry finds itself called upon each year to make arrangements to issue export certificates in respect of fresh countries. At the present time 26 different countries have regulations under which it is necessary that one or more species of animals imported from Great Britain shall be accompanied by the Ministry's certificate, and 932 such certificates were issued during the year ended March 31, 1928.

The export of live stock continued to be hampered by special regulations and prohibitions during the past year as a result of outbreaks of foot-and-mouth disease in this country, and there has been little relaxation of the special restrictions which have prevented the shipment of stock to a number of our best customers abroad. Noteworthy exceptions are the concessions made by the Governments of Canada and the United States of America in accepting stock from Scotland. In addition, the opening of the quarantine station at the London Docks on April 4, 1928, enables stock to be exported to South Africa, and it is hoped that the station will be a means of re-establishing the trade with those parts of the Empire which now refuse to accept stock from Great Britain.

Tables showing the number and declared value of cattle, sheep and pigs exported from Great Britain and Northern Ireland to each country abroad are published quarterly in the JOURNAL OF THE MINISTRY OF AGRICULTURE, and the total exports (exclusive of exports to the Irish Free State) for the calendar years 1926 and 1927 are given below:—

	1927		1926	
	No.	Value	No.	Value
Cattle	1,015	£ 161,583	793	£ 94,664
Sheep	1,986	41,915	1,223	31,512
Pigs	331	6,986	410	10,739

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 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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FRUIT MARKETING REFORM: APPLES AND PEARS

THE need for reform in the methods of marketing home-grown fruit has long been recognized. It has increased with the growing intensity of the competition of imported fruits, particularly apples. Imported supplies are almost invariably standardized as to grade, pack and package; in addition, they are marketed in bulk and have the commercial advantage of regularity and continuity of supply.

It is freely admitted that well-grown English apples are unsurpassed in quality and flavour, and retailers will invariably pay higher prices for English fruit than for imported fruit of comparable quality. The sole complaint of the retail trade is that it is impossible to obtain regular and adequate supplies of home-grown apples of good quality, properly graded and packed. To meet this demand, the following scheme has been drawn up jointly by the Ministry and by the National Farmers' Union. Its objective is to give a better service of home-grown apples and pears to distributors in the large consuming centres and so to help home produce to capture ground held by imports and to develop home markets for an increasing production.

The Agricultural Produce (Grading and Marking) Bill, at present before Parliament, is intended to provide the legislative background. It proposes to authorize the Minister of Agriculture and Fisheries to define grades by regulation, to prescribe a grade designation mark (referred to in this article as the National Mark) for use as a label on packages of home-grown produce, and to draw up such conditions as may be necessary to regulate its use.

Although provision will be made eventually to apply

similar proposals to all home-grown fruits, the scheme outlined below is restricted to apples and pears, and it is hoped to inaugurate it in the autumn of the present year.

(1) **Standard Grades, Packs and Packages.**—Standard grades have been drawn up and have been approved by the industry. Details of these standards, together with standards of packs and packages which are required to be used with these grades, when the National Mark is applied, are given in Marketing Leaflet No. 7, a copy of which may be obtained free and post free on application to the Ministry. These standards are experimental in the sense that they are subject to review in the light of experience.

(2) **The National Mark.**—National Marks are common on Dominion and foreign produce of various kinds on the English market, and the trade is accustomed to them. Their use is only authorized on goods that reach a prescribed standard of quality. A National Mark on home produce will, in the same way, provide an outward and visible sign of guaranteed origin and reliability; it will give the distributive trades in the large centres of population a token that will engender confidence, which is the basis of sound business.

The idea of a National Mark is thus bound up with the needs of the wholesale market. It also arises from the necessity of devising some means of accelerating the adoption of a standardization policy for home-produce, having regard to the competition of imported fruits which come on our markets continuously and in large and increasing quantities. The best accelerator is to create a demand for standardized English produce, and the best way of doing this is to market such produce under a badge, a National Mark, which will be a popular guarantee to the trade, easy to see, easy to understand, and with a goodwill value based both on national sentiment and on trade efficiency. Further, if, as is the intention, the same national design is used on packages of English eggs as on English fruit and, later, on English poultry, and so on, then standardized English products will advertise one another, and a snowball demand will be created for the produce of our own farms and orchards, marketed in an orderly manner.

Anyone may grade to the national standards, and the use of the National Mark is, likewise, wholly voluntary, and packers may use the National Mark in addition to, or in substitution for, a private mark; but, obviously, a National

Mark which may, in time, come to mean so much for English agriculture, must, from the start, be carefully safeguarded against misuse. In order to give confidence to buyers, only those persons and organizations will be authorized to use the National Mark who are in a position to conform to certain conditions calculated to ensure efficiency, and who are ready to submit to a voluntary control for that purpose. Thus, it will be necessary that the National Mark label should indicate not only the grade standard of the contents of any package to which it may be applied, but also the identity of the registered user, so that complaints in regard to produce marketed under the National Mark can be followed up. If the contents of a package bearing the National Mark do not comply with the grade standard specified, the purchaser will be entitled to recover damages for breach of warranty, or he may reject the goods and sue for damages for breach of contract. The ultimate penalty for carelessness will be withdrawal of the right to use the Mark.

National Mark Committee.—A small National Mark Committee will be appointed by the Minister to act as his executive in matters appertaining to the use of the Mark, including its protection from misuse. To this Committee, therefore, will fall the responsibility for correlating all schemes involving the use of the National Mark on any agricultural commodity.

Trade Committee.—A small Trade Committee consisting of growers and distributors, with an independent Chairman, will be appointed by the Minister to advise the National Mark Committee in regard to the use of the Mark on fruit.

Roll of Registered Growers or Packers.—The National Farmers' Union, through its branches in fruit-growing areas and in co-operation with independent growers' associations, will be responsible for receiving applications from those who desire to participate in the scheme, but it is not necessary for an applicant to be, or to become, a member of the National Farmers' Union or of any other Association to qualify for using the National Mark. Applications so received will be passed to the Trade Committee for consideration and recommendation to the National Mark Committee. Where the Trade Committee has withdrawn its permission to a grower to use the National Mark, the grower concerned shall have the right to appeal to the National Mark Committee.

Inspection Service.—In a voluntary scheme of this kind, it is safe to assume that the great majority of participators have honest intentions, and, on this account, the inspection necessary

should be very small compared with that required for a compulsory scheme; distributors' organizations may be expected to co-operate by reporting cases of default to the Ministry. The inspection service will be supplied, at the start, by the Ministry.

(3) Conditions Attaching to the Use of the Mark.—(A) In the first year, permission to use the Mark will not be granted to growers or packers whose total output of apples of approved dessert or culinary varieties is less than 1,000 bushels (or 20 tons), or whose output of approved dessert or culinary varieties of pears is less than 500 bushels, or, in the case of the variety Doyenné du Comice, 250 bushels. Separate registration is necessary for the use of the Mark on apples and on pears. Applicants for registration will, therefore, be required to state the estimated total quantities of apples and pears separately in respect of (a) maximum production in a previous season and (b) estimated production in the ensuing season. It will be seen that growers and packers of smaller quantities than those specified above are debarred from using the Mark during the early stages of the working of the scheme. The terms and conditions under which such growers will be permitted to use the Mark, consistent with its due protection from misuse, will be considered jointly by the Ministry and the National Farmers' Union at the end of 12 months.

(B) Registered users will be required to comply with the following conditions:—

- (i) The grade of the contents of each package to which the National Mark is applied must conform to the grade title on the official National Mark label;
- (ii) the package must be one of those indicated in Appendix "A" for the particular fruit and grade and must be in conformity with the dimensions and capacity specified therein;
- (iii) the official label embodying the National Mark and appropriate to the grade concerned must be completed by the packer in the following particulars:—
 - (a) variety of apple or pear;
 - (b) weight and/or count of contents at time of packing, as laid down in the grade standards (Appendix "A");
 - (c) date of packing;
 - (d) the name, registered number or registered mark of the grower, association or packing station concerned;
- (iv) allow all packing premises and all equipment and records to be inspected at any reasonable time by duly authorized persons acting on behalf of the National Mark Committee, to allow such persons to open and inspect, at any time and place, packages packed by the applicant and bearing the National Mark, and generally to assist such persons in the performance of their duties in regard to the protection of the Mark;
- (v) pay for official National Mark labels at such rate as may be considered necessary.

(C) The National Mark for apples and pears shall be used only on those dessert or culinary varieties set out in Appendix "B."

(4) Supply of Official National Mark Labels.—Official labels bearing the National Mark and appropriate to the various grades will be issued to registered users by or on behalf of the Ministry of Agriculture and Fisheries in sizes to fit the standard packages. They may not be obtained from any unauthorized source and they will not be transferable.

(5) Conclusion.—The objective of the scheme outlined is to secure that, at least in the "exporting" areas of England and Wales where production exceeds local requirements, supplies will, so far as practicable, be marketed through packing stations where they can be assembled and handled efficiently in bulk and transferred promptly and economically to the centres of demand. This work may be undertaken by growers, individually or in association, or by fruit buyers or by specialist graders and packers. It is not desired to disturb the course of trade or the customary relations between sellers and buyers, but only to fill up the gaps in the assembly organization where gaps exist.

Packing stations have already been established in many parts of the country by individuals and firms and, in a few cases, by producers' co-operative societies. It is believed that assembly organizations of this kind are already sufficient in number to ensure that from its very start the scheme, if backed by the goodwill of the industry, will make a definite impression on the market and will do much to secure for home-grown fruit the same commercial advantages as are, at present, enjoyed by imported supplies.

Growers who pack their own apples and pears, and other packers, who desire to avail themselves of the advantages likely to accrue from the use of the National Mark and who are able to fulfil the conditions set out above should apply at once for an enrolment form to the Secretary of the nearest local branch of the National Farmers' Union or to the Headquarters of the Union, 45 Bedford Square, London, W.C. 1.

AUGUST ON THE FARM

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Grassland.—The grazing season may be divided into three periods. There is, first, the early bite of soft, laxative spring grass in April and May. June and July comprise the second period, which is generally regarded, in the most parts of England, as the best of the grazing season, when stock make the greatest daily gains or yields with the minimum of supplementary feeding. From August onwards, which is the third period, the grazing, in many cases, is not only less abundant but also for some reason less effective as fodder. Apart from the difficulties of supporting the stock during August in hot seasons, it is common farming knowledge that grazing stock do not thrive so well after the end of July as in the earlier period. Cows that calve in this month make comparatively low records of milk yield unless artificially fed; and young calves first learning to graze on August pasture need more dry food to prevent loss of bloom than calves of the same age when put out on June herbage.

Formerly it was taught that after July the grass became deficient in protein, and feeders were advised to use an increasing proportion of this constituent in their concentrated supplements as the season advanced. This view may still be correct for pastures of secondary quality that are not kept closely grazed. As regards short, leafy herbage, however, there is no deficiency in protein percentage; but the output of leafy growth in this month is low and, under ordinary grazing conditions, the animals may have to consume a larger proportion of older and less nutritious forage in order to obtain their fill.

So far the present season has not been marked by abundance of herbage either in the pastures or in the meadows. Growth was late in starting, and during May it failed to keep pace with the rate of consumption. Consequently all through June cattle had to bite close to the ground. "We have had a nice lot of rain since the first week in June," said a farmer to me the other day, "but it does not seem to have made the grass grow." It has also been noticeable that the clovers have been slow to fill up the bottom as they usually do about the middle of summer.

After two grassy years, when, especially in 1926, pastures appeared to be somewhat understocked, this season has

brought us back to the recognition of the value of a little reserve of grass area. "Short pasture is all right," a Leicestershire grazier recently remarked, "provided that you have some long pasture to fall back on. I have had too much short grazing this year." Probably the immediate cause of the general lack of keep this summer was the cold, backward spring. Not only grass but also corn and roots were retarded in their growth. The influence of the previous year, however, cannot be ignored. Apart from the leaching and poaching effects of the wet year 1927, the favourable grass-growing conditions of the past two seasons may have had an exhaustive influence; and this seems to be reflected in the present year, especially on soils of only moderate fertility.

Early Wheat.—The suggestion in last month's notes regarding the growth of a catch crop such as mustard on bare fallows to ward off wheat bulb fly raised two queries. The first was whether mustard also prevents wireworm troubles, there being a common notion that the grubs eat mustard until they burst. Doubtless the idea that mustard has insecticidal properties may be explained by reference to the habits of the bulb fly in laying preferably on bare ground and passing over land that is covered by mustard or any other crop. Roebuck records a case where wheat following a catch crop of mustard was affected with bulb fly on parts of the field where the mustard had failed to grow, but free where the catch crop had succeeded. The fact that wireworms may be fed on mustard plants in the laboratory without apparent ill effects seems to contradict the idea that this pest can be reduced by the use of mustard in the rotation. Wireworm, however, is blamed for most of the damage done by insect pests to wheat in spring, and probably the preventive effect of mustard on wheat bulb fly has been erroneously associated with the prevention of wireworm attack.

Another farmer wondered whether it was practicable to sow wheat early enough on bare fallow to get the land covered with wheat plants by the time the bulb fly lays its eggs. Obviously if this suggestion were practicable it would save the not inconsiderable labour and expense of growing and ploughing-in the catch crop; on the other hand, where the mustard could be fed on with sheep it might afford keep of a value equal to its cost. The answer to this question turns on that of what is the earliest safe date for sowing wheat under field conditions in this country. On this point there is little experimental evidence. In Professor Percival's experimental

grounds at Reading, however, a row of wheat has been sown every week of the year for several years. These sowings indicate that while the June to August drillings seem to have no appreciable advantage over plants sown in September and October, these early planted wheats behave much the same as those sown in autumn.

In Northern Europe, September is a favourite time for sowing wheat and rye, and in upland districts the latter cereal is sometimes planted early in August. September is also the favourite month for sowing rye in this country when early spring feed is desired; and the 20th of that month is the traditionally correct date for sowing wheat on bare fallows. I have not been able, however, to find any record of field sowings of wheat in August. Judging from what I have observed when rye has been sown in August, it is very likely that wheat sown in this month would require grazing back with sheep in the autumn. Besides the risk of the crop becoming winter proud, there is the possibility of its being more than usually liable to attack by fungus pests and by birds at harvest time. Also, unless the land were very clean—as it might be expected to be after bare fallow—weeds of the couch type might obtain a serious grip of the soil if the crop were sown in July or August. It is perhaps needless to add that early sowing would allow of considerable economy in seed, provided that the soil contained sufficient moisture for early germination.

Cattle Shows.—The practice of holding an annual exhibition of live stock has been in existence in this country for more than a century. The first such show is said to have been that of the Bath and West of England Society in 1777; and the first exhibition of a national character was that organized by the then Board of Agriculture in 1821, an event on a scale exceeded by many small one-day shows to-day. During the middle third of the 19th century, when farming was very prosperous, county and large-district show societies were formed in all parts of the kingdom; and, associated with the revival of interest in cattle improvement, many local cattle shows were organized during the years immediately preceding the War.

During the past few years, cattle-show committees have in many cases encountered serious financial difficulties. Some societies have found it necessary to suspend activities, while others are considering such measures as amalgamation with neighbouring bodies for the purpose of holding more attractive

but less frequent exhibitions. In all cases special attention is necessarily devoted to the organization of features that attract the sight-seeing public, while the purely agricultural sides of the societies' activities tend to stagnate.

In the above-mentioned circumstances, it is difficult to initiate changes in methods and objects of exhibiting cattle. Prizes of an attractive nature cannot be offered to counteract any reluctance to exhibit that might be caused by alterations in conditions; and a similar difficulty prevents the addition of special classes with conditions embodying the desired progressive features. The desirable departures from customary methods of cattle showing are, however, the exhibition of groups of related animals—classes in which the individual is subordinated to the strain or family of which he is a member. The showing of individual animals as a means of demonstrating the approved type is not so necessary now as it was formerly, when farmers had fewer opportunities of seeing, and less interest in the points of, good cattle.

Competition between individual animals may still serve a useful purpose at small local shows by stimulating healthy rivalry between neighbours. The larger shows, however, should serve to indicate and advertise the herds from which good, reliable breeding stock may be obtained; and in this respect the exhibition of single animals is far from satisfactory. The practice of admitting entries of animals of unknown ancestry still persists; but even in the pedigree classes, too many of the specimens exhibited come from herds which have little fixity of type.

The ideal class of competition would be one that brought into prominence the herds or strains of cattle whose members were shown to breed most uniformly true to good type. Young bulls from such herds could be reasonably expected to beget offspring that bore considerable resemblance to the parental type. This points to the desirability of competitions between groups of related animals rather than between single individuals. There is no doubt that awards indicating capacity to transmit desirable characters would gradually acquire high commercial value; and this class of competition would lead to a better appreciation of pedigree as an aid to the breeding of profit-earning cattle.

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named and are net cash for prompt delivery.

Description	Average price per ton during week ending July 4				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	..	10 5	10 10	10 7	13 5
" " lime (N. 13%) ..	..	..	..	11 7†	17 6
Nitro-chalk (N. 10%) ..	7 0f	7 0f	7 0f	7 0f	14 0
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%)	11 19g	11 3h	..	..	..
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	10 13*	10 13*	10 13*	10 13*	10 4
Calcium cyanamide (N. 19%) ..	9 0‡	9 0‡	9 0‡	9 0‡	9 6
Kainit (Pot. 14%) ..	3 7	2 17	2 18	3 1	4 4
Potash salts (Pot. 30%) ..	5 2	..	..	4 19	3 4
" (Pot. 20%) ..	3 17	3 5	3 10	3 10	3 6
Muriate of potash (Pot. 50·53½%)	9 10	9 0	9 9	10 0	3 9
Sulphate, " (Pot. 48·51½%)	11 10	11 0	11 14	12 2	4 9
Basic Slag (P.A. 15½%)|| ..	3 1§	2 8§	2 9§	2 19§	3 9
" (P.A. 14%)|| ..	2 16§	2 3§	2 4§	2 14§	3 11
" (P.A. 11%)|| ..	2 7§	1 18§	1 19§	2 5§	4 2
Ground rock phosphate (T.P. 58%)					
Fine grade|| ..	2 8	2 8	..	2 0d	0 8
Superphosphate (S.P. 35%) ..	3 0	..	3 1	3 0	1 9
" (S.P. 33%) ..	..	..	2 19	..	..
" (S.P. 30%) ..	2 15	2 8	2 15	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 12	8 2	..
Steamed bone flour (N. ½%, T.P. 60·65%)	5 17†	5 17†	6 5	5 15	..

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

* Delivered in 6-ton lots at purchaser's nearest railway station. 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.

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

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

§ Prices for 6-ton lots delivered to purchaser's nearest railway station. The prices quoted under Bristol relate to deliveries in Somerset, under Hull to Yorkshire, under Liverpool to Lancashire and under London to Middlesex.

|| Fineness 80% through standard screen of 10,000 holes to the square inch (100 mesh sieve).

d Price for 4-ton lots f.o.r. at Northern London Stations. At G.W.R. and S.R. London stations the cost to purchasers is 2s. 6d. per ton extra.

f Delivered in 6-ton lots at purchaser's nearest railway station.

g F.o.r. Gloucester.

h F.o.r. Goole.

NOTES ON FEEDING STUFFS FOR AUGUST

H. E. WOODMAN, M.A., Ph.D., D.Sc.,

School of Agriculture, Cambridge.

The Vitamins in the Ration.—The recognition, during the second decade of the present century, of the essential rôle played by vitamins in the nutrition of growing animals not unnaturally gave rise to hopes that the information gained in biochemical research on this subject would prove of great practical utility in connexion with the feeding of farm animals. It cannot be said, however, that these hopes have been realized. The vitamin hypothesis, while affording in part an explanation of the well-recognized effects of certain feeding stuffs, has not led to any outstanding modification of the previously accepted principles of feeding practice. A short sketch of recent vitamin investigations on farm animals will serve to emphasize the correctness of this assertion.

As far back as 1915, Theiler and his associates in South Africa carried out an extensive series of investigations to ascertain the vitamin requirements of cattle, goats, sheep and horses. They drew the surprising conclusion that the requirements of these animals are so small, that it would be no easy matter to devise a ration of ordinary feeding stuffs which would produce the symptoms usually ascribed to vitamin deficiency. Compared with small animals, such as rats, guinea-pigs and pigeons, on which most of the vitamin research had been carried out, cattle and horses appeared to be relatively insusceptible to deficiencies of vitamins in the diet. The mistake should not be made of assuming that results obtained with one species of animals are capable of being applied, without reservations, to any other species.

The conclusions drawn from these early experiments have been amply confirmed by the more recent investigations of Orr and his co-workers at the Rowett Research Institute. Dr. Orr points out that the farm animal most likely to suffer from vitamin deficiency is the pig, partly on account of its rapid growth and partly on account of the fact that swine husbandry tends to proceed on more artificial lines than is the case with other classes of stock. Yet in experiments with pigs at the Rowett Institute, it has not been found possible to produce signs of malnutrition which could be attributed to deficiency of vitamins A and C. On the other hand, when the animals were kept on rations in which the *known* essential

constituents (protein and minerals) were deficient or improperly balanced, they developed disorders resembling those attributed to lack of vitamins. Farm animals are much more liable to suffer from mineral, rather than from vitamin, deficiencies, and it is clear from the Aberdeen work that the earlier investigators frequently attributed to lack of vitamins, nutritional disorders which were in reality the result of deficiency or ill-balance of the mineral constituents of the diet. The common home-produced feeding stuffs (grains, grain offals, green crops, hay, roots and dairy by-products) are satisfactory sources of vitamins, and Dr. Orr concludes that farm animals are not likely to suffer from deficiency troubles of any kind when they are receiving *properly balanced* rations containing such feeding stuffs.

The distribution of the vitamins A, B and C in the common feeding stuffs of the farm is shown in the accompanying table. It may for the present be assumed that feeding stuffs which are rich in vitamin A will also contain some vitamin D.

	<i>Vitamin A</i>	<i>Vitamin B</i>	<i>Vitamin C</i>
Young pasture grass	Plentiful amount	Plentiful amount	Plentiful amount
Fresh lucerne ..	" "	" "	" "
Fresh clover ..	" "	" "	" "
Meadow hay ..	Moderate amount	Moderate amount	" Trace "
Tower silage ..	Plentiful amount	Plentiful amount	Small amount
Straw	None	None	None
Roots	Small amount	Small amount	Plentiful amount
Bran and middlings	" "	Plentiful amount	None
Barley meal ..	" "	Moderate amount	"
Linseed cake ..	Moderate amount	Plentiful amount	"
Cotton cake ..	" "	" "	"
Coco-nut cake ..	" Trace "	Moderate amount	"
Earth-nut cake	None	" "	"
Dried yeast ..	?	Plentiful amount	?
White fish meal	Moderate amount	?	?

Young pasture grass is probably the best source of vitamins on the farm. It contains in abundance the vitamins A, B and C (and presumably D). Further, it is rich in protein of high digestibility and biological value, and contains satisfactory amounts of lime and phosphate. It is clearly desirable to attempt the preservation of such young grass for use in winter feeding. Investigations in this connexion are being conducted at the present time in Cambridge.

Well-made tower silage is rich in vitamins A and B, and contains sufficient vitamin C to guard against nutritional disorders in farm animals. The vitamin content of silage, however, may be much lowered, especially in respect of

vitamin C, when a high temperature has been maintained over long periods during storage, or when the volume of juice draining away from the silo has been excessive.

Of special interest is the fact that, of all the feeding stuffs commonly used in winter, only roots are rich in the anti-scorbutic vitamin C. The inclusion of roots in the rations of dairy cows must tend therefore to keep up the amount of the anti-scurvy food factor in milk during the non-grazing winter season, a fact of considerable importance from the standpoint of child welfare. This consideration might well be borne in mind when the question of the desirability, or non-desirability, of feeding roots to dairy cows is under discussion.

On account of the richness of cod-liver oil in respect of vitamins A and D, it is but natural that arguments should have been put forward in favour of its wider use in the feeding of all classes of farm stock. Golding and his co-workers at Reading state that pigs kept in confinement, without access to green fodder, benefit greatly in growth and general condition if given daily doses of cod-liver oil. The requirements of large pigs are satisfied by daily additions of one to two ounces to the diet, and it is claimed that such doses do not in any way affect the flavour of the pork or fat. The Aberdeen workers, however, deprecate the use of cod-liver oil simply and solely as a source of vitamins, on the grounds that the pig's requirements for these growth factors are inconsiderable and can readily be supplied by the use of the ordinary farm feeding stuffs. They state, further, that the incautious administration of fishy oils to pigs may cause a taint to appear in the cured bacon, even in cases where the fishy flavour is not detectable in the fresh pork.

Promising results have been secured at Reading in connexion with the use of cod-liver oil for dairy cows. The presence of vitamin A in cow's milk is shown to be entirely dependent on its presence in the diet of the animal. Cows stalled in the winter and fed on ordinary winter rations of seeds, hay, roots and concentrates may yield milk with only one-tenth the growth-promoting factor found in the milk of grass-fed cows. The addition of small doses of cod-liver oil to such deficient rations induces a sharp rise in the vitamin A value of the milk fat of the cows. No such rise is noted when oils deficient in this growth factor are given. The administration of cod-liver oil in doses from one to eight ounces per day to milking cows appears to cause no fishy taint in the milk or butter-fat.

A continuance of these investigations into the effect of vitamin-rich foods on the growth and health-promoting value of the milk of the cows receiving them is obviously desirable. The writer ventures the opinion that in this direction the results of vitamin research will find their most serviceable application to the problems of animal husbandry. A note of warning is necessary, however, since the initial work carried out at Reading indicates that excessive administration of cod-liver oil to milking cows may result in a distinct lowering of the percentage of butter-fat in the milk.

In the Notes for last month, it was stated that the action of sunlight, natural or artificial, on the skin of animals, resulted in the formation of vitamin D, a deficiency of which is associated with defective bone and teeth formation. Speaking at the 1927 Meteorological Conference of the Ministry of Agriculture, Dr. H. E. Magee explained that rickets was very liable to develop in young animals fed on diets badly balanced in regard to lime and phosphate. Experiments on pigs had shown that animals fed on such diets were less liable to develop rickets if allowed access to sunshine. Other experiments had shown that the absorption of lime and phosphate from badly balanced rations was improved if the animals were subjected to artificial irradiation with ultra-violet light from a carbon arc lamp.

It is probably a far cry to the time when the piggeries of this country will be fitted with the necessary appliances for producing ultra-violet light. Meanwhile, a step will be taken in the right direction by keeping in mind the value of light and airy surroundings for growing pigs—an important matter in swine husbandry which certainly does not seem to have been recognized by bygone generations of pig-feeders.

DESCRIPTION	Price per qr.		Price per ton	Manu-rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Pro-tein equiv. %
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	
Wheat, British.. ..	—	—	11 7	0 13	10 14	72	3 0	1.61	9.6
Barley, British feeding ..	—	—	10 5	0 10	9 15	71	2 9	1.47	6.2
" Canadian No.3 Western	40 0	400	11 3	0 10	10 13	71	3 0	1.61	6.2
" Danubian	39 0	"	10 18*	0 10	10 8	71	2 11	1.56	6.2
" Persian	39 3	"	11 0	0 10	10 10	71	2 11	1.56	6.2
" Tunisian	37 0	"	10 7†	0 10	9 17	71	2 9	1.47	6.2
Oats, English, white ..	—	—	13 13	0 11	13 2	60	4 4	2.32	7.6
" black and grey ..	—	—	11 10*	0 11	10 19	60	3 8	1.96	7.6
" Canadian No. 2 Western	35 6	320	12 8	0 11	11 17	60	3 11	2.10	7.6
" " " 3 ..	34 6	—	12 0	0 11	11 9	60	3 10	2.05	7.6
" " feed ..	32 3	—	11 5*	0 11	10 14	60	3 7	1.92	7.6
" Argentine	32 9	—	11 10	0 11	10 19	60	3 8	1.96	7.6
" Chilian	38 6	—	13 10	0 11	12 15	60	4 3	2.28	7.6
Maize, American	45 3	480	10 12§	0 11	10 1	81	2 6	1.34	6.8
" Argentine	44 0	—	10 5	0 11	9 14	81	2 5	1.29	6.8
Beans, English, winter	—	—	10 12†	1 6	9 6	66	2 10	1.52	20
Dari	—	—	10 5	0 13	9 12	74	2 7	1.38	7.2
Millers' offals—									
Bran, British	—	—	7 7	1 3	6 4	42	2 11	1.56	10
" broad	—	—	8 7	1 3	7 4	42	3 5	1.83	10
Middlings, fine, imported	—	—	9 0	0 18	8 2	69	2 4	1.25	12
" coarse, British ..	—	—	8 7	0 18	7 9	58	2 7	1.38	11
Pollards, imported ..	—	—	8 0	1 3	6 17	60	2 3	1.20	11
Meal, barley	—	—	12 0	0 11	11 9	71	3 3	1.74	6.2
" maize	—	—	11 10†	0 11	10 19	81	2 8	1.43	6.8
" " S. African ..	—	—	10 10	0 11	9 19	81	2 5	1.29	6.8
" " germ	—	—	10 5	0 16	9 9	85	2 3	1.20	10
" " gluten feed ..	—	—	10 0	1 1	8 19	76	2 4	1.25	19
" locust bean	—	—	10 0	0 8	9 12	71	2 8	1.43	3.6
" bean	—	—	12 15	1 6	11 9	66	3 6	1.87	20
" fish	—	—	21 10	3 10	18 0	53	6 10	3.66	48
Maize, cooked flaked ..	—	—	12 5	0 11	11 14	85	2 9	1.47	8.6
Linseed—									
" cake, English 12% oil	—	—	12 11	1 11	11 0	74	3 0	1.61	25
" " " 10% ..	—	—	12 6	1 11	10 15	74	2 11	1.56	25
" " " 9% ..	—	—	12 1	1 11	10 10	74	2 10	1.52	25
" " " 6% ..	—	—	11 10	2 4	9 6	69	2 8	1.43	36
Soya bean	—	—	11 10	2 4	9 6	69	2 8	1.43	36
Cottonseed cake English—									
" Egyptian 5½% ..	—	—	8 5	1 10	6 15	42	3 3	1.74	17
" " Egyptian 5½% ..	—	—	8 2	1 10	6 12	42	3 2	1.70	17
Decorticated cottonseed cake, 8% oil	—	—	12 0	2 5	9 15	74	2 8	1.43	35
Coconut cake, 6% oil ..	—	—	11 5	1 6	9 19	79	2 6	1.34	16
Ground nut cake, 7% oil ..	—	—	10 10*	1 7	9 3	57	3 3	1.74	27
Decorticated ground-nut cake, 7% oil	—	—	13 5*	2 5	11 0	73	3 0	1.61	41
Palm kernel cake, 6% oil ..	—	—	10 15*	0 19	9 16	75	2 7	1.38	17
" " " meal, 6% oil ..	—	—	10 10†	0 19	9 11	75	2 7	1.38	17
" " " meal 2% ..	—	—	9 10	1 0	8 10	71	2 5	1.29	17
Feeding treacle	—	—	5 17	0 9	5 8	51	2 1	1.12	2.7
Brewers' grains, Dried ale ..	—	—	8 12	1 0	7 12	49	3 1	1.65	13
" " " porter ..	—	—	8 2	1 0	7 2	49	2 11	1.56	13
Malt culms	—	—	6 10	1 9	5 1	43	2 4	1.25	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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manual value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. 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. 6d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.29d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manual value per ton figures are calculated on the basis of the following unit prices: N, 9s. 11d.; P₂O₅, 3s. 10d.; K₂O, 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 follows:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	10 17
Maize	81	6.8	10 8
Decorticated ground nut cake	73	41.0	13 5
" cotton cake	71	34.0	12 0

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

The cost per unit starch equivalent works out at 2.78 shillings, and per unit protein equivalent 1.65 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, 1927 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	10 16
Oats	60	7.6	8 19
Barley	71	6.2	10 8
Potatoes	18	0.6	2 11
Swedes	7	0.7	1 1
Mangolds	7	0.4	1 0
Beans	66	20.0	10 16
Good meadow hay	31	4.6	4 14
Good oat straw	17	0.9	2 9
Good clover hay	32	7.0	5 0
Vetch and oat silage	13	1.6	1 19
Barley straw	19	0.7	2 14
Wheat straw	11	0.1	1 11
Bean straw	19	1.7	2 16

MISCELLANEOUS NOTES

THE Seventh International Judging Competition for Young Farmers' Clubs took place, by the courtesy of the Governors, at the South-Eastern Agricultural College, Wye, Kent, on July 5, 1928, for possession, for the ensuing year, of the *Daily Mail* Gold Challenge Cup. The competing teams, champions, by eliminating tests, of the Young Farmers' Calf Clubs of England and the United States, respectively, were as follows:—

SUSSEX BABY BEEF CLUB
Mabel Harriott.
Edith Harriott.
Edward Wise.

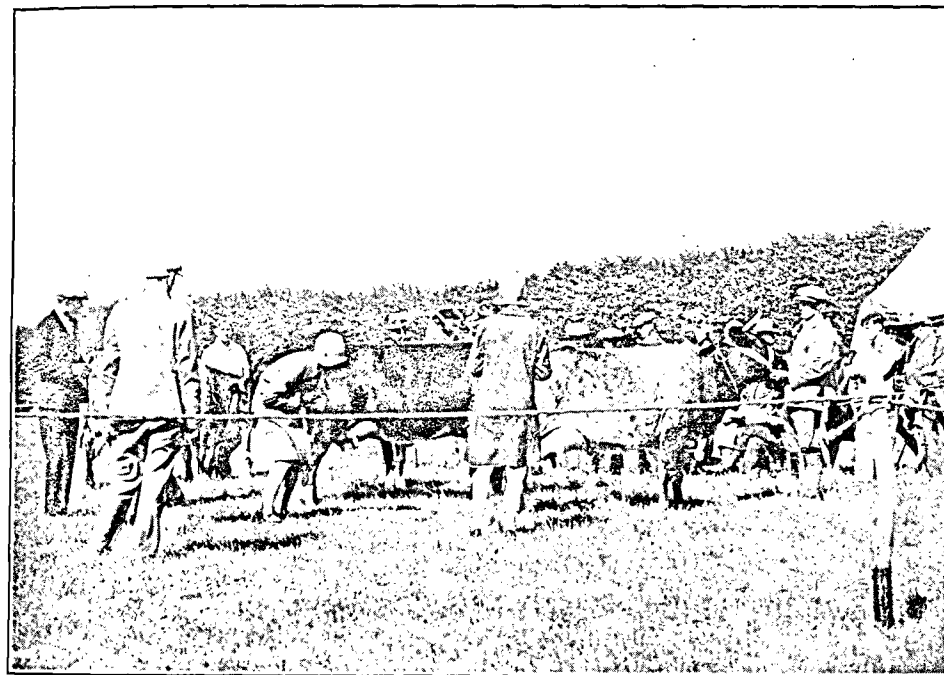
BOONE COUNTY, NEBRASKA, CALF CLUB
Jesse Bilyeu.
Joe King.
Russell Hughes.

The competition was favoured by brilliant weather, and a considerable number of spectators witnessed a very interesting and close contest. Three rings of cattle were judged by the competitors—Dairy Shorthorns, Jerseys and Friesians—each ring comprising four animals. A maximum of 50 points was allocated for placing the animals in order of merit, and a further 50 points for giving satisfactory reasons for the placing. For the first time in these international contests, the Judges gave the competitors information as to the ages and dates of calving of the animals in each ring. As a factor of considerable importance in assessing the merit of the respective animals, it was felt that the competitors, in fairness to themselves, should have this information.

The English team, holders of the Cup for the past two years, successfully defended the trophy, defeating the American team by the narrow margin of $12\frac{1}{2}$ points, England obtaining 660 points to America's 647 $\frac{1}{2}$. The individual scores were:—

SUSSEX BABY BEEF CLUB	BOONE COUNTY CALF CLUB
Mabel Harriott .. 233 $\frac{1}{2}$	Jesse Bilyeu .. 250
Edith Harriott .. 232 $\frac{1}{2}$	Russell Hughes .. 199
Edward Wise .. 194	Joe King 198 $\frac{1}{2}$
<u>660</u>	<u>647$\frac{1}{2}$</u>

The contest was characterized, this year, by another new feature, which added considerably to the interest. After each ring of cattle had been judged by the competitors, one of the judges announced the order in which he and his colleagues had placed the animals, giving a lucid explanation of the reasons for that decision.



Judging Shorthorns.



An English Competitor giving reasons for her placing. [Photos: V. C. Fishwick.
YOUNG FARMERS' CLUBS INTERNATIONAL LIVE STOCK JUDGING COMPETITION.

Mr. R. M. Wilson, the Principal of the South-Eastern College, in presenting the Cup to the winners, congratulated both teams on their remarkably good performance with the cattle.

* * * * *

THE twelfth Annual Poultry Conference of the Harper Adams College and the National Institute of Poultry Husbandry will be held at the Harper Adams

National Poultry Agricultural College, Newport, Salop,
Conference at from Tuesday, August 14, to Friday,
Harper Adams August 17, 1928, both dates inclusive.
College The opening meeting will be at 2.45 p.m.

on the Tuesday afternoon, when Lieut.-

Col. H. P. Sykes, Chairman of the College Board of Governors, will preside, and addresses will be given by Dr. Charles Crowther, the College Principal, and Sir Charles Howell Thomas, Permanent Secretary of the Ministry of Agriculture and Fisheries.

After the tea interval, a visit of inspection will be paid to the College Laying Trials; and at the evening session, commencing at 8 p.m., over which Professor Raymond Parkhurst, Director of the National Institute, will preside, Capt. E. T. Halnan, School of Agriculture Cambridge, will read a paper on "Recent Work on the Digestibility of English Cereals"; to be followed by Mr. F. C. Bobby on "The Influence of Confinement on the Production of White Leghorn Pullets."

At the morning session on August 15, Professor Parkhurst will deal with "The Influence of Certain Feeds on Egg Weight"; and Mr. T. J. Underhill, Manager of the Gloucestershire Fruit and Vegetable Co-operative Marketing Society, Ltd., will follow with a paper on "Some Phases of Co-operative Marketing." In the afternoon, Mr. F. W. Rhodes, Head of the Department of Poultry Husbandry, South-Eastern Agricultural College, Wye, Kent, will read a paper on "Fattening Poultry"; and will be followed by Mr. T. Montague Way on "The Preparation and Marketing of Ducks." An important paper will be given at the evening session by Dr. F. A. E. Crew, Professor of Animal Genetics, Edinburgh University, on "Principles of Poultry Breeding."

On Thursday morning, there will be papers by Mr. F. J. Dudley, Statistician to the National Institute, on "Some Observations from a Study of the Records of the Harper Adams Egg-Laying Trials"; by Professor Parkhurst on "Commercial Hatcheries"; and by Mr. F. B. Hutt on "Abnormal Embryos in Incubation."

The remainder of the Conference, Thursday afternoon and Friday morning, will be devoted to problems of Rabbit Husbandry, an interesting innovation at these meetings. On the Thursday afternoon, Mr. E. C. Richardson will read a paper on "The Appearance and Elimination of Recessive Characters in Rabbits"; to be followed by Mr. A. Arbuthnot on "Commercial Fur Production." A visit to the Rabbit section of the National Institute will follow the tea interval; and Dr. J. B. McDougall will lecture in the evening on "Rabbit Production." The papers at the Friday morning session, which brings the Conference to a close, will be on "Rabbit Growth Studies," by Mr. W. King Wilson, Rabbit Specialist to the National Institute of Poultry Husbandry; and on "Rabbit Diseases," by Mr. N. S. Barron, of the Ministry's Veterinary Laboratory. During the Conference, demonstrations will be given with the new egg-grading machine, invented by Mr. W. R. Dunlop, which is at present exciting much interest. The full programme, and other particulars concerning the Conference, can be obtained on application to Dr. C. Crowther, the Principal of the College.

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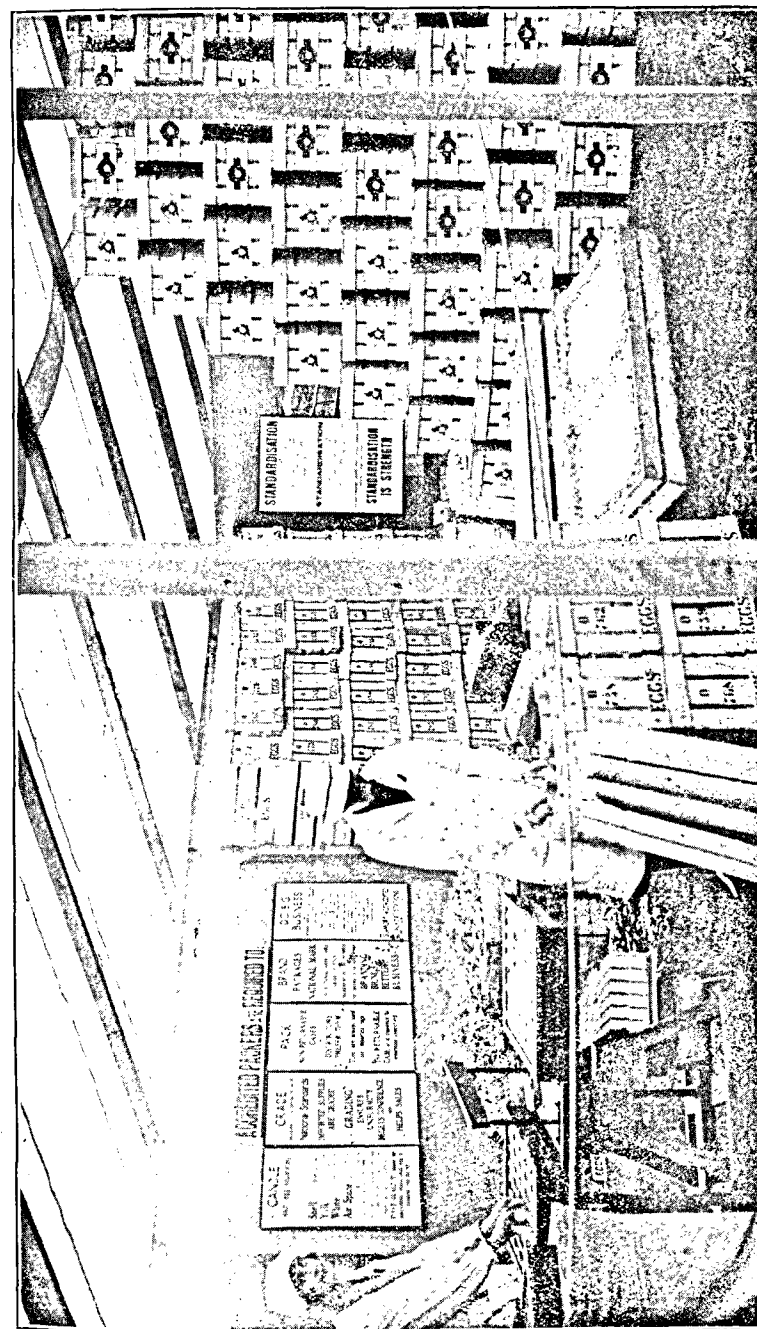
THE demonstrations in the marketing of home produce at the Royal Agricultural Show, Nottingham, July 10-14, covered five different sections of produce—

Demonstrations in Marketing Home Produce eggs and poultry, fruit, pigs, potatoes, and cattle. It was the largest display that has been staged this season, occupying an area of some 1,900 square feet. The

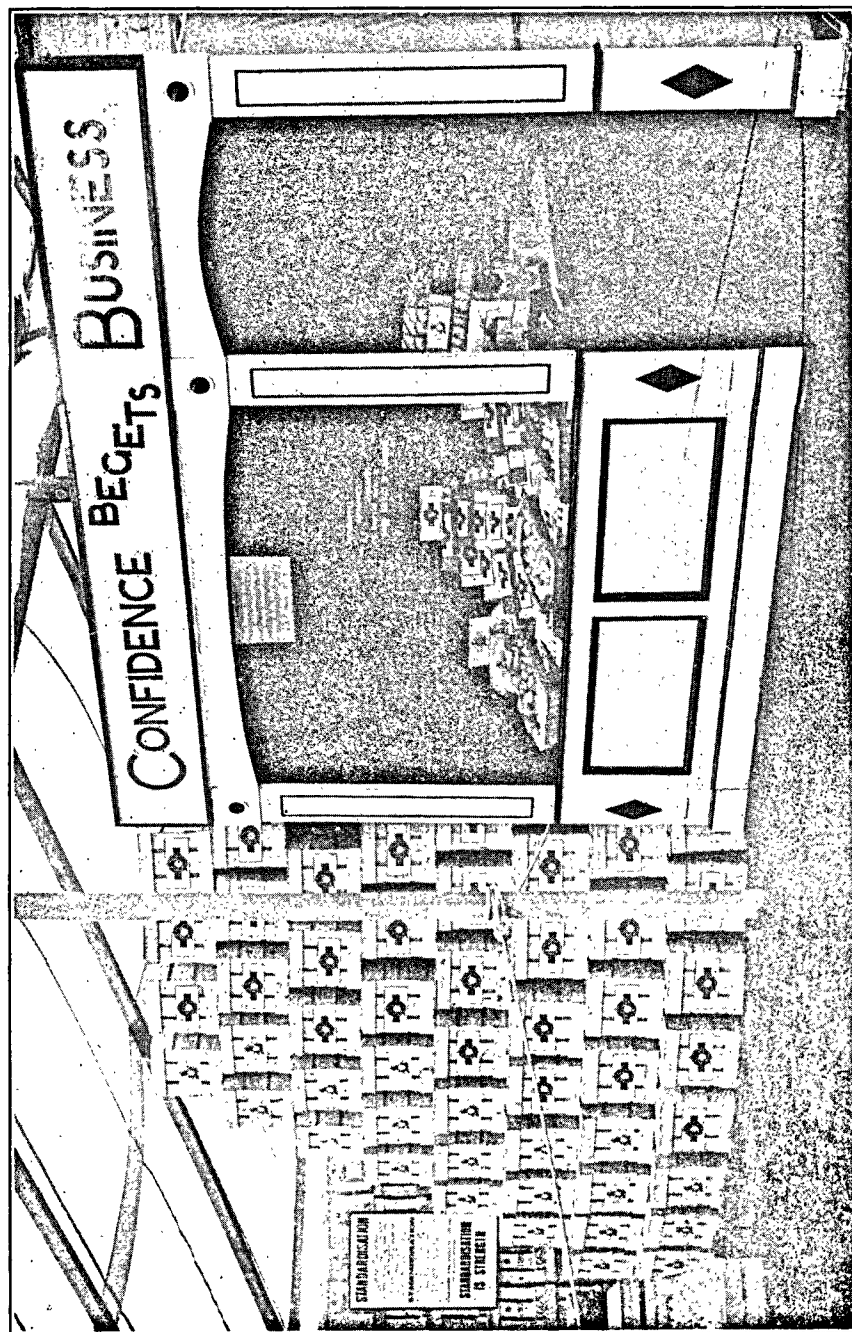
demonstrations were visited by Their Majesties, the King and Queen, who graciously expressed their appreciation of all they saw. Throughout the period of the Show the demonstrations were very largely attended, and elicited expressions of approval from all sides. The cattle marketing demonstration, which is a new feature, will be described in the next issue of the JOURNAL; a photograph of a poster used in this demonstration, which attracted considerable attention, is reproduced in this issue. Other demonstrations given during the month of July were as follows:—

July 18-20	Great Yorkshire Show, Halifax	..	Potatoes.
„ 25-26	Tunbridge Wells Show, Tunbridge Wells	..	Eggs and poultry; cattle.

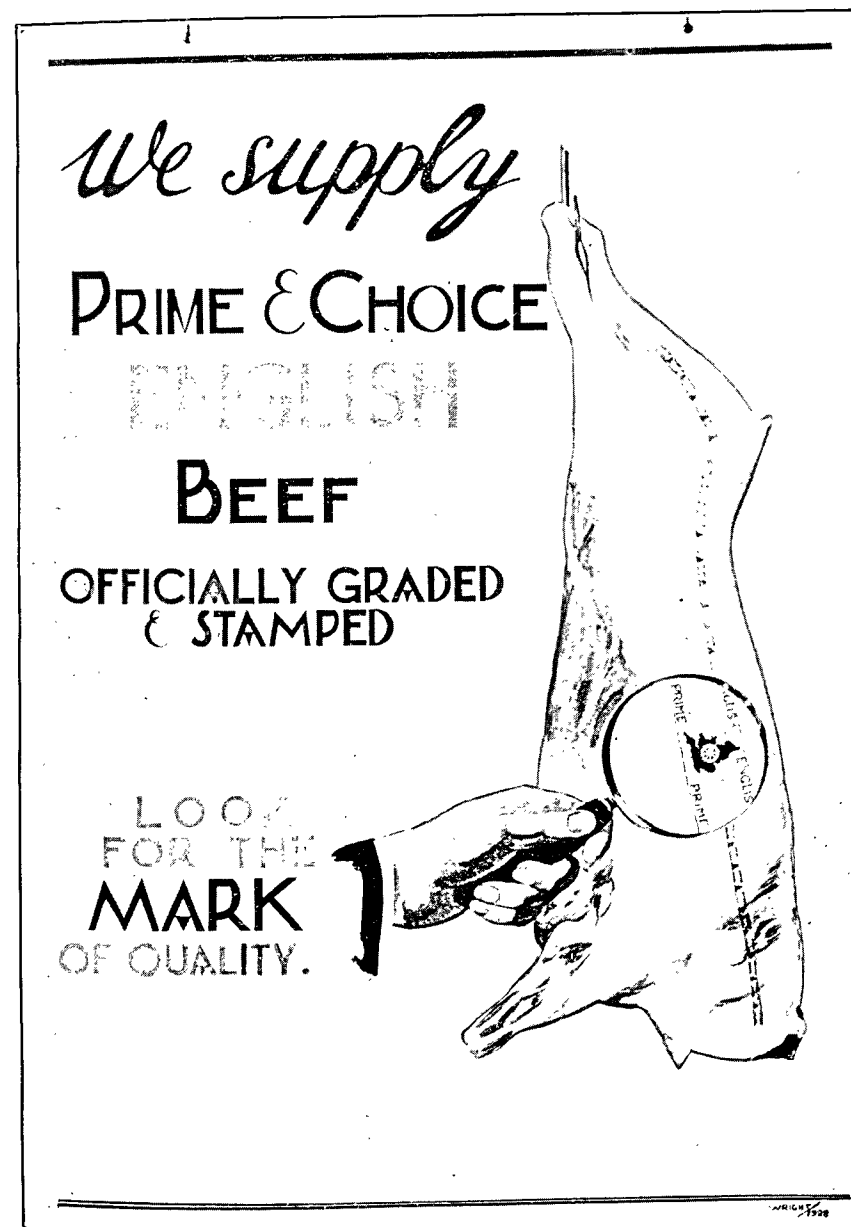
The following demonstrations are to be given during the present month (August):—



Egg and Poultry Marketing demonstration at the Wharfedale Show at Otley. Grading and packing eggs for the wholesale market. Note pile of cases ready for despatch bearing the National Mark label.



Egg and Poultry Marketing demonstration at the Wharfedale Show at Otley. Retail shop window display of eggs graded to national standards; also packed in cartons sealed with the National Mark label.



A grading scheme for home-grown meat is now being considered by the Ministry and the retail trade. In the event of the scheme being adopted, the above is a suggested poster for use by retail butchers handling beef marked under the scheme.

August 2-6	Royal Lancashire Show at Oldham..	Pigs ; potatoes.
„ 8-9	Taunton Deane Horticultural Show at Taunton	Fruit.
„ 8-10	Royal Welsh Show at Wrexham ..	Eggs and poultry ; cattle.

A potato marketing demonstration is also to be given at Sandy, Beds., on August 30.

* * * * *

UNDER the auspices of the National Farmers' Union, the second annual competition in the judging of live stock, open to students of Farm Institutes in England

Farm Live Stock and Wales, was held on June 1, on the
Judging farm of Mr. W. F. G. Watts, Elsfield,
Competition near Oxford. The object of this competition is to encourage young farmers,

who have undergone a course of training at a Farm Institute, to develop a sound judgment in the comparative merits of different animals ; and to apply and test the principles, taught in the classroom, in the judging and selection of the most suitable animals for commercial purposes.

This year, teams from seven Institutes competed, namely, the Cheshire School of Agriculture, the Cumberland and Westmorland Farm School, the Llysfasi Farm Institute, the Monmouthshire Agricultural Institute, the Northamptonshire Farm Institute, the Staffordshire Farm Institute, and the East Sussex Farm Institute. The number of competing teams last year was six. The classes of stock to be judged were dairy Shorthorn cows in milk, Shire horses, sheep, Large Black pigs, and Rhode Island Red poultry. There were four animals in each class, except the poultry, where there were four pens of four birds each. Each team had to judge all five classes of stock, whereas last year there were six classes and the competitors had the choice of five.

The winning team came from the Llysfasi Farm Institute, the students from the Cheshire School of Agriculture coming second, while the team from Northampton, which secured the cup last year, took the third place.

Mr. T. Williams, the President of the National Farmers' Union, attended, and presented to the winning team the challenge cup which is presented annually by the Union. Several other members of the Union were also present. In the speeches made after the competition, the educational value of these competitions was emphasized, the speakers pointing out how much greater the opportunities were to-day for young farmers to learn how to make a success of their occupation.

DETAILS regarding the operation of this scheme during its fourth season are now available, and reveal steady progress in several directions. This is also indicated

The Stud Goat by the figures given in the following Scheme, 1927-28 table :—

	Centres	Goats entered	Goats registered	Services given	Services disallowed	Premiums	Administrative and travelling expenses
1924-25	73	106	73	841	41	£187	£116
1925-26	83	108	89	1,115	38	£229	£121
1926-27	100	115	104	1,603	107	£303	£117
1927-28	110	126	113	1,609	118	£301	£124

It is interesting to notice that, while the number of stud goats and centres increases, the average cost for premium per service has declined by more than 9 per cent. New centres have been opened in various counties, Cornwall being represented for the first time. Of the animals accepted under the scheme 6 were Saanens, 8 Toggenburgs and 13 Anglo-Nubians, the remainder consisting chiefly of Anglo-Nubian-Swiss. Four of these goats were imported in 1922, 10 were sired by imported goats, 45 were "Dagger" males (*i.e.*, descended from milking stock on both sides), 24 had Dagger males as sires, while 14 were the progeny of "Star" dams (*i.e.*, milch goats which had obtained a minimum number of points in a recognized milking competition). The quality of the animals accepted for stud purposes is further indicated by the number of services which were disallowed because stud fees had been charged in excess of the 5s. maximum, the fees in some cases having been as high as one and two guineas. Of the 1,491 services allowed for premium, 301 were given gratis, while fees varying from 6d. to 5s. were charged for the remainder.

As in previous years, the inspection was undertaken by an officer appointed by the British Goat Society. Ninety-four animals qualified for premiums, of which 30 (as compared with 28 in 1926-27) earned the full premium of £5. These 30 goats gave 900 services, of which 846 qualified for premiums, or an average of 28 per goat. Fifteen goats were stationed in the County of Durham, and only one of them failed to gain a premium, while 12 qualified for full premium. One animal gave 85 services. Yorkshire had 14 goats, Essex and Sussex, 11 each. The fact that this season all the animals entered for inspection were eligible by pedigree is a notable indication of the progress which has been made since the scheme first came into operation four years ago. At various

shows special medals and money prizes have been awarded for stock bred under the scheme, and judges have remarked on the improved quality of the resultant progeny. It should be added that these successful results are in no small measure due to the economical and efficient administration of the scheme by the British Goat Society.

It is, nevertheless, true, however, that the value of the goat as a producer of milk for human consumption, especially in places where cow's milk is not easily obtainable, is not yet sufficiently appreciated in this country.

* * * * *

THE Midland Agricultural and Dairy College, Sutton Bonington, Loughborough, will hold its fifth Annual Poultry Conference on Tuesday, September 25, commencing at 10.45 a.m., and all persons interested are cordially invited to attend. These Conferences, which last a day, are arranged to give residents in the locality, and others who are unable to attend the National Poultry Conference, an opportunity of hearing short papers by experts upon various aspects of poultry keeping, and of joining in the discussions that follow. At the forthcoming Conference, Dr. Edward Brown will preside; and papers will be read by Professor Parkhurst, National Poultry Institute, on "Breeding Problems"; by Captain Norman Bissett, of Cardiff, on "Poultry Diseases"; by Mr. A. V. Clarkson, of London, on "Marketing Problems"; and by Mr. R. B. Shaw, the College Poultry Instructor, who will deal with "Some Aspects of Table Poultry Production," based on investigations conducted on the College Farm, 1927-28. Particulars of the arrangements, accommodation for visitors, meals, etc., can be obtained on application to Dr. T. Milburn, the Principal of the College.

* * * * *

A COURSE in agricultural engineering work and tractor driving was recently held at the Midland Agricultural and Dairy College, Sutton Bonington, Loughborough, and proved so successful that it has been arranged to hold a second, similar, course to commence on Monday, September 10, 1928. The course will last three weeks; and instruction will include lectures and demonstrations on the construction, setting, management, care and overhaul of all classes of agricultural machinery. Practical instruction will

be given in the driving operations and overhaul of tractor and other engines; repair and testing at work of other classes of machinery; also, practical methods of tracing and dealing with mechanical troubles on the farm. The fees for the three weeks' course will be as follows :—

- (a) For those outside the college area, three £ s. d.
weeks' board, lodging and instruction .. 9 15 0
- (b) For those resident within the college area
(Derbyshire, Leicestershire, Lindsey [Lincs],
Nottinghamshire and Rutland), three weeks'
board, lodging and instruction 6 0 0

Entries for the course should reach Dr. Milburn, the Principal of the College, not later than September 3, 1928.

* * * * *

ONE of the most interesting features in the Ministry's Agricultural Meteorological Scheme is the series of annual

Agricultural Meteorological Conferences

Conferences at which those engaged on the study of various aspects of the work discuss the results of their investigations. At the Conference held last year, a number of important papers were read. These were summarized in the issues of this JOURNAL in February and March last, pp. 1043 and 1099 respectively. A full report of that Conference has now been issued, and a limited number of copies may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

The papers which will be read at the Conference arranged for September 27 and 28 of the present year, at the Meteorological Office, are as follows :—

Historical Climatology of England and Wales: Mr. C. E. P. Brooks, Meteorological Office, London.

The Effect of Climate on the Growth of Vegetables: Mr. M. C. Vyvyan, East Malling Research Station.

The Effect of Weather Conditions on the Moisture Content of Cereals during Harvesting: Institute of Agricultural Engineering.

The Effect of Weather Conditions during Harvesting on the Chemical Composition of Hay: Mr. T. W. Fagan, Welsh Plant Breeding Station.

The Effect of Weather in connexion with Tar Distillate Spraying: Mr. L. N. Staniland, Long Ashton Research Station.

The Connexion between Meteorological Conditions and Pests and Diseases of Fruit: Mr. A. H. Lees, late of Long Ashton Research Station.

Meteorological Conditions and Drainage from the Soil: Dr. B. A. Keen, Rothamsted Experimental Station; Mr. H. D. Welsh, North of Scotland College of Agriculture; and Professor G. W. Robinson, University College of North Wales, Bangor.

The Relation between Air Temperature and Soil Temperatures at various Depths: Mr. F. Tutin, Long Ashton Research Station.

Soil Temperatures in Egypt: Dr. E. McKenzie Taylor, the School of Agriculture, Cambridge.

The Influence of Meteorological Conditions on the Spread of Parasitic Worms: Professor R. T. Leiper, Institute of Agricultural Parasitology, London.

Effect of Soil Temperature on the Behaviour and Migration of Soil Fauna: Professor Dr. E. Handchin, Switzerland (late of Rothamsted Experimental Station).

Artificial Heating of Soils: Dr. W. F. Bewley, Experimental and Research Station, Cheshunt.

The Conference will be open to all who are interested in agricultural meteorology. Those who desire to attend should notify the Secretary, Agricultural Meteorological Committee, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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THE general index number of prices of agricultural produce during June was 53 per cent. above the base years 1911-13, as compared with 54 per cent. in May

The Agricultural Index Number and 41 per cent. in June, 1927. Prices as a whole were little altered from those of the preceding month, the changes being about normal for the season, and the most considerable variation was in the price of fat sheep, which receded appreciably from the high level recorded in May.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :—

				Percentage increase compared with the average of the corresponding month in 1911-13					
Month				1923	1924	1925	1926	1927	1928
January	..	..	..	67	60	71	58	49	45
February	..	..	..	63	61	69	53	45	43
March	..	..	..	59	57	66	49	43	45
April	..	..	..	54	53	59	52	43	51
May	..	..	..	54	57	57	50	42	54
June	..	..	..	49	56	53	48	41	53
July	..	..	..	50	53	49	48	42	—
August	..	..	..	52	57	54	49	42	—
September	..	..	..	52	61	55	55	43	—
October	..	..	..	50	66	53	48	40	—
November	..	..	..	51	66	54	48	37	—
December	..	..	..	55	65	54	46	38	—

Grain.—The price of wheat fell a little during June, the average of 10s. 11d. per cwt. being 2d. lower, and the index number 2 points lower at 38 per cent. above pre-war. Oats also declined from 12s. 11d. to 12s. 8d. per cwt., and at 69 per cent. above pre-war the index number was 5 points below the level of the preceding month. Barley at 10s. 10d. per cwt.

showed no reduction in price, but as there was a fall in the corresponding period of the base years the index number advanced 5 points to 46 per cent. above pre-war. A year ago wheat was 60 per cent., barley 54 per cent., and oats 33 per cent. dearer than in June, 1911-13.

Live Stock.—A somewhat lower level of prices ruled for live stock during the month under review. Fat cattle and bacon pigs were almost unaltered, the index number for the former being 1 point lower at 47 per cent. above the base years, and for the latter 1 point higher at 43 per cent., while pork pigs were about 4d. per 14 lb. stone cheaper, and the relative index number fell by 2 points to 38 per cent. above pre-war. In the case of fat sheep, the fall in price was more considerable, the reduction of 1d. per lb. for second quality animals resulting in a decline of 7 points in the index number to 83 per cent. above pre-war. In June last year fat sheep stood at 48 per cent. above the 1911-13 level. Prices of store stock generally were lower than in May, as is customary at this time of year, and in the case of store cattle the reduction was relatively the same as in the corresponding period of the base years, and the index number was unaltered. For dairy cows and store pigs, however, the fall was proportionately larger, and for store sheep proportionately smaller, so that for store sheep the index number shows a rise of 5 points to 55 per cent. above pre-war.

Dairy and Poultry Produce.—Milk at 53 per cent. above 1911-13 was unaltered on the month, whereas both butter and cheese showed the customary fall. In each case, however, the decline in price was not so large as in the corresponding period of the base years, and the index numbers are higher by 2 and 6 points respectively at 54 and 91 per cent. above pre-war. Eggs were about 1½d. per dozen dearer on the month, and the index number rose from 35 to 38 per cent. above 1911-13, and poultry, which showed much the usual fall in price, averaged 52 per cent. A year ago eggs were 30 and poultry 53 per cent. dearer than pre-war.

Other Commodities.—The rise in potato prices, which was marked during April and May, continued to some extent during June, and on average prices advanced about 15s. per ton, with a rise of 5 points in the index number to 125 per cent. above 1911-13. Both clover and meadow hay made slightly lower prices, and realized 13 per cent. more than in pre-war years, as compared with 3 per cent. in June, 1927. Soft fruits sold at about 60 per cent. dearer than pre-war,

or much the same as a year ago, but vegetables at about 150 per cent. above 1911-13 were very much dearer than in June, 1927, when they were on average about 60 per cent. above pre-war. Wool prices continued to rise, and reached the high level of 75 per cent. above the base years.

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

Commodity	1926	1927	1928			
	June	June	Mar.	Apl.	May	June
Wheat	71	60	30	34	40	38
Barley	21	54	36	41	41	46
Oats	31	33	49	64	74	69
Fat cattle	40	25	38	43	48	47
Fat sheep	66	48	61	78	90	83
Bacon pigs	87	54	40	43	42	43
Pork pigs	90	60	45	45	40	38
Dairy cows	38	21	31	34	33	32
Store cattle	28	21	23	22	26	26
Store sheep	71	53	47	46	50	55
Store pigs	134	90	35	35	26	22
Eggs	26	30	26	37	35	38
Poultry	70	53	40	41	51	52
Milk	60	53	56	63	53	53
Butter	54	41	47	55	52	54
Cheese	80	54	65	78	85	91
Potatoes	—5*	61	82	94	120	125
Hay	9	3	12	11	14	13
Wool	25	33	70	71	72	75

* Decrease.

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Aldershot Command Horse Show.—At the Aldershot Command and District Horse Show, held at Rushmoor Arena, Aldershot,

on July 4, 5 and 6, a large marquee was erected and placed at the disposal of the various Empire Governments for the purpose of staging exhibits. The Ministry, in collaboration with the National Farmers' Union and other bodies, organized a display of British produce, and every Dominion and most of the Colonies also availed themselves of the facilities offered by the Show authorities. The British display comprised bacon and hams, eggs, canned fruit, cider, cheese, condensed milk and glasshouse produce. The attendance was excellent and the interest shown in the home exhibit was very gratifying. In particular, eggs graded in accordance with the new national standards received much genuine appreciation; the eggs were supplied by the Gloucester

Fruit and Vegetable Market, Ltd. (Cheltenham Egg-Packing Station) and by Wiltshire Egg Producers, Ltd. This was the first occasion on which a display of produce has been arranged by the Ministry apart from the Empire Marketing Board.

Canadian National Exhibition, Toronto (August 24 to September 8).—This is reputed to be the biggest annual exhibition in the world, the average attendance each year being about two millions. This year the Empire Marketing Board has taken a pavilion in which will be illustrated, in various ways, the several phases of the Board's work. In the section devoted to research subjects, an important exhibit will illustrate the work of the East Malling Research Station on root stocks. Another section is designed to draw attention to the excellence of British pedigree stock, and to the facilities offered by the Board for the export of stock from this country to the Dominions and Colonies. For this section, a number of models of the better-known British breeds of live stock have been made and will be shown in an appropriate setting, with dioramas in the background depicting a typical English agricultural show. Machines have been prepared which will show, in rotation, photographs of every British breed of horses, cattle, sheep and pigs and of the more important breeds of poultry. By arrangement with the Ministry, most of the breed societies have had suitable literature prepared for free distribution at the Exhibition. A collection of rabbit pelts and rabbit wool garments will also be shown as the basis of an appeal to Canadians to buy British rabbits for breeding purposes. In addition, the Ministry is arranging, in the same pavilion, an exhibit of such home products as are already exported to North America or for which there is a potential demand there. For example, there is already a market for certain types of English cheese in North America and it is believed that a "luxury" trade could be developed in the best grades of English Cheddar and Cheshire. The cheese exhibit, therefore, will comprise graded Cheshire and Cheddar cheeses, as well as Stiltons, Wensleydales and crustless cheeses of several varieties. Comprehensive exhibits of Scottish and English wool and English bulbs are also being sent out by the Ministry.

An exhibit comprising all the principal periodicals devoted to agriculture and kindred subjects will also be shown.

It is hoped that this effort will stimulate interest in British products amongst Canadians and Americans, and thus lead to an increase in our export trade to those countries.

Empire Marketing Board Advertisements.—The Board's campaign in favour of liquid milk is progressing. Fresh display

material has recently been issued to retailers, and two sets of posters have appeared on the special frames erected by the Board all over the country. One of these poster sets is an attractive series of photographs illustrating the organization of the milk industry from the farm to the consumer.

At the height of the strawberry season, the Board, at the suggestion of the Ministry, inserted an advertisement in all English daily newspapers and certain weeklies, exhorting the public to buy English strawberries and English cream. During July, a poster set in favour of home-grown strawberries and new potatoes appeared on the Board's special frames. A footnote invited the public to apply for the Ministry's leaflet, "Twenty Potato Dishes," and several thousand requests were received.

* * * * *

A PUBLICATION of the Imperial Agricultural Research Conference, recently issued, contains abstracts of papers by research and advisory workers in Great Britain and Northern Ireland, which were published in the year October, 1926, to September, 1927. The large volume of work summarized in this publication is presented under 14 headings, such as soils, entomology, animal diseases, dairying, etc.

The primary purpose of the publication is to inform agricultural research and advisory workers in other parts of the Empire of the work which is being done in the mother country; the volume should, however, prove of great interest to all who are concerned with agriculture and allied industries, both at home and abroad.

The price of the publication is 1s. net, post free; it is obtainable from the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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At the beginning of the Report* on their inquiry into the second application for an Order-in-Council to require the marking of imported eggs, the Standing Committee recall the findings of their First Report and enumerate the several steps that have been taken, since it was presented, to effect an improvement in the conditions under which home-produced eggs are marketed.

**Merchandise
Marks Standing
Committee :
Second Report
on Eggs**

* Cmd. 3145, price 3d. net.

The Committee go on to state their opinion that, while the new Egg Marketing Scheme should go far to remove the difficulties which they expressed in their First Report, some time must elapse before substantial results can be expected. They point out that information as to the progress made with the Scheme will constantly be before the responsible Departments, and recommend that an Order in respect of eggs in shell should be made when those Departments are satisfied that sufficient progress has been made with the Marketing Scheme.

As regards dried eggs, the Committee recommend marking both on importation and on exposure for sale, and sale.

* * * * *

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on June 27 and July 17 at 7 Whitehall Place, S.W. 1, the Chairman, 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 into effect the Committees' decisions:—

Cambridgeshire and Isle of Ely.—An Order fixing special minimum rates of wages for the employment of male and female workers during 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.

Dorset.—An Order cancelling as from December 22, 1928, the minimum and overtime rates of wages for male and female workers at present in force, and fixing rates in substitution therefor as from December 23, 1928. The minimum rates in the case of male workers of 21 years of age and over continue at 30s. per week of 51 hours in summer and 48 hours in winter, except during the weeks in which Christmas Day and Good Friday fall, when the minimum rates are 30s. per week of 39½ hours and 42 hours respectively. The overtime rate for male workers of 21 years of age and over is 8d. per hour. In the case of female workers of 15 years of age and over the minimum rate is 5d. per hour, with overtime at 6d. per hour. The Order will continue in force until December 21, 1929.

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 wage is 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 to come into operation

on July 2, 1928, fixing special differential rates of wages for male workers for overtime employment on the corn harvest in 1928, the rate in the case of such 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 male 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 wages 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.

Special minimum rates for employment on the corn harvest have also been fixed by the Agricultural Wages Committees for Devonshire, Dorset, Hertfordshire, Norfolk, Somerset, Wiltshire, and the East Riding of Yorkshire, particulars of which were given in the last issue of the JOURNAL.

Copies of the Order for any area 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 15, legal proceedings were instituted against three employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fines			Arrears of wages			No. of workers concerned
		£	s.	d.	£	s.	d.	
Devon ..	Holsworthy ..	10	0	0	60	0	0	1
Derby ..	Bakewell ..	2	0	0	13	0	0	1
Flint ..	Holywell ..	2	2	0	15	12	0	1
		£14	2	0	£88	12	0	3

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Foot-and-Mouth Disease.—The existence of foot-and-mouth disease was certified on July 11, at Heworth Without, near York, Yorks, North Riding. This was the first case to occur in Great Britain since the outbreak at Sandon, near Stafford, on May 20. The usual restrictions were applied to an area of approximately 15 miles round the infected premises, in close proximity to which two further outbreaks have since been confirmed, on July 12 and 15. One hundred and five outbreaks in all have been confirmed since January 1 last, involving 14 countries and the slaughter of 2,959 cattle, 4,167 sheep, 1,622 pigs and 6 goats.

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Proceedings under the Seeds Act, 1920.—On May 7, proceedings were taken against a trader in Hants. for exposing two parcels of rye-grass seed for sale without giving the particulars required under

the Act. A check test on a control sample of one of these lots showed that the germination was very low and that the seed was probably old seed. The defendant pleaded that the seed was intended for sale as bird seed, and not for sowing, although it was exposed for sale with seed for sowing. Case dismissed under the Probation of Offenders Act on payment of 8s. costs.

On May 10, a Scottish firm of seed potato merchants were fined £8 for making a false statement as to the variety of seed potatoes supplied to English customers. The crops grown by four English farmers from seed supplied under a true stock number by the defendant were found on inspection to contain approximately 20 per cent. of rogues.

On May 30, a trader in South Wales pleaded guilty to giving a false statement as to the germination of some onion seed. A control sample, declared by the defendant to germinate not less than the minimum prescribed by the Seeds Regulations, *viz.*, 60 per cent., was found to be entirely dead seed. Fined £2 and 2 guineas, costs.

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NOTICES OF BOOKS

The Gardener's Year Book, 1928.—Edited by D. H. Moutray Read, F.R.H.S. pp. 325. (London: Philip Allan & Co., Ltd. Price 5s. net.)

The publishers and the editor have both made improvements on previous issues and have now published a book of real use and interest to many. It contains a list of the Horticultural Institutions, Colleges and Schools, Botanic Gardens, Horticultural Societies; the names and descriptions of new and noteworthy plants, together with a really good catalogue of the year's horticultural publications, which make it valuable as a work of reference.

The special articles—Burma-Tibet Expedition; the History of Garden Design; Irises for the Amateur—are timely articles for this year.

The British Goat Society's Year Book for 1928. Pp. 188. (Compiled and issued by the Honorary Secretary, Thomas W. Palmer, 10 Lloyds Avenue, E.C. 3. Price 1s. 6d.)

Those who are interested in the care and management of goats will find much useful information in this Year Book, the eighth issue of which well maintains the standard set by its compiler in previous years. In an article entitled "Propaganda," the Poultry Commissioner gives some account of the progress that has been achieved by means of the Ministry's stud goat and milk recording schemes. Attention is drawn to the fact that during the year ended October 1 last, two goats gave a recorded yield of over 4,000 lb. each, *viz.*, Wonderstrike, whose yield was 4,464 lb., and Ch. Didgemere Dream, which gave 4,444 lb. 1 oz. "The Advantages of Goats' Milk" as an article of diet are discussed by Mr. R. A. Cooke, M.R.C.S., L.R.C.P., and by Dr. William Ker Bell.

The subject of "Feeding for Milk Production" is dealt with by Captain E. T. Halnan, of the School of Agriculture, Cambridge. Mr. J. Cochrane, Superintendent of the Experimental Station attached to the West of Scotland Agricultural College, writes on "The Goat and her Ration"; Mr. A. W. Barker on "A Milk Ration for Goats"; and Mr. F. E. Corrie on "Iodine in Nutrition." Other subjects dealt with include "The American Milch Goat"; "Milk Goats in Trinidad"; the "Inheritance of Multiple Births," etc. There are other interesting and informative articles by recognized authorities on their subjects, as well as many excellent illustrations.

APPOINTMENTS

FEELING that it might be of considerable assistance to farmers and others to know to whom they may apply for guidance and advice on the various technical matters connected with their work, the Ministry decided to publish in this JOURNAL lists of the principal officers of the various institutions for agricultural education in England and Wales. Thereafter, changes in the staffs will be notified from time to time as they occur; and various other appointments of interest to farmers may be similarly recorded.

A list of the principal officers of the various County Agricultural Education Staffs and Farm Institutes appeared in the April and May issues. In this issue is given a list of the staffs of certain of the Agricultural Colleges and University Agricultural Departments; the remainder will appear next month.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES

(Note: These lists also include those Advisory Officers who undertake teaching duties.)

Agricultural Department, University College of Wales, Aberystwyth

<i>Agriculture</i>			
Professor	..	..	J. JONES GRIFFITH, B.Sc.
Lecturer	..	..	RICHARD PHILLIPS, M.Sc., A.I.C.
<i>Agricultural Botany</i>			
Professor	..	..	R. G. STAPLEDON, M.A., M.B.E.
Lecturer	..	..	Miss K. SAMPSON, M.Sc.
<i>Agricultural Chemistry</i>			
Head of Department ..	..	..	T. W. FAGAN, M.A., F.R.C.
Lecturer	..	..	R. O. DAVIS, M.Sc.
<i>Agricultural Economics</i>			
Lecturers	..	..	{ A. W. ASHBY, M.A.
			{ J. PRYSE HOWELL, Dip. Agric.
<i>Dairying</i>			
Senior Instructress ..	..	..	Miss D. M. EVANS, N.D.D., B.D.F.D.
<i>Agricultural Engineering</i>			
Lecturer	..	..	RICHARD PHILLIPS, M.Sc., A.I.C.
<i>Agricultural Zoology</i>			
Special Lecturer in Entomology			J. R. W. JENKINS, M.Sc.

Department of Agriculture, University College of North Wales, Bangor

<i>Agriculture</i>			
Professor	..	..	R. G. WHITE, M.Sc.
Lecturer	..	..	E. J. ROBERTS, M.A., M.Sc.
<i>Agricultural Botany</i>			
Lecturer	..	..	R. ALUN ROBERTS, B.Sc., Ph.D.

<i>Dairy Bacteriology</i>			
Lecturer	..	Miss P. M. HICKSON, N.D.D.	
<i>Agricultural Chemistry</i>			
Professor and Adviser ..	..	G. W. ROBINSON, M.A.	
Lecturer	..	W. McLEAN, B.A., B.Sc., A.R.C.Sc., A.I.C.	
Assistant Lecturer ..	..	RICE WILLIAMS, M.Sc.	
<i>Plant Pathology</i>			
Adviser	..	T. WHITEHEAD, M.Sc., Ph.D.	
<i>Agricultural Zoology</i>			
Adviser	..	W. MALDWYN DAVIES, B.Sc., Ph.D.	

School of Agriculture, University of Cambridge

<i>Agriculture</i>			
Professor	..	T. B. WOOD, C.B.E., M.A., LL.D., F.R.S., F.I.C.	
Lecturer	..	A. AMOS, M.A.	
Demonstrator	..	F. H. GARNER, B.A.	
<i>Agricultural Botany</i>			
Professor	..	Sir R. H. BIFFEN, M.A., F.R.S.	
Lecturer	..	J. LINE, M.A.	
<i>Animal Pathology</i>			
Professor	..	J. B. BUXTON, M.A., F.R.C.V.S., D.V.H.	
<i>Animal Husbandry</i>			
Lecturer	..	W. S. MANSFIELD, M.A.	
<i>Agricultural Physiology</i>			
Reader	..	F. H. A. MARSHALL, Sc.D., F.R.S.	
Demonstrator	..	T. K. W. FAIR, B.A.	
<i>Agricultural Chemistry</i>			
Lecturers	..	{ E. MCKENZIE TAYLOR, Ph.D., D.Sc. R. H. ADIE, M.A., F.I.C. L. F. NEWMAN, M.A., F.I.C. H. E. WOODMAN, M.A., D.Sc.	
<i>Horticulture</i>			
Lecturer	..	D. BOYES, M.A.	
<i>Estate Management</i>			
Lecturer	..	E. P. WELLER, P.A.S.I.	
<i>History and Economics</i>			
Lecturer	..	J. A. VENN, M.A.	
<i>Engineering</i>			
Lecturer	..	R. H. ADIE, M.A., F.I.C.	
<i>Genetics</i>			
Lecturer	..	F. L. ENGLEADOW, M.A.	
<i>Statistics</i>			
Lecturer	..	G. UDN YULE, M.A.	
<i>Tropical Agriculture</i>			
Lecturer	..	C. A. BARBER, C.I.E., Sc.D.	
<i>Plant Diseases</i>			
Lecturer	..	F. T. BROOKS, M.A.	
<i>Agricultural Law</i>			
Lecturer	..	J. E. FEW, M.A., LL.B.	
<i>Economic Entomology</i>			
Lecturer	..	C. WARBURTON, M.A.	
<i>Veterinary Science</i>			
Lecturer	..	Lt.-Col. W. A. WOOD, C.B.E., M.A., M.R.C.V.S.	

Department of Agriculture, University of Leeds.

Particulars of the Teaching Staff of the Department of Agriculture, University of Leeds, were included in the list showing the Agricultural Education Staff in the County of Yorkshire published in the May issue of this JOURNAL, with additional appointment notified in the June issue.

Faculty of Agriculture and Horticulture University of Reading

<i>Dean of the Faculty</i>	..	..	Professor H. A. D. NEVILLE, M.A., B.Sc., F.I.C.
<i>Agriculture</i>			
Professor	..	..	S. PENNINGTON, B.Sc., M.R.C.V.S.
Lecturer	..	..	K. W. CAMPBELL, B.Sc.
<i>Horticulture</i>			
Lecturer and Practical			
Instructor	..	..	A. J. COBB
Assistant Lecturers and Practical			{ H. H. COOK
Instructors			{ Miss DORIS R. HOLE, B.Sc.
Assistant Practical Instructor ..	..	..	J. R. LLOYD
<i>Poultry-keeping</i>			
Lecturer	..	..	Miss E. G. STOWARD, N.D.P.H.
<i>Agricultural Chemistry</i>			
Professor	..	..	H. A. D. NEVILLE, M.A., B.Sc., F.I.C.
Lecturers	..	..	{ C. N. CURRY, B.Sc. J. A. MURRAY, B.Sc. H. H. NICHOLSON, M.A.
Analyst	..	..	J. THOMPSON, Ph.D., F.I.C.
<i>Agricultural Botany</i>			
Professor	..	..	J. PERCIVAL, M.A., Sc.D., F.L.S.
Lecturer	..	..	Miss ADELA G. ERITH, B.Sc., Ph.D.
<i>Agricultural Bacteriology</i>			
Lecturer	..	..	Miss GRACE HEATHER MASON, N.D.D.
<i>Dairy Bacteriology</i>			
Lecturer	..	..	A. T. R. MATTICK, B.Sc.
<i>Building Construction and Surveying</i>			
Lecturer	..	..	W. W. HITCHINS, L.R.I.B.A., P.A.S.I.
<i>Agricultural Machinery</i>			
Lecturer	..	..	J. B. PASSMORE, M.C., B.Sc.
<i>Agricultural Economics</i>			
Lecturer	..	..	E. THOMAS, B.Litt., B.Sc.
<i>Dairying (British Dairy Institute)</i>			
Manager and Chief Instructor ..	..	..	ALEC TODD
Assistant Instructor	..	..	ROBERT BRYAN, N.D.A., N.D.D.
Instructress	..	..	Miss ANNIE SHEPPARD, N.D.D.

School of Rural Economy, University of Oxford

<i>Agriculture</i>			
Professor	..	..	J. A. SCOTT WATSON, M.A.
Departmental Demonstrator ..	..	..	A. S. WALFORD, B.A.
<i>Agricultural Chemistry</i>			
Reader	..	..	C. G. T. MORISON, M.A.
University Demonstrator ..	..	..	J. C. B. ELLIS, M.A.
Departmental Demonstrator ..	..	..	G. R. CLARKE, M.A., B.Sc.

Agricultural Botany

University Demonstrator .. Miss H. BANCROFT, M.A., D.Sc.

Agricultural History and Economics of Agriculture

University Lecturer .. G. D. AMERY, M.A.

Zoology and Entomology

University Demonstrator .. N. CUNLIFFE, M.A.

School of Veterinary Science, University of Liverpool*Veterinary Anatomy*Professor .. J. SHARE-JONES, D.V.Sc., M.Sc.,
Pres. R.C.V.S.Lecturers.. .. { H. V. HUGHES, B.V.Sc.,
M.R.C.V.S., D.V.H.
A. C. SHUTTLEWORTH, B.V.Sc.,
M.R.C.V.S.*Veterinary Pathology and Bacteriology*

Professor .. S. H. GAIGER, F.R.C.V.S.

Veterinary Medicine

Lecturer .. R. ISHERWOOD, M.R.C.V.S.

APPOINTMENTS :—CHANGES AND CORRECTIONS**County Agricultural Education Teaching Staffs, England***Hampshire*: Mr. T. H. ROSE, B.Sc., Ph.D., N.D.A., Lecturer in Agriculture, and Warden, Sparsholt Farm Institute, has resigned. Miss D. O. Winfield has been appointed an Assistant Instructress in Poultry Keeping.*Lincolnshire (Lindsey)*: Mr. A. MCGIBBON, B.Sc., N.D.A., N.D.D., Instructor in Agriculture, has left the staff.*Nottinghamshire*: Mr. R. A. DRUMMOND has been appointed an Assistant Instructor in Horticulture, vice Mr. A. SMITH.*Sussex, West*: The position of Mr. J. C. W. SIMMS, B.Sc., N.D.D., has been altered to that of Assistant Agricultural Organizer and Dairy Instructor.*Yorkshire (University of Leeds, Agricultural Department)*: Mr. H. E. BROOKS, N.D.H., has been appointed an Instructor in Horticulture. Mr. G. F. PILLING, B.A., N.D.A., Assistant Lecturer in Agriculture, has left the staff.**County Agricultural Education Teaching Staffs, Wales***Glamorganshire*: Mr. E. W. WITHERS, Horticultural Instructor, has been appointed Horticultural Superintendent vice Mr. G. H. COPLEY, N.D.H.

Appointment of Organizer in the Isle of Man.—At the invitation of the Manx Legislature, the Ministry's Divisional Educational Inspector visited the Island a short time ago and submitted a report on the conditions of agriculture in the island. He also made suggestions for a scheme of agricultural education in the light of the experience gained of the educational scheme in this country, and suggested, as a first step, that the services of an efficient agricultural organizer should be engaged. The Manx Board of Agriculture accordingly decided to appoint an organizer, and the Divisional Inspector was invited to be present at the interviewing of applicants by the Selection Board. Mr. G. W. Howie, B.Sc., of the Chadacre Agricultural Institute, has been appointed to the post.

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NOTES FOR THE MONTH

ALTHOUGH most readers may be aware of the different grades of milk sold under Ministry of Health regulations, perhaps too few yet realize the assistance that is available, under a Ministry of Agriculture and Fisheries scheme, to dairy farmers who seek not only to improve the cleanliness and keeping quality of their milk but also to avoid faults in the making of butter and cheese.

**Better Milk
and Dairy
Produce**

While it is possible that inferiority in the taste, cleanliness and keeping quality of milk, and faults in butter and cheese, may not in all cases be entirely attributable to bacteriological causes, it is probable that by far the most important factor in this connexion is the quantity and kinds of bacteria present.

Undesirable bacteria may gain an entry into milk in very many ways before it reaches the consumer—from the cow herself, particularly from the hair on the udder and surrounding parts; from the hands, clothing, etc., of the milker; from the utensils, cloths, etc., into or through which the milk is poured; from dust in the air; from water used in cleansing, etc. Milk so contaminated will possess poor keeping qualities and may produce inferior butter and cheese.

Obviously, if cleaner milk and faultless butter and cheese are to be produced, we must know what are the harmful bacteria, their degree of harmfulness in different quantities, the manner in which they gain entry, the conditions which favour their multiplication, and the means of preventing their entry and multiplication.

Knowledge regarding the bacteria that are harmful to human beings has been, and is being, acquired through the researches and experience of medical men and veterinarians. Knowledge as to those which, without possibly being harmful to the consumer, make milk unpalatable and affect its keeping quality, is acquired through research work in dairying.

The task of ascertaining what bacteria are present in any particular milk or dairy produce, and the examination of possible sources of contamination, with the object of determining the precise cause of the trouble—and hence the

advice as to how to avoid the trouble—are matters for dairy bacteriologists.

Provision has been made in this country by the Ministry of Agriculture and Fisheries for research to be carried out both in veterinary science and in dairying. Research in animal diseases is carried on at a special Laboratory of the Ministry near Weybridge, at an Institute of Animal Pathology attached to the Royal Veterinary College, Camden Town, London, and at a second Institute of Animal Pathology at Cambridge University. Research in dairying is carried on at the National Institute for Research in Dairying, which has been set up, in connexion with Reading University, at Shinfield, near Reading.

Dairy bacteriologists have been appointed under the Ministry's Scheme at 11 centres in England and Wales, and there are similar officers in Scotland just as there are similar Institutes in that country for animal diseases and dairying research. Each of these 11 centres caters for a number of counties grouped round them. The duties of these dairy bacteriologists are, in the first place, to ascertain the kinds and numbers of bacteria in samples of milk and dairy produce sent to them. These samples reach them in many ways. Some come from farmers who are licensed producers of graded milk and who wish to make sure that their milk continues to satisfy the requirements of the Ministry of Health regulations. Others are sent by farmers who contemplate applying for licences and who wish to satisfy themselves in advance that they are producing milk which is of the required standard. Samples are also submitted by farmers who have had trouble with their milk or dairy produce, and who wish to ascertain its nature and cause, whilst others are obtained through clean milk campaigns and competitions. Clean milk competitions are usually organized by County Agricultural Education Authorities and extend over a period of several months. Samples of milk from farmers entering the competitions are examined from time to time and prizes are awarded for the best results obtained during the period, due regard being had to the circumstances accompanying the production of milk on the farm.

The results revealed by the analyses carried out by the dairy bacteriologist not infrequently form the starting-point of advisory and research work which often proves extremely helpful to the dairy farmer. Laboratory examination may show the presence of harmful or undesirable bacteria in

large numbers, in which case the dairy bacteriologist takes the first opportunity of ascertaining the conditions under which the milk is produced. He inquires either by letter or through the dairy instructor of the county in question, or he may make a personal visit of inspection to the dairy farmer in company with the dairy instructor. The water supply, utensils, etc., are next examined for the presence of the harmful or undesirable bacteria, and, if such are found, advice is tendered to the dairy farmer as to the best method of eliminating the trouble. Whilst charges are made for the bacteriological examination of milk samples, the advice and assistance which may follow such examination are given entirely free.

Should the dairy bacteriologist fail to ascertain the cause of the trouble, it may be necessary for him to carry out a piece of research work, or he may decide to consult his parent Institute, the National Institute for Research in Dairying at Reading, to which reference has been made above. Many troubles due to bacterial causes have been solved by the latter Institute. The chief of these troubles encountered by dairy bacteriologists are taints of various kinds in milk and dairy produce, ropiness, and abnormal acidity in milk. It is possible that the inspection of premises and animals by the dairy bacteriologist may reveal troubles of a pathological nature. In this case the dairy farmer may be referred to a veterinary surgeon, or the assistance of a veterinary research institute may be enlisted.

An idea of the volume of work carried out by these dairy bacteriologists can be obtained when it is stated that some three or four clean-milk competitions are carried out for every centre annually, that as many as 3,000 samples of milk may be submitted to a centre for bacteriological analysis, and that over 100 visits may have to be paid to farms during the year. A very valuable part of their work also consists in giving courses of instruction to local sanitary inspectors. The latter are the officials locally charged with the administration of milk regulations, and through these courses they are afforded a good insight into the conditions of production of milk and are enabled to appreciate the difficulties which confront dairy farmers.

In addition, dairy bacteriologists frequently co-operate with members of the county staffs in giving demonstrations of modern milk production at Agricultural Shows and other suitable centres.

THE Agricultural Produce (Grading and Marking) Act, 1928, received the Royal Assent on August 3, and, in accordance with Section 2 (1) of the Act, the Minister of Agriculture and Fisheries has issued the Agricultural Produce (Grading and Marking) Draft and Provisional (General) Regulations, 1928, which provide for the appointment of a Committee (to be known as the National Mark Committee) and which empower the Committee to grant to accredited growers and packers the right to use grade designation marks, subject to such conditions as the Minister may from time to time approve. The Committee, which has been duly appointed and empowered, is constituted as follows :—

The Rt. Hon. Lord Darling (Chairman),
Sir F. A. Jones, K.B.E., C.B.,
Sir W. H. Peat, K.B.E.

As the next step, the Agricultural Produce (Grading and Marking) Draft and Provisional (Apples and Pears) Regulations, 1928, have been issued which prescribe and define the following as grade designations for home-produced apples and pears :—

"Extra Fancy," "Fancy," and "C."

These latter Regulations also prescribe that the appropriate grade designation marks for apples and pears shall be used in association with the words "Empire Buying Begins at Home" and with what has come to be known as the "National Mark," which is a map of England and Wales in silhouette, with the words "Produce of England and Wales" inscribed in a circle placed centrally in the map, within which circle is a design representing the Union Jack. It has been arranged that applications from those who desire to participate in the scheme shall be received in the first place by the National Farmers' Union, which will transmit them to the Ministry for consideration by a small committee of practical men engaged in various branches of the fruit industry. This Committee, known as the Trade Committee (Fruit), has been appointed by the Minister and consists of :—

Professor B. T. P. Barker, M.A. (Chairman),
Mr. R. Martin Cowley,
Sir William Lobjoit, O.B.E., J.P.,
Mr. F. R. Ridley, and,
Mr. W. P. Seabrook,

all being members of the Horticultural Advisory Council. The task of the Committee is to advise the National Mark Com-

mittee in regard to the authorization of applicants to use the grade designation mark or the suspension or withdrawal of the right should necessity arise. Should the Trade Committee decline to recommend an applicant to the National Mark Committee, or advise that permission given should be withdrawn, the person or organization concerned has the right to appeal to the National Mark Committee. The Secretary of both Committees is Mr. S. A. Smith, of the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1, to whom all communications should be addressed.

* * * * *

At a meeting of representatives of various organizations concerned—including the National Farmers' Union, the National Federation of Fruit and Potato Trades' Associations, the Co-operative Wholesale Society, and the National Federation of Retail Fruiterers, Florists and Fishmongers—held in connexion with the Ministry's marketing demonstrations at the Royal Lancashire Show at Oldham on August 2, the grades for ware potatoes there being demonstrated by the Ministry were approved, subject to the following provision :—

"Where a riddle of greater mesh than $1\frac{1}{4}$ in. has been employed in dressing selected potatoes, the size of the riddle used may, at the packer's discretion, be appended to the grade name, e.g., 'Selected (2-inch).'

The grades thus agreed to are as follows :—

						Minimum size
Selected	..	..	..	..	..	$1\frac{1}{4}$
Standard	..	..	..	..	..	$1\frac{1}{8}$
Medium	..	..	..	..	..	$1\frac{1}{2}$

The tolerances recommended for all grades have already been published. (See this JOURNAL, August 1928, p. 405.)

Subject, it may be, to further demonstration of the grades by the Ministry, the road now seems clear to consider ways and means of applying to the trade in ware potatoes the machinery of the Agricultural Produce (Grading and Marking) Act, which received the Royal Assent on August 3. A scheme to apply this Statute to home-produced apples and pears has already been worked out and will come into operation on September 1, 1928. The application of the Act to home-produced hens' and ducks' eggs will follow.

At the request of the Governors of the Royal Veterinary College, Camden Town, the Minister of Agriculture and Fisheries has appointed a Departmental Committee, under the Chairmanship of Sir C. J. Martin, C.M.G., D.Sc., F.R.S., Director of the Lister Institute, "to consider and report generally on the reconstruction of the Royal Veterinary College and the probable cost: and in particular on the questions:—What accommodation should be provided, having regard to the training to be given; whether that accommodation can and should be provided on the present site; if not, where the College should be transferred; and what arrangements should be made in respect of the Animal Pathology Research Institute now situated at the College, if it appears necessary to change the existing arrangements."

The Committee consists of Sir C. J. Martin, C.M.G., D.Sc., F.R.S. (Chairman), Dr. O. Charnock Bradley, M.D., D.Sc., M.R.C.V.S., Sir Merrik Burrell, Bart., C.B.E., H. E. Dale, Esq., C.B., Sir W. M. Fletcher, K.C.B., Sc.D., F.R.S., J. R. Jackson, Esq., M.R.C.V.S., Sir E. Cooper Perry, M.D., F.R.C.P., Major-General H. T. Sawyer, C.B., D.S.O., and Lieut.-Col. Sir Archibald Weigall, K.C.M.G.

Mr. V. E. Wilkins, of the Ministry of Agriculture and Fisheries, will act as Secretary to the Committee, and all communications relating thereto should be addressed to him.

As, from the Forest Products Research Bulletin on Dry-Rot,* we learn that a fertile fruit-body of *Merulius lacrymans* shoots off spores violently, at a rate estimated to be equal to fifty million to the square yard in each minute, and that each appropriate pair of spores can produce a little fungus which will, in a few days, break up in turn into thousands of spores, the wonder is not that dry-rot is so common a pest, but that, relatively, it is so rare. It will be obvious, however, how necessary it is to take all reasonable precautions to avoid creating conditions favourable to the propagation and growth of the fungi. This Bulletin

* *Dry-Rot in Wood*: Forest Products Research Bulletin No. 1, Department of Scientific and Industrial Research. Published by H.M. Stationery Office, Adastral House, Kingsway, W.C.2. Price 1s. 6d. net.

carries investigation of the subject beyond the Ministry's Leaflet No. 113 (now withdrawn) and the brochure on dry-rot issued by the Royal Institute of British Architects, which before the initiation of timber research work by the Department of Scientific and Industrial Research, constituted the only available reference matter on the subject.

Part I of the Bulletin, dealing with the identification of the fungi causing dry-rot, and the investigation of the conditions favourable to their existence, has been written by Professor Percy Groom, D.Sc., F.R.S., of the Imperial College of Science and Technology. It is an admirable exposition, with very clear descriptions and illustrations of the different types of fungus and their effects on timbers. Part II, dealing with the detection of, and remedies for, dry-rot, contributed by H.M. Office of Works, with assistance, as regards the section on preservatives, from Professor Groom, is also distinctly helpful in prescribing tests and methods of sterilization, and in giving exact recipes for preservative solutions, with advice on the means of employing them. Part III, on precautions to be taken, when designing buildings, against conditions favouring outbreaks of dry-rot, prepared by the Building Research Station, shows less advance on previous publications. In particular, the method of supporting ground-floor joists on offsets, shown in Figs. 9 and 10, appears likely, in the presence of defects (not uncommon) to encourage decay, and omits the safeguarding method of the independent sleeper wall, advocated in the Ministry's former leaflet, referred to above.

THERE are 15 farm institutes in England and Wales, and all except one have demonstration farms attached. The

Courses at County Farm Institutes

The main purpose of the curricula is to provide instruction in the scientific principles underlying sound farming practice. The existence of the demonstration farms allows of such instruction to be closely related to practice, and this applies not only to general agriculture but also to gardening, dairying, and poultry-keeping instruction. The subjects dealt with and their order of importance vary somewhat at the different institutes, but a typical curriculum includes the following: Soil, manures, crops, live stock, implements, machinery, veterinary hygiene, surveying and mensuration, farm book-keeping, general agricultural science (biology and chemistry), horticulture, dairying, poultry-keeping and 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 given. There are also 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); Holland, Lincs. (at Kirton, near Boston); Northamptonshire (at Moulton, Northampton); Somerset (at Cannington, near Bridgwater); Staffordshire (at Rodbaston, Penkridge); East Sussex (at Plumpton); West Suffolk, the Chadacre Agricultural Institute (at Hartest, Bury St. Edmund's); Caernarvonshire (at Madryn Castle, Bodfean); Carmarthenshire (at Carmarthen); Denbighshire (at Ruthin); and Monmouthshire (at Usk, Newport).

A certain number of scholarships are awarded at these institutes by the various county councils to residents within their areas, and the Ministry itself awards scholarships for the sons and daughters of agricultural workers.

Brief particulars of the courses for the session 1928-29 are given in the Ministry's Form No. 732/T.E., which can be obtained on application from the Ministry, and more detailed information can be obtained from the principal of the institute concerned. Anyone desirous of attending one of the courses commencing in October should make application immediately to the principal, as accommodation at the institutes is limited.

* * * * *

THE Ministry has recently published a Report on the Occurrence of Insect Pests on Crops in England and Wales for the years 1925, 1926 and 1927,*

**Insect Pests
of Crops,
1925-27**

being the sixth report of the series dealing with the incidence of insect and other invertebrate pests which are harmful to farm, fruit and garden crops.

The report follows the lines of the preceding one, but contains valuable additional features in the shape of (1) a list of the species of chief commercial importance upon which attention is in future to be concentrated, and (2) a chart showing for

* Miscellaneous Publications, No. 62, obtainable from the Ministry's Office, 10 Whitehall Place, London, S.W. 1., price 2s. net (post free),

the principal pests the fluctuations in the degree of prevalence. Developments in methods of control, such as the use of calcium cyanide, sodium cyanide, and poisoned bait for Leather Jackets are dealt with, and it is recorded that tar oil winter washes of the better makes have satisfactorily come through numerous field trials. Winter spraying with such washes now forms a definite routine measure in commercial fruit growing. Under the section, "Foreign Introductions," instances are given indicating how readily an insect pest can be transferred from one country to another, and the extreme difficulty of guarding against such introductions.

Amongst the numerous facts chronicled for the three years under review may be mentioned: (1) a progressive decrease in the losses due to Frit Fly, (2) severe infestations in 1926 of Wheat Midges in certain counties, and (3) the spread of the Common Green Capsid to bush and top fruits, a comparatively new development which is regarded with some alarm.

The chart above referred to indicates the general nature of the fluctuations in the incidence of attack of a few typical pests during the 11 years, 1917-27, covered by this series of Reports. Many of the species chosen appear to vary very considerably in numbers from year to year, but a few, notably the Mangold Fly, show much less rapid fluctuations. Certain years stand out as "good" or "bad" for almost all the insects chosen. In 1924 and 1927, for example, practically every species was "below normal" in numbers, whereas in 1918 almost every species was "above normal." It is hoped that the collection of records of insect abundance, continued over a longer period, may help towards an understanding of the factors responsible for such marked differences and so, perhaps, lead eventually to the possibility of attempting forecasts of the degree of severity of attack to be expected in any particular year.

* * * * *

A CONFERENCE of Rural Community Councils was held recently at Queen's College, Oxford. These Councils have already been formed in 16 counties

**Conference of
Rural
Community
Councils**

in England and Wales. Their objective is to give social and educational service to rural people, and incidentally to help to develop our latent and struggling rural industries. The body responsible

for the general scheme of Rural Community Councils is the National Council of Social Service, of which the Speaker of the

House of Commons has followed his predecessor as President, and the late Speaker has become permanent Vice-President. The Carnegie Trustees have been far-seeing in giving the Councils a start, and the Development Commissioners, on behalf of the Government, have also assisted. It is expected that the Councils will, in time, through the known character of their good work, become wholly supported by funds locally obtained. At present, many of them get additional income from grants made by local authorities and associations, and from subscriptions and donations from private individuals.

The Minister of Agriculture and Fisheries attended the Conference and congratulated it upon the growing importance of its work. In the several Sessions, which were presided over by Professor Adams, Lord Hampden, Mr. Guy Ewing, Lord Shaftesbury and Sir Daniel Hall—names all of them meaning a good deal in the agricultural world and among the workers of this movement—various problems were dealt with.

An important session, from a general point of view, was that in which a paper was read by Mr. J. S. Scott Watson, Sibthorpe Professor of Rural Economy at Oxford University, on "Tendencies in Agriculture and their Social Reactions," a very wide subject, the discussion of which should prove most helpful to the members of the Conference in placing their various works in order of real importance. The main argument was that in agriculture to-day—when a farmer gets only half as much again for his produce, and has to pay twice as much for his labour, as before the war—some change of domestic economic policy on his part will have to be made before agriculture can be firmly placed on its feet again. Professor Watson incidentally drew attention to the greatly increased quantities of artificial manures now available, the chief of them at prices actually cheaper than they were before the war: a position which tends to put our land more on an equality with the foreign corn-growing lands which have lost their early virgin fertility. He agreed also that there was much scope for improvement in the better marketing of produce. The paper will be printed by the National Council of Social Service, and will be available shortly; its many careful statements and conclusions should be of great interest to all farming people.

In the discussion on this paper, Sir Horace Plunkett put in a strong plea for greater combination among groups of farmers, and Professor Adams submitted that what was needed was a greater output per man and per acre; he thought

that all the resources of the community should press forward to secure this one great object.

Other sessions carried discussion into the field of public health services, in which there was much scope for purely voluntary service; and the demand that exists for good music in country districts and the methods at hand for meeting it. The final session dealt with the kind of educational help that a countryman requires and how it can be supplied.

The members of the Conference showed such keenness and enthusiasm that one may reasonably hope that the movement will soon extend throughout the country, until each county, as suggested by the Minister, will have its own Rural Community Council, some counties, perhaps, even going so far as to set up Village Community Councils. Considering the whole matter, one may be permitted to regard with satisfaction the great usefulness, both present and to come, of an organization which on the one hand can assist in bringing life to a decaying rural industry, and on the other make pleasanter the path of life through the recreational, educational and other social facilities which the scheme supplies.

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THE UTILIZATION OF DRIED WHEY IN THE MILLING AND BAKING INDUSTRIES

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OWING to the concentration of cheese-making in factories, very large quantities of whey are produced annually at centres where no adequate provision has been made for its disposal. The difficulty is largely an economic one, for 93 per cent. of whey is water, which renders storage difficult and makes the cost of transport very heavy. Further, the supply is irregular, as it is produced at the factories in the spring and summer months only, the average factory season lasting about 165 days.

To overcome these difficulties, attempts have been made to dry whey. Dried whey keeps well and for an indefinite period; it possesses great nutritive value and has small bulk. Storage is therefore easy and transport relatively cheap. Drying on a small factory scale has been attempted in recent years in this country, and the cost of production has been greatly reduced through the introduction of an improved

roller drying plant.* This plant has been developed and patented by Captain J. Golding, of the National Institute for Research in Dairying, at Shinfield, Reading, and Mr. J. C. Stead, and is now being tested on a commercial scale. A private company, under the name of Deco, Ltd., has been started to develop the process on the lines suggested by the Ministry of Agriculture for dealing with discoveries made at agricultural research stations.

Chemical Composition of Whey.—Whey consists of approximately 93 per cent. water and 7 per cent. solid matter. Table I shows the average of many determinations given by R. A. Berry :—†

TABLE I.						Per cent.
Water	..	..	..	..	..	93·17
Total solids	..	..	..	..	..	6·83
Fat	..	..	..	..	..	0·21
Protein	..	..	..	..	..	0·87
Lactose (or milk sugar)	..	..	..	..	..	4·80
Ash	..	..	..	..	..	0·48
Undetermined solids ¹	..	..	..	..	..	0·47
						<u>100·00</u>

The ash² includes :—

Phosphoric acid					
(P ₂ O ₅)	..	0·119	per cent.	= 22·4	per cent. of the total ash
Lime (CaO)	..	0·066	"	= 12·5	" " "
Magnesia (MgO)	..	0·017	"	= 3·3	" " "
Potash (K ₂ O)	..	0·163	"	= 28·3	" " "

¹ Mainly organic acids and salts of organic acids.

² This ash represents 70 to 75 per cent. of the ash of the milk.

After drying, the approximate average composition of the dried product is :—

	Per cent.
Water	.. 7
Lactose	.. 70
Protein	.. 13
Milk salts (ash)	.. 10

Nutritive Value of Whey.—Numerous feeding trials have been carried out at various times with pigs, and it seems well established that 12 lb. (=1·165 gal.) of whey=1 lb. barley meal; also that 50 to 60 lb. (=5·8 to 6·8 gal.) whey=1 lb. live-weight increase in pigs. The actual value, however, depends to some extent on the food deficiencies of the rest of the diet. Thus Henry, as long ago as 1891, found that whey possesses a food value over and above that supplied by the protein, fat and carbohydrate (sugar) present. Henry stated that the whey increases the availability of a ration, *e.g.*, of barley or maize meal, by more than the solids it contains. This was confirmed by Berry in Scotland in 1922.

* Brit. Pat. No. 248,131 (1926).

† *Jour. Agric. Sci.*, 13 (1923), pp. 192-239.

This extra value is possibly connected with the mineral or ash content.

The importance of the mineral constituents of feeding stuffs has been recognized in recent years, and it is now realized that the nutritive value of a feeding stuff cannot be completely expressed in terms of protein content and starch equivalent; the amount and composition of the ash is also of importance. Moreover, modern stock breeding has developed largely in the direction of producing animals, *e.g.*, pigs or sheep, that mature quickly, or animals that produce large quantities of milk, or hens that lay large numbers of eggs. It is known to investigators that for the rapid production of tissue, whether live weight or milk or eggs, not only is an increased mineral requirement necessary, but the ratio of ash to calorific value (*i.e.*, to starch equivalent) of the food must also be increased. This is illustrated in Table II, which shows that animals whose young mature quickly secrete milk of higher ash content than those whose young develop slowly.

TABLE II.

	No. of days in which weight of new-born animal is doubled	Milk of species contains	
		Ash	Ash per 1,000 calories
	Days	Per cent.	Grms.
Man	180	0·25	3·7
Cow	47	0·72	10·5
Pig	14	1·03	10·9
Rabbit	6	2·50	15·0

It is known too that the so-called "deficiency diseases" are most likely to occur with quickly growing, *e.g.* young, animals.

To support this rapid growth, the practice has become common of feeding large quantities of concentrates to animals. Such concentrates consist largely of commercial by-products of cereals and tropical seeds and nuts, and these are markedly

TABLE III.—PROTEIN AND ASH CONTENT (GRAMMES) PER 1,000 CALORIES.

	Protein	Calcium	Phosphorus	Sodium	Potassium	Chlorine
Cultivated pasture ..	65·3	2·65	1·18	0·69	9·58	3·52
Cow's milk ..	51·6	1·73	1·52	0·58	2·66	1·39
Wheat ..	35·0	0·13	1·18	0·11	1·32	0·15

deficient in some of the essential mineral elements. This is illustrated by Table III, which shows the marked inferiority of wheat as regards ash content relatively to green pasture or cow's milk.

Further, modern stock-raising necessitates for practical purposes the adoption of fixed standard rations which can be fed with little or no change for months on end. Unless such rations are very carefully compounded as regards mineral content, there will be a cumulative effect due to mineral deficiency, or to lack of balance among the mineral constituents. It has, in fact, been stated that "in practice, the cottager's pig, with a varying diet consisting largely of scraps, differing in kind from day to day, seems less liable to disease and more successful in bearing and rearing large litters than pigs fed in large numbers under what might almost be termed factory conditions."*

Many experiments could be cited illustrative of the practical effects of the above considerations. The following account of a recent experiment in Northern Ireland† will, however, demonstrate the extreme practical importance of the problem. "On the farm in question a number of breeding sows were kept, and a large herd of from 200 to 300 fattening pigs. The breeding results were most unsatisfactory, the average number of pigs per litter at birth having been reduced to seven, and the average number at weaning to less than three. The fact that, with such a large herd of pigs, the supply of separated milk available was negligible pointed to the probability of a mineral deficiency in the diet. A mineral mixture containing several ingredients was incorporated in the diet of all the sows, their past breeding records were collected, and the effect of the mineral addition traced through two succeeding litters. So far the experiment has been completely successful. The number of the litters at the time of farrowing has been almost doubled and the number at weaning trebled."

Addition of Dried Whey to Millers' Offals.—It would appear from the above considerations that it is desirable to increase, generally, the mineral constituents of feeding stuffs, and, further, that in any mineral addition the constituents should be present in proper proportions. Dried whey is a particularly useful product in this connexion; it is cheap, it is almost completely digestible and, as a milk product, its mineral

* J. B. Orr, Pres. Address, Section M, British Association, 1925. Tables II and III are taken from this address.

† Fourth Ann. Rep., Min. of Agric. N. Ireland, 1924-25, p. 20.

constituents are well balanced. It is also particularly rich in lime, the mineral constituent in which wheat and wheat offals are deficient. Table IV, showing the composition of the ash of whey, of wheat and of wheat bran, illustrates this:—

TABLE IV.—ASH OF WHEY, WHEAT AND BRAN.

	Whey	Wheat	Bran
	Per cent.	Per cent.	Per cent.
Phosphoric acid (P_2O_5)	22.4	52.1	52.8
Lime (CaO)	12.5	3.1	2.5
Magnesia (MgO)	3.3	13.2	14.7
Potash (K_2O)	28.3	29.7	28.2

Table V shows a comparison of the relative feeding values of various millers' offals and dried whey.

From this table it is seen that by adding 10 per cent. dried whey to fine middlings the total ash content is increased by

TABLE V.

	Ash	Diges- tible protein	Diges- tible carbo- hydrate	Starch equiva- lent S.E.	Ratio of Ash to S.E., i.e., to calorific value
Fine middlings	2.4	13.2	52.0	72	.0333
Bran	5.4	10.6	32.0	45	.1200
Dried whey	10.0	13.0	70.0	81	.1247
Fine mids. + 10 per cent. dried whey	3.10	13.2	53.8	72.9	.0433
Fine mids. + 20 per cent. dried whey	3.92	13.2	55.6	73.8	.0533
Bran + 10 per cent. dried whey	5.86	10.84	41.2	48.6	.1206
Bran + 20 per cent. dried whey	6.32	11.08	44.4	52.2	.1212

0.76 per cent., the digestible carbohydrate by 1.8 per cent., and the starch equivalent by nearly 1 per cent. Moreover, the deficit of lime natural to the offals is partially made good and the ratio of ash content to total calorific value is considerably increased.

An additional improvement could be effected by adding 5 per cent. of ground limestone,* or better, of mineral phosphate,† to increase still further the lime content of the feed.

* Price about 28s. to 34s. per ton.

† Price at present £2 2s. 6d. per ton.

Utilization of Dried Whey in Breadmaking.—From time to time suggestions have been put forward that whey could be used profitably in breadmaking, by substituting whey for the water normally used. The ease and speed with which whey deteriorates, and the large bulk of water, make transport from factory to bakery quite impracticable. These objections do not apply to dried whey which, on account of its small bulk and excellent keeping qualities, can be transported and stored cheaply and easily. By replacing 5 or 10 per cent. of flour with a corresponding amount of dried whey, some hundreds of very excellent loaves have been made in the Research Association's bakehouse. Such loaves contain more ash and somewhat more protein than ordinary loaves, and will keep longer without staling; they are quite eatable and palatable a week or ten days after baking.

The acidity of dried whey is due largely to lactic acid, and varies somewhat, especially if made from whey that is not absolutely fresh; the buffer value, however, is high on account of the high phosphate content (approximately $2\frac{1}{4}$ per cent.). The buffer value of the resulting loaf is considerably increased by the addition of 10 per cent. dried whey to the flour. Further, the hydrogen in concentration is not seriously affected. This is illustrated by the following figures:—

	pH. of loaf	Buffer value
No. 2 N. Manitoba flour	5.66	0.69
No. 2 N. Manitoba+10 per cent. dried whey	5.60	0.54
Millennium flour	5.50	0.75
Millennium+10 per cent. dried whey ..	5.48	0.47

The texture or pile of the loaf is good and the grain is good, but rather more open than that of ordinary loaves. The flavour is distinct and characteristic, and very pleasant. The crust is good and somewhat biscuit-like in character, and the colour of the crumb is somewhat darker and yellower than that of ordinary loaves. The colouring matter in whey is supposed to be similar in character to the carotin of flour, but it has been found impossible to bleach it even with very heavy treatments with chlorine or agene.

The doughs are considerably more sticky than ordinary flour dough, but the stability does not appear to be seriously affected. The fermentation period is lengthened; or, rather, good loaves can be made over a longer fermentation period, which is a practical advantage. As the fermentation time is increased the characteristic whey colour and flavour and stickiness are diminished.

TABLE VI.

	Dry Gluten (by washing out)	
	First worker	Second worker
	Per cent.	Per cent.
Flour	10.47	11.34
Whey flour	9.35	9.54
Caramelized whey flour ..	9.36	9.82
Meal	13.63	14.07
Whey meal	11.41	11.73
Caramelized whey meal ..	11.81	12.03

This increase in fermentation time is not apparently connected with gas production, but rather with dough ripening. The stickiness observed may result in a binding action on the dough in consequence of which the dough may not break down so easily under the action of proteoclastic enzymes. On the other hand, the amount of gluten obtained from both flour and meal by washing out is decreased by whey and by caramelized whey, as shown in Table VI. The gas production figures are given in Table VII, which shows the gas production in each hour of the fermentation. With the wholemeal the maximum gas production, both without and with whey, occurred in the sixth hour, after which a sharp drop occurred. The dried whey did not affect gas production in the sixth hour, but diminished it during the first four hours; the caramelized whey diminished gas production throughout up to seven hours.

TABLE VII.—EFFECT OF WHEY ON GAS PRODUCTION (50 GRMS. FLOUR, 1.5 PER CENT.; YEAST, 1.5 PER CENT.; SALT, AT 80°F.).

	Flour	Whey flour	Cara-melized whey flour	Meal	Whey meal	Cara-melized whey meal
Time in hours	Ccs. gas per hr.	Ccs. gas per hr.	Ccs. gas per hr.	Ccs. gas per hr.	Ccs. gas per hr.	Ccs. gas per hr.
1	13	10	17	13	17	12
2	62	48	44	75	63	68
3	76	67	52	80	82	76
4	92	72	67	120	94	85
5	90	83	74	128	122	116
6	95	100	83	137	140	121
7	87	100	92	87	93	86
8	71	75	51	48	57	50
Total gas in 24 hours	1,036	860	780	1,060	1,112	1,088

With the flour, maximum gas production occurred during the fourth, fifth and sixth hours, after which there was a slight fall; the addition of whey decreased gas production at first but increased it slightly during the sixth and seventh hours. Caramelized whey reduced gas production throughout, except during the seventh hour when the effect was inappreciable. One curious feature was that both whey and caramelized whey produced a large decrease in total gas production during 24 hours with flour; no similar effect was observed with the wholemeal.

Many baking tests have also been carried out with admixtures of 5, 10 and 15 per cent. dried whey with various wholemeals. In all cases, the whey made the doughs sticky, but no ill-effect on stability was observed. With all meals, the added whey made a distinct improvement in colour, texture and flavour of the loaves.

If the powdered whey is heated for one hour at 120° C. (=248° F.) the sugar is partly caramelized and the colour becomes bright brown. Some moisture is lost and the product becomes quite hard and can be easily ground into a fine powder. This caramelized whey can also be used for bread-making, but the yellowish-brown, almost ginger colour, of the resulting loaf is probably too pronounced to meet with popular favour. In any case no advantage results from such caramelization that would offset the extra cost of production involved. With brown bread the case is probably different; the rich brown colour resulting from the use of caramelized whey might prove attractive to lovers of wholemeal bread.

Caramelized whey can be easily ground to pass through a No. 10 or 11 flour silk. Ordinary dried whey can be ground to an equal fineness, although somewhat less easily than the caramelized whey; there is, however, no real difficulty, and the finely powdered whey can be incorporated with the flour or wholemeal to produce "whey flour" or "whey meal." This is undoubtedly the best method of utilizing the whey for bread-making purposes. It yields a uniform product which can be stored satisfactorily, and the resulting loaves would be less affected by differences of treatment as between different bakers, for baking instructions could be issued with the flour.

Experiments are also being made in drying whey with admixtures of separated milk. The dried products of such mixtures are of better colour, are more friable and therefore more easily powdered than dried 100 per cent. whey. These dried mixtures of whey and separated milk appear to be even more valuable than dried whey alone for breadmaking

purposes. The doughs containing 10 per cent. of these mixtures are less sticky and therefore easier to handle. The loaves are closely similar in crumb to those made from flour without admixture. Crumb colour is very little affected and the crust is generally of richer colour and somewhat biscuit-like. The flavour (taste) is not unlike that of milk bread, being much less pronounced than that of loaves made from flour plus dried 100 per cent. whey. Loaves made with dried whey or dried whey-separated-milk mixtures are undoubtedly more nutritious than ordinary loaves, while, judging from some 100 or more reports received, they appear to be more palatable than much modern bread.

Many hundreds of baking tests have been carried out in the bakery of the Research Association of British Flour Millers on flours and wholemeals mixed with 5 to 15 per cent. of the dried whey obtained by the Deco process, and many tests have also been carried out in the making of small goods such as rolls, scones and biscuits. This work has been strictly collaborative work, carried out in close conjunction with Captain Golding, who has kindly supplied the writer with the necessary samples of dried whey. It is an attempt to utilize in one industry—flour milling and baking—a material which, in a very literal sense, is a troublesome waste product of another industry—dairying. The result of this work has been to show quite definitely that dried whey should be a very valuable material to the miller and baker if it can be produced sufficiently cheaply. There ought to be no difficulty in the use of whey in small goods; similar material—dried skim milk—is widely used in the American baking industry, and the baking industry of this country consumes considerable quantities of dried separated milk which is imported from New Zealand and elsewhere. Such material is purchased at prices that work out at 6d. or 8d. per lb. There should be little difficulty in making dried whey or dried whey-separated-milk mixtures by the Deco process at a cost that would enable the product to be put upon the market at a price materially below that of the imported article. This should stimulate consumption, especially in the making of fancy Vienna rolls and other small goods which will probably always be the main outlet for this material. At the same time, as indicated above, a still cheaper, and perhaps cruder, form of dried whey should prove of no little interest and importance to millers and farmers on account of its value as a feeding stuff for stock when mixed with millers' offals.

RESEARCH INTO FOOT-AND-MOUTH DISEASE

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The Committee of medical and veterinary pathologists which was appointed in 1924 to investigate foot-and-mouth disease has now presented a Third Progress Report* ; and it is, therefore, proposed to summarize the work of the Committee from the commencement. As most readers are aware, foot-and-mouth disease is one of the most infectious diseases known, and is caused by an organism so minute that it cannot be seen by the aid of the most powerful microscope, and passes through filters which hold back ordinary bacteria. For these reasons it is known as an ultra-visible or filter-passing virus. In fact, the term "virus" is now frequently applied to those disease-causing organisms which possess these characteristics and which are assuming great economic importance. Influenza in man, distemper in dogs, and mosaic disease in plants are other examples of virus diseases.

Symptoms of the Disease.—The clinical symptoms of foot-and-mouth disease, which principally affects cattle, sheep, goats and pigs, are a rise in the temperature of the animal and the appearance of vesicles or blisters on the mouth and feet—the latter symptom giving rise to the name of the disease. It has long been known that the virus is present in the blisters, but since it cannot be seen or isolated, its presence can only be detected when characteristic symptoms appear in infected animals. Experiments in connexion with the investigation of the disease consequently involve testing at some stage with animals which are easily infected and in which easily recognizable symptoms appear. Up to 1920, investigators had to employ farm animals for experimental purposes, and this made research work very difficult and costly, but in that year it was discovered that the disease could be regularly induced in guinea-pigs by inoculation, and that typical vesicles appeared on the mouth and feet. Since then big strides have been made in the study of the disease by means of these laboratory animals.

Attempts to Propagate the Virus.—The first object of the Committee in 1924 was to verify the results obtained by

* Published by H.M. Stationery Office, 1928. Price 5s.

previous workers, and, after carefully sifting the reliable from the unreliable observations, to lay a sound foundation on which further work could be based. At the outset, much time was devoted to attempts to cultivate the virus outside the bodies of animals, but the only result was to show that the claims of others to have accomplished this were unfounded. The advantage to further research, were a method discovered for propagating the virus in artificial media, would be considerable and has not been lost sight of, but, recently, less time has been spent in attempting to do this than formerly. A few experiments have been made in which the conditions present inside the cells of the body have been imitated as closely as possible, but no evidence of multiplication of the virus has been obtained. Similar experiments abroad have been no more fortunate. In this line of research, the work of those occupied with other virus diseases is very helpful, and further attempts are being made to propagate the virus of foot-and-mouth disease in cultures of the cells of different tissues of susceptible animals, but as yet it is too early to indicate the results.

Disappearance of Virus in the Bodies of Living Animals.—

It has often been suggested that cattle may carry infection in or around the hoof for some months after an attack of the disease, and may distribute it as the hoofs wear or are pared away, but there is no evidence that such animals are at all numerous. Of 63 cattle examined by Professor Waldmann in Germany, in 1926, no infective hoof was discovered one to two months after the disease, but an American Commission discovered in the same year one animal, out of 23 examined, still carrying the virus 34 days after infection. In Germany, the carcasses of any cattle killed during convalescence from foot-and-mouth disease are regarded as free from infection and are distributed for human food. Experiments on the infectivity of cattle at different stages of the disease have recently been commenced by the Committee's workers, but have not progressed very far owing to the Experimental Station at Pirbright having been out of commission. In the experiments on small animals, the virus has been but seldom recovered even from the feet and tongues of guinea-pigs 6 or 7 days after infection, but a few exceptions have been observed. It is clear that in the living animal a process of natural disinfection takes place, beginning immediately after the blisters on the feet and tongue have reached their maximum and proceeding so quickly that infective

material cannot usually be found about the animal after a week. Occasionally, however, this process fails to be completed and an animal may harbour the virus for a considerably longer time.

Conditions under which the Virus remains alive for a Considerable Time.—(1) *Survival of the Virus in Carcasses.*—The survival of virus in the carcasses of dead animals has been investigated, and it has been found that tissues from the bodies of guinea-pigs killed when the blood was infective may remain infective for some time in cold store. In two carcasses of guinea-pigs which had not been bled the blood was infective after 36 days and in one of these the bone-marrow too was infective up to 96 days. In a carcass of a guinea-pig which had been bled, the bone-marrow was infective for at least 36 days, while skin containing blisters was infective after 102 days. Experiments were also undertaken to determine how long the virus may be recovered from the carcasses of cattle and pigs which had been slaughtered in the early stages of foot-and-mouth disease, dressed for market and either chilled or frozen, as well as in the case of carcasses of pigs when dry or wet salted. The virus was not recovered from the flesh after *rigor mortis* but the blood was infective for from 30 to 40 days and the bone-marrow up to 76 days; whether the carcasses were frozen or merely chilled. After dry or wet salting, the virus was recovered from the bone-marrow after 42 days. It should be emphasized that carcasses have been shown to be potentially infective only when the animal was killed during the early acute stage of the disease, for in the living body the virus is destroyed so rapidly as convalescence proceeds that it usually disappears from the internal organs within a few days.

(2) *Survival of Virus apart from the Bodies of Infected Animals.*—A low temperature and dry atmosphere are the most favourable conditions for the survival of the virus outside the living body. Light, and particularly ultra-violet light, tends to destroy it. When kept chemically dry, the virus has survived for two years in the ordinary temperature of the laboratory, and there is no reason to suppose that the limit has been reached. Under natural atmospheric conditions, virus has not, so far, been found to live longer than five months. The nature of the material upon which the virus is dried exerts a potent and as yet unexplained influence upon its survival. Whereas it dies rapidly upon clean glass, cotton wool and filter paper, it has been found to live much longer

when dried upon hay or bran. Some diluted vesicle fluid dried on bran was infective after 20 weeks, and cow hair was one of the materials on which it survived for a month. It must not be supposed that these recorded times represent the maximum duration of infectivity which may occur naturally. If many more observations had been made it is possible that there would have been instances of much longer survival. The real significance of these observations is that the virus of foot-and-mouth disease may persist in nature upon inanimate objects much longer than has hitherto been thought possible, and that the materials on which it survives longest happen to be those which may actually be concerned in the spread of the disease. The virus of foot-and-mouth disease is not necessarily rapidly destroyed by the putrefaction of the material in which it is suspended, for material containing virus has been allowed to putrefy and the virus was still infective after three weeks.

All these experimental observations on the survival of the virus inside and outside the animal body help to explain the several ways in which infection may lie dormant for months and then give rise to further outbreaks of disease. The persistence of the virus in carcasses, or in dried discharges upon fodder, hair, etc., appears to be of greater significance than its carriage in the bodies of recovered animals.

Disinfection of Material contaminated by the Virus of Foot-and-Mouth Disease.—The best methods of disinfecting materials and premises contaminated by the virus of foot-and-mouth disease have been studied in considerable detail, on account of their practical importance. Hitherto, disinfectants commonly employed to destroy bacteria had been used, but it was not known whether they were equally effective against the virus of foot-and-mouth disease. To ascertain this, the minimum concentrations in which various chemical substances would destroy the virus in a reasonable time have been determined. Many different concentrations of each substance had to be tried, and the only way to determine whether disinfection had been achieved was by inoculating guinea-pigs and noting whether or not infection occurred.

Experiments were first made with the virus as it occurs in diluted fluid from foot-and-mouth disease blisters, *i.e.*, accompanied by a minimum amount of organic matter, but as a disinfectant is generally required to act in the presence of dirt and other organic material, a second series of determina-

tions had to be made under conditions resembling as nearly as possible those likely to be encountered in practice. A good deal of valuable information has been obtained, but the observations are too technical to discuss here in detail. Suffice it to say that the effectiveness and utility of a disinfectant can only be determined by taking into consideration the conditions under which it is to be used. For example, a solution of formalin will disinfect both contaminated hay and hides. In the first case it does not harm the feeding value of the hay, but in the second case it damages the hides and, consequently, other means must be found for disinfecting hides. The cost of an effective disinfectant must also be borne in mind, otherwise, in the case of material of little value, disinfection may prove more costly than destruction.

Where feasible, the simplest means of disinfecting materials contaminated by foot-and-mouth disease virus is heat, for the virus is rapidly destroyed by water at 60° C., a temperature which is a little hotter than the hand can bear without pain.

Types of Virus.—Two French investigators (Vallée and Carré) discovered that there were two types of foot-and-mouth disease, and that animals recently recovered from one type could still be infected with the other. The symptoms of both types of the disease are identical. Vallée called these types "A" and "O" (A and O being the initial letters of the localities where they occurred). With one exception all the types of virus of those examined responsible for outbreaks in this country have proved to be identical with Vallée's type "O." The single exception has been identified with Vallée's type "A." A further complication has now arisen through the discovery by two German workers (Waldmann and Trautwein) that there are three distinct types of virus. This discovery has now been confirmed by the workers of the Committee. The existence of more than one type of foot-and-mouth disease virus complicates preventive measures, since a vaccine prepared for one type would be ineffective against either of the others. It would also be necessary first of all to ascertain which type was responsible for a particular outbreak if preventive measures were to have a reasonable chance of succeeding. So far, no simple and speedy method of determining the type of virus in farm animals has been discovered.

Experiments on the Susceptibility of Animals not readily Susceptible to the Disease.—As it has been impossible to discover the origin of infection in many outbreaks of foot-

and-mouth disease, the Committee decided to examine the possibility of some animal other than farm stock harbouring and spreading the disease. Numerous experiments have been carried out with tame and wild rats, rabbits, dogs, cats, pigeons and birds of various species, but all these animals, except rabbits, have been found to possess natural resistance to foot-and-mouth disease, and, even when they could be infected by inoculation, the disease did not spread by natural means. The experiments lend no support to the view that these animals play any part in spreading the disease. There was, however, a possibility that the virus had to adapt itself to rodents before it could produce a natural spread of the disease in those animals, and that such adaptation might be only slowly or occasionally acquired. Experiments were, therefore, made in which the virus was passed successively through a number of rats and of rabbits, but no evidence of increasing virulence was obtained. On the contrary, the virus passed through white rats eventually died out. No evidence was obtained that the disease became more infectious, and wild rabbits infected with virus which had been propagated in tame rabbits for some time did not infect their companions although kept in close contact with them.

Immunity.—(a) *In Farm Animals.*—A good deal of attention has been devoted to this question. It is now known that farm animals which have had an attack of foot-and-mouth disease are resistant to inoculations of the same type of virus for from six months to one year. The observations of previous workers indicating that immunity was short-lived can now be explained by the recent discovery that there are at least three types of foot-and-mouth disease which, although clinically indistinguishable, do not protect against one another. The discovery of the fundamental difference between a recovered animal and one that has not suffered from the disease would be of great scientific importance, for if the factors responsible for the immunity of the recovered animal were understood and could be imitated, a valuable method for controlling the spread of foot-and-mouth disease would be ensured. Owing to our geographical position, slaughtering and compensation are undoubtedly the most effective and economical means of dealing with isolated outbreaks at present, but should the disease get out of control this procedure would be impracticable. In such a case some less drastic, if less efficient, method would have to be adopted. For this and other reasons the nature of acquired immunity to foot-and-mouth disease and how best to produce it,

have been, and are still being, investigated by the Committee's workers.

Three means of inducing immunity in farm animals have hitherto been used abroad. The first aims at producing a mild attack of the disease by inoculation with a strain of living virus of low virulence. This procedure is hardly to be recommended even in a country where the disease is endemic, as the severity of the attack following inoculation is not sufficiently under control. The second method, which is extensively used on the Continent, is to inject a considerable quantity of blood serum taken from a convalescent animal or from an animal which has been made specially immune by artificial means. As long as sufficient of this borrowed serum circulates, the animal resists infection. The protection lasts from 10 to 14 days only, but is a safeguard against the risk of infection during transport and visits to markets and shows, and can also be used for the temporary immunization of cattle in an area adjoining an outbreak. The third method is a combination of the two preceding ones. Doses of serum and living virus are injected almost simultaneously, the aim being to produce an infection which, owing to the presence of the serum, shall be so rapidly suppressed that the disturbance to health is slight, but, nevertheless, sufficient to arouse a reaction adequate to protect the animal from attack when exposed to natural infection. The relative doses of serum and virus must be skilfully adjusted, but as individual animals differ in their susceptibility to the virus, it is difficult to prevent the occurrence of severe illness in a number of cases. This method is now applied in Germany to animals which have been in contact with diseased ones, and as it entails an extension of the number of infective animals, it is customary to protect temporarily those in the surrounding neighbourhood by the second method, *i.e.*, by an injection of immune serum.

All these methods have their drawbacks. The ideal method would be one that would give a lasting immunity without an actual attack of the disease and the consequent danger of the spread of infection. This has been attained in the case of small-pox, rabies and anthrax by inoculation with the corresponding microbe in an attenuated or weakened state, and for enteric fever by employing a killed culture of the typhoid bacillus. The Committee's workers have so far sought in vain to produce an attenuated virus of foot-and-mouth disease, and, until 1925, all attempts to obtain protection by inoculating with the killed virus had failed. Since then, it has been established that a

useful method of protection against rabies and canine distemper can be produced by injections of the killed viruses of these diseases, and, in 1926, a French scientist (Vallée) showed that animals could be immunized in a similar way against foot-and-mouth disease. He inoculated cattle with virus which had been treated with formalin and found that they resisted an inoculation of infective blood, and, further, that when these animals were placed in contact with others suffering from the disease they did not contract it. In the same year two of the Committee's workers (Drs. Bedson and Maitland) independently discovered that guinea-pigs could be protected by the injection of virus which had been rendered inactive by formalin. By this means these animals could be immunized to the extent that when inoculated with massive doses of virus the disease did not spread throughout the body.

Various methods of killing the virus have been tried, but for the manufacture of a "vaccine" a better method than treatment with dilute formalin has not yet been discovered. By this method of preparation, the amount of killed virus required to obtain the best results is approximately equivalent to one million times the minimum quantity of virus that would infect an animal by intradermal inoculation supposing the virus had not been treated with formalin.

(b) *In Guinea-pigs.*—The onset of immunity in guinea-pigs, after a single injection of formalized vaccine, is so rapid that it can be recognized in 48 hours. It is fully established in four days, and is effective for two months. "Complete" immunity is not, however, obtained by vaccination, as subsequent inoculation on the soles of the feet is followed by the development of blisters at the site of inoculation. These, however, soon heal, and the spread of the disease throughout the body and the development of secondary blisters on the tongue and feet do not occur. On the other hand, however, a guinea-pig which has recently recovered from an inoculation of the living virus exhibits complete immunity. Its blood contains some property which prevents both local and general symptoms occurring after a second inoculation on the feet. The difference between a recovered and a vaccinated animal is of considerable scientific interest and may be due to a number of causes, but the subject is too technical to discuss here. It is, however, still under investigation.

The results obtained on the immunization of guinea-pigs have not been further tested on cattle, partly because the Experimental Station at Pirbright has been out of com-

mission and partly because it seemed desirable to investigate the matter further upon laboratory animals. There appears to be little doubt, however, that cattle too can be protected against inoculation by foot-and-mouth disease by a sufficient dose of virus killed by formalin. An immunity which will endure is not, however, to be expected, for, even after an inoculation with the living virus, some animals have been re-infected within six months by the same type of virus. In this respect foot-and-mouth disease resembles influenza in man.

Treatment of Foot-and-Mouth Disease.—A number of remedies for foot-and-mouth disease have been advocated from time to time, but the evidence on their behalf has not been convincing. Recent experiments on calves in India appeared to be more hopeful. Animals were inoculated with the virus of foot-and-mouth disease, and immediately a rise of temperature was detected a large dose of a solution of iodine was given intravenously. It was found that this treatment prevented the occurrence of secondary blisters on the tongue and feet and that the animals speedily recovered. It was hoped that this treatment might not only be a means of shortening the illness in the case of natural outbreaks of foot-and-mouth disease, but also that herds could be protected against the disease by infecting and immediately thereafter curing the animals. The Committee was unable to repeat these observations at once upon English cattle, but in the meantime undertook experiments on guinea-pigs. In this case, however, the subsequent development of the disease was not influenced by injecting a solution of iodine. Recently, it was possible to try the effect of iodine upon calves, but the results were not the same as those obtained with Indian cattle.

The injection of immune serum into farm animals has proved useful abroad in controlling the spread of foot-and-mouth disease where slaughter is impracticable, and the methods of the preparation and standardization of such serum, as well as the results of its administration, have been the subject of researches by the Committee. The work done on these lines has afforded experience which will be of great value should the use of a protective serum for cattle become desirable at any time in this country.

General.—A great deal of investigational work has been carried out from time to time which is highly important scientifically, but rather too technical for discussion here. For instance, an exhaustive histological study of the origin and

development of the secondary vesicles in guinea-pigs and rabbits has been made, and a number of microphotographs taken which show the lesions throughout the various stages of their development and healing. A technique has also been worked out in guinea-pigs, though not yet in cattle, for determining the type of foot-and-mouth disease virus in the laboratory without the direct aid of animals, while the multiplication and distribution of the virus in the bodies of laboratory animals has also been studied. For further and more detailed information regarding these and other investigations of the Committee the reader should consult the three Progress Reports which have been issued by the Committee and published by H.M. Stationery Office.

In conclusion, the following passage from the Third Progress Report may be quoted :—

“The Committee realizes full well that the progress of discovery must inevitably be slow in a ‘frontal attack’ upon a disease, the causal agent of which cannot be seen, cannot be propagated in artificial media, and can be recognized only by its effects upon susceptible animals, and that the making of experiments, which shall be even roughly quantitative is, in these circumstances, so difficult and tedious as to dismay all but those possessed of a stout heart and much patience. Notwithstanding these difficulties, the work undertaken on its behalf has resulted in the acquisition of valuable knowledge concerning the pathology, epizootiology and immunology of foot-and-mouth disease. Some of this knowledge is susceptible of immediate useful application, and all of it is a sound contribution towards the complete understanding and ultimate control of the disease.”

DEVELOPMENT OF AGRICULTURAL EDUCATION IN NORWAY

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FROM the oldest times, Norway has been a prominent farming country, although more than 71 per cent. of the 324,000 sq. kilometres which comprise the total area of the country are quite unproductive. Only 11,000 sq. kilometres, *i.e.*, about 3·7 per cent. of the area, are suitable for agriculture, pasture and horticulture; distant field pastures comprise about the same, or 3·9 per cent. (12,500 sq. kilometres), and woods cover more than 21 per cent. (70,000 sq. kilometres).

We see from the table, given below, that, at the commencement of the nineteenth century, four-fifths of the population of Norway were living on the products of the soil; and that, towards the close of the nineteenth century, the majority were still living on farming and woodcraft. At the beginning of the twentieth century, however, there had been a considerable change in favour of industry and mining. Even so, agriculture and woodcraft still play a large part in the country's activities.

	Livelihood of the Population			
	1801	1878	1891	1916
	Per cent.	Per cent.	Per cent.	Per cent.
Farming and woodcraft ..	80·0	58·0	49·0	42·0
Industry and mining ..	6·0	19·0	23·0	47·0
Commerce and land-traffic	2·0	7·0	9·0	14·0
Navigation	11·0	6·5	5·9	11·0
Fishing		4·5	8·6	
Immaterial trade ..		4·0	4·4	
	1·0		5·0	

The average European population is about 38 inhabitants per sq. kilometre, but, of the two and a half million inhabitants of Norway, there are only eight on an average per sq. kilometre, which is less than any other country in Europe. If we take the cultivated country only, the density of the population is 227 per sq. kilometre, which is about the same as in Belgium.

The Norwegian farms are small and, from the European point of view, can hardly be considered as farms. Out of the 250,000 registered properties, more than 33,000 are without any cultivated land, consisting of pasturage and woodland only. About 100,000 properties have from 5 to 10 dekar of cultivated soil, 120,000 have from 10 to 200 dekar, while

only 35 Norwegian properties can be called small estates having more than 1,000 dekar of cultivated land. The increasing parcelling out of the properties has made Norway the most pronounced small farming country in the world.

In the past, the Norwegian population was practically self-supporting as regards bread-corn. This was chiefly barley and oats, and these still form 90 per cent. of the grain cut in Norway; after these come rye, 5 per cent.; wheat, 2 per cent.; and peas, 2 per cent.

The cultivation of potatoes and root-crops, also, has grown considerably during the last century, in addition to the corn-crops mentioned above.

The area under the plough in Norway which is covered with grain and peas is 186,400 dekar, with potatoes 460,000 dekar, and with turnips and other root-crops 76,000 dekar.

Although the growth of both grain and potatoes has increased, the country is far less self-supporting as regards bread-corn than in the past, and imports of grain have grown from 2,600 tons in 1876 to 6,600 tons in 1900, while during the war the want of grain was very considerable.

In spite of the rather primitive implements, especially in the past, the output of the small but intensively manured plots has always been fairly large; and Norway still grows more grain for the same area than most of the better situated countries of Europe, the average output being, for barley 10 times, for oats 9 times, for wheat 8½ times, and for rye 11½ times the seed.

The necessity of agricultural instruction and education was met in our country about 100 years ago, when, in 1825, the first agricultural school was founded by Jacob Sverdrup in southern Norway, in the county of Jarlsberg. The school course was for two years, but the school itself only existed for 12 years, during which time it had a subsidy from the State of 600 species (*i.e.*, about £130 per annum). In 1836, the subsidy was withdrawn and the school abolished. It was carried on at a neighbouring farm, at the personal cost of Sverdrup's son, for another 12 years, after which it was taken over by the county.

In 1842, the Storting again gave subsidies to agricultural schools, which were now established in most of the counties of the kingdom. They were managed partly as government and partly as county schools. They were essentially practical schools, which gave the pupils sound tuition in all sorts of work occurring on a well-managed farm. The theoretical

education was mostly limited to a slight knowledge of agriculture and even less of domestic animals, and, occasionally, a very superficial acquaintance with agricultural chemistry, besides exercises in reading, writing and counting. These schools were, without doubt, looked upon with sympathy and interest by the more prominent farmers in the various districts, who sent their sons there, but their influence was too small to lead to any real progress in the average farming of the country. The number of pupils (8-10 or 14 from each two-year course) was small and could produce very little increase in the want of the general farmer for more knowledge.

In the year 1860 the public subsidy was again withdrawn from a large number of the agricultural schools in several counties. Nevertheless, the seed sown by the schools had grown strongly, and in the 'eighties there came a flourishing interest in agricultural education. Soon there was a school in every county, and in 1893 the State resolved to pay three-fourths of the amount necessary for instruction while the county provided the other one-fourth together with a farm with buildings convenient for the purpose.

The Royal Agricultural University of Norway.—The earlier schools had suffered from the lack of properly educated teachers, but this was altered later by the establishment of the "Higher Agricultural College" in 1859 at Aas, 33 km. south of Christiania. Working on a somewhat varying plan, this institution has been the centre for agricultural science and study in Norway. In 1897 it was thoroughly reorganized as *The Royal Agricultural University of Norway*. There are five departments in the college, viz.:—

- (1) Agriculture.
- (2) Forestry.
- (3) Horticulture.
- (4) Dairy farming.
- (5) Surveying.

The course is for $2\frac{1}{2}$ years, and is arranged partly for private persons desiring practice and partly for the education of public functionaries. During the first year, studies are mostly common for all departments and are chiefly to do with the natural sciences, viz.: physics, chemistry, botany, geology, zoology with anatomy (for agricultural students), besides mathematics and national economy. Having undergone a test in these subjects, the students, during the next $1\frac{1}{2}$ years, devote themselves to the applied sciences concerning their own special departments.

The teaching staff of the college consists of 32 professors with 16 assistants and several extra lecturers and other functionaries. The number of students has varied somewhat during the life of the college. For the first 25 years the request for admittance was great, as many as 70 to 80 students a year being entered, but during later years bad times have made themselves felt by the decreasing number of students, and the admittance is now only about 25 to 30 to all groups.

For scientific instruction the college has a series of well equipped laboratories and museums. The college is connected to a farm which is managed for the State, and it is used for demonstration and experimental purposes. The live stock comprises 140 milking cows and 30 horses, while the farm consists of 136 ha. of cultivated land and 111 ha. of woodland.

The students have no part in the manual labour of the farm, but, before they can gain admission to the college, they must have worked at least two years as practical agriculturists, foresters, gardeners or dairy farmers, so that they may be already fully acquainted with the manual side of their profession. After this practical side of their training, they are expected to take a theoretical course in any of the local schools which deal with their main subjects.

In addition to the above, there is a supplementary course for the written treatment of the Norwegian language, mathematics and one or two foreign languages, the standard being somewhat similar to that demanded from the students at the University of Oslo.

Since its foundation in 1859, the college has not only been the central institution in the country for higher education in agriculture, but also a centre for scientific research and experiment. Although this was only on a small scale at first, yet, at the same time, Anton Rosing, the first teacher of agricultural chemistry, laid the foundation of this subject in Norway, in spite of the fact that on his return from England, after travelling in that country, Denmark, Germany and France, he lay on a sick-bed for seven years until he died in 1867. Considering the period in which he lived, he received a very fine education indeed and one that was far ahead of his time.

When the institution was reorganized in 1897, it was established by law of the Storting that the purpose of the Agricultural College at Aas was:—

That in addition to giving instruction on a scientific basis in agriculture, forestry, horticulture, dairy farming and surveying,

the college was also to advance scientific research in all directions covered by the course of training carried on at the college.

During the 30 years since this law was passed, scientific research and experimental activity have flourished greatly considering the means of the country. The yearly grants given to the college by the State have risen from about 150,000 kroner (£8,000) to 1,400,000 kroner (£77,300). During the last few years, the Government has had to cut down the grants to some extent owing to the financial situation, but this loss has been partly compensated for by the private and public funds for the advancement of scientific research in the different trades of the country.

Experimental Stations.—Besides the experimental activity displayed by the college at Aas, there have grown up in Norway a large number of experimental stations specializing in plant culture as affected by the varied natural circumstances of our widely extended country. In the three largest towns of the country, Oslo, Trondhjem and Bergen, the State has established chemical stations for the analytical control of commercial fertilizers and feeding stuffs, and these institutions have occasionally done experimental work of great interest. A few subjects of investigation among many may be mentioned here.

Of the different experimental departments, which, to a large degree, aim at solving agricultural problems in Norway, the plant-culture and plant-breeding experiments are the oldest. These experimental stations were founded in 1889 by the Royal Society for the Welfare of Norway under the late Professor Bastian Larsen (died, 1919). Later, in 1898, the direction for these experiments was transferred to the college at Aas, with local stations all over Norway.

In the *Journal of Agricultural Research* of 1920, I had the pleasure of giving a short report on the method invented by my late friend, Bastian Larsen, for making field experiments by plots and getting comparable results from the different plots in spite of the lack of comparability and homogeneity that always exists between field plots in the natural state. This method should always be used in field experiments, not only for comparing different sorts of plants but also for experiments with different fertilizers. Comparing clover of Norwegian and foreign kinds, Larsen got results of which the value to his country was counted in millions of kroner. His successors, Professor W. Christie (died 1927) and Professor K. Vik continued the work of breeding new sorts of grasses,

fodder plants, potatoes and grain plants; and, no doubt, this part of the Norwegian agricultural experiments will ultimately furnish the different parts of Norway with strains of greater economical value than those of former days. Through systematic improvement of old Norwegian wheat, Mr. Vik has recently succeeded in getting a wheat capable of increasing the output in Norway by 17 to 20 kg. per 10 ars.

With special interest in vegetables and horticulture, Professor O. Moen has bred a variety of cabbage of greater resistance, greater output and shorter growing time than the former sorts grown in Norway. The Moen Cabbage is now cultivated in all the northern counties.

Some years ago, a number of experiments in different parts of Norway for comparing the different methods for utilizing the forest, especially with regard to the method of selection by cutting the trees singly, mostly of the same dimensions, or by cutting down a definite area with trees of about the same age. The quantitative output of timber won by the two systems of cutting, as well as the quality, is compared. These experiments will continue for a long period, as also will the experiments of Professor A. Barth with regard to the quality of seeds and the energy of growth of seeds from different sorts of white firs, the influence of the age of the mother-tree (of white fir) on the quality of seed and offspring, the influence of the time of collection of seeds on the said results, hereditary researches with different sorts of white firs, experiments with culture of foreign trees in Norway, and experiments for bringing up the old forests of oak in the southern parts of Norway. Quite independent of the college of Aas, but situated at the same place, a special *Experiment Station for Forestry Researches* is working with different questions of interest.

In the department for treating domestic animals there has been a rather intensive development of scientific research since the early years of this century. In the 'nineties, I had the pleasure of trying the effect of the feeding of milk cows with whale meal and herring meal, without finding any effect on the percentage of fat or the quality of the produced milk or the butter, if the said animal feeding stuffs were not used in greater quantities than 1.5 kg. per animal daily in a mixed ration.

Since about 1902-03, the feeding experiments of the agricultural college at Aas have become a regular feature under the leadership of Professor H. Isaachsen.

The laws of heredity are also studied in Norway by Mr. Wriedt and Professor Lous Mohr at Oslo. These research workers are collaborating with Professor Crew at Edinburgh on the heredity of the *lethal achondroplasia* met with in the British Dexter cattle, which has been observed also in some cattle in Telemark in Norway.

Pot experiments, as well as fertilizer experiments on field plots, were commenced by Mr. J. Lende-Njaa, who, however, died in October last year. He had begun an extensive work on the effect of liming and the want of lime in different soils of Norway, and believed that, with the right degree of lime in the soil, it would be possible to increase the crops of the arable soil in Norway by a value approximating thirty millions of kroner.

Mr. R. Mork, lecturer on dairy economy, has for some years been studying systematically the importance of the daily technical control of production and the different methods which may be employed for the purpose. Through this control, in a number of practical dairies, he has been able to show that a change of management would give not only an increase in the output, but even an improvement of the products.

For several years a lot of questions of great interest to dairying have been the object of investigation independently of the Agricultural College through special State experiments under the leadership of Mr. L. Funder.

Although not coming into the category of experimental work, mention should be made of the very interesting investigations of Professor S. Hasund concerning the history of the older agriculture of Norway, also of the studies of Norwegian agricultural laws by Dr. Kristian Ostberg, and of those on Rural Economy by Dr. Borgedal.

Finally, I should like to mention that, since 1909, a special institute for trying all kinds of machinery for agricultural purposes has been connected with the college at Aas under Professor M. Langballe.

As the results of scientific agricultural work and of education in agriculture can only be regarded as effective in so far as they are able to raise the economic prosperity of the people, we are glad to be able to state that agriculturists and foresters in Norway have, on the whole, utilized the instruction and scientific results within their reach, so that Norwegian farming and woodcraft are, generally speaking, on a level with those of the most progressive nations of Europe.

CHOICE OF SEED CORN

WITH PARTICULAR REFERENCE TO OATS IN HILLY DISTRICTS

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Changed Conditions.—To the farmer of the present day, one of the chief points to merit attention is the choice of seed corn. Up to about 30 years ago, the number of varieties of wheat, barley and oats alike were so few, and the organization of distribution so limited, that the farmer had small scope for selection. Each occupier tried to save his own seed from year to year, even for several generations. Occasionally, however, he was forced to procure new seed owing to his own crop being heated in the stack or partially ruined as the result of adverse harvesting weather. The so-called "new seed," nevertheless, would usually be obtained from his more fortunate neighbour and would represent the same strain as his own, the common practice being to exchange "feed corn" for "seed corn."

With better transport facilities and the advent of more up-to-date machinery for thrashing and winnowing, farmers began to go further afield for their new seed. The result was that, particularly in the case of those farming in late districts and on poor hill holdings, better crops were obtained from "new seed" from another district than from home-grown seed. These better crops stimulated an interest in seed production and, eventually, in the breeding and selecting of new and improved varieties suitable for particular conditions; consequently, during recent years there has been a vast increase in the number of varieties from which the farmer can choose. Indeed, so thorough have some seed firms been in the marketing of new varieties, that they have but added to the difficulties of selection, as many of the newer sorts are not necessarily an improvement on the older ones for all conditions.

Choice of Variety.—Maximum crop production is not to be achieved simply by a system of good husbandry tending to enhance soil fertility, but varieties must be selected which suit the conditions, since the farmer can no more alter the aspect, elevation or exposure of his fields than he can regulate the weather conditions to which his crops will be subjected.

On fertile soils at the lower elevations, varieties of the

"heavy grained" type, which are intermediate in regard to the time of ripening, are the most profitable. Examples of this type are Record, Crown, Victory, Abundance and Yelder. On more exposed ground, provided soil fertility is maintained at a high level, varieties with a somewhat slender grain, such as Radnorshire Sprig, Black Bell III and Black Tartarian, give the best yields. In the case of fields poor in condition and subjected to considerable exposure, oats representative of the late ripening group with a high tillering capacity, such as the Welsh Sprig or Cornish Black, are usually the most suitable.

On the highest and most exposed situations, the only oats that are sufficiently hardy to withstand the adverse weather conditions, and to thrive on the very scant food supply, are those belonging to the *strigosa* group.

On fields which are fairly sheltered and dry, winter oats do well. The chief limiting factors, reacting against their more extended use, are the fear of very hard winters and their tendency to lodge in wet seasons. A strong point in their favour is that a drought during the spring or summer affects them very much less than a spring-sown crop.

In selecting a variety for a particular field, it is very important not to over-estimate the cropping capacity of the field, having regard to all the conditions. A variety must be chosen which will be sufficiently hardy to produce a reasonable thickness of stand, this being one of the chief factors contributing to final yield. Should the season be worse than usual, a type which is too delicate may perhaps fail to produce more than half a crop; whilst a type suitable for poorer conditions will be certain to produce a full crop. It must always be remembered that a full crop of a second-grade variety is likely to be more valuable than a 75 per cent. crop of a first-grade variety.

The Quality of Seed.—Plants, like animals, are greatly influenced in their later stages of growth by their progress during the initial stages, so that those which are stunted in their early growth do not thrive so well afterwards even if conditions subsequently become entirely favourable. As the young seedling depends primarily for the first two or three weeks on the food supply stored up in the endosperm of the seed, it is very important that the grain should be as plump as possible. Plump seed not only gives more nourishment to the seedling during the first few days than does poor seed,

but also continues to supply a certain amount of food for a longer period, and this assistance to the seedling counts for very much if the weather turns unfavourable.

Moreover, when a poorly dressed sample of grain is sown, containing both large seed and small seed, the rate of growth of the seedlings varies. Consequently, when competition for light and plant food sets in, the smaller seedlings are hampered still further so that they will, ultimately, die off, leaving a thin stand—likely to give rise to a poor crop which will ripen unevenly. Not only does the amount of food stored up in the seed influence the young seedling, but the quality of this food is of equal importance. During the ripening of the grain in the standing crop, and afterwards during the maturing of the grain, whilst still on the straw in the stack, certain changes take place in the kernel, which render it more readily available for use by the seedling. Where this process is checked the "energy of germination" of the sample will be greatly impaired, so that there will be delayed germination after sowing. The "low energy" seeds may then rot before they germinate, or else will produce small seedlings, many of which will be unable to establish themselves.

A crop derived from a poorly matured sample of seed, with its delayed germination and slow growth, is also very liable to suffer from the attacks of wireworms and the frit fly, as the seedlings remain far too long in a stage at which the pests can do most damage. Cases have come under the writer's observation in which, on fields infected by wireworms, a full crop resulted from well-matured seed, but only a third of a crop from seed not well matured, although quite plump—the two crops growing alongside one another.

The result of sowing badly matured seed is often seen in the poor "take" where winter oats are thrashed from the stook and sown immediately. With an autumn-sown crop, it is essential that the seed should germinate quickly and the seedlings make rapid headway, so as to be well established before any hard frost sets in.

A far greater loss, due to the sowing of badly-matured seed, occurs, however, where spring oats are grown in hilly districts, which, of necessity, are also late districts on account of the high rainfall and the low temperature. On such farms, sowing has to be late, the heading stage is late, and then, ultimately, in the autumn, the ripening process becomes abnormal and incomplete, the grain drying prematurely while

the straw is yet somewhat green. (This bleaching of the crop is accelerated very considerably during frosty weather.) The seed thus produced will, eventually, be very slow in germinating, and will yield, also, a high proportion of weak seedlings, so that, in the following season, delayed germination and a retarded rate of initial growth will shorten still further the period available for active growth, thus causing a marked reduction in the crop.

With winter oats, the difficulty of the grain not being "germination ripe" may be overcome by using yearling seed, but, in the case of late hilly districts, the easiest solution is to buy fresh seed from a district more favourable to the ripening and maturing of the grain. In the case of *pure strains*, experiments have shown that the environment does not change the constitution of the strain, neither will a strain deteriorate through growing in a particular district, provided good well-matured seed is always available for sowing. With *composite varieties*, the constitution of the individual strains is still unaltered by the environment of a district, but the *proportions of the strains in the mixture* may be altered very considerably when grown in the same locality for prolonged periods. This effect of the locality may alter the proportions of the strains for better or for worse, depending upon whether the selection favours the increase of the most or the least productive strains.

Plump, well-matured grain can be produced most economically in moderately early districts with a fairly dry climate and fertile soil. At present, the farmers in hilly districts, and those who have to operate under poor conditions generally, have to decide between two evils—either to use good, well-matured seed of a variety for which their land is too poor (for the lowland farmer but seldom grows the varieties best suited to the needs of the upland farmer) or else to sow a poor, ill-matured sample of a suitable variety, which will, of necessity, have been home-grown or procured from a farm subject to very similar conditions to his own. Much could be done to help the hill farmer by the formation of seed-growing societies through the medium of which the more favourably situated farmers of a large district or county would undertake to grow a supply of seed of pure strains of the varieties suitable for the hill farmer.

WINTER RATIONING OF COWS IN SUFFOLK

B. A. STEWARD,

Secretary, Suffolk Milk Recording Society.

WHILE it is quite simple, on paper, to ration cows, it is a vastly different matter to translate the theory of scientific rationing into actual practice on the farm. The adoption of a proper system of weighing and measuring feeding stuffs is entailed, and differences in the quality of home-grown foods, as well as the relative costs of purchased and home-produced foods, have to be taken carefully into consideration. The keeping of accurate milk records is essential, as cows have to be fed according to yield, with due regard to the eccentricities of individual cows, while, above all, it is absolutely essential that the co-operation of the herdsmen be secured at the outset of any attempt to revolutionize the feeding methods.

The advantages of careful rationing are, however, so considerable that it will pay to overcome these difficulties. Where rationing is carried out in a haphazard manner, it is practically impossible to calculate even the approximate cost of milk production, and it is probably true to say that many dairy farmers do not know what it costs them to produce a gallon of milk. It is certainly true that the saving of at least a penny per gallon in rationing costs is a measure of practical politics on many farms. This means a useful additional income where there is a large dairy of cows, and no herd-owner can afford to neglect such a substantial saving.

As it is only in recent years that Suffolk has become, to some extent, a dairying county, perhaps less attention has been given to this matter than in some other counties, and when the Suffolk Milk Recording Society initiated a rationing scheme during the past winter, it was the first effort of the kind in the county. The scheme was in operation for a period of five months commencing November 1, 1927, and was developed on the basis of the Ministry's rationing recommendations, with the addition of advisory visits to the farm. An entrance charge of £2 2s. was made to cover expenses incurred in connexion with these advisory visits, and it was also arranged that prizes should be given to herdsmen in charge of herds where the best results had been obtained at the end of the scheme. Mr. A. W. Oldershaw, Agricultural Organizer for East Suffolk, and Mr. J. Robinson, Chadacre Agricultural Institute, acted in an advisory capacity for East and West Suffolk respectively.

Ten herds entered, of which three were Friesian herds, two Shorthorns, one each Guernseys, Jerseys and Red Polls, and two mixed herds, with annual herd averages which ranged from 600 to over 1,000 gallons for the previous year.

As a first step, rationing sheets were completed by the Society's recorders at their visits to each herd early in November; and, following this, an advisory visit was made to each farm, in order to check the information given and to advise alterations where necessary. This first advisory visit was undertaken by Mr. Boutflour, who examined the system of rationing on each farm, explained to owners and herdsmen his methods, and advised separately on each ration. The next visit to herds was carried out by Mr. Oldershaw in East Suffolk and Mr. Robinson in West Suffolk, during December, and this was succeeded in February by a visit made to all herds by Messrs. E. T. Halnan and C. F. Newman, from the School of Agriculture, Cambridge. Following each of these visits, detailed recommendations were forwarded in a letter to each entrant.

In March, another rationing sheet was completed by recorders on each farm, and each herd was afterwards visited on behalf of the Society by Mr. F. C. Smith, of Walton Hall, Felixstowe, who undertook the judging of herdsmen for the award of prizes. Costings sheets, showing comparative costs at the commencement and the end of the period, were sent to each herd-owner in April.

There is no space here to give details of the rationing costs on each farm, but the following figures may serve to give a general idea of what may be accomplished in this way:—

Herd letter	November, 1927		March, 1928	
	Average milk per cow (lb.)	Average cost per gallon (d.)	Average milk per cow (lb.)	Average cost per gallon (d.)
A	21.0	12.0	12.5	11.07
B	23.0	8.5	25.0	7.7
C	20.5	10.25	18.75	†7.9
D	29.5	*8.2	21.0	10.2
E	22.0	†7.2	25.5	8.04
F	34.75	*7.9	35.0	7.3
H	30.75	*7.5	34.0	8.02
J	17.75	12.1	25.5	7.4
Average of ALL FARMS ..	24.9	9.2	24.66	8.45

* Denotes sugar beet tops used.

† Denotes herds with ration below scientific requirements.

The method of working out the cost of rations was that advised in the Ministry's Report on the Rationing of Dairy

Cows, and thus home-grown foods were valued at a price representing the feeding value of these foods as compared with certain standard foods purchasable in the open market. Due consideration was also given to the varying qualities of foodstuffs, and this was ascertained by careful observation on the farm. The figures of two herds are omitted from these comparisons, reliable figures as to quantities used not being available and, moreover, the recommendations made at the first advisory visit not having been carried out.

It is difficult, of course, to draw any definite conclusions from these figures without referring in detail to the separate rationing sheets, but it will be seen that they confirm the generally accepted view that high yields are associated with low costs, and *vice versa*; also that they exemplify the contention that useful reductions in cost may be obtained by careful rationing. In this latter connexion, it should be remembered that the month of March is usually more expensive for milk production than November, and this was undoubtedly the case in Suffolk during the period under review.

It will be noted that with three herds sugar beet tops were used in November, and this helped to lessen the cost of the ration on these farms. In Herd D, 80 lb. of sugar beet tops were used per cow for maintenance without any other food. The higher cost in March in this herd was due chiefly to the lower average milk yield, most of the cows being advanced in their lactations at that time. Sugar beet top silage was very successfully used in this herd during this latter month.

Herd J is rather an extreme case. The November cost is chiefly due to the use of hay to the extent of 23 lb. per cow. In this herd the bulk ration was rigorously cut down, the hay being reduced to 8 lb. and only 20 lb. of roots being fed, with very beneficial results both as regards costs and milk yields. The increase in the latter can be safely attributed to rationing, as a study of the milk records and calving dates of the cows gave no evidence of more favourable circumstances in March as compared with November.

All of the herds, with Herd A as a partial exception, carried out the main principles of the Boutflour system, although a few roots, in no case exceeding 30 lb., were fed in six out of the eight herds, as a daily ration. It was found to be a great advantage to adopt a cut-and-dried system on which to base a rationing scheme of this nature, and for this purpose the Boutflour system was admirable. There is no ambiguity

about Mr. Boutflour's instructions, and his first advisory visit was particularly helpful because the recommendations given, especially to herdsmen, lacked nothing in clearness and were a very definite programme upon which to build experimental rationing work on the farm. The Boutflour system was adopted in its main essentials, if not in its entirety, by seven out of these eight herds, and with marked success.

To Mr. Boutflour's personal assistance the scheme was indebted from start to finish, and his special lectures to herdsmen, which were held in May in three centres, Ipswich, Beccles and Bury St. Edmund's, were well attended and helped considerably to stimulate interest in rationing among those who do the actual work of herd management on the farm. At these lectures the prizes and certificates awarded in connexion with the Rationing Scheme were presented by Mr. Boutflour. Throughout the period of the Scheme, it was apparent in most of the herds that the main object of encouraging keenness among the herdsmen had been achieved.

The chief lesson to be gained from this first attempt at an organized rationing scheme in Suffolk is not so much concerned with what has been accomplished in this instance, as with what can be accomplished in the future. The recent development of the dairying industry in this county is such that a great deal of scope exists for extended and profitable work in the rationing of dairy cows.

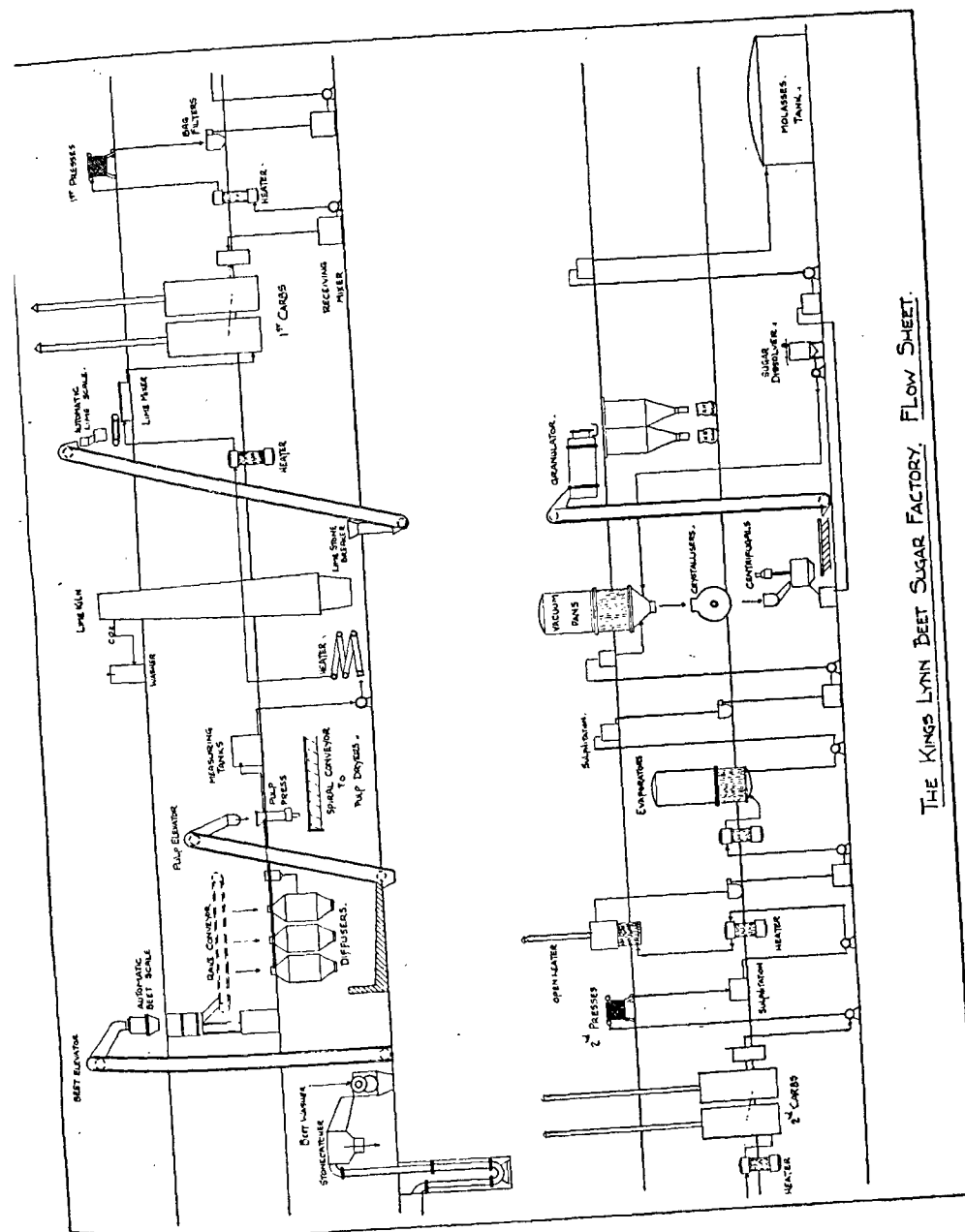
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KING'S LYNN BEET SUGAR FACTORY

THE King's Lynn Beet Sugar Factory was erected during the summer of 1927. It is situated on the banks of the River Ouse, about one mile south of King's Lynn.

The river, being still tidal at this point, renders the site particularly favourable from the point of view of effluent discharge; the large volume of available water ensures great dilution of the effluent and the tide carries it straight out to sea. The salt water from the river is used in the factory for condensing purposes only; the fresh water, required by the factory, is obtained from the River Nar, about three-quarters of a mile away.

The factory, which is the latest enterprise of the Anglo-Dutch Group (the other factories owned or operated by this Group are Cantley, Ely, Ipswich and Kelham), was completed



in time to deal with the 1927 crop and during the manufacturing season sliced 41,000 tons of beet, from which were produced 5,500 tons of white sugar, 2,400 tons of dried pulp and 1,550 tons of molasses.

The factory has a beet-slicing capacity of 1,200 tons per 24 hours, and the design not only embodies labour-saving devices but also pays special attention to heat economy.

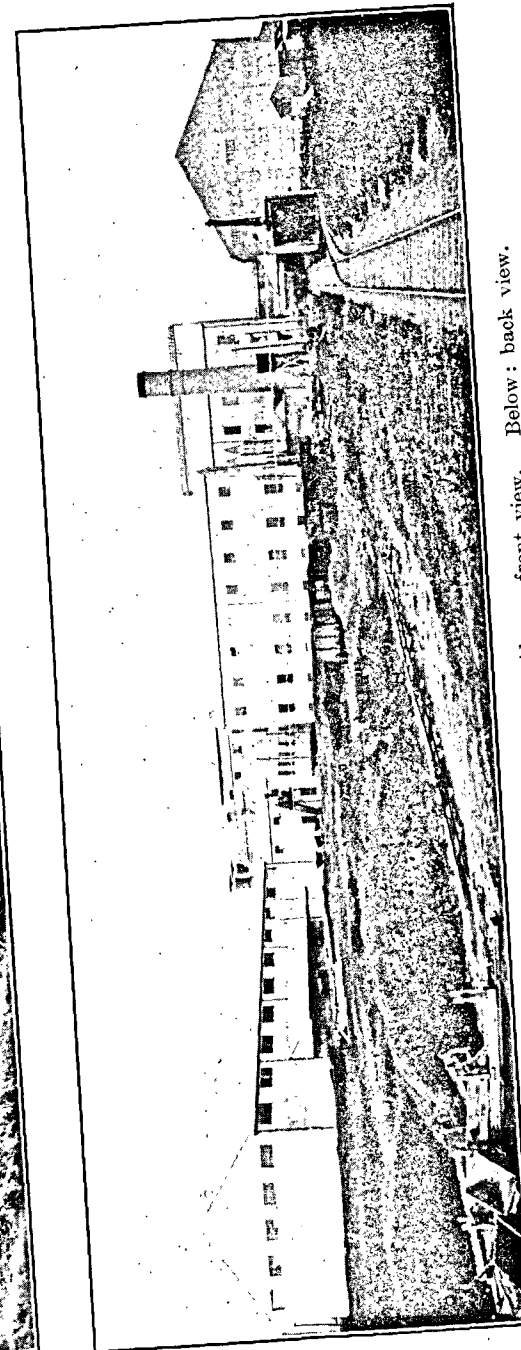
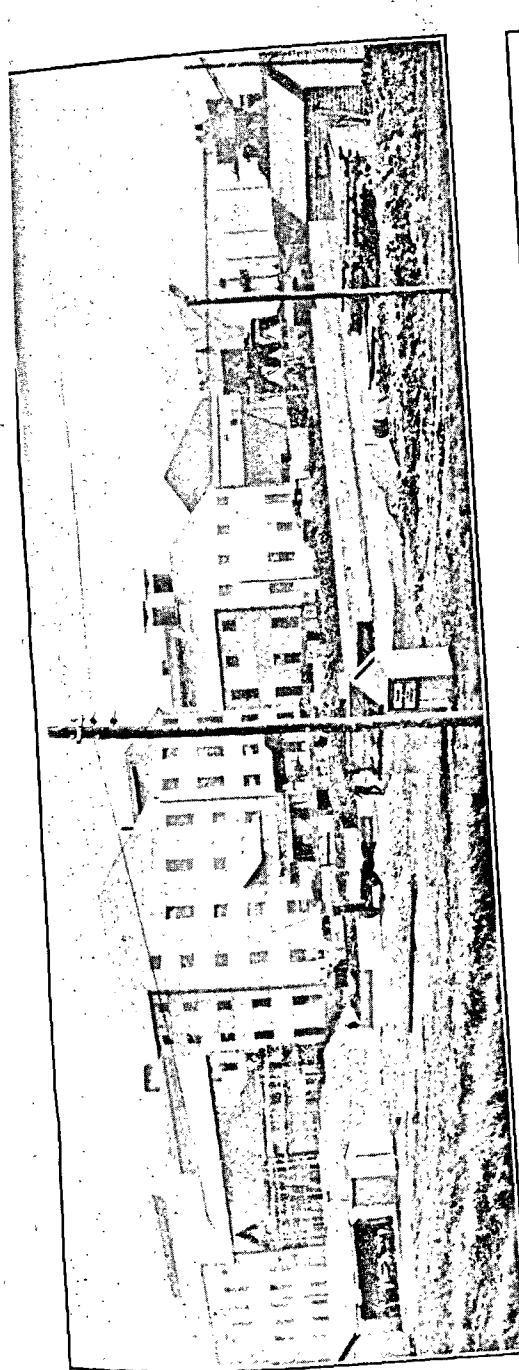
The boiler installation consists of four high-pressure water-tube boilers, producing superheated steam for driving the turbo-generators and two low-pressure boilers for evaporation purposes, all equipped with automatic stokers. The boiler feed water is obtained direct from the first and second bodies of the evaporator, which, being worked under pressure, deliver condensed water of a temperature above boiling point. The power and light required are obtained from two turbo-generators of 1,140 K.V.A. each.

When the beets arrive in the yard, either by road or rail, they are weighed and sampled for tare and sugar content in the usual way. Those delivered by rail are unloaded by water power and conveyed direct to the factory, except when the beet delivery is too large, when the surplus is discharged by crane and stored in silos. Last year, all the beets delivered by road were discharged by hand, but, on account of the expected increase in road deliveries this year, an installation for unloading them by water power has been provided. This will enable the farmer to unload his deliveries quickly.

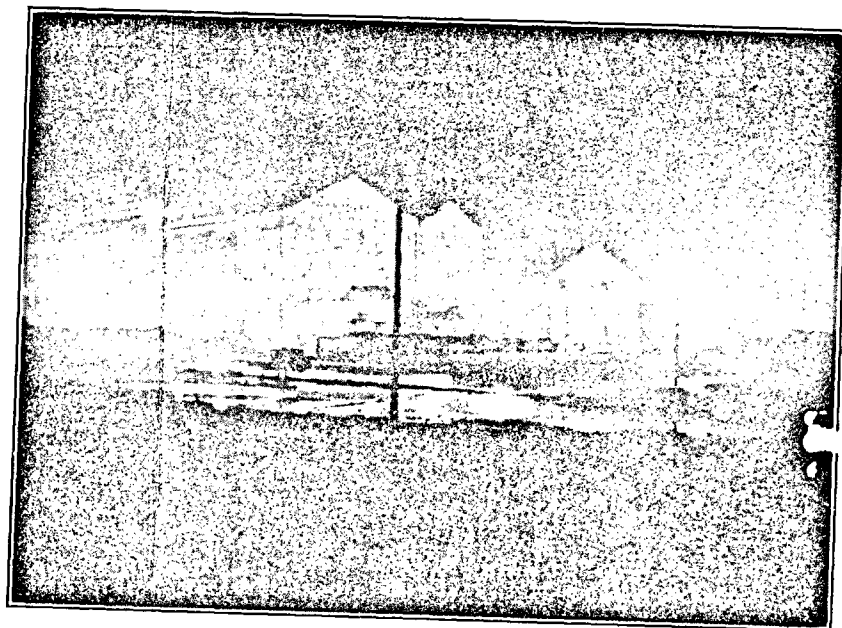
The beets are conveyed into the factory through water channels called "flumes" and, after passing over a stone catcher, are lifted into the beet washer by compressed air. The water used for unloading and fluming is warm Ouse water obtained from one of the condensers. Warm water is to be preferred to cold water, especially when frozen beets are being worked.

After leaving the washer—the muddy water from which, together with the flume water, passes to the settling ponds—the clean beets drop into a bucket conveyor which brings them to the top of the factory building and tips them into an automatic weighing machine. This machine records the weight and then empties the beets into the slicers, where they are cut up into "cosettes" which are then carried to the two diffusion batteries by means of a rake conveyor.

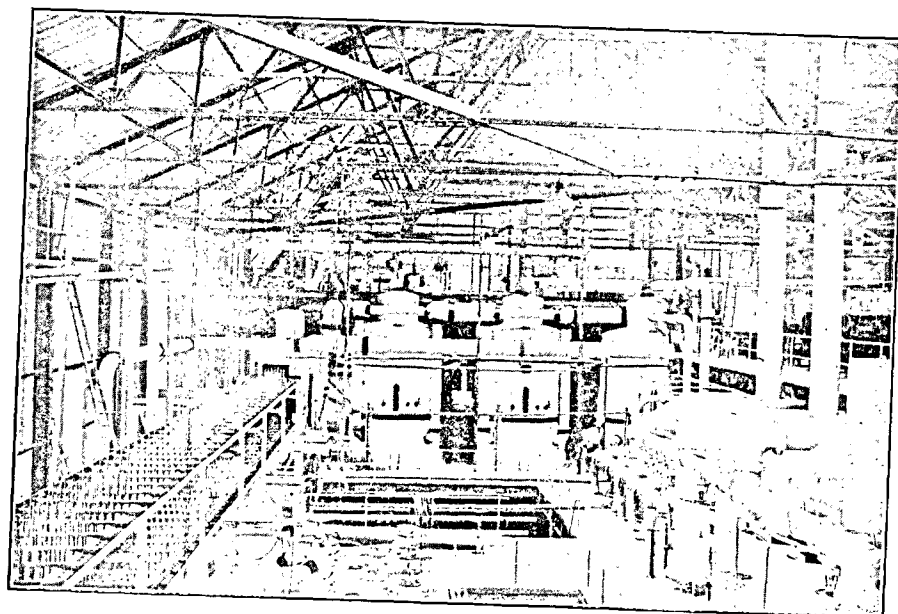
The diffusion batteries are of the old approved type, each battery consisting of ten diffusers with a capacity of from $4\frac{1}{2}$ to 5 tons of slices each. The juice is here extracted from



KING'S LYNN BEET SUGAR FACTORY. Above: front view. Below: back view.



The Factory by night.



View of the interior.

KING'S LYNN BEET SUGAR FACTORY.

the cossettes in the ordinary way.* The exhausted cossettes (pulp) are then dropped into a large concrete trough underneath the battery and carried by means of a bucket elevator to presses which remove from 16 to 20 per cent. of the water. The water removed by the presses invariably contains some small pulp particles which are eliminated by a rotary sieve. The pressed pulp is now conveyed to the drying plant where the water content is reduced to approximately 12 per cent. This plant consists of two rotary drum dryers, in which hot gases from special furnaces are drawn evenly over the pulp by means of powerful fans. The hot gases, after absorbing the moisture from the pulp, pass through cyclones which collect any pulp particles drawn through by the fans. At the delivery end of the dryer, the dried pulp is discharged into a bucket elevator and conveyed into the store, where it is automatically weighed and bagged, ready for delivery to the farmer.

The raw juice, when drawn from the diffusion battery, is first measured and then pumped through heaters, which are of two kinds, one being heated with the surplus hot water and the other with vapour from the evaporator. The water-heaters raise the temperature from 25° to 65° C., and the vapour-heaters then further increase it to 85° C. From the heaters the juice passes to the lime mixers, where dry, unslaked lime, obtained from the factory kiln, is added. Roughly, 5 tons of limestone and $\frac{1}{2}$ ton of coke are consumed per 100 tons of beet. The action of the lime on the raw juice is both chemical and mechanical. Chemically, the lime precipitates impurities; mechanically, it carries down suspended matter with the precipitates.

The limed juice flows by gravity to the first carbonatation tanks, where precipitation of the lime is effected by means of carbonic acid gas obtained from the lime-kiln. The mixture is now heated up to 95° C. and pumped through filter presses, which are of the frame and plate type. The lime precipitate, called "scums," is collected in the frames between filter cloths, the filtered clear juice running on to a set of bag filters where a second filtration under minimum pressure takes place. All the lime is not removed in the first carbonatation tanks, however, and the process is repeated in the second carbonatation and second filter presses. The

* See previous articles in the October, 1927, and June, 1928, numbers of this JOURNAL, describing the Poppleton and Allscott factories respectively.

"scums" from both first and second presses, after being washed to remove any remaining sugar, are mixed with water and flow by gravity into a settling pond. After settling, this waste lime is available for use on the land.

The clear thin juice, leaving the second filter presses, is now further purified by the action of sulphur dioxide gas, which is obtained by burning roll sulphur in a specially designed furnace. This gas has also a bleaching effect on the clarified juice and consequently on the sugar.

On leaving the sulphitation tanks, the juice is again brought up to a temperature of 95° C. and then pumped to an open heater, where it is boiled under atmospheric pressure. It now receives a final filtration through bag-filters and is pumped into the evaporator, through closed heaters, where it is raised to a temperature of 115° C.

The evaporator consists of four vessels, the first three of which are of equal size. The juice passes from one to the other and is boiled under pressure at 124° C. in the first body; at 112° C. in the second; and at 102° C. in the third. In the fourth body, which is small, the juice is boiled under vacuum. The first body is heated with the exhaust steam from the turbines, supplemented by steam from the low-pressure boilers if required. A certain amount of the juice vapour in this first vessel is used to heat the juice in the second, whilst some of it is used for the heaters and vacuum pans. Similarly, the vapour of the juice in the second body passes to the third and from the third to the fourth. In this way all the heat required for juice-heaters, vacuum pans and diffusion battery is derived from the evaporator. Even the vapour from the fourth body is not lost, but goes to the condensers, which consist of two connected vessels, the vapour passing through from one to the other. The first condenser is cooled with fresh water which, together with the condensed vapours, is used in the diffusion battery for sugar extraction. The second condenser is cooled with water from the Ouse.

The evaporator reduces the water content of the thin juice by 75 per cent. The resulting thick juice is now treated with sulphur dioxide gas, filtered, and then boiled in vacuum pans until crystallization takes place. When this operation is judged to be far enough advanced, the mixture of sugar grains and syrup, called "massecuite," is dropped into a crystallizer, where further grain formation takes place. The massecuite is then treated in centrifugals where the white sugar grains are separated from the liquid.

The separated liquid is reboiled until it no longer contains crystallizable sugar; it is then called molasses.

The hot white sugar discharged from the centrifugals is conveyed by shaker and elevator into a granulator, where it is dried and cooled. It is then screened and stored in bins, whence it is bagged and weighed ready for delivery. Lumps removed by the screen are dissolved and returned to the vacuum pans, together with any sugar which is not of the standard colour. Second-grade sugars are also dissolved, filtered and reboiled to produce white sugar, which is the only grade made by the factory.

During last season, the factory employed, on an average, 690 men. During this summer, 140 men have been at work at the factory making necessary alterations and repairs.

For the next season, 12,000 acres of sugar beet are under cultivation; this area, under normal weather conditions, should yield about 100,000 tons of clean beet.

* * * * *

THE NATIONAL POULTRY INSTITUTE SCHEME

The following statement on the National Poultry Institute Scheme was made to the National Poultry Parliament at Portsmouth on July 17, 1928, by Mr. P. A. Francis, O.B.E., Poultry Commissioner, on behalf of the Ministry of Agriculture and Fisheries.

WORK under all sections of the Scheme is now in full progress, as will be seen from the detailed reports which follow.

It will be remembered that a sum of £26,000 was provisionally allocated to meet the initial capital expenditure under the Scheme, of which one-fourth, £6,500, was to be provided by contributions from the Industry and the remainder by the Development Commissioners. The collection of this sum of £6,500 was undertaken by the National Poultry Council, and both the Council and the Industry are now to be congratulated on the accomplishment of what was by no means an easy task, and there is no doubt that if this substantial contribution of funds by the Industry had not been forthcoming, the Scheme must have either fallen through entirely or been severely curtailed. The following is a sum-

mary of the present position as regards capital expenditure under the Scheme :—

<i>Amounts advanced to meet Capital Expenditure at the following Centres :—</i>			
	£	s.	d.
At the National Institute of Poultry Husbandry ..	14,842	1	0
„ Cambridge—Nutrition Research Centre ..	498	10	2
„ „ Breeding „ „ ..	3,150	0	8
„ New Haw, Weybridge—Disease Research Centre ..	2,196	7	7
„ Reaseheath—Northern breeding experiments ..	2,497	11	4
„ Wye—Southern table poultry experiments ..	2,230	0	0
Total amount advanced, including the Industry's contribution	£25,414	10	9

Except for a few details of equipment at the National Institute and at the Breeding Research Centre at Cambridge, the capital expenditure under the Scheme has been practically completed. The annual maintenance expenditure, amounting to a sum exceeding £7,000 per annum, is being met entirely out of public funds.

The following is a brief account, in some detail, of the work which is now proceeding under the Scheme.

The National Institute of Poultry Husbandry, Newport, Salop.—The National Institute of Poultry Husbandry at Harper Adams Agricultural College is now in the third year of its existence and is under the direction of Professor Raymond T. Parkhurst. This branch of the Scheme is devoted especially to the advancement of knowledge of the science and practice of poultry husbandry in this country. It provides specialized courses of instruction in poultry, waterfowl, and small live stock, and undertakes general investigations into commercial problems and experiments dealing with technical problems associated with and underlying practical commercial work.

Nature of the Work.—Although the staff are called upon to do considerable extension work in the nature of lectures, farm visits, and visits to important poultry gatherings and poultry shows, the work of the Institute is primarily concerned with advanced instruction and investigation, between which the time of the staff and the Institute's facilities are about equally divided.

Instructional Work.—During 1925-26, before the formal opening in November, 1926, seven students completed the Elementary Certificate Course. During 1926-27, 10 students completed the course, 6 students obtained the Elementary Poultry Certificate and 10 additional students spent less

than a full year at the Institute. During 1927-28, 16 students have completed the Elementary Course. Eleven of these students have taken the N.D.P. Preliminary Examination and, if successful in passing it, will take the examination for the National Diploma in Poultry Husbandry in September, 1928. Two students have been doing advanced work. Eleven other students have taken work for less than the full year.

Although the entire plant is indirectly used for instructional purposes, there are between 500 and 600 poultry and nearly 300 ducks used exclusively for the purpose of providing practical experience and supervised instruction in management.

The new Advanced Certificate Course will be given for the first time during 1928-29. This course will be of an advanced nature for students who have previously had a full year of poultry instruction. A research course will also be offered.

Experimental Work.—During the first two years after the Institute was established a comparison of five mashes was made, and the laying mash now used and recommended has been developed from this work. This mash consists of 2 cwt. of thirds, 2 cwt. of maize meal, 1 cwt. of bran, and $\frac{1}{2}$ cwt. of meat meal. Work on the preservation of duck eggs during this period showed that it was inadvisable to preserve duck eggs with normal solutions of water-glass. Green duck eggs kept even more poorly than white eggs.

During 1926-27 and to date comparisons have been made between birds confined to a glass-fronted house and an open-fronted house, and a check pen not confined. Indications are that the unconfined pen had :—

- (a) A very definite advantage over the confined pen with the glass front.
- (b) A small advantage over the confined pen with the open front.

The confined pen with the glass front showed—

- (a) Definite signs of leg weakness, possibly due to rickets in adult stock. No similar signs appeared in the other pens.
- (b) Loss in body weight compared with birds in other pens.

During 1927-28, 240 late-hatched Leghorn pullets were divided between two pens in a house and one given lights during the winter months from 4 a.m. The pen of late-hatch pullets that were lighted showed—

- (1) Definite advantage in favour of the lighting, 120 birds giving 1,000 eggs more than the non-lighted pen.
- (2) A profit over feed and lighting cost of about 1s. per bird for the six winter months.
- (3) No loss in body weight during the experiment.

For two years between 500 and 600 chicks have been

equally divided into two groups and one given only mash and the other a scratch and mash ration. Quite as good growth was obtained by the use of the all-mash as with the mash and grain. Mortality was practically the same in both pens. Further work needs to be done on the kind of mash best adapted to the all-mash method of feeding before this method can be definitely recommended. Some work has also been done on the use of thyroid in tablet form and a weak solution of potassium iodide for laying hens. From the results it seems that there is no increased production or increase in hatchability due to thyroid.

Present Programme of Experimental Work.—The active experiments this year include a comparison of the dry mash, combined dry and wet mash, all-mash, and wet mash methods of feeding; a trial to study the value of artificial light on late-hatched Leghorn pullets, and a test of pens of birds confined to a glass-fronted laying house, confined to an open-fronted laying house, and unconfined. The nutrition experiments include comparisons between vegetable and animal protein foods such as meatmeal, meatmeal and mineral mixture, fishmeal, soya bean meal, and minerals and extracted decorticated ground earth nut meal, and minerals. A comparison is also being made with two pens, one of which has the wheat in the scratch grain replaced by barley. In the management of chicks, the test of the all-mash as compared with the scratch and mash methods of feeding is being continued. The use in the ration of wheat germ meal, alfalfa meal, irradiated scratch feed and cod liver oil for breeding stock has been studied this year. The White Bresse-White Leghorn cross for sex linkage is also being tested.

There are, at present, about 900 adult birds and 500 chicks in active experiments.

The Work of the Rabbit Husbandry Department.—Instruction in rabbit husbandry also has been given to the students at the Institute since 1926. Thirty-eight students have had lectures, demonstrations and practical work through one term. In addition, eight students have received intensive short courses up to a month in duration. During April, 1928, a short rabbit course for Poultry Instructors was held for one week, and seventeen Poultry Instructors attended.

About 250 rabbits are being used in experiments, including studies in growth curves, restricted versus self-fed mash, hutch types, ordinary glass versus vitaglass, and kibbled feed versus flaked and steamed feeds.

Poultry Nutrition Section, Animal Nutrition Institute, Cambridge.—The work carried out under the National Poultry Institute scheme under Captain Halnan's direction has fallen naturally into two groups, *i.e.*, work carried out on the changes in composition of the fowl during growth, and work carried out on the digestibility of poultry feeding stuffs. The work on the changes of composition of the body during growth has been carried out on two breeds, the White Leghorn and Light Sussex, and although the actual analytical work is completed, the analysis of the figures has not yet proceeded to the stage when a general statement of the position can be made. One definite fact has, however, emerged—namely, that there is a definite sex difference in the composition of the body, the fat in the body of the pullet showing a distinct increase at about the time that egg-laying commences. This increase in fat in the body continues during the laying period, and appears to be a physiological condition associated with egg laying.

With regard to the digestibility determinations, considerable progress has already been achieved, and facts of commercial importance to the industry can be stated as the result of this work. The scientific results of these experiments are being published elsewhere, and it will suffice in this statement to give only the main conclusions. Digestibility determinations have been carried out on the following materials: Little Joss wheat, Yeoman II wheat, Bearded Rivett wheat, Swedish Iron wheat, Durum wheat, Grey winter oats, Scotch Potato oats, Black Bountiful oats, Yellow Plate maize, "flaked" maize, and Bulrush millet. The work on wheats has shown that, from a digestibility standpoint, there is little difference in value between a "strong" wheat of the Yeoman II type and a "weak" wheat of the Swedish Iron type. For poultry feeding, from the purchaser's standpoint, for good clean samples of wheat, these experiments indicate that the price factor is the only one that needs consideration. From the wheat producer's standpoint, if intended for poultry feeding, those wheats should be grown which give the biggest yield of grain per acre.

With regard to oats, however, a distinct varietal difference is shown, and poultry keepers need to exercise considerable discretion in the type of oats they buy for poultry feeding. In the varieties tested, on the basis of equal bulk, Grey Winter oats proved the best, Black Bountiful came next, and Scotch Potato oats proved the worst of the three varieties.

The digestibility of the oats appeared to vary according to the fibre content, high fibre content being associated with low digestibility.

With regard to maize and "flaked" maize, both these products proved to possess a high digestibility, and the fowl's digestive system appears to be adapted for dealing efficiently with hard grain such as wheat and maize. The pre-cooking of the maize that occurs in the preparation of flaked maize leads to a considerable increase in digestibility and there is no doubt that "flaked" maize is a more digestible feeding stuff than ordinary maize.

The Bulrush millet (*Pennisetum Typhoideum*) is a new feeding stuff of Empire origin. Palatability and digestibility tests showed that this grain is very suitable for inclusion in all poultry mixtures, since it possesses a high digestibility and is readily consumed by both young and adult stock.

All digestibility tests carried out at Cambridge have emphasized the incapacity of poultry to digest fibre, and the inclusion of this material in poultry feeding stuffs appears to be unnecessary except in so far as its presence is required to add bulk to the ration.

A point of considerable interest to all poultry keepers who are also interested in other classes of live stock is as to whether poultry digest their food as efficiently as other classes of live stock. Efficient digestion is particularly shown in the case of pigs, which form an alternative class of live stock for the consumption of cereal grains and by-products commonly used for poultry feeding. Light has been thrown on this point by the digestibility tests on maize and "flaked maize," which gave almost identical digestibility figures for fowls, except in the case of fibre, as those obtained in digestibility trials on those materials carried out with pigs by Dr. H. E. Woodman, of the Animal Nutrition Institute, at Cambridge. It can be stated with considerable confidence that, so far as food products low in fibre are concerned, the fowl possesses just as efficient digestive powers as the pig.

Another point of considerable practical importance to poultry keepers has also been tested, namely, whether the digestibility of a food decreases as the quantity fed per day increases. For this purpose, four White Leghorn cockerels were fed with varying amounts of a mixture of Sussex ground oats and milk powder. The amounts fed per day were approximately 2 oz., 3½ oz. and 5 oz. of the dry food, mixed with water to produce a suitable mash. The last quantity fed was very

close to the margin of the bird's appetite. No material difference in the digestibility was shown, proving that, within the limits of the bird's appetite, the digestibility of a normal food mixture is not affected by varying the quantity fed.

Research in Poultry Genetics at Cambridge University.—

The main problem under investigation by Professor Punnett is the question whether or not there exists a sex-linked factor influencing the fecundity of the hen. Should this prove to be the case the cock becomes the more important bird in breeding for pullets of high laying quality, and the choice of hens would become of less importance. According to Pearl such a sex-linked factor exists; according to Goodale it does not. To test the matter, definite series of experiments are in progress, the nature of which was explained to the National Poultry Parliament when it met in Cambridge in 1926. During the present season the first crop of pullets produced by mating the F_1 cocks back to the triply recessive hens is being tested by trap-nesting. Until the records are closed next October it is not desirable to make any definite statement of results.

Meanwhile, in order to test the matter as thoroughly as possible, a further experiment is being made with the object of introducing a third sex-linked factor, *viz.*, the factor which inhibits the production of slaty pigment in the shanks. When the postulated factor for high fecundity has been adequately tested against the three well-known sex-linked factors, *i.e.* those for barred plumage, for silver and for the inhibition of shank colour, there can be no doubt that Professor Punnett will be in a position to give a definite answer to the question as to whether there exists a sex-linked factor for fecundity or not.

Apart from the main line of inquiry, some investigations have been made in connexion with the occurrence of the light head patch in the down of barred birds. In past years there were reported a few cases of difficulty in making use of this character as a sex-linked distinction in the down. These difficulties have now been largely cleared up, and it has been shown that in some cases they proceeded from the use of certain strains of Black Leghorns in which an abnormal amount of white occurred in the down. Other cases of difficulty may perhaps be explained by the fact that the barring factor probably occurs in more than one state, varying in potency. An account of this work will be found in two

papers published in the *Journal of Genetics* during the past year.

Some experiments have been started in crossing different breeds of ducks with the object of trying to detect some sex-linked factor apparent in the down. The only cross so far worked out, viz., between the Black and White "Penguin" and the "Rouen," has given a negative result, but it is proposed, as far as means will allow, to continue the search in coming years.

Poultry Disease Research at the Ministry's Veterinary Laboratory, New Haw, Weybridge.—The following work is now in progress under the direction of Mr. T. M. Doyle:—

- (1) Immunization experiments against tuberculosis.
- (2) Immunization experiments against fowl pox.
- (3) Immunization experiments against Newcastle disease.
- (4) Immunization experiments against avian typhoid.
- (5) (a) Starlings as "carriers" of coccidiosis.
- (b) Possibility of coccidiosis being transmitted from starlings to chickens.

With regard to the last-named investigation, which has been carried out by Mr. N. S. Barron, M.R.C.V.S., the following conclusions have been arrived at:—

- (1) Infected adult starlings show no apparent effect from the presence of the parasite.
- (2) The degree of infection is very mild as compared with that of domestic chicks.
- (3) The morphology and developmental cycle suggest that the parasite is different from *Eimeria avium* and specific for the starling.
- (4) Starlings play little, if any, part in the transmission of avian coccidiosis from one premises to another.

Publications issued during the Year.—(a) "A hitherto unrecorded Disease of Fowls due to a Filter-passing Virus—Newcastle Disease." *Journal of Comparative Pathology and Therapeutics*: XL, 2, 1927.

This is an acute febrile, infectious disease of fowls which greatly resembles fowl plague; it is caused by a filter-passing virus and is characterized by a difficulty in respiration and a high mortality.

Since the disease was first reported in the spring of 1925, outbreaks have been diagnosed by the Ministry's Laboratory in eleven counties, and it is certain that many more outbreaks have occurred, but have not been reported. In all cases investigated the mortality among infected fowls has been between 95 and 100 per cent.

(b) "Fowl Pox." (Part I.)

An investigation of this disease was carried out in collaboration with Dr. F. C. Minett. The results were published in the *Journal of Comparative Pathology and Therapeutics*, XL., 4, 1927.

- (1) Every case of disease determined by the virus of fowl pox, no matter what may be the symptoms manifested or the lesions induced, should be called fowl pox.

Both comb and mouth lesions in birds affected with fowl pox are due to the same virus. The comb form confers immunity against the mouth form, and vice versa.

There is no evidence that bacteria alone produce false membranes. Though it is possible that bacteria may play an important secondary part, the preliminary action of the specific virus is essential.

Fowl pox virus may be associated with roup. The use of the term "roup," however, should be restricted to the condition characterized by catarrhal inflammation of the conjunctiva and upper air passages when these are unaccompanied by lesions of fowl pox in any bird of the flock.

- (2) Strains of fowl pox virus have been obtained from 12 separate outbreaks. Cross immunity tests have shown these to be immunologically indistinguishable.
- (3) Pigeons could be successfully infected with fowl-pox virus by frequent passage on the skin of the leg. The viruses of fowl pox and pigeon pox are immunologically indistinguishable.
- (4) Cow-pox virus produces characteristic lesions on the fowl's comb. Frequent passage of cow-pox virus through fowls failed to change the character of the lesions or to bring about a resemblance to the lesions of fowl pox.
- (5) Certain results of fundamental importance in the control of the disease were obtained. In the first place, direct contact between diseased and healthy birds is necessary for the spread of the disease and the virus does not pass through unbroken skin. Secondly, experiments failed to provide any evidence for the existence of disease carriers. We have been unable to demonstrate the persistence of the virus in the internal organs of recovered birds or on the comb after complete disappearance of lesions.

Northern Experiments in Breeding Poultry for Egg Production.—A special sub-committee of the main Advisory Committee was formed in 1923 for the purpose of studying experimentally the methods practised in the North of England in the breeding of high fecund stock, and experiments have been conducted since March, 1924, with the object of obtaining information on points of immediate practical value to the breeder. Thus, in the case of the common practice of mating together a cock and his own daughters with the object of improving the laying capacity of the strain, or obtaining a more uniformly fecund stock, it should be possible by a series of properly controlled trials to determine whether, on the average, such matings give, or do not give, the anticipated result. The sub-committee therefore decided at one of its first meetings to institute a series of empirical trials to ascertain the results of the following matings:—

Father and daughter inbred (with control)

" " " outbred "

Brother and sister (with control)

in the case of the three breeds White Wyandotte, Rhode Island Red and White Leghorn.

The Cheshire County Council generously placed eight acres of land at the School of Agriculture, Reaseheath, and other facilities, at the disposal of the Sub-Committee for the purpose of these experiments, and a plant which now extends to 34 laying cabins, capable of accommodating 600 birds, has been gradually built up. From an original stock of 12 yearlings of each of the three breeds named, the stock has been multiplied as rapidly as possible since the experiments began in March, 1924, and now comprises over 500 adult birds.

It has been evident from the commencement of the experiments that, owing to the natural variability in fecundity of similarly bred stocks, and the necessity of treating results by exact mathematical methods, a large quantity of data would have to be accumulated before any conclusions could safely be arrived at. As the experiments are still in a comparatively early stage, it is not yet possible to state even interim results. The data already accumulated are, however, being examined by a statistician, a preliminary report by whom is now under discussion by the sub-committee.

Southern Table Poultry Experiments.—The southern experiments in table poultry production are also under the management of a special sub-committee of the main Advisory Committee, and the work is being conducted at the South-Eastern Agricultural College, Wye, generous facilities for the purpose having been afforded by the Governors of the College. The 1927 experimental year ending on April 30, 1928, saw the completion of three years' work on the plans formulated at the commencement of the scheme for investigation into the table poultry side of poultry husbandry. It will be remembered that it was decided that no accurate or reliable conclusions could be formed from figures gathered on one year's working, but that any experiment carried out must go on over a course of years.

The scheme was designed to furnish data on the following questions :—

- (1) The best methods of feeding and marketing, at all times of the year, birds produced as a by-product on commercial egg farms.
- (2) The economic value for table purposes of the breeds most generally used by commercial egg farmers as compared with the breeds and cross-breeds usually regarded as the best for table use.

- (3) The amount of weight and value of weight gained by the various breeds and cross-breeds used in the investigation in relation to the weight and value of food consumed.

The breeds used for obtaining these data are those most commonly kept by egg farmers, and some of the better-known table breeds and cross-breeds, viz.: White Leghorns; White Wyandottes; Rhode Island Reds; Light Sussex; Indian Game (male) $\times$ Light Sussex (female); and Silver Grey Dorking (male) $\times$ Light Sussex (female).

The chickens from each breed and cross-breed were to be divided into four lots and marketed as follows :—

- (1) Petits Poussins.
- (2) Off the run or green chickens.
- (3) Trough-fed chickens.
- (4) Crammed chickens.

At the commencement of the experiments it was decided to use broody hens for rearing the requisite number of chickens. After a trial of two seasons, however, this proved unsatisfactory. In the early part of the year the broodies available were not nearly sufficient to meet requirements and incubators had to be borrowed from the South-Eastern Agricultural College Poultry Department to supplement them.

At the beginning of 1927 it was decided to do away with the broody hens and go over to artificial hatching and rearing. To this end an incubator-house was erected, a proprietary mammoth incubator (1,200) was installed, and the requisite number of brooder-houses and hovers purchased. No difficulty is now experienced in incubating all the eggs required throughout the year.

Preliminary figures have been got out and submitted for the first two years of the experiments. Work is now being completed on the collection of the data obtained during the third year, and it is hoped to submit the whole of these figures for statistical analysis and report this autumn.

During 1928 the experiments have been varied somewhat, though still keeping in mind the terms of reference laid down at the commencement of the work. The breed chosen as a representative one was the Light Sussex, and most of the chickens now reared on the plant are from this breed. Ten pens of pure Light Sussex pullets, and two pens of pure White Leghorn pullets are being used for breeding purposes.

It being realized that the main body of poultry farmers now use the dry mash system of feeding, the principal object of this year's work is to ascertain the relative merits of dry

mash, wet mash, and combined dry and wet mash for chickens intended for table purposes.

The chickens hatched are, therefore, being divided into four groups and fed from birth as follows:—

- (1) Light Sussex chickens : Four wet mashes and one grain feed per day.
- (2) Light Sussex chickens : Dry mash always before the chickens, and one grain feed per day.
- (3) Light Sussex chickens : Dry mash always before the chickens, one wet mash per day and one grain feed per day.
- (4) White Leghorn chickens : Four wet mashes and one grain feed per day.

Every effort is made to keep the ratio between the mash and grain as constant as possible.

The composition of the mash is the same in all cases, and was adopted on the recommendation of Captain E. T. Halnan, of the School of Agriculture, Cambridge. It is as follows:—

During the first week, grain only to be fed.

Grain Feed.

Cracked wheat	..	..	..	..	..	1 part.
Maize grits	..	..	..	..	..	1 "
(The above to be fed up to the age of one month.)						
Whole wheat	..	..	..	..	..	1 part.
Kibbled maize	..	..	..	..	..	1 "
(The above to be fed from one month up to crate feeding stage.)						

Mash.

Middlings	..	20 parts.	Mineral Mixture (to be incorporated into mash.)	
Sussex ground oats	..	20 "	Charcoal	.. 1 part.
White maize meal	..	20 "	Steamed bone flour	.. 1 "
Dry skim milk	..	10 "	Precipitated chalk	.. 1 "
Meat meal	..	10 "	Salt	.. ½ "
Linseed meal	..	3 "		
Mineral mixture	..	4 per cent.		

After 8 weeks the meat meal is reduced by half, and at 12 weeks of age the milk is omitted. This mash is fed right through to trough-feeding stage, which varies from 12 weeks at the commencement of the year to 22 weeks at the end of the season.

The foods remain as before for trough feeding and cramming, viz.:—

<i>Trough Feeding :</i>		Sussex ground oats	..	..	13 parts.
		Dry skim milk	..	..	2 "
		Water	..	..	20 "
<i>Cramming :</i>		Sussex ground oats	..	..	13 "
		Dry skim milk	..	..	2 "
		Fat	..	..	1 "
		Water	..	..	20 "

From a preliminary survey of returns so far obtained this year (a period of six months) it would seem that chickens fed

on dry mash from birth (1), and also those fed on a combined diet of dry and wet mash (2), have done equally as well at the crate-feeding stage as chickens reared on wet mash only (3), whilst the fattener on the plant has experienced no difficulty in cramming (1) and (2) as satisfactorily as (3). The weights obtained in all cases are approximately the same, and the market returns do not favour one class more than another.

There has been no trouble from disease on the plant this year; the hatching and rearing have both proceeded on normal lines. 4,214 chickens were hatched during the period January 1 to June 15, 1928; 91 per cent. of Light Sussex chickens hatched were reared, and 70 per cent. of White Leghorn chickens. It is hoped during the course of the year to carry out experiments in caponizing.

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SEPTEMBER ON THE FARM

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Seasonal Notes.—Just as the summer of 1927 was remarkable for its long period of wet and cloudy weather, so that of 1928 has been characterized by an unusually long spell of bright sunshine and low rainfall. Haymaking has proceeded almost without interruption, and although the stacks are rather smaller than usual, it is generally believed that the deficiency in bulk has been more than counterbalanced by the superior nutritive value of the fodder secured. In contrast with last year also, when many meadows had to be left uncut, haymaking was completed in most districts by the end of July; and it has even been possible in some cases to run the mower over rough pastures, thereby conferring benefit to the pastures concerned and at the same time securing an additional few loads of winter fodder.

At the time of writing, pastures are still bare, and many have not yet cast off the brown appearance caused by the drought. It is several years since grasslands in the Midlands showed their recent appearance; indeed, there was a tendency to forget the possibility of a dry summer and shortage of grass keep. Having regard to recent grazing conditions, the 4 per cent. reduction in numbers of cattle and sheep, as revealed in the Ministry's preliminary returns, has not been entirely disadvantageous, though regrettable on general grounds.

The aftermaths of the earliest mown fields are now ready for grazing, and the immediate prospects of grass in the pastures are better than they were a fortnight ago. Farmers are now discussing the likelihood of a verdant autumn, some contending that the herbage has been bitten so close and so frequently during the summer that it will be slow to recover, others being confident of an autumn flush.

The reservation of new grass for winter consumption does not appeal to the judgment of farmers who occupy heavy land in humid districts. Indeed, after their experience of last autumn, when pastures were badly poached in the attempt to lengthen the outdoor period by feeding cabbages and other green crops on the grass, many have arranged to shorten the green foddering period this year. On some soils hoof marks made in the autumn fill up with *Agrostis* and other undesirable grasses in the following summer, to the obvious detriment of the pasture. On the other hand, there are soils on which hoof culture during the winter is undoubtedly beneficial, and in such circumstances there are valuable possibilities in specially grown winter pasturage. Speaking at the Midland College Grass Land Conference in January last, Mr. J. G. Stewart explained how by the application of a suitable top dressing to an area of 25 acres of pasture he had obtained grazing for 40 ewes and 60 lambs in January, the grass providing sufficient nutriment for good progress without supplementary feeding. His expectation that the field would support the sheep for a month was, it is understood, considerably exceeded. The top dressing, which was applied at the end of September, consisted of 1 cwt. of sulphate of ammonia, 3 cwt. of superphosphate, and 3 cwt. of kainit per acre.

Field Operations.—On the grassland farm September is not a period of heavy pressure. Where hedge-brushing is practised this work may be taken in hand; the cleaning of ditches and waterings may also provide useful employment, and preparations may be made for under-draining where this improvement is intended. Harrowing to spread droppings and the mowing of rough places are operations which should be carried out in other months besides September, but perhaps this month is one in which more opportunities can be found for such jobs. On arable land, the completion of the corn harvest demands first consideration, and commonly the work extends beyond the middle of the month. The rule is, however, that "the rain that stops the reaper starts the plough." In many districts it is customary to cart the manure out of

the cattle courts at this time of the year and to apply it to the clover stubbles in preparation for wheat. The ploughing of the clover root is typically September work; but in the case of grassy leas, the risk of frit fly attack in the young wheat is reduced by ploughing a month earlier.

This year, with such a large acreage of bare fallow—nearly half a million acres—a considerable area of wheat should be sown in this month. It is, therefore, likely that there will be a good demand for seed wheat from the early districts, and from the early thrashings elsewhere. The other crops suitable for September sowing—rye and rye-grass for early feed, white winter oats, and winter beans—are not commonly sown after bare fallow but on stubbles that have received autumn cultivation. The use of Italian rye-grass sown in September for early spring feed on land about to be bare fallowed was mentioned in the July Notes.

Autumn Cultivation.—The preparation of land for sowing in spring, and the problem of securing a good plant of roots are greatly simplified when the stubble of the previous corn crop has been skimmed and cleaned in autumn. It must be granted that in our climate stubble cleaning is not always possible owing to adverse weather conditions, while in the northern and upland districts harvest is usually so late as to leave little time for stubble cultivations. Nevertheless, it may be fairly urged that the advantages of autumn tillage are not generally valued at their full worth. Outside certain districts it is not regarded as an essential rule of good husbandry to skim or broadshare the stubbles immediately they are accessible. The work of extracting weeds from land intended for roots or potatoes too often continues to be closely associated with the spring rather than the autumn months. This seems to be a relic of pre-reaper days, when spring cultivations taxed the labour resources of the farmer less severely than the gathering of the harvest.

Unseeded stubbles should be "skimmed" about 2 to 3 inches deep as soon as practicable after the corn has been cut. "Hitch the plough to the reaper" expresses the theoretical ideal. On heavy land in a dry autumn, prompt attention is repaid by the fact that the surface is movable if attacked directly the corn has been cut, whereas after it has been hardened by exposure to sun and wind, it is almost impenetrable with horse-drawn implements.

Special stubble breakers are made for tractor work on hard soils, and, as shown in the Cambridge demonstrations in

1926, implements of this type perform excellent work under really difficult conditions. Where the soil is not hard-baked to a considerable depth, horse-drawn implements can be used. The grubber or cultivator fitted with broadshares and shin pieces will loosen the soil and leave it in the narrow ridges preferred by the Kent farmer. For smaller areas a lea plough fitted with a paring share and used without the breast may be recommended. After the soil has lain in small ridges for a fortnight, tine implements are introduced to draw out the couch roots and kill the annual weeds.

A correspondent has called my attention to a method of extracting couch that he has found very effective. Observing the manner in which the potato spinner threw out weeds and divested them of soil, he decided to try the effect of this implement specially as a weed eradicator. After ploughing and cultivating the stubble he drew it up in ridges suitable for the action of the digger, and then cast the ridges down with this machine. The results were so satisfactory that for the last two years he has adopted this method as his regular practice. To clean a really dirty field he finds it necessary to repeat the operation. I am not informed whether he also uses the side delivery rake in the process, but where the soil is sufficiently free from stones to allow of the use of this machine it is a valuable aid.

Live Stock.—Since last September the outlook of the cattle farmer has undergone considerable change. At this time last year fat cattle were making poor prices, and the prospects of profitable feeding seemed remote. From September until the end of the year cattle values continued to fall, those for December being only 13 to 16 per cent. above pre-war figures. From January onwards prices improved, and farmers who obtained cheap stores in the early winter months had the satisfaction of selling out at an appreciably higher price per cwt. live weight than that at which the animals were purchased. The sheep feeder had a similar experience. Store sheep have advanced in price to a greater extent than store cattle, and perhaps there is not so much reason for confidence in the prospects of profitable fattening in this case; but in the case of the cattle feeder there does seem to be good reason for believing that his results will be better this winter than they were in 1926-27 and the first half of last winter. The corn farmer is very dependent on a satisfactory price for his winter-fattened cattle and sheep.

The dairy farmer also is hoping for a better financial return

than he obtained last winter. The N.F.U. Scheme price for liquid milk was 1s. 4½d. per gallon delivered at the buyer's station, with a lower price in respect of 10 per cent. of the winter quantities, this percentage being paid for at "Surplus" price. Now, after the month of October, accommodation milk began to realize more than contract supplies. The average

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named and are net cash for prompt delivery.

Description	Average price per ton during week ending August 8				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	..	10 15	10 7	10 12	13 9
" " lime (N. 13%) ..	7 0f	7 0f	7 0f	7 0f	14 0
Nitro-chalk (N. 10%) ..	..	..	..	..	..
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%)	11 19g	11 3h	..	..	..
Sulphate of ammonia:—					
Neutral (N. 20.6%) ..	10 0*	10 0*	10 0*	10 0*	9 9
Calcium cyanamide (N. 20.6%) ..	9 0†	9 0†	9 0†	9 0†	8 9
Kainit (Pot. 14%) ..	3 7	2 17	2 18	2 17	4 1
Potash salts (Pot. 30%) ..	5 2	..	..	4 12	3 1
" (Pot. 20%) ..	3 17	3 5	3 10	3 7	3 3
Muriate of potash (Pot. 50.53½%)	9 10	9 0	9 9	8 5	3 4
Sulphate „ (Pot. 48.51½%)	11 10	11 0	11 14	10 5	4 3
Basic Slag (P.A. 15½%)|| ..	3 1§	2 8§	2 9§	2 19§	3 9
" (P.A. 14%)|| ..	2 16§	2 3§	2 4§	2 14§	3 11
" (P.A. 11%)|| ..	2 7§	1 18§	1 19§	2 5§	4 2
Ground rock phosphate (T.P. 58%)	2 8	2 8	..	2 5	0 9
Fine grade|| ..	3 0	..	3 1	3 0	1 9
Superphosphate (S.P. 35%) ..	2 15	2 8	2 15	2 15	1 10
" (S.P. 30%) ..	8 15	8 10	8 12	8 7	..
Bone meal (N. 3½%, T.P. 45%) ..	..	..	..	..	..
Steamed bone flour (N. ½%, T.P. 60.65%)	5 17†	5 17†	6 5	5 15	..

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

* Delivered in 6-ton lots at purchaser's nearest railway station. 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.

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

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

§ Prices for 6-ton lots delivered to purchaser's nearest railway station. The prices quoted under Bristol relate to deliveries in Somerset, under Hull to Yorkshire, under Liverpool to Lancashire and under London to Middlesex.

|| Fineness 80% through standard screen of 10,000 holes to the square-inch (100 mesh sieve).

§ Delivered in 6-ton lots at purchaser's nearest railway station
g F.o.r. Gloucester.

h F.o.r. Goole.

quotations reported by the Ministry at seven London stations were as follows: November 17½d., December 21d., January 17¾d., February 20½d., and March 18½d. The difference between the contract prices and those obtainable for "free" supplies to some extent indicates the adverse effect of the poor fodder and expensiveness of concentrated foods. The fact cannot be disputed that dairy farmers found their business comparatively unremunerative last winter. Prospects in the matter of fodder are better this year, but with a 5½ per cent. reduction in the numbers of cows and heifers in calf on June 4, and with oil cakes 30 per cent. dearer than last year, milk supplies are not likely to be in excess of the demand. In view of these facts there should this year be no cause for complaint that many milk producers prejudice the interests of their fellows by entering into contracts too soon and at unnecessarily low prices.

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NOTES ON FEEDING STUFFS

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Sugar Beet Pulp.—Much of the farmer's interest in the newly established beet sugar industry is centred on the value, from the feeding standpoint, of the various by-products which arise during the process of extraction of the sugar from the beets. It has rightly been pointed out that in those countries where sugar beet constitutes a normal crop in the rotation, farmers look upon the cheap supply of sugar beet pulp as one of the chief inducements to its cultivation. During the early days of the beet sugar industry in this country, however, growers and others appeared somewhat reluctant to purchase supplies of sugar beet pulp with any freedom. As a consequence, considerable quantities of this by-product remained over for export, largely to America. That its merits as a feeding stuff are now much more widely recognized is shown by the increased quantities which are being purchased for home use. Evidence of this growing demand is supplied by the accompanying data:—

Season		Total dry pulp produced	Purchased for home use	Exported
		Tons	Tons	Tons
1924-5	..	7,510	7,510	Nil
1925-6	..	21,795	17,138	4,657
1926-7	..	62,800	26,040	36,760
1927-8	..	91,436	68,272	23,164

If, as appears probable, the growing of sugar beet is destined to become a permanent feature of British agriculture, it is necessary that sugar beet pulp should find a place in the recognized dietary of the farm animals of this country. Our present knowledge of the uses and nutritive properties of this feeding stuff, however, is based largely on the results of old German trials and of somewhat more recent experiments carried out in America. Little or no experimental work on the feeding of sugar beet pulp has been carried out in this country up to the present time. For that reason, considerable doubt exists in the minds of both the farmer and the scientific man as to the actual nutritive value of this new feeding stuff. When seeking advice on this question, the farmer is usually instructed to regard beet pulp solely as a substitute for roots in the ration, and to base the replacement on the assumption that 1 lb. of dried beet pulp is equivalent to 7-8 lb. of mangolds. The possibility of being able to look on dried beet pulp as a carbohydrate concentrate (*i.e.*, as a food capable of replacing concentrates in the productive part of the ration) is one which appears to have escaped proper recognition, presumably on account of the rather high fibre content of this feeding stuff, which has led the stockfeeder to regard it as possessing, at best, but a moderate feeding value.

Investigations were carried out at Cambridge during the autumn and winter of 1927 with the object of securing information concerning the feeding value of sugar beet pulp as produced in this country. Data were obtained respecting—

- (1) The composition and digestibility of wet sugar beet pulp.
- (2) The composition of dried sugar beet pulp, and the digestibility of this feeding stuff when fed to *ruminants* (a) in the dry condition and (b) after preliminary soaking in water.
- (3) The composition of molasses-sugar beet pulp.

The supplies of fresh and dried beet pulp for the purposes of the trials were obtained from the Ely Beet Sugar Factory; the molasses-sugar beet pulp was supplied by the beet sugar factory at Peterborough.

It will be advisable to state at once the main conclusion which has been drawn from the results of these experiments. Sugar beet pulp has been shown to be highly digestible in the *ruminant* organism. The view that this feeding stuff should be employed solely as a substitute for roots in the ration

has been shown to be too narrow. Dried sugar beet pulp must be regarded as a carbohydrate concentrate, 1 lb. of which is capable of replacing 0.8 lb. of maize or 0.9 lb. of barley in the productive part of the rations of *ruminants*. Moreover, from the standpoint of price per unit or per lb. of starch equivalent, dried sugar beet pulp constitutes a cheap source of digestible carbohydrate in comparison with either maize meal or barley meal.

Before considering the Cambridge experiments in detail, it will be useful to describe briefly the factory processes for producing dried sugar beet pulp and molasses-sugar beet pulp. The pulp remaining after the extraction of the beet sugar contains from 93 to 95 per cent. of water. This is reduced by pressing to about 85 per cent. The wet sugar beet pulp so obtained is dried either by (1) the Büttner process, or (2) the Imperial process.

In the Büttner process, the drying is conducted in a large cylindrical iron drum provided on its internal surface with a system of plates or vanes. The wet beet pulp enters the drying apparatus from above at one end, and is passed along into the drum by means of worm action. The drum revolves $2\frac{1}{2}$ times per minute, so that the pulp is kept in continual movement, dropping from plate to plate as a result of the revolving motion. At the inlet end of the dryer is built a brick kiln in which small coal is burnt at bright red heat. At the exit end, a draught is induced through the kiln and the dryer by means of a fan. The pulp as it enters the dryer is exposed to the full heat of the kiln gases, the temperature of the inlet gases being probably in the region of 800–1,000° C. So long as the pulp, however, contains an appreciable amount of water, the temperature of the material does not rise beyond 100° C., and consequently no charring occurs.

The influence of the induced draught is sufficient to keep the pulp moving continuously towards the exit, since as drying proceeds, the density of the pulp is reduced and the lighter particles are carried forward. The temperature of the exit gases varies from 110–120° C., this being sufficiently high to prevent condensation of water vapour removed from the pulp.

The dried pulp obtained by this method usually possesses a light brown, slightly scorched colour, as a result of the influence of the high temperature in the last stages of drying. A Büttner dryer is able to turn out about 36 tons of dried beet pulp every 24 hours.

In the Imperial process, the furnace gases from the boilers are utilized for the purpose of drying the wet beet pulp. These gases have cooled off slightly during transit from the boiler house, the inlet temperature being about 350° C. The drying apparatus consists of an inner revolving drum contained within an outer stationary drum. The furnace gases are led into the inner drum and from thence pass through perforations into the space between the two drums. Here

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	10 17
Maize	81	6.8	11 2
Decorticated ground nut cake	73	41.0	11 15
„ cotton cake	71	34.0	12 0

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

The cost per unit starch equivalent works out at 2.94 shillings, and per unit protein equivalent 0.96 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, 1927 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	11 1
Oats	60	7.6	9 4
Barley	71	6.2	10 15
Potatoes	18	0.6	2 13
Swedes	7	0.7	1 1
Mangolds	7	0.4	1 1
Sugar Beet Pulp, dried	65	5.2	9 16
Beans	66	20.0	10 13
Good meadow hay	31	4.6	4 15
Good oat straw	17	0.9	2 11
Good clover hay	32	7.0	5 1
Vetch and Oat silage	13	1.6	2 0
Barley straw	19	0.7	2 17
Wheat straw	11	0.1	1 12
Bean straw	19	1.7	2 17

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British..	—	—	10 5	0 13	9 12	72	2 8	1.43	9.6
Barley, British feeding	—	—	11 10	0 10	11 0	71	3 1	1.65	6.2
" Canadian No.3 Western	39 6	400	11 2	0 10	10 12	71	3 0	1.61	6.2
" Danubian ..	38 9	"	10 17*	0 10	10 7	71	2 11	1.56	6.2
" Persian ..	37 6	"	10 10	0 10	10 0	71	2 10	1.52	6.2
" Tunisian ..	38 6	"	10 15	0 10	10 5	71	2 11	1.56	6.2
" Algerian ..	39 6	"	11 2§	0 10	10 12	71	3 0	1.61	6.2
Oats, English, white ..	—	—	12 0	0 11	11 9	60	3 10	2.05	7.6
" " black and grey	—	—	11 5*	0 11	10 14	60	3 7	1.92	7.6
" Canadian No. 2 Western	31 3	320	10 18	0 11	10 7	60	3 5	1.83	7.6
" " " 3	29 9	"	10 8	0 11	9 17	60	3 3	1.74	7.6
" Argentine ..	29 6	"	10 7	0 11	9 16	60	3 3	1.74	7.6
" Chilian ..	35 6	"	12 8	0 11	11 17	60	3 11	2.10	7.6
Maize, Argentine ..	47 6	480	11 2	0 11	10 11	81	2 7	1.38	6.8
Beans, English, winter	—	—	10 10†	1 6	9 4	66	2 9	1.47	20
Peas, Japanese ..	—	—	24 10§	1 3	23 7	69	6 9	3.62	18
Dari ..	—	—	10 0	0 13	9 7	74	2 7	1.38	7.2
Millers' offals—	—	—	—	—	—	—	—	—	—
Bran, British ..	—	—	7 15	1 3	6 12	42	3 2	1.70	10
" broad ..	—	—	8 17	1 3	7 14	42	3 8	1.96	10
Middlings, fine, imported	—	—	10 0	0 18	9 2	69	2 8	1.43	12
" coarse, British ..	—	—	9 7	0 18	8 9	58	2 11	1.56	11
Pollards, imported ..	—	—	8 10	1 3	7 7	60	2 5	1.29	11
Meal, barley ..	—	—	12 0	0 10	11 10	71	3 3	1.74	6.2
" maize ..	—	—	12 0	0 11	11 9	81	2 10	1.52	6.8
" " germ ..	—	—	10 15	0 16	9 19	85	2 4	1.25	19
" locust bean ..	—	—	10 0	0 8	9 12	71	2 8	1.43	3.6
" bean ..	—	—	12 15	1 6	11 9	66	3 6	1.87	20
" fish ..	—	—	20 10	3 10	17 0	53	6 5	3.44	48
Maize, gluten feed ..	—	—	10 5	1 1	9 4	76	2 5	1.29	19
" cooked flaked ..	—	—	12 15	0 11	12 4	85	2 10	1.52	8.6
Linseed—	—	—	—	—	—	—	—	—	—
" cake, English 12% oil	—	—	13 5	1 11	11 14	74	3 2	1.70	25
" " " 9% "	—	—	12 12	1 11	11 1	74	3 0	1.61	25
" " " 8% "	—	—	12 7	1 11	10 16	74	2 11	1.56	25
Soya bean " 5½% "	—	—	11 15	2 4	9 11	69	2 9	1.47	36
Cottonseed cake English—	—	—	—	—	—	—	—	—	—
" Egyptian 4½ 5% "	—	—	8 10	1 10	7 0	42	3 4	1.78	17
" " Egyptian 4½% "	—	—	8 10†	1 10	7 0	42	3 4	1.78	17
Decorticated cottonseed cake,	—	—	—	—	—	—	—	—	—
" 7% oil ..	—	—	12 0	2 5	9 15	74	2 8	1.43	35
Coconut cake, 6% oil ..	—	—	11 5	1 6	9 19	79	2 6	1.34	16
Ground nut cake, 6.7% oil ..	—	—	10 10*	1 7	9 3	57	3 3	1.74	27
Decorticated ground-nut cake,	—	—	—	—	—	—	—	—	—
" 6.7% oil ..	—	—	11 15	2 5	9 10	73	2 7	1.38	41
Palm kernel cake, 4½ 5½% oil	—	—	10 0†	0 19	8 11	75	2 3	1.20	17
" " " meal, 4½% oil	—	—	10 10†	0 19	9 11	75	2 7	1.38	17
" " meal 1% "	—	—	9 10†	1 0	8 10	71	2 5	1.29	17
Feeding treacle ..	—	—	6 0	0 9	5 11	51	2 2	1.16	2.7
Brewers' grains, dried ale ..	—	—	8 5	1 0	7 5	49	3 0	1.61	13
" " " porter ..	—	—	7 15	1 0	6 15	49	2 9	1.47	13
Malt culms " " ..	—	—	7 15*	1 9	6 8	43	2 11	1.56	16

* At Bristol

* 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 prices of the feeding stuffs on locally at £10 per ton, its manurial value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. 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. 5d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.29d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 11d.; P₂O₅, 3s. 10d.; K₂O, 3s. 3d.

the hot gases encounter the wet pulp, which is kept in continuous agitation by means of plates or vanes fixed to the outer surface of the inner revolving drum. The temperature of the exit gases varies from 95–110° C. Owing to the lower temperature to which the pulp is exposed in the Imperial drying process, the final product retains the light grey colour of the wet pulp, and meets with a special demand, especially from Holland. It commands a slightly higher price than the Büttner-dried pulp. For home consumption, it is customary to mix the products from the two processes, and it was on such mixed pulp that the dried beet pulp digestion trials in the Cambridge investigation were carried out. The Imperial process is not quite so efficient as the Büttner, the rate of drying being about 1½ times as rapid in the latter process as in the former.

In the manufacture of molasses-sugar beet pulp, the wet pulp, after leaving the pressers, enters a scroll, at one end of which a stream of molasses is allowed to run on to the pulp. The scroll conveys the material a considerable distance, and in this process the pulp and molasses become intimately mixed. The mixture then enters the dryer and is dried in the usual way. As made in the Peterborough Beet Sugar Factory, such molasses-beet pulp is said to contain ordinarily about 20 per cent. of sugar.

[In the Notes for next month, it is proposed to deal with the composition and manurial value of dried sugar beet pulp and molasses-sugar beet pulp.]

* * * * *

MISCELLANEOUS NOTES

AGRICULTURAL produce, during July, was 45 per cent. dearer than in the base years 1911-13, as compared with 53 per cent. in the previous month, and

The Agricultural Index Number 42 per cent. a year ago. Prices, as a whole, tended towards lower levels during the month, but the considerable reduction

in values for fat cattle and sheep, and the low prices obtained for early potatoes, were the principal factors contributing to the fall of 8 points in the general index number.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13					
	1923	1924	1925	1926	1927	1928
January	67	60	71	58	49	45
February	63	61	69	53	45	43
March	59	57	66	49	43	45
April	54	53	59	52	43	51
May	54	57	57	50	42	54
June	49	56	53	48	41	53
July	50	53	49	48	42	45
August	52	57	54	49	42	—
September	52	61	55	55	43	—
October	50	66	53	48	40	—
November	51	66	54	48	37	—
December	55	65	54	46	38	—

Grain.—The average price of wheat was 10s. 10d. per cwt. during July, or 1d. per cwt. lower than in June, and the index number declined by 4 points to 34 per cent. above pre-war. Barley and oats were both 7d. per cwt. cheaper on the month at 10s. 3d. and 12s. 1d. per cwt. respectively, and the index number for the former was 9 points lower at 37 per cent. above 1911-13, and, for the latter, 11 points lower at 58 per cent. In July last year, wheat and barley were comparatively the dearest cereals at 56 and 57 per cent. respectively above the base years, while oats were cheapest at 33 per cent.

Live Stock.—The prices realized for fat cattle and sheep during July were considerably lower than in the preceding month. There was a decline of nearly 4s. per live cwt. in the average for second quality fat cattle, the relative index number falling by 3 points to 44 per cent. above pre-war, while second quality fat sheep at an average of 1s. were 1½d. per lb. lower, and the index number declined from 83 to 66 per cent. above the pre-war level. Fat pigs, however, as is customary at this season of the year, showed very little alteration in values, but the tendency of prices was lower and the index numbers recorded a fall. With the exception of dairy cattle, which were in good demand and about 10s. per head dearer in July, the prices of store stock were lower, although the difference in values was less acute than is usual at this period, and the index numbers were, therefore, higher than in June, store cattle being 5 points higher at 31 per cent. above pre-war, store sheep 12 points at 67 per cent., and store pigs 3 points at 25 per cent.

Dairy and Poultry Produce.—Milk, at 55 per cent. above the pre-war level, was a little dearer during July, the shortage caused by the exceptionally hot weather conditions resulting

in higher prices in the north-western area. Butter was also dearer, but the price did not rise to the customary extent, and the index number fell from 54 to 50 per cent. above 1911-13. A very considerable decline occurred in the price of cheese, and the index number, at 66 per cent. above pre-war, was very similar to that recorded in the first three months of the year, but was 8 points higher than in July last year. Eggs, at 36 per cent. above pre-war in July, were 2 points lower than in the previous month, and poultry 2 points higher at 54 per cent.

Other Commodities.—The average prices obtained for first early potatoes in July were 37 per cent. above the base years 1911-13, as against 61 per cent. in July, 1927, 21 per cent. in 1926 and 43 per cent. in 1925. Fruit and vegetables, however, sold at approximately double the pre-war prices. There was very little variation in hay prices, but the average was lower, and the index number declined by 2 points to 11 per cent. above pre-war as compared with 6 per cent. a year ago. Wool prices were rather higher on the month at 78 per cent. above 1911-13, a rise of 3 points on the June index figure.

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

Commodity	1926	1927	1928			
	July	July	Apl.	May	June	July
Wheat	73	56	34	40	38	34
Barley	17	57	41	41	46	37
Oats	33	33	64	74	69	58
Fat cattle	40	30	43	48	47	44
Fat sheep	59	45	78	90	83	66
Bacon pigs	83	43	43	42	43	41
Pork pigs	84	49	45	40	38	34
Dairy cows	38	25	34	33	32	34
Store cattle	33	26	22	26	26	31
Store sheep	82	55	46	50	55	67
Store pigs	139	80	35	26	22	25
Eggs	33	31	37	35	38	36
Poultry	52	52	41	51	52	54
Milk	60	55	63	53	53	55
Butter	56	42	55	52	54	50
Cheese	78	58	78	85	91	66
Potatoes	21	61	94	120	125	37
Hay	8	6	11	14	13	11
Wool	23	40	71	72	75	78

In continuation of the article on this subject, which appeared in the January, 1928, issue of this Journal, the following further data are given, obtained from trials carried out at two centres

The Use of Water Bowls : during the winter of 1927-28, for the purpose of ascertaining the effect of continuous access to drinking-water, as against intermittent watering, in the case of milking cows receiving a ration containing no roots.

The centres conducting the trials were the Monmouthshire Agricultural Institute and the East Sussex Farm Institute. At the outset, it was hoped that the same experiment would be carried out also at the centres in Somerset and Cheshire, but circumstances making this impossible intervened later. The scheme outlined in the article referred to was followed, with the exception that a further provision was made that the cows should be rationed on dry foods only.

The periods occupied by the trials were: Monmouthshire Agricultural Institute, October 12, 1927, to December 13, 1927 (each trial period four weeks with an interval of one week), East Sussex Farm Institute, February 19, 1928, to May 5, 1928 (each trial period five weeks with an interval of one week).

The total amount of milk yielded by each group of cows with and without access to water bowls was as follows:—

<i>Monmouthshire Agricultural Institute</i> (5 cows in group 1).			
(4 " " 2).			
		With bowls.	Without bowls.
		lb.	lb.
Group 1	.. ..	2,356	3,238½
Group 2	.. ..	2,846	2,303½
		5,202	5,542½
Net decrease with bowls		.. ..	340½ lb.
<i>East Sussex Farm Institute</i> (5 cows in each group).			
		With bowls.	Without bowls.
		lb.	lb.
Group 1	.. ..	7,785	6,246½
Group 2	.. ..	6,406½	7,470
		14,191½	13,716½
Net increase with bowls		.. ..	475 lb.

With regard to butter-fat content, the results at Monmouthshire Agricultural Institute are slightly in favour of the bowls, but in the case of East Sussex Farm Institute the results are against them.

There are no facilities for weighing cattle at East Sussex Farm Institute; particulars of weights of the cows before and after the trials, therefore, were not recorded.

It may be observed that the cows at the two centres differ materially in the average daily milk yield per head. Thus, at East Sussex Farm Institute, this average is approximately 40 lb. per cow per day, whilst the corresponding figure for Monmouthshire Agricultural Institute is 21 lb.

The yield obtained when water bowls were in use shows a slight increase (134½ lb.) compared with the yield from the same cows watered in the ordinary way without the use of bowls. This increase is well within the range of experimental error, and bearing in mind that the scope of the experiment on this occasion was limited to trials at only two Institutes, there appears to be nothing to add to the "Discussion of Results" in the article previously referred to.

* * * * *

IN 1920 Miss L. Jones-Bateman, of Cae Glass, Abergele, presented to the Royal Horticultural Society a valuable silver-gilt replica of the Warwick Vase to be used for the encouragement of fruit production. It has been decided to offer it triennially for researches in the growing of hardy fruits, figs, grapes and peaches in the open or under glass, and it is available for award in 1928.

Candidates should submit accounts of their work by October 31, 1928. The work dealt with must have been carried out by the candidate in the United Kingdom mainly during the past five years. The Cup will be held for three years by the successful candidate, who must give a bond for its safe return, and when the Cup is relinquished the holder will receive a commemorative gold medal. The holder will be eligible to compete on the next or any succeeding occasion.

The assessors will be three, two appointed by the Royal Horticultural Society and one by the National Farmers' Union, and they will report to the Council of the Royal Horticultural Society upon the originality and comparative potential value to the fruit-growing industry of the work of the candidates. The Council of the Royal Horticultural Society will award or withhold the Cup at its discretion.

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended June, 1928, compared with the corresponding period in 1927. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	April to June, 1928		April to June, 1927	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	178	33,347	104	17,809
Brazil	64	4,483	0	0
Belgium	0	0	34	837
Uruguay	32	6,340	13	3,200
United States of America ..	12	1,365	0	0
Irish Free State ..	449	7,375	1,828	24,526
Kenya Colony	8	467	12	904
Rhodesia	6	200	0	0
Union of South Africa ..	2	290	0	0
Australia	0	0	46	6,943
Canada	40	3,135	0	0
Other countries	7	1,035	9	720
Total	798	58,037	2,046	54,939
SHEEP AND LAMBS				
Argentina	39	965	4	100
Belgium	25	207	2	40
Brazil	117	1,560	0	0
Germany	2	20	2	70
Spain	9	113	2	24
Uruguay	18	800	0	0
Irish Free State ..	35	91	100	268
Australia	0	0	65	1,121
Other countries	24	354	10	213
Total	269	4,110	185	1,836
SWINE				
Argentina	1	22	3	120
Czecho-Slovakia	0	0	4	84
Denmark	0	0	4	20
France	2	26	7	301
Germany	0	0	8	82
Italy	23	810	0	0
Poland	0	0	4	100
Portugal	6	112	1	26
Japan	0	0	10	636
Irish Free State ..	5	33	368	1,153
Other countries	4	155	5	154
Total	41	1,158	414	2,676

AN Order-in-Council, dated July 13, 1928, made under the Merchandise Marks Act, 1926, requires the marking with an indication of origin in certain circumstances of imported Honey and imported fresh Apples.

Marking of Imported Honey and Fresh Apples

The Order is published as Statutory Rules and Orders, 1928, No. 571, copies of which can be obtained through any bookseller or directly from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2 (and branches), price 1d. each, excluding postage.

* * * * *

STUDLEY COLLEGE is one of the two colleges in England, aided by the Ministry, established for the education of women in agriculture. The college was founded 30 years ago at Reading and was removed to Studley in 1903. In recognition of the value of the work done at the college, the Departmental Committee on the Re-assessment of Annual Grants to Institutions providing Higher Agricultural Education, recommended that Studley should be placed on the list of colleges receiving maintenance grants from the Ministry, and it now receives an annual grant of £1,000.

The college and the adjoining farm are held on lease from the Trustees of the late Earl of Warwick. The Governors are proposing to acquire the freehold of the property, and the Treasury have authorized the Ministry of Agriculture and Fisheries to make a grant for the purpose not exceeding £5,000, on condition that the college provides a similar sum on a £ for £ basis and undertakes to furnish the balance needed to complete the purchase. It is understood that the Governors will shortly launch an appeal for raising the sum required.

* * * * *

A DEMONSTRATION of fruit marketing was given at the Taunton Deane Horticultural Show—the Chelsea Show, of the West—which was held in Vivary Park,

Marketing Taunton, on August 8 and 9 under ideal weather conditions. Growers from all parts of Somerset and Devon watched with much interest the demonstrations of grading and packing of apples on modern commercial lines.

The Ministry's officials in attendance were very fully occupied throughout the Show in answering inquiries of all kinds relating

to the marketing of fruit, and it is estimated that no fewer than 4,000 persons passed round the exhibit. The interest displayed in the demonstration, not only by those engaged in the fruit-growing industry but by the general public, was remarkable.

An instructive and interesting exhibit concerning the marketing of cider, provided by the Somerset Farm Institute, was included in the demonstration.

The approved National Mark labels were used for the first time at this demonstration, and the recently issued leaflet on Fruit Marketing Reform (Marketing Leaflet No. 7) was freely distributed. Many inquiries were made regarding the use of the National Mark, and it is worth noting that three prominent Somerset fruit farmers, in addition to deciding to adopt the National Mark Scheme, expressed their keen appreciation of the Ministry's efforts to assist in the better production and marketing of home-grown fruit.

Demonstrations covering pigs and potatoes were given at the Royal Lancashire Show at Oldham on August 2 to 6, and eggs, poultry and cattle at the Royal Welsh Show at Wrexham on August 8 to 10.

The Ministry's autumn programme of demonstrations is under consideration, and particulars will be given in a later issue of this JOURNAL.

* * * * *

WITH the aid of a grant from the Sugar Beet Factories, the Ministry in 1927 made arrangements, through the Local

Education Authorities in the principal

Sugar Beet beet-growing districts, for a scheme of
Demonstrations demonstrations designed to bring before farmers various important points to be

borne in mind in the cultivation of sugar beet. A review of one year's work has now been issued by the Ministry,* indicating the conclusions provisionally reached, pending confirmation by the further work which is being undertaken.

The scheme of demonstrations was designed to determine such points as the best width between rows, the difference between shallow and deep hoeing, time of singling, sowing on the ridge or on the flat, and most suitable manuring.

It was, however, arranged that each demonstration should be confined to the elucidation of one factor.

Growers will find in this concise report information and advice which should prove of considerable value to them.

* Miscellaneous Publications, No. 63, *Sugar Beet Demonstrations*, obtainable from the Ministry, price 2d., post free.

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1928*

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, 1928.

(The figures for 1928 are subject to revision.)

CROPS AND GRASS.

Distribution	1928	1927	Increase		Decrease	
			Acres	Per cent.	Acres	Per cent.
TOTAL ACREAGE under all CROPS and GRASS ..	25,504,000	25,590,000	—	—	86,000	0.3
*ROUGH GRAZINGS ..	5,176,000	5,126,000	50,000	1.0	—	—
ARABLE LAND ..	10,111,000	10,310,000	—	—	199,000	1.9
PERMANENT GRASS :						
For Hay ..	4,499,000	4,317,000	182,000	4.2	—	—
Not for Hay ..	10,894,000	10,963,000	—	—	69,000	0.6
TOTAL ..	15,393,000	15,280,000	113,000	0.7	—	—
Wheat ..	1,397,000	1,636,000	—	—	239,000	14.6
Barley ..	1,187,000	1,049,000	138,000	13.2	—	—
Oats ..	1,760,000	1,751,000	9,000	0.5	—	—
Mixed corn ..	119,600	109,200	10,400	1.0	—	—
Rye ..	31,200	36,000	—	—	4,800	13.3
Beans, harvested as corn ..	156,900	189,900	—	—	33,000	17.4
Beans, picked or cut green ..	12,600	11,800	800	6.8	—	—
Peas, harvested as corn ..	69,400	76,900	—	—	7,500	9.8
Peas, picked or cut green ..	45,000	41,900	3,100	7.4	—	—
Potatoes ..	488,500	513,900	—	—	25,400	4.9
Turnips & Swedes ..	722,100	716,300	5,800	0.8	—	—
Mangold ..	298,400	305,600	—	—	7,200	2.4
Sugar Beet ..	175,400	222,600	—	—	47,200	21.2
Cabbage for fodder, Kohl-rabi and Rape ..	125,100	129,000	—	—	3,900	3.0
Vetches or Tares ..	67,500	80,700	—	—	13,200	16.4
Lucerne ..	37,300	43,600	—	—	6,300	14.4
Mustard for seed ..	26,700	38,000	—	—	11,300	29.7
Cabbage for human consumption ..	27,900	26,000	1,900	7.3	—	—
Brussels sprouts ..	30,400	23,700	6,700	28.3	—	—
Cauliflower or Broccoli ..	13,600	11,700	1,900	16.2	—	—

* Mountain, Heath, Moor, Down and other rough land used for grazing.

CROPS AND GRASS—*continued.*

Distribution	1928	1927	Increase		Decrease	
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Per cent.</i>	<i>Acres</i>	<i>Per cent.</i>
Carrots	10,100	8,700	1,400	16.1	—	—
Onions	1,700	1,700	—	—	—	—
Celery	5,900	5,700	200	3.5	—	—
Rhubarb	7,200	6,700	500	7.5	—	—
Linseed	2,600	2,500	100	4.0	—	—
Hops	23,800	23,000	800	3.5	—	—
Small fruit ..	64,700	69,200	—	—	4,500	6.5
Orchards	248,300	248,700	—	—	400	0.2
CLOVER and ROTATION GRASSES:						
For hay	1,568,000	1,586,000	—	—	18,000	1.1
Not for hay ..	871,000	875,000	—	—	4,000	0.5
TOTAL ..	2,439,000	2,461,000	—	—	22,000	0.9
BARE FALLOW ..	468,200	423,400	44,800	10.6	—	—

The total area returned this year under crops and permanent grass or classified as rough grazings on agricultural holdings exceeding one acre in extent in England and Wales is 30,680,000 acres, or 36,000 acres less than in 1927. The area under crops and permanent grass is 25,504,000 acres, a reduction of 86,000 acres as compared with 1927, while the acreage of rough grazings at 5,176,000 acres shows an increase of 50,000 acres.

The reduction in arable land has continued, the acreage returned this year being 10,111,000 acres, or 199,000 acres less than in 1927, while land laid down to permanent grass shows an increase of 113,000 acres.

Cereals.—The improvement shown in the wheat acreage during the last two years has not been maintained, the acreage of 1,397,000 acres returned this year showing the large reduction of 239,000 acres, or 14.6 per cent. With the exception of the years 1895 and 1904 the wheat acreage is the lowest on record.

The reduction has been general throughout the country, only one county in England and three in Wales showing increases, and these are quite negligible. While substantial decreases have occurred in all the largest wheat-growing areas, the heaviest decreases were in the North-Eastern Counties, where Norfolk lost over 20,000 acres and Lincolnshire nearly 27,000 acres. The Yorkshire wheat acreage decreased by nearly 33,000 acres, while Essex returned nearly 13,000 acres and Suffolk about 14,000 acres less.

There has been a substantial recovery in the barley acreage, which last year was the lowest on record. The area returned under this crop is 1,187,000 acres compared with 1,049,000 acres in 1927, an increase of 138,000 acres, or over 13 per cent. The great majority of the counties returned larger areas under this crop, the biggest increases being 28,000 acres in Lincolnshire, 22,000 acres in Norfolk, 15,000 acres in Suffolk and 13,000 acres in Yorkshire.

The acreage under oats is slightly larger than last year, the area being 1,760,000 acres compared with 1,751,000 acres in 1927. Relatively small increases in acreage were shown in most of the

Northern and Eastern counties, and also in the East Midland counties, but these increases were almost counterbalanced in total by the decreases which occurred in the remaining counties in England and in the whole of Wales.

Mixed corn shows an increase of 10,400 acres, or 1 per cent., in which nearly every county shared.

Forecasts of the yields per acre of corn crops, based on the condition of the crops on August 1, suggest that the total production of wheat, barley and oats this year will be approximately as shown in the following table. These forecasts were made when practically all the crops were still uncut and are consequently subject to revision:—

				<i>Forecast</i>	<i>Production</i>
				1928	1927
				Tons	Tons
Wheat	..	..	..	1,201,000	1,423,000
Barley	..	..	..	938,000	862,000
Oats	..	..	..	1,355,000	1,344,000

Beans and Peas.—The total area of beans is 169,500 acres, or 32,000 acres less than in 1927. The decrease is wholly in beans for harvesting as corn, which decreased by 33,000 acres, or 17.4 per cent. The acreage of beans picked green shows an increase of 800 acres, or 6.8 per cent. The total area of peas is 114,400 acres, a reduction of 4,400 acres compared with 1927. Here again the reduction is due to the drop in the acreage to be harvested as corn, which decreased by 7,500 acres to 69,400 acres. Peas for picking green occupied 45,000 acres, an increase of 3,100 acres over 1927.

Potatoes.—There is a decrease of 25,400 acres, or nearly 5 per cent., in the acreage of potatoes as compared with last year, the acreage returned this year being 488,500 acres against 513,900 acres in 1927. Minor increases are shown in four counties only. The greatest decreases are in Yorkshire, which shows a reduction of nearly 5,500 acres, or about 8 per cent. Lincolnshire shows a net decrease over its three divisions of 488 acres, while Cheshire and Lancashire show losses of 800 acres and 1,402 acres respectively. Other noteworthy decreases are 1,370 acres in Staffordshire, 1,250 acres in Durham and 1,690 acres in Kent.

Sugar Beet.—A sharp reduction is shown in the acreage under sugar beet, which at 175,400 acres is 47,200 acres, or over 21 per cent., less than in 1927. The bulk of this reduction is shown in the Eastern Counties, where Norfolk, Suffolk and Essex returned about 10,000, 6,000 and 5,000 acres respectively less than last year, and in Lincolnshire and Yorkshire, which returned 9,000 acres and 5,000 acres respectively less. Salop lost the relatively small acreage of 700 acres, and the Isle of Ely 2,780 acres. Minor increases were shown in Warwick and Hereford.

Fodder Roots.—The area under turnips and swedes is 722,100 acres, a slight increase of 5,800 acres on the acreage recorded last year. This increase was distributed over a large number of counties in England, but only one county in Wales increased its acreage under this crop. On the other hand, the acreage under mangolds continued to decline, the area for this year being 298,400 acres compared with 305,600 acres in 1927. Most of the English counties, and all except two counties in Wales, recorded a decrease in the acreage of mangolds, exceptions being found in the Northern and North-Eastern counties, where the biggest, though relatively small, increases occurred in Lincolnshire and Yorkshire.

Other Crops.—Most other farm crops again show reduced acreages. Cabbage for fodder, kohlrabi and rape show a decrease from 129,000 acres to 125,100 acres. Mustard for seed is reduced from 38,000 acres

to 26,700 acres. Vetches on 67,500 acres show a decrease of 13,200 acres, while lucerne has dropped from 43,600 acres in 1927 to 37,300 acres this year. The acreage of rye is 31,200 acres, or 4,800 acres less than in 1927. Hops are being grown on a slightly increased acreage, the area for this year being 23,800 acres, or 800 acres more than in 1927.

Vegetables.—The acreage under vegetables shows an appreciable increase. Cabbage for human consumption was grown on 27,900 acres, or 1,900 acres more than in 1927. Brussels sprouts increased from 23,700 to 30,400 acres, and cauliflower or broccoli from 11,700 acres to 13,600 acres. The area of carrots has been increased from 8,700 acres to 10,100 acres, and celery from 5,700 acres to 5,900 acres. Rhubarb has increased from 6,700 acres to 7,200 acres. The acreage of onions is returned at 1,700 acres, the same as in 1927.

Fruit.—The total acreage of orchards is returned at 248,300 acres, or practically the same as last year. Minor changes shown in almost every county result in a net decrease of about 400 acres. The largest increases recorded are 610 acres in Kent and 560 acres in Worcester, while Gloucester and Middlesex show reductions of 450 acres and 370 acres respectively. A greater decrease is shown in the area of small fruit, the acreage of 69,200 acres returned last year having fallen to 64,700 acres, a reduction of 4,500 acres, in the current year. This decrease is mainly due to a reduction in the strawberry acreage, which decreased by 2,800 acres to 20,000 acres. The raspberry acreage at 6,200 acres shows little change, while currants and gooseberries grown on 34,600 acres show little or no material variation from last year's returns.

Clover and Rotation Grasses and Meadow Hay.—The acreage returned as under clover and rotation grasses is 2,439,000 acres, or 22,000 acres less than in 1927. The decrease is mainly in the acreage used for hay, which at 1,568,000 shows a loss of 18,000 acres. Meadow hay shows an increase from 4,317,000 acres to 4,499,000 acres, an addition of 182,000 acres.

Bare Fallow.—The area of land returned as bare fallow has increased from 423,400 acres to 468,200 acres, an addition of 44,800 acres, or 10.6 per cent. The North-Eastern counties show the greater proportion of this increase.

LIVE STOCK. CATTLE.

	1928	1927	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Cows and Heifers in Milk ..	2,066,200	2,096,400	—	—	30,200	1.4
Cows in Calf, but not in Milk ..	301,700	307,000	—	—	5,300	1.7
Heifers in Calf ..	355,200	387,300	—	—	32,100	8.3
Other Cattle :—						
Two years and above ..	1,008,100	1,059,900	—	—	51,800	4.9
One year and under two ..	1,175,000	1,226,500	—	—	51,500	4.2
Under one year	1,119,800	1,198,100	—	—	78,300	6.5
TOTAL OF CATTLE	6,026,000	6,275,200	—	—	249,200	4.0

The total number of cattle is 6,026,000. This total is 249,200, or 4 per cent. less than the number returned in 1927, and represents the first decrease to be recorded since 1921. All classes show a reduction. With the exception of the four Northern Counties, decreases were shown throughout the country, but the relatively heaviest reductions were in the eastern counties.

The number of cows and heifers in milk or in calf is 2,723,200 compared with 2,790,700 in 1927, a drop of over 2 per cent. In heifers in calf alone the reduction is 32,100, or over 8 per cent. The number of cattle under one year shows a substantial decrease of 78,300, or 6.5 per cent., while yearlings, which increased very slightly last year, show a decrease of over 4 per cent. Other cattle (over two years old) have also been reduced by 51,800, or about 5 per cent.

SHEEP.

	1928	1927	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Ewes kept for Breeding ..	6,833,900	6,962,200	—	—	128,300	1.8
Other Sheep :—						
One year and above ..	2,579,400	2,821,600	—	—	242,200	8.6
Under one year	6,972,800	7,288,500	—	—	315,700	4.3
TOTAL OF SHEEP	16,386,100	17,072,300	—	—	686,200	4.0

For the first time since 1922 there has been a reduction in the number of sheep returned, the total of 16,386,100 being 686,200, or 4 per cent. less than in 1927. The decrease is general throughout the country except for minor increases in five counties in England and one in Wales. The reduction in the number of breeding ewes, however, is relatively much less than in other sheep, the number of ewes being only 128,300, or 1.8 per cent. less than last year, whereas other sheep, one year and above, have declined by 242,200, or 8.6 per cent., to 2,579,400, and lambs under one year by 315,700, or 4.3 per cent., to 6,972,800. The number of rams and ram lambs for service in 1928 shows an increase from 196,350 to 200,410.

PIGS.

	1928	1927	Increase		Decrease	
	No.	No.	No.	Per cent.	No.	Per cent.
Sows kept for Breeding ..	379,800	392,900	—	—	13,100	3.3
Other Pigs ..	2,588,100	2,298,600	289,500	12.6	—	—
TOTAL OF PIGS..	2,967,900	2,691,500	276,400	10.3	—	—

The number of pigs returned as on agricultural holdings on June 4 is not far behind the record year of 1924. The total number returned is 2,967,900, an increase of 276,400, or 10.3 per cent. over the previous

year. Practically every county shared in the increase. There is, however, a reduction of 13,100 in the number of sows kept for breeding. Most counties share in this reduction, the chief exceptions being Devon, Norfolk and Sussex, with increases of 657, 975 and 425 respectively.

HORSES.

	1928	1927	Decrease	
	No.	No.	No.	Per cent.
Horses used for Agricultural purposes (including Mares for Breeding)	732,500	746,200	13,700	1·8
Unbroken Horses (including Stallions) :—				
One year and above ..	96,500	106,900	10,400	9·7
Under one year ..	38,100	40,200	2,100	5·2
Other Horses	171,300	183,900	12,600	6·9
TOTAL OF HORSES	1,038,400	1,077,200	38,800	3·6

The number of horses on agricultural holdings continues to decline, although it may be noted that the total reduction is somewhat less than that recorded last year. Horses used for agricultural purposes (including mares for breeding) show a decrease of 13,700, or rather less than last year's reduction. On the other hand, the decline in breeding, as evidenced by the number of foals, which last year showed signs of being arrested, is again in evidence.

The number of foals is 38,100, a drop of 2,100, or over 5 per cent., compared with a reduction of 800, or 2 per cent., recorded last year. The decrease in the number of foals is actually and relatively greater in the case of heavy foals than light foals, a fair number of counties showing an increase in the latter. The number of stallions being used for service increased from 3,174 to 3,199.

Acreage of Hops.—Preliminary statement compiled from the returns collected on June 4, 1928, showing the acreage under hops in each county of England in which hops were grown, with a comparative statement for the years 1927 and 1926.

Counties, &c.		1928 Acres	1927 Acres	1926 Acres
Kent	East	3,280	3,170	3,500
	Mid	4,940	4,790	5,260
	Weald	6,580	6,330	6,940
	Total, Kent ..	14,800	14,290	15,700*
Hants .. ..	.. ..	990	950	1,030
Hereford ..	.. ..	3,780	3,590	4,170
Surrey .. ..	.. ..	160	150	180
Sussex .. ..	.. ..	2,150	2,150	2,380
Worcester ..	.. ..	1,790	1,770	2,030
Other Counties ..	.. ..	130	100	110
Total .. ..	.. ..	23,800	23,000	25,600

* * * *

Merchandise Marks Act, 1887.—The Berkshire County Council have carried through, on behalf of the Ministry, the prosecution of a Hampshire firm of millers in respect of the sale as "Sussex ground oats" of a mixture of ground oats, ground tapioca root, ground barley and ground oat shuders. The firm was fined £10 and costs.

* * * *

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
W. W. Glaister	Animal Husbandry.
W. A. Jones	Agricultural Botany.
G. T. Joyce	Dairying.
A. B. Fowler	Animal Breeding.

Two of the three existing scholars are being sent for their second year to Cornell University, U.S.A.

* * * *

Research Scholarships.—On the recommendation of the Advisory Committee on Agricultural Science, research scholarships have been awarded to the following :—

Name	Subject
A. J. Pugh	Soil Chemistry.
H. E. Wright	Animal Nutrition.
G. D. H. Bell	Plant Breeding.
A. C. Hoyle	Plant Pathology.
F. R. Tubbs	Plant Physiology.
J. Y. Bogue	Veterinary Physiology.

Two existing scholars in soil chemistry are being sent to Zürich and Dresden and one scholar to Ames, Iowa; seven existing scholars are continuing their work in this country.

* * * *

Enforcement of Minimum Rates of Wages.—During the month ending August 15, legal proceedings were instituted against six employers for failure to pay minimum and overtime 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 concerned.
		£ s. d.	£ s. d.	£ s. d.	
Cumberland ..	Whitehaven	8 0 0	4 17 0	110 0 0	3
Lindsey ..	Horncastle	2 0 0	1 0 0	7 0 0	1
Wiltshire ..	Malmesbury	4 0 0	1 0 0	5 0 0	1
Brecon ..	Talgarth*	—	0 11 0	4 16 0	1
Flint ..	Caerwys	1 0 0	—	6 7 10	1
Glamorgan ..	Penmaen	0 5 0	—	2 13 10	1
		£15 5 0	£7 8 0	£135 17 8	8

Proceedings were also taken against an employer under Section 9 (3a) of the Act (refusing information). The case was heard at Kendal in Westmorland and the defendant was fined £1.

* Dismissed under the Probation of Offenders Act.

Foot-and-Mouth Disease.—The existence of foot-and-mouth disease was confirmed on August 2, at Catforth, Woodplumpton, near Preston, Lancs, and the usual restrictions were applied to an area of approximately 15 miles round the infected premises. A further outbreak on premises about two miles from the original case occurred on August 8.

No further outbreak having occurred in the Yorks, North Riding, infected area—referred to in the August issue of this JOURNAL—the restrictions in that area were withdrawn on August 13.

One hundred and seven outbreaks in all have been confirmed since January 1 last, involving 14 counties and the slaughter of 3,046 cattle, 4,204 sheep, 1,673 pigs and 6 goats.

* * * * *

NOTICES OF BOOKS

Cost Accounting Applied to Agriculture, as an aid to more productive farming. J. S. King, B.Sc. (Econ.), B.Sc. (Agric.), London, N.D.A. Pp. xiii+182. (Oxford: The University Press. Price 7s. 6d. net.)

Cost accounting is a somewhat laborious form of book-keeping, devised solely to give the management of the business to which it is applied information about the costs of processes and products, which is essential to the efficiency of its organization. In industrial undertakings with any claim to scientific management, costing systems are, nowadays, a recognized part of the office routine; in agriculture in this country they are so rare as to be virtually non-existent. Considering the circumstances of the farming industry, however, there are fairly adequate reasons for this deficiency, but agricultural costing is carried on, notwithstanding, as one of the means of approach to the study of farm economics, by co-operation between farmers and agricultural economists.

The methods of agricultural costing are of recent origin, and they may be regarded as still somewhat experimental. As practised, the costs determined divide themselves into two classes—direct and indirect. To take the wheat crop as an example, the direct cost is composed of the labour, both manual and horse, the seed, and certain fertilizers (e.g., nitrate of soda) which may be applied. These things make up what Mr. King names the *prime* cost of the crop, and each of them can be allocated with ease and accuracy. Other costs are incurred in the process of wheat production which cannot be apportioned directly: there is the rent of the land, the residual fertility from previous years, the wear and tear of implements and gear of all kinds, and the general expenses incurred in the maintenance of the establishment as a whole. It is in regard to the treatment of these indirect costs that Mr. King's handling of his subject differs, in substance, from that of previous writers.

The recognized practice of agricultural cost accountants is to apportion the indirect as well as the direct costs over the saleable products of the farm. Thus the wheat crop will be debited, in addition to the prime costs charged against it, with its share of rent, the estimated value it derives from manures and cultivations applied in previous years, and with a proportion of the general expenses of the farm establishment. The amounts of the rent and of the general expenses are accurately ascertainable, but their apportionment is, of course, arbitrary. The amount of the benefit inherited from previous acts is itself an arbitrary figure, and its apportionment renders it doubly so. Agricultural economists working by the costing method have thought it worth while to make these arbitrary apportionments

and to include them in the make-up of the total product-cost. It does not vitiate comparisons of prime costs, whilst it permits of comparisons of total costs.

It is here where Mr. King tries a fall with the earlier exponents of farm costing. His contention is that these apportionments of indirect charges have no substantial basis, that in general the individual farm product has no final cost that is determinable independently of the costs of other produce, and that there is little advantage to be gained from a comparison of total costs except in those cases where conditions exactly comparable obtain on the farms in question. Mr. King advocates the construction of prime costs only, and the inclusion of other matters in accounts of their own. Whether this check on the exuberance of the cost accountant in agriculture is timely, or whether his estimates and apportionments are worth the risk, is a matter for the consideration of individual readers.

The book has a good index, but, curiously, no list of contents, and the reader has to hunt through its pages to discover what are the subjects of the different chapters.

Electro-Farming, or the Application of Electricity to Agriculture. By R. Borlase Matthews, Wh.Ex., A.M.Inst.C.E., M.I.E.E. Pp. xvii+357. (London: Ernest Benn, Ltd., 1928. Price 25s.)

Mr. Borlase Matthews spoils his case by undue enthusiasm. If he realized that a few authenticated cost accounts are worth a world of estimates, which in the nature of things are not easy of verification, the cause for which he stands might be further advanced. What are we to make of an author who can print such a statement as this (p. 30):

“In certain districts in France, 125 horse-power ploughs are in use, coupled through their own transformers direct to the main 30,000 volt transmission lines. Such a set works steadily all through the autumn, winter and spring—*Sundays and night time included*—and hence is a welcome addition to a rural distribution scheme.”

The words italicized must be strong meat to the most credulous reader—but Mr. Matthews offers no explanation of this 168-hour week; he does not seem to think such a revolution in farming practice worthy of comment.

He goes on to say (p. 32) that “the farmer can afford to pay a good price for electric service,” and calculates (p. 33) that on the Continent the average charge to the farmer is 4d. a unit for power and 7d. for lighting; and yet later on (p. 179) he bases certain calculations upon current costing 0.85d., 1.0d. and 1.4d. a unit. One wonders if he thinks these “good prices” in present circumstances in English rural areas. Again he assumes (p. 177) that if electric ploughing were introduced, the farmer would pay the driver less than a tractor-driver because less skill would be required. He cannot realize that such arguments—and these are but samples—tend to destroy rather than create faith in his estimates and forecasts.

Frankly, Mr. Matthews does not seem to have faced fairly the obvious difficulty which confronts most enthusiasts for rural electrical development. To prove that it is financially remunerative, they not infrequently assume that the farmer will substitute electricity for other forms of power in ploughing and other cultivations, and although Mr. Matthews admits that electric ploughing “will probably not be used in many districts for a few years” (p. 28), he seems to regard it as an immediate possibility. It need not be disputed that the farmer would probably adopt electric ploughing if the cost proved in practice to be less than under the present system, and if the supply of electricity

were made reasonably easy: but proof that electric ploughing is cheaper still appears to be lacking. It may be true that "over 200 electric ploughs are now in existence" in Europe (p. 182), but readers are not favoured with those comparative costings which would give them at least part of the information required. These costings might not be conclusive, because the relative advantages of different sources of power differ with the country concerned: but they would be distinctly helpful and illuminating. Some of the 200 electric ploughs are certainly unsuccessful: but what of the more or less successful ones? Will not some investigator provide reliable returns of work done and profits or losses incurred?

We may all be in agreement with Mr. Matthews that electricity possesses very great social advantages, and that rural electrification is desirable upon these grounds if upon no others. The progress of rural electrification nearly everywhere has shown that the primary demand is for lighting, and that a certain demand for other household purposes and for power to drive stationary machinery for agriculture and rural industries follows or accompanies the primary demand. At the present time it does not seem discreet to urge the case upon other grounds, and advocacy should be restrained by prudent consideration for financial success. One must distinguish between accomplished fact and experimentation and expectation. This seems to be where Mr. Matthews fails us. He would have written a better book if he had kept to the one or the other. A practical handbook based rigorously upon accomplished fact would have been more useful; a prophetic work dealing with experimentation and the possibilities of the future would have been more entertaining.

A commendable feature of the book is the copious bibliography appended to each chapter: this will be useful to every student of the subject, whether he shares Mr. Matthews' enthusiasm or not.

A minor correction may be noted: Mr. Matthews at pp. 200-201 gives credit to the Ministry which belongs elsewhere.

Sixteenth Report of the Board of Agriculture for Scotland. (Cmd. 3100.

H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price 2s. net.)

The report of the Board of Agriculture for Scotland for the year ended December 31, 1927, gives a comprehensive survey of the numerous activities of the Department, and contains valuable detailed information on such subjects as land settlement, loans, agricultural education, research and development.

The number of applicants settled on the land during the year was 156, making a total of 4,915 settled since 1912; outstanding applications numbered 8,226, and an attempt is made in an appendix to classify these into various categories. During the year the Board acquired seven properties for subdivision into small holdings, and at the close of the year the number of separate estates in the Board's possession was 71, covering a total area of 315,834 acres. Of this area 250,119 acres had been allocated to applicants either as new holdings or enlargements of existing holdings, while the bulk of the remainder consisted of crofts, woodlands, etc., unsuitable for land settlement purposes.

In view of the prevalent misunderstanding relating to the disposal of vacant holdings, the report includes a useful explanation of the Board's position and procedure in this connexion.

In regard to agricultural education, there is an interesting note, summarizing the report of Mr. J. R. Campbell, late Assistant Secretary of the Department of Agriculture and Technical Instruction for Ireland, who was invited by the Board to carry out an inquiry "as to how far agricultural education in Scotland is reaching those actually engaged

in farming and is directly productive of improvement in farm practice." Mr. Campbell's main conclusions were that while agricultural education had undoubtedly been the means of effecting very great improvement in farm practice, particularly as regards dairying, manuring, seeding and poultry-keeping, it was not reaching a sufficiently large proportion of those engaged in farming. This was not due to any lack of effort on the part of the Colleges, but to the difficulty of conveying instruction in scientific subjects to the older generation of farmers, whose habits and minds were already formed and fixed before the attempt to educate them in technical agriculture commenced. Mr. Campbell considers that local organization of young farmers and workers, primarily for educational purposes, is essential, and he suggests short winter courses at local centres and the formation of circles, clubs, or societies which would organize further activities for the extension of agricultural knowledge.

Under the auspices of the Scottish Milk and Health Association, an important investigation was carried out by the Rowett Research Institute to test the effect on the health and growth of school children of supplying them with an extra ration of milk. Experiments were carried out at seven different centres in Scotland. It was found that the addition of $\frac{1}{2}$ pt. to 1 pt. of milk per day during school days was followed by a definitely increased rate of growth, and in most cases there was a distinct improvement in the children's condition. This beneficial effect was obtained with either whole or separated milk, but the eating of biscuits of caloric or energy-yielding value equal to that of the separated milk had no such effect. These findings are of importance both from the point of view of the children's health and from that of the milk industry, and the tests are to be repeated by the Scottish Board of Health.

The report records a steady increase in the number and membership of the Scottish Women's Rural Institutes. At the close of the year there were 625 Institutes with a membership of, approximately, 35,000. As in previous years, shows for the exhibition of handicrafts and farm and garden produce were organized in various parts of the country. The Carnegie Trustees renewed for a period of three years their grant in aid of the organization of classes in dramatic art, folk-dancing and choir singing in the Institutes in the north-western area, and also provided a grant for similar classes in other parts of the country.

Classing the Clip: A Handbook on Wool-Classing. By Clarence E. Cowley. Pp. 186: 9 plates. (Sydney: Angus & Robertson, 1928. Price 15s.)

This book has been written in plain language to provide, for those concerned in the Australian wool trade, a survey of the various processes from shearing to selling the wool—but particularly of "classing" the clip. The survey is necessarily rapid, but we should imagine that, to the Australian farmer, as well as to those engaged in handling the clip for the market, it should be instructive. To the English farmer, as an individual, the book will be of academic rather than of practical interest. On the other hand, the co-operative wool-marketing societies that are developing in this country will, doubtless, find much information of value in Mr. Cowley's work. It should be remembered, however, that wool-growing is on a different basis in Australia, and its relative importance in the farming industry is very much greater than is the case here.

The author's purpose is practical, and he is not concerned to discuss the latest technical investigations into wool problems; but it is a little surprising to find no specific mention either of defects due to tar-branding or of the recently discovered substitutes. Apparently there is less trouble from branding in Australia than in other parts of the world.

APPOINTMENTS

FEELING that it might be of considerable assistance to farmers and others to know to whom they may apply for guidance and advice on the various technical matters connected with their work, the Ministry decided to publish in this JOURNAL lists of the principal officers of the various institutions for agricultural education in England and Wales. Thereafter, changes in the staffs will be notified from time to time as they occur; and various other appointments of interest to farmers may be similarly recorded.

A list of the principal officers of the various County Agricultural Education Staffs and Farm Institutes appeared in the April and May issues. In last month's (Aug.) issue was given a list of the staffs of certain of the Agricultural Colleges and University Agricultural Departments; the remainder are given below.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES

(Note: These lists also include those Advisory Officers who undertake teaching duties.)

Department of Agriculture, Armstrong College, Newcastle-upon-Tyne

<i>Agriculture</i>			
Professor	CLEMENT HEIGHAM, M.A.		
Lecturers	{ R. W. WHELDON, D.Sc. H. C. PAWSON C. H. WESTWATER, M.A., B.Sc., N.D.A., N.D.D.		
<i>Agricultural Chemistry</i>			
Adviser	B. THOMAS, M.Sc., A.I.C.		
Lecturer	A. A. HALL, M.Sc., Ph.D., F.I.C.		
<i>Agricultural Zoology and Entomology</i>			
Adviser	R. A. H. GRAY, M.A., M.Sc.		
Lecturer	L. MORRISON, B.Sc.		
<i>Agricultural Botany</i>			
Lecturer	R. G. HEDDLE, M.A., B.Sc.		
<i>Land Surveying and Estate Management</i>			
Lecturer	D. T. ADAM, B.Sc., N.D.A., P.A.S.I.		
<i>Veterinary Science</i>			
Adviser	W. L. STEWART, M.R.C.V.S.		
<i>Dairy Bacteriology</i>			
Adviser	D. W. HENDERSON, B.Sc., N.D.A., N.D.D.		
<i>Agricultural Economics</i>			
Adviser	D. H. DINSDALE, M.A.		
<i>Agricultural Mycology</i>			
Adviser	F. T. BENNETT, B.Sc.		

South-Eastern Agricultural College, Wye

<i>Principal</i>	R. M. WILSON, B.Sc. (Agric.).		
<i>Agriculture</i>			
Lecturers	{ R. M. WILSON, B.Sc., (Agric.). V. R. S. VICKERS, M.R.A.C. H. W. KERSEY		
Assistant Lecturers	{ V. C. FISHWICK, P.A.S.I., N.D.A., N.D.D., B.D.F.A. H. B. BESCOBY, P.A.S.I., N.D.A.		
<i>Economics</i>			
Lecturer	J. WYLLIE, B.Sc., N.D.A. (Hons.), N.D.D.		
<i>Agricultural Engineering</i>			
Lecturer	C. W. DAVIES, T.D.A.		
<i>Veterinary Science</i>			
Lecturer (and Vice-Principal) ..	T. W. CAVE, F.R.C.V.S.		
<i>Chemistry</i>			
Adviser	W. GOODWIN, M.Sc., Ph.D.		
Lecturer	S. D. F. HARWOOD, M.A., F.I.C. F. L. C. SCRIVENER, B.Sc. (Agric.), Dip. Agric.		
Assistant Lecturers	{ A. H. BURGESS, B.Sc. (Agric.) L. W. COLE, B.Sc. (Agric.), Dip. Agric.		
<i>Botany</i>			
Lecturer	S. T. PARKINSON, B.Sc.		
Assistant Lecturers	{ R. T. PEARL, B.Sc., A.R.C.Sc., D.I.C. R. M. HARRISON, B.Sc., A.R.C.Sc.		
<i>Geology and Zoology</i>			
Lecturer	The Rev. S. G. BRADE-BIRKS, D.Sc.		
<i>Agricultural Zoology</i>			
Lecturer	C. A. W. DUFFIELD, M.C., F.E.S.		
<i>Mycology</i>			
Adviser	Prof. E. S. SALMON, F.L.S.		
<i>Surveying and Building Construction</i>			
Lecturers	{ A. H. HAINES, P.A.S.I. W. G. V. GLOSSOP		
<i>Agricultural Law, Forestry, Bookkeeping and Cost Accounting</i>			
Lecturers	{ A. H. HAINES, P.A.S.I. H. W. KERSEY		
<i>Poultry</i>			
Lecturer	F. W. RHODES, D.S.O.		
<i>Horticulture</i>			
Lecturer	W. MISKIN		
Assistant Lecturer	A. H. BIRD, M.A., Dip. Hort.		

Midland Agricultural and Dairy College, Sutton Bonington

<i>Principal</i>	THOS. MILBURN, Ph.D., N.D.A., N.D.D.		
<i>Agriculture</i>			
Lecturer	H. G. ROBINSON, M.Sc., F.L.S.		
Lecturer and Farm Manager ..	J. DUNCAN, N.D.A.		
Farm Bailiff and Demonstrator	J. HALL		

<i>Chemistry</i>			
Lecturer	A. C. BURNS, M.Sc., F.I.C., F.C.S.		
Assistant Lecturers	{ E. R. LING, B.Sc., A.R.C.Sc., A.I.C. G. O. FOX		
<i>Botany</i>			
Lecturers.. .. .	{ E. HOLDEN, M.Sc. H. H. STIRRUP, M.Sc. A. ROEBUCK, N.D.A.		
<i>Zoology, Entomology and Geology</i>			
Lecturer	E. HOLDEN, M.Sc.		
<i>Veterinary Science</i>			
Lecturer	W. J. IRONSIDE, M.R.C.V.S.		
<i>Economics</i>			
Lecturer	A. JONES, B.Sc.		
<i>Bookkeeping</i>			
Lecturer	C. W. ROBERTS, B.Sc., N.D.A.		
<i>Surveying and Engineering</i>			
Lecturer	G. R. HUNTER, B.Sc.		
<i>Building Construction</i>			
Lecturer	G. TOLLEY		
<i>Dairying</i>			
Lecturer and Instructor	J. G. W. STAFFORD, N.D.D.		
Assistants	{ Miss A. A. PRITCHARD, B.D.F.D. Miss K. F. KAYE, N.D.D.		
<i>Bacteriology</i>			
Lecturer	Miss M. G. D. TAYLOR, N.D.D.		
<i>Poultry-keeping</i>			
Lecturer and Instructor	R. B. SHAW		
Assistant	Miss V. MILNER, N.D.P.		
<i>Horticulture</i>			
Lecturer and Instructor	O. D. KIMBLE, F.R.H.S.		

**Harper Adams Agricultural College,
Newport, Salop**

Principal	C. CROWTHER, M.A., Ph.D.		
<i>Agriculture</i>			
Lecturer and Farm Director	W. B. THOMPSON, B.Sc., N.D.A. (Hons.), N.D.D.		
Lecturer	A. C. CAMPBELL, N.D.A., N.D.D.		
<i>Chemistry</i>			
Head of Department	W. M. DAVIES, M.A., B.Sc., A.I.C.		
Lecturer	T. O. WILSON, B.Sc.		
Demonstrator	W. H. RADFORD, A.I.C.		
<i>Botany and Zoology</i>			
Lecturers.. .. .	{ D. H. ROBINSON, B.Sc., N.D.A. N. C. PRESTON, B.Sc. S. G. JARY, B.A., Dip. Agric.		
<i>Economics and Accounts</i>			
Lecturers.. .. .	{ F. S. DENNIS, Dip. Econ. A. C. CAMPBELL, N.D.A.		
<i>Veterinary Science</i>			
Lecturer	W. T. WILSON, F.R.C.V.S., M.R.S.I.		
<i>Surveying and Building Construction</i>			
Lecturer	W. E. WATSON, N.D.A., P.A.S.I.		
<i>Dairying</i>			
Lecturer	Miss J. A. BROWNE, N.D.D., C.D.D.		

NATIONAL INSTITUTE OF POULTRY HUSBANDRY

Director	Prof. T. RAYMOND PARKHURST, B.Sc. (Agric.), M.Sc.		
Assistant Director	H. HOWES		
Research Assistant	F. C. BOBBY, N.D.P., N.D.A.		
Senior Practical Assistant	E. W. FOGDEN		
Assistant	W. KING WILSON		
Statistician	F. J. DUDLEY, B.A., Dip. Agric.		

**Seale-Hayne Agricultural College,
Newton Abbot, Devon**

Principal	D. R. EDWARDES-KER, O.B.E., M.A., B.Sc.		
<i>Agriculture</i>			
Head of Department	T. J. SHAW, M.C., N.D.A.		
Lecturer	A. NOBLE, N.D.A.		
Assistant Lecturer	L. R. WAUGH, B.Sc. (Agric.)		
Farm Bailiff	J. F. CODD		
<i>Agricultural Chemistry</i>			
Lecturer	E. VANSTONE, D.Sc., M.Sc., F.I.C., F.C.S.		
<i>Agricultural Biology</i>			
Lecturers.. .. .	{ F. R. HORNE, B.A., N.D.A., N.D.D. (Hons.) C. A. COSWAY, B.Sc.		
<i>Agricultural Engineering, Surveying, &c.</i>			
Lecturer	J. J. FLOWER, B.A., B.A.I., P.A.S.I.		
<i>Dairying</i>			
Lecturer	W. B. V. TRESIDDER, N.D.A., N.D.D.		
<i>Horticulture</i>			
Lecturer	C. T. MACKINTOSH, Dip. R.H.S., F.R.H.S.		
<i>Poultry-keeping</i>			
Lecturer	I. RHYS, N.D.P.		
<i>Book-keeping</i>			
Lecturer	C. C. CATTERMULL, F.I.S.A.		
<i>Forestry</i>			
Lecturer	H. MCCLELLAND		

Royal Agricultural College, Cirencester

Principal	Prof. J. R. HANLEY, A.R.C.Sc., Ph.D.		
<i>Agriculture</i>			
Lecturers.. .. .	{ J. F. H. THOMAS, B.Sc., N.D.A. P. S. BROWN, N.D.A.		
<i>Dairying and Poultry Management</i>			
Lecturer	H. E. WELLS, N.D.A., N.D.D.		
<i>Estate Management and Book-keeping</i>			
Lecturer	S. W. EDWARDS, P.A.S.I., A.A.I.		

The Horticultural College, Swanley, Kent

Principal	Miss K. BARRATT, D.Sc., A.R.C.Sc.		
<i>Horticulture</i>			
Lecturers.. .. .	{ Miss A. M. DICKENS, B.Sc. D. WILMSHURST Miss S. FILLMER		

<i>Botany and Geology</i>		
Lecturer	Miss M. G. HOLMES, M.Sc.	
<i>Chemistry and Physics</i>		
Lecturer	Miss H. G. MITCHELL, B.Sc.	
<i>Vegetable Pathology and Zoology</i>		
Lecturer	Miss A. P. WILSON, M.B.E., A.R.C.Sc.	
<i>Dairying</i>		
Lecturer	Miss V. P. BRUFF	
<i>Poultry-keeping</i>		
Lecturer	Miss F. M. HILL, N.D.P.	

Studley College, Warwickshire

Principal	Miss E. H. EKINS, B.Sc., N.D.H.
<i>Agriculture</i>	
Lecturer and Instructress ..	Miss S. E. B. BLAIR, B.Sc. (Agric.)
Farm Manager and Lecturer ..	E. E. DUDDLES, C.D.A.
<i>Horticulture</i>	
Lecturers	{ Miss D. GARSTANG, N.D.H.
	{ Miss M. RICHARDS
Instructor	F. SORE
<i>Veterinary Science and Bacteriology</i>	
Lecturer	Miss V. E. CHEKE, N.D.D.
<i>Dairying</i>	
Lecturers	{ Miss V. E. CHEKE, N.D.D.
	{ Miss H. M. HATCHWELL, N.D.D.
<i>Chemistry and Botany</i>	
Lecturer	Miss M. MADGE, B.Sc., Ph.D.
<i>Book-keeping</i>	
Lecturer	Miss M. BUCKLE, B.A.
<i>Poultry Husbandry</i>	
Lecturers	{ Miss M. Mann
	{ Miss M. CARTER, B.Sc.
<i>Entomology</i>	
Lecturer	Miss D. GARSTANG, N.D.H.

Royal Veterinary College, London

Principal	F. T. G. HOBDAV, C.M.G., F.R.C.V.S., F.R.S.E.
<i>Pathology and Bacteriology</i>	
Professor	TOM HARE, M.D., B.V.Sc., M.R.C.V.S.
<i>Surgery</i>	
Professor	J. MACQUEEN, F.R.C.V.S.
<i>Medicine and Hygiene</i>	
Professor	G. H. WOOLDRIDGE, F.R.C.V.S., M.R.I.A.
<i>Materia Medica</i>	
Professor	A. R. SMYTHE, M.R.C.V.S., D.V.S.M.
<i>Anatomy</i>	
Professor	J. MCCUNN, M.R.C.S., L.R.C.P., M.R.C.V.S.

APPOINTMENTS:—CHANGES AND CORRECTIONS

County Agricultural Education Teaching Staffs, England
Hereford: Miss O. Jenkins, N.D.D., has been appointed Instructress
 in Dairying and Poultry-keeping vice Miss B. Wall, N.D.D.,
 B.D.F.D.

ADDITIONS TO THE LIBRARY**Agriculture, General and Miscellaneous**

- Ashley, Sir W.*—The Bread of our Forefathers. An Inquiry in Economic History. (206 pp. + 8 pl.) Oxford: Clarendon Press; London: Humphrey Milford, 1928, 12s. 6d. [338.1; 63; (09).]
- Bateson, Beatrice.*—William Bateson, F.R.S. His essays and addresses, together with a short account of his Life. (473 pp. + 2 pl.) Cambridge University Press, 1928, 21s. [59; 92.]
- Bensusan, S. L.*—Latter-day Rural England, 1927. (221 pp.) London: Benn, 1928, 8s. 6d. [63 (42).]
- Power for Cultivation and Haulage on the Farm. Being the Report of a Conference held at Rothamsted on February 9, 1928, under the chairmanship of *Sir Merrik Burrell, C.B.E.* (61 pp.) London: Benn, 1928, 2s. 6d. (Rothamsted Conferences VI.) [537; 63.17.]
- Ramann, Dr. E.*—The Evolution and Classification of Soils. (Translated by C. L. Whittles.) (128 pp. + 1 pl.) Cambridge: W. Heffer, 1928, 7s. 6d. [63.111.]
- Jones, D. F.*—Selective Fertilization. (163 pp.) University of Chicago Press. London: Cambridge University Press, 1928, 10s. [575.4.]
- Reychler, L.*—Mutation with Orchids. (164 pp. + 48 pl.) Brussels, 1928. [Private circulation only.] [63.1952; 63.522.]
- International Labour Office (League of Nations).*—Studies and Reports, Series K. (Agriculture) No. 8. The Representation and Organization of Agricultural Workers. (210 pp.) Geneva, 1928. London: P. S. King & Son, 3s. [331.88.]
- Rural Industries Bureau.*—Pamphlet No. 26. Small Power Plant for Farm and Workshop (Second Edition). (47 pp.) London, 1928, 4d. [63.17; 63.193.]
- Rural Industries Bureau.*—Leaflet No. 30. The Country Woodworker and His Shop. (23 pp.) London, 1928, 6d. [63.193.]
- Merchandise Marks Act, 1926.—Report of the Standing Committee, set up by the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department, and the Secretary of State for Scotland, on Apples and Pears. (11 pp.) [Cmd. 3062.] London: H.M. Stationery Office, 1928, 3d. [343.53; 63.41.]
- British Museum.*—Guide to an Exhibition of Manuscripts and Printed Books illustrating the History of Agriculture. (30 pp. + 8 pl.) London, 1927, 1s. [06; 63 (09).]
- Shaw, Sir Napier.*—Manual of Meteorology. Vol. II. Comparative Meteorology. (445 pp.) Cambridge: University Press, 1928, 36s. [551.5.]
- Howard, A., and Howard, G. L. C.*—India of To-day. Vol. VIII. Indian Agriculture. (98 pp. + 6 pl.) Oxford University Press; London: Humphrey Milford, 1927, 3s. 6d. [63 (54).]
- Chatterton, Sir Alfred.*—Rural Economics in India. (The Russell Lecture, 1926.) (30 pp.) Oxford University Press; London: Humphrey Milford, 1927, 1s. 6d. [338 (54); 338.1 (54).]
- U.S. Institute of Government Research.*—Monograph No. 47. The Bureau of Plant Industry; Its History, Activities and Organization. (121 pp.) Baltimore: Johns Hopkins Press, 1927. [63 (73).]
- The Condition of Agriculture in the United States and Measures for its Improvement; A Report by the Business Men's Commission on Agriculture. (273 pp.) New York and Washington: Chamber of Commerce of U.S.A., 1927, \$2.50. [338.1 (73); 63 (73).]

Agricultural Education and Research

Ministry of Agriculture and Fisheries.—Report of a Sub-Committee of the Inter-Departmental Committee of the Ministry of Agriculture and Fisheries and the Board of Education on the Practical Education of Women for Rural Life. (61 pp.) London: H.M. Stationery Office, 1928, 6d. [37 (42); 376.]

Midland Agricultural and Dairy College.—Its Establishment and Development 1895-1928. Together with Students' Successes. (19 pp.) Sutton Bonington. 1928. [374.9.]

Colonial Agricultural Service. Report of a Committee appointed by the Secretary of State for the Colonies. [Cmd. 3049.] (47 pp.) London: H.M. Stationery Office, 1928, 9d. [37.]

Co-operative Marketing

U.S. Department of Agriculture.—Technical Bulletin No. 57. Co-operative Marketing of Live Stock in the United States by Terminal Associations. (111 pp.) Washington, 1928. [334.6; 63.6: 38.]

U.S. Department of Agriculture.—Technical Bulletin No. 63. Co-operative Marketing of Grain in Western Canada. (116 pp.) Washington, 1928. [334.6; 63.31: 38.]

Legal Handbooks

Dumsday, W. H.—Milk and Dairies Handbook, being the fourth edition of Hadden's Handbook of the Laws relating to Dairies, Cow-sheds, and Milk-shops. (264 pp.). London: Hadden Best, 1927, 15s. [614.32; 63.70.]

The Surveyors' Institution.—The Landlord and Tenant Act, 1927. (Prepared by Edgar Foa, M.A.) (100 pp.) London, 1928, 2s. 6d. [347.]

Field Crops

Seale-Hayne Agricultural College.—Pamphlet No. 26. Grassland Management. A report on Intensive Stocking and Nitrogenous Manuring. By T. J. Shaw. (20 pp.) Newton Abbot, 1928. [63.33; 63.33-16.]

Soviet Union.—The Selection, Breeding and Culture of Sugar Beet Seeds in the Soviet Union. (54 pp.) New York: Amtorg Trading Corporation. [63.3433 (47).]

Seale-Hayne Agricultural College.—Pamphlet No. 24. Four Years' Variety Trials with Potatoes. By A. Noble. (15 pp.) Newton Abbot, 1928. [63.512-194.]

Ohio Agricultural Experiment Station.—Bulletin 415. The Influence of Fertilizers on the Vitamin B Content of Wheat. (41 pp.) Wooster, 1927. [63.311.]

Tobler, Prof. F.—Der Flachs als Faser—und Ölpflanze. (273 pp.) Berlin: Julius Springer, 1928. [63.34111.]

Fruitgrowing

Tukey, H. B.—The Pear and its Culture. (125 pp. + 11 pl.) New York: Orange Judd Publishing Co., and London: Kegan Paul, Trench, Trubner & Co., 1928, 7s. 6d. [63.41.]

Plant Pests and Diseases

South-Eastern Agricultural College, Wye.—The Downy Mildew of the Hop. By Prof. E. S. Salmon and W. M. Ware. (28 pp. + 5 pl.) Dept. of Economic Mycology, Wye, 1927, 6d. [63.24.]

Minnesota Agricultural Experiment Station.—Technical Bulletin 37. Physiologic Specialization and Parasitism of *Helminthosporium sativum*. (101 pp. + 12 pl.) St. Paul, 1926. [63.24.]

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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OCTOBER, 1928.

NOTES FOR THE MONTH

IN view of the many inquiries it has received as to the scope of the new Agricultural Credits Act, the Ministry thinks that it may be useful to state briefly what are the main provisions of the Act.

The Agricultural Credits Act, 1928 The Agricultural Credits Act, which received the Royal Assent on August 3, is a measure designed to improve the credit facilities obtainable by farmers as regards (1) Long Term Loans for the purchase or improvement of agricultural land, and (2) Short Term Loans for ordinary trading purposes.

It is important to observe that loans under the Act will not be made by the Government, nor is any Government machinery set up by the Act for this purpose.

The scheme in outline is as follows:—

Part I. Long Term Credit.—Under this part of the Act, long term loans will be made by a Company to be established for the purpose, and to be known as "The Agricultural Mortgage Corporation." Loans secured on mortgages on agricultural land will be for a period not exceeding 60 years, and will amount to not more than two-thirds of the ascertained value of the land. They will be repayable by equal yearly or half-yearly instalments of capital and interest or on such other terms as may be authorized. The company will also be empowered to make loans under the Improvement of Land Acts, 1864-1899, for agricultural purposes.

Steps are being taken to establish the Corporation, but some time must necessarily elapse before it is in a position to start business. When it has been formed, full particulars will be announced. It is not at present possible to give any information as to the rate of interest or other details, which can only be settled by the Company when established.

Part II. Short Term Credit.—This part of the Act is exclusively concerned with facilitating advances to farmers or co-operative societies from the ordinary banks.

Hitherto the farmer has been able to borrow from the bank on his personal security or on the security of title-deeds (if he

is an owner of property) or on the security of such non-agricultural wealth as he may possess. He has not been in a position to borrow by giving the banks an effective first charge on the wealth which his own industry created, *i.e.*, farm crops and stock. Crops and stock are the tenant-farmer's main assets. The purpose of this part of the Act is, therefore, to enable the farmer, if he so desires, to obtain advances from the banks on the security of those assets; it empowers a farmer to create a charge in favour of a bank on any or all of his farm stock, farm implements and other agricultural assets. The charge would be either a fixed charge on certain specified assets, or a floating charge, but would not prevent the farmer selling in the ordinary way the property so charged, provided the amount received on sale was paid over to the bank. The charge will rank after rent, rates and taxes, and will be registered by the Land Registry. The Register will be open to inspection, but it will be illegal to publish any list of such charges or the names of farmers who have created them.

The Act does not in any way restrict the purposes for which money may be borrowed under Part II. Whether it be for the purchase of farm requisites, for the execution of minor improvements, or for the payment of seasonal labour, the farmer is left entirely free. It also provides considerable freedom as to the way in which the farmer may create a charge on his property as security for a loan.

This part of the Act came into operation on October 1, 1928, and farmers desiring to make use of it should apply to their banks.

Copies of the Act are available from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 3d., or post free 4d.

* * * * *

THE second report of the Empire Marketing Board, recently issued,* shows that during the period under review, *viz.*, May, 1927, to May, 1928, the Board has considerably increased its support of scientific research and economic investigations. Although the majority of the grants have been made to institutions in the United Kingdom—owing, no doubt, to the fact that these institutions are relatively well staffed and equipped—

* E.M.B. 9, Empire Marketing Board, May, 1927, to May, 1928, H.M. Stationery Office. Price 4s. 6d. net.

it is pleasing to note that the Board has now extended its grants to other countries in the Empire, and also to new fields of science.

In an appendix to the report is given a list of grants for research and other schemes supported by the Board, among these being: £22,000 per annum towards the organization and establishment of a Colonial Advisory Council of Agriculture and Animal Health, and a Colonial Agricultural Service, with a specialist wing for research work and an agricultural wing for administrative work; £3,000 per annum to the Liverpool School of Tropical Medicine for research into metazoan immunity—which for lay purposes may be described as the rendering of animals immune to insect attack through the skin; a capital grant of £45,000 and £5,000 per annum to the Department of Scientific and Industrial Research for the erection of a new station at East Malling, for cold-storage experiments on a semi-commercial scale. With the aid of a further grant from the Board the Department of Scientific and Industrial Research is also undertaking an investigation into the refrigerated transport of Irish Free State dairy produce.

The Royal Botanic Gardens, Kew, with the assistance of a grant from the Board, will now be able to classify a further collection of over 300,000 herbarium specimens in its possession, while the Imperial Bureau of Mycology has been given a grant to enable it to be housed in a new building on a site which will allow it to retain its close connexion with the Botanic Gardens. A capital grant of £30,000 has been made to the Natural History Museum to provide adequate accommodation for the housing of its entomological library and collection of some 5,000,000 insects.

The Government of Southern Rhodesia is now taking part in the Board's scheme for the investigation of the mineral content of pastures, with special reference to certain deficiencies in the soil and their effect on the growth and strength of live stock. The Ontario Agricultural College is undertaking a study of quality in eggs and the effect of diet on their hatching capacities. With the aid of a grant from the Board, the New Zealand Department of Scientific and Industrial Research proposes to establish a Plant Breeding and Seed Research Station at Palmerston North, while the Welsh Plant Breeding Station has been given a grant for the prosecution and co-ordination of research in grasses and clovers. A grant has been made to the Scottish Society for Research in Plant Breeding to enable it to undertake an investigation into virus

disease in potatoes. A capital grant of £10,000 and a maintenance grant of £3,000 has been made to the Animal Breeding Research Department of Edinburgh University and the British Research Association for the Woollen and Worsted Industries, for research into fundamental problems of sheep breeding and determination of effective standards of raw wool.

A special worker has been appointed to the staff of the Agricultural Economics Research Institute of Oxford University for the collection and dissemination of data concerning the economics of agricultural production, with special reference to the technique and results of cost accounting and survey methods.

The Government of Sierra Leone has been given a grant, on a pound for pound basis, towards the establishment of an experimental fruit farm for testing the economic cost of growing and shipping bananas and grape fruit; and the Government of Fiji has been promised a grant for work on the improvement of methods of cultivating, handling, drying and grading of copra.

Grants from the Board have also enabled leading agricultural scientists of the Empire to travel overseas, while the recent Imperial Agricultural Research Conference was an occasion when overseas research workers visited this country and were enabled to discuss their problems both with members of the Board and research workers in the United Kingdom.

In pursuance of its general policy of utilizing existing Government organizations, the Board has sought the advice of the Ministry on applications for grants for investigations bearing on the agriculture of the home country. Where grants have actually been made to research institutes already aided by the Ministry, the administration of these grants has, at the request of the Board, been undertaken by the Ministry. The more important of the investigations, the grants for which are administered by the Ministry, are as follows:—Research into grasses and clovers (Aberystwyth); the relation between the conditions under which fruit trees are grown and the keeping quality of the fruit (Bristol University); the physiology of reproduction and growth of farm animals, and the metabolism of pigmented animals (Cambridge University); root-stock development and the principles underlying stock and scion relationships (East Malling); and the control of insect pests of stored products (Imperial College).

THE twelfth Annual Poultry and Rabbit Conference at the Harper Adams Agricultural College was held on August 14 to 17.

Twelfth Annual Poultry Conference At the opening session Sir Charles Howell Thomas, Permanent Secretary to the Ministry, addressed the Conference; a full report of his address will be found

on page 613.

In the evening, papers were read by Captain E. T. Halnan and Mr. F. C. Bobby. Captain Halnan dealt with the work of the poultry nutrition experiments at Cambridge on the digestibility of the commoner poultry feeding stuffs, while Mr. Bobby reviewed certain experiments recently conducted at the Institute on the effect on egg production of different methods of housing poultry.

Professor R. T. Parkhurst opened the proceedings on Wednesday morning with an address on the influence of certain foods on egg production, and particularly with regard to the size of the egg. Experimental work at Idaho had shown that sour skim milk was superior to all other foods in the influence it had on the weight of eggs produced.

Mr. F. W. Rhodes, of Wye College, contributed a paper on fattening poultry, and Mr. T. Montague May spoke on the preparation and marketing of ducks. The demand for table poultry, Mr. Rhodes said, was satisfactory. The most suitable food for fattening had been found to be Sussex ground oats mixed to the consistency of cream by the addition of sour, separated milk, with 10 per cent. of fat added during the last week or 10 days.

A large audience attended the lecture given by Dr. F. A. E. Crew on the principles of poultry breeding. Dr. Crew's contention was that the real test of breeding is in the behaviour of the progeny, and that the breeding value of an individual should be estimated by an examination of a sample of its early progeny. Pedigree is a valuable aid in the work of selection, but its importance is commonly over-emphasized. Dr. Crew also dealt with the question of in-breeding and the value of first crosses.

On Thursday morning, Mr. F. J. Dudley contributed a paper on a study of the records of the Harper Adams Egg Laying Trials; Mr. F. B. Hutt, of the Animal Breeding Research Department, Edinburgh, dealt with the subject of abnormal embryos in incubation; and a paper by Professor Parkhurst on commercial hatcheries in the United

States and the principles underlying their successful working concluded the poultry section of the conference.

At the rabbit conference which followed, Mr. E. C. Richardson gave a lantern lecture on the appearance and elimination of recessive characters in rabbits, and Mr. A. Arbuthnot dealt with the question of commercial fur production, particularly in reference to the fight against disease. In the evening Dr. J. B. MacDougall gave an interesting lecture on rabbit production, with special reference to the economic side of the question. Addresses by Mr. W. King Wilson, on some experimental work at the National Institute of Poultry Husbandry, and Mr. N. S. Barron, on rabbit diseases, brought a most successful conference to a close.

* * * * *

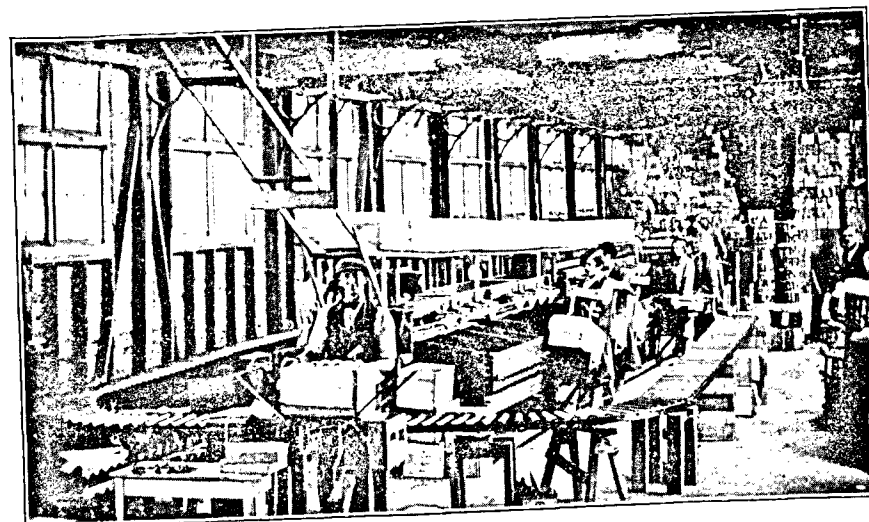
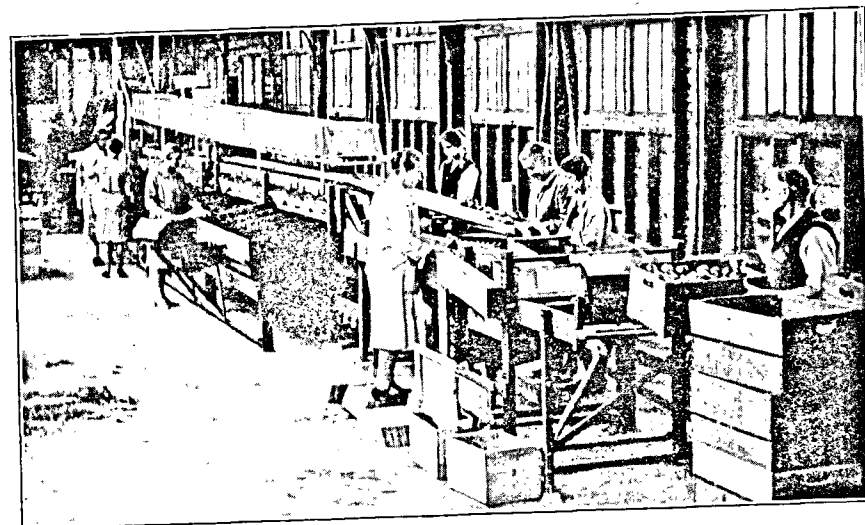
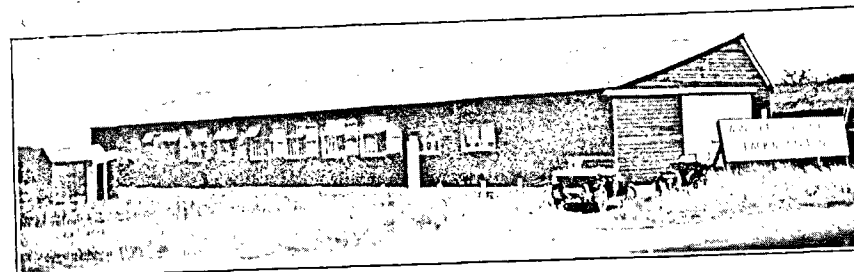
THE packing station of the Swanley Fruit Packing Company, Limited, of which photographs appear opposite, was opened by Sir William Lobjoit on

Swanley Fruit Packing Station September 3, 1928. On the same day, apples were consigned from it to various markets under the National Mark, the first label being pasted on a case by Mr. R. J. Thompson, C.B., O.B.E., an Assistant Secretary of the Ministry. The Swanley Station was thus the first incorporated packing station to use this mark.

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Marketing Demonstrations at Agricultural Shows THE following is a list of the marketing demonstrations arranged for the months of October, November and December :—

<i>Show or Place</i>	<i>Date</i>	<i>Subjects</i>
Wisbech (in connexion with Wisbech Commercial Fruit Show)	October 10-11 ..	Fruit.
Imperial Fruit Show, Manchester	October 19-27 ..	Fruit; potatoes.
London Dairy Show	October 23-26 ..	Eggs; pigs.
Northampton (Live Stock Market)	October 31- November 1	Pigs.
Great Yorkshire Potato Show, Doncaster	November 6 ..	Potatoes.
Birmingham Fat Stock Show ..	December 1-6 ..	Pigs.
Smithfield Show, London ..	December 10-14 ..	Pigs.



(Top) Exterior view. (Centre) Receiving end of grading machine, showing grading table. (Bottom) Delivery end of grading machine, showing box press.

THE SWANLEY FRUIT PACKING CO.'S PACKING STATION.

RECENT DEVELOPMENTS IN GRASSLAND MANAGEMENT

SIR A. D. HALL, K.C.B., LL.D., F.R.S.,

Chief Scientific Adviser, Ministry of Agriculture and Fisheries ;

AND

J. G. STEWART, M.A., B.Sc.,

*Deputy Chief Inspector for Education, Ministry of Agriculture
and Fisheries.*

OF late years, considerable interest has been aroused in a method for increasing the productivity of grassland by the use of repeated dressings of nitrogenous manures, a method which had originated in Germany during the War period. The employment of nitrogenous fertilizers on grazing land was contrary to usual British practice, which had grown up round the experimental work initiated by Sir William Somerville at Cockle Park. The British practice was founded upon the development of white clover in the pastures, which follows the application of basic slag or other phosphatic manures. Since the white clover gathers nitrogen from the atmosphere and accumulates combined nitrogen in the soil, the pasture was enriched for the grasses as well as the clovers, and a marked improvement in the grazing value of the herbage followed.

The British experiments also seemed to show that nitrogenous fertilizers, or even dung, deteriorated rather than improved the quality of the herbage, and resulted in no increase but even a diminution in the amount of meat or milk yielded by the pasture. Speaking broadly, the British principle was to stimulate the growth of clover by the fertilizers, and to trust to the clover alone to bring in the essential nitrogen. Without doubt it has proved to be a cheap and effective way of improving the class of pasture with which the experiments were chiefly concerned, *i.e.*, the poorer hill pastures on heavy or sour land.

The German trials, however, made a more direct attack upon the problem of production. They were concerned with grassland of perhaps more than average quality, already useful for milch cows, and were directed to making the grass do more towards furnishing the food required for milk production, having regard to the fact that supplies of cake and similar concentrated nitrogenous foods were lacking, while synthetic nitrogen fertilizers were available. Professor Warmbold, to whom the conception of the system is due, began with a basal manuring with phosphates and potash, and

followed it up with repeated dressings of sulphate of ammonia, amounting on the whole to three or four times the amount a British farmer would ever employ. By this means he obtained a very rapid growth of grass, rich in the proteins which are so essential to nutrition, and it was an essential feature of his system that the stock should always have the young leafy grass that is characteristic of a good pasture in its spring flush of growth. To this end he divided the grassland into a series of small paddocks which were heavily stocked in succession, so as to be grazed down in a short time. As one enclosure was eaten off, the stock were moved on to an adjoining fresh pasture, and a dressing of nitrogen was given to the grazed area in order to start it into growth again.

There is no essential discrepancy between the British and the German systems, contradictory as the methods may seem to be: the one is a cheap means of effecting a slow reform of poor land, the other an intensive method of rapidly converting fertilizer into cattle food of high productive value. When the Ministry was first led to examine Professor Warmbold's results it was clear that a considerable increase in the output of milk from the given area of land had been attained, and particularly that the high feeding value of the grass was maintained much later in the season. It was impossible to assess with any exactitude the financial results of the system, but there was evidence that it was being considerably taken up by progressive farmers in Germany, accustomed to intensive methods calling for a good deal of skill in the handling. The expenditure for fencing and water supply that seems to be involved was, however, minimized under the German conditions of small farms, predominantly arable. The limited area of grassland is as a rule divided into small paddocks, and any further division required was usually effected by a light fence of a couple of strands of barbed wire held by posts driven in at wide intervals. Again, as the cows were milked at home, often three times daily, they could then be watered without bringing a supply to the fields.

On the other hand, the general conditions of farming would seem to be more favourable to the system in at least the Midlands and South of England. The German winter is long and usually severe, so that the fields are clear of stock for five or six months, and grazing cannot begin so early as in England. With our milder and more pastoral climate, it ought to be possible to make even better use of the principle than in Germany, though some of

the procedure adopted by Professor Warmbold, *e.g.*, making hay of short grass when growth is in excess in the early summer, may not be practicable with our dearer labour.

At the instigation of the British Sulphate of Ammonia Federation (now incorporated in Nitram, Ltd.—associated with Imperial Chemical Industries, Ltd.), intensive grassland experiments on the lines adopted in Germany were started in England in 1925. Trials were begun by several educational institutions, *e.g.*, the National Institute for Research in Dairying at Reading; the Agricultural Colleges at Wye and Seale-Hayne; the Farm Institutes of Cheshire, Staffordshire, Hertfordshire, and Hampshire; and by individual farmers. At the present time a large amount of experimental and demonstrational work is being conducted at numerous centres throughout Great Britain and Ireland.

The New Method Described.—The usual plan has been to fence off four to eight paddocks. The size of the paddocks is in accordance with the number of stock to be grazed: thus, with a herd of 40 cows, six paddocks of 3 to 4 acres each would be required. The treatment begins with a complete mineral fertilizer applied in the winter—for example, 10 to 15 cwt. ground lime, 4 cwt. superphosphate and 3 cwt. potash salts (20 per cent.) per acre. The first nitrogenous dressing of 1 cwt. per acre of sulphate of ammonia is usually given in February, just before spring growth would begin. In most cases the stock employed have been dairy cows, at the rate of one to two cows per acre for the whole area. They stay on from three days to a week, but as soon as they begin to show signs of having to wander in search of eatable grass they are moved into the next paddock and are replaced by store cattle, dry cows, sheep or horses in order to clean up and eat the pasture down close. Sheep and horses make excellent followers. When they are removed, the field is chain-harrowed to spread the dung, and a fresh application of nitrogenous fertilizer is given. The paddock should be ready for use again in three weeks or a month, according to the weather, and if the nitrogenous dressing has been repeated three or four times in the season. In many cases the early grass in spring has been used for ewes and lambs, and in some cases sheep alone have been grazed throughout the summer. In these cases, sheep have done well from February till Midsummer, but after this date lambs have sometimes not made as good gains in weight as in the early part of the season.

The majority of the trials have been of a simpler nature and have not aimed at obtaining an exact record of the production. In such cases there has been no special provision of fences or water. Existing facilities have been utilized. Manuring also has been less intensive. As a rule, one or two dressings of about 1 cwt. of nitrogenous fertilizer have been added to the orthodox phosphatic and potassic application. Invariably in such cases the aim has been an "early bite" and the nitrogenous manure has been applied, sometimes in October followed by a period of rest, but more frequently in February.

Officers of the Ministry have from time to time examined all the principal and a large number of the subsidiary trials. It is as yet too early to set out, even for any simple case, a proper profit-and-loss account, taking capital outlay, labour and other considerations into account; indeed, for a full financial estimate of the value of the system the results over a series of years of varying seasons must be available. Nevertheless, from the reports already received the Ministry is satisfied that the main principle of the use of successive nitrogenous dressings on grassland is sound, and that thereby a considerable increase of production can profitably be obtained. This opinion is strengthened by the cognate experiments of Professor T. B. Wood at Cambridge, which demonstrate the high nutritive value of young leafy grass and the maintenance of this character in the renewed growth that follows the fresh nitrogenous manuring after the grass has been eaten off. Certain matters have, however, to be worked out in practice before the principle can be embodied in a system that is assured of success.

Important Questions.—The questions still at issue are:—

(1) *Fencing and Watering.*—While the optimum output may be obtainable only from a scheme of six or seven paddocks of such an area that the stock complete the rotation in monthly periods, the expense involved in new fences and the laying on of water may be greater than the ordinary farmer is able to face. He need not, however, be deterred from aiming at something less intensive. A simpler division of existing fields and water supplies, with perhaps fewer dressings of nitrogen, would effect an appreciable improvement. Indeed, the dressing at fortnightly intervals of successive sections of an otherwise undivided field, after the usual phosphates and potash have been given over the whole, may be suggested as a rough and

ready means of securing a measure of rotational grazing, which invites further investigation.

(2) *Time of Applying Nitrogen.*—How late in the year are applications of nitrogen profitable? Some of the experimenters are disposed to think that the earlier spring dressings give proportionately the greater returns, and that when growth is well established and growing conditions generally are favourable nitrogenous applications may be omitted.

There is collateral evidence that during the summer the root system of the grasses is at its maximum, and is best able to make use of increased supplies of plant food, provided the water supply is adequate. Probably no general rule can be laid down other than that the dressings must be withheld in periods of drought. There is much, however, to be said for a renewal of the applications in September to take advantage of the warmer soil and the more humid conditions which usually begin about that time.

(3) *Winter or Early Spring Grass.*—Are autumn or winter dressings likely to be remunerative in producing winter grass or an early bite? This promises to be one of the most remunerative features of the new system, if grass can be obtained "out of season" for conversion into products of a relatively high cash value, such as milk or fat lambs. The earlier bite seems to be assured, but to determine its extent, and, again, to ascertain whether any winter growth of real feeding value can be obtained, demands carefully controlled trials over a series of years.

(4) *Disposal of Manure.*—What is the best way of dealing with the accumulations of manure on the rotational plots? Chain harrows are now made which spread the droppings efficiently, but in a dry spell the herbage is apt to remain smeared and distasteful. In some cases cows, for example, have been allowed to graze a plot for two-hour intervals and have been then turned on to adjoining unimproved land or the last grazed plot to rest, chew the cud, and dung before returning to feed. This, of course, involves extra trouble and careful organization, but it may be worth consideration if only as a means of distributing the improvement obtainable by the intensive use of fertilizers on a limited area. The principle is more readily applicable with sheep: if the lower levels only are treated, manurial residues will be transferred to the higher ground where sheep prefer to lie.

(5) *Distribution of the Plots.*—What should be the distribution on a grass farm of rotational grazing plots, reserve plots

for grazing if required, and hay land for winter keep? Although figures are available which throw some light on such questions, the experiments have not been continued long enough to warrant definite statements on the points at issue. Seasons vary, as well as pastures. The stock-carrying capacity of a wet season like 1927, when in some cases increases of the order of 100 per cent. and more were obtained, may not have been repeated in the drier conditions of 1928. Manuring does have the effect of postponing the cessation of growth due to drought, and does enable the pasture to recover more quickly after rain, but if a field—whether manured or not—is caught short in a severe drought it has practically no stock-carrying capacity. Hence the need for reserves, the exact extent of which each farmer will have to settle according to his circumstances. Obviously, few farmers would, without trial, venture to adopt this system over the whole of the farm. They might, however, aim at providing for the requirements of their cows by a system of rotational grazing. If drought supervened they should be able to fall back upon some marginal land, less intensively manured and less intensively stocked, to see them through the period of shortage. There seems to be little doubt that even lightly manured land, stocked so as never to be eaten down quite bare and yet never allowed to become coarse, has considerably greater drought-resisting power than unmanured land, however lightly stocked.

The essence of the method consists in providing the stock throughout the season with fresh, young, leafy grass; and the necessary conditions are the repeated applications of nitrogen to induce growth, and systematic close grazing to keep the herbage short. It has thus been found possible to extend the grazing season both at its beginning and end, and also to maintain the high feeding value of the grass at a time in the summer when it usually falls off. Without doubt the system calls for more watchful management and some increase in the labour of moving the stock more frequently. As indicated above, there are various questions still to be worked out by practical farmers, but the Ministry is satisfied that they can be solved with advantage to agriculture, and therefore presses upon farmers the importance of trying out the method and adapting it to the conditions of each farm.

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TWELFTH ANNUAL POULTRY AND RABBIT CONFERENCE

Address by

SIR CHARLES J. HOWELL THOMAS, K.C.B., C.M.G.,
Permanent Secretary, Ministry of Agriculture and Fisheries,

The following address was delivered by Sir Charles J. Howell Thomas at the Twelfth Annual Poultry and Rabbit Conference, held at the Harper Adams Agricultural College, on August 14-17, 1928.

It is probably quite unnecessary for me to attempt to deal in detail, either with the recent developments in the industry with which the College and the National Institute of Poultry Husbandry are so closely concerned, and for the development of which they are so largely responsible, or with the history of this important Agricultural College where we have the good fortune to hold our meetings.

But there are one or two points to which, with your permission, I would venture to draw attention.

The establishment of the National Institute of Poultry Husbandry in affiliation with Harper Adams College marked a fitting tribute to the great influence which this centre had for some time exercised in the great poultry industry, and particularly in the educational, experimental, and instructional aspects of the industry.

Until recent years, education in poultry-keeping was more or less the Cinderella of agricultural education, but, thanks very largely to the great effort which has been made and is still being made by those responsible for the Harper Adams College, scientific and practical training in poultry-keeping is receiving something approaching that measure of attention which its importance undoubtedly demands.

The field of investigation which education in poultry husbandry offers has at least as wide a scope for intellectual ability as that available in any other branch of agriculture.

The National Institute of Poultry Husbandry has now been in existence for three years, and forms part of a larger scheme which comprises research work on disease, genetics, nutrition, and general experimental work in connexion with breeding for egg production and the production and marketing of table poultry.

The problems awaiting solution in connexion with the industry are many and complicated—only yesterday, for example, reference was made in *The Times* to the difficulty of

obtaining reliable data bearing on the economics of poultry-keeping on the general farm—and it is obvious that there exists a wide field affording scope for interesting and profitable investigation by those best qualified to carry out such tasks.

Harper Adams College, which for so many years has been closely associated with the poultry industry, is, I feel, particularly well equipped for the work which has to be done, and I should like, if I may, to tender to those responsible for the College my hearty congratulations upon the success which has attended their efforts, and my best wishes for the future. This success is obviously due, to a very considerable degree, to the great effort which has been made by the Principal, Dr. Charles Crowther, who presides with such marked success over the activities of the College, to the Wardens, and to the very able staff who are associated in the work.

I should like also to pay tribute to the effort being made by Professor Parkhurst, the new Director of the Institute, who came to Harper Adams a short while back with a high reputation which he had earned in America.

I have referred to the poultry industry as a great industry. It is not only great, but it is of growing importance, and what is more encouraging probably than most other things is the fact that its importance from an agricultural point of view is fast becoming recognized.

The number of poultry of all classes in England and Wales in the year 1927 was over 43½ millions, an increase of 3 millions over the previous year, and of 11 millions over the year 1913, whilst the production of eggs in 1927 was approximately 2,165 millions, an increase of 150 millions over the previous year and of 900 millions over the year 1913.

Lancashire—where Dr. Crowther for a time exercised his influence—holds the record for this country with 6.53 birds per cultivated acre, Northumberland being in this respect at the bottom of the list with only .59 bird per cultivated acre.

From a commercial point of view, the rabbit, in which this Conference is interested, is also assuming growing importance, and here again there is ample scope for further development.

So far as concerns poultry, we have still a long road to travel before we can claim to have reached the goal, which should be the aim of all of us, to be self-supporting, and to see that the home production of poultry and eggs is sufficient to meet the home demands.

According to the returns for the year 1927, it is estimated that we imported 2,921 million eggs of a value of £16 million, probably equivalent to rather more than one-half of our total consumption.

For poultry, we, in this country, imported for the same year about £3 millions worth, which is about one-third of our total consumption.

In this connexion I should like to refer also to the export trade in live poultry. This, of course, consists almost entirely of pedigree birds, for the breeding of which our country is held in high esteem by so many of our overseas competitors.

I am sure that we can all look with confidence to the Harper Adams College and the National Institute of Poultry Husbandry further to improve our breeds, having in view the production of that ideal bird which would produce eggs of the greatest value during its active career and be, not only valuable, but attractive to the gourmet when its activities have been ended.

We in the Ministry watch your progress with the greatest interest, and are anxious on our part to do anything which may be practicable to further your ends.

In this connexion I may perhaps refer to the Grading and Marking Bill which, during the Session of Parliament which has just ended, was placed on the Statute Book. Of itself it cannot do much, if anything, to improve matters immediately, but, nevertheless, I attach considerable importance to that Act of Parliament.

It marks an epoch in agricultural history in this country. It is the first occasion on which there has been in this country any legislation providing for the grading and marking of agricultural produce.

I have said that the Act of itself does little or indeed nothing. What it does is to provide machinery for, and give protection to, efforts to be made with a view to the standardization of agricultural produce and its grading and marking.

The whole of the scheme under the Act is permissive, and I should like, on behalf of the Ministry, to express appreciation of the great assistance which we in the Ministry have received from such bodies as the National Poultry Council, the Poultry Advisory Committee, the National Farmers' Union, and other bodies, who, I am happy to say, all show a willingness to co-operate with enthusiasm in the development of schemes for grading and marking under the Act.

The Act provides for a National Mark, a mark which, with

the label "Produce of England and Wales," will inspire the confidence of all purchasers of commodities bearing that mark, and which, in course of time, will build up a valuable business goodwill for the benefit of producers in this country. Meanwhile we can all be confident that the National Mark will be duly safeguarded by the National Mark Committee, over which Lord Darling has consented to preside, and which will be advised by Commodity Committees.

This Grading and Marking Act and the National Mark laid down under it will, I hope, be of considerable service to those in this country who are interested in the poultry industry, as well as to agriculturists generally.

Conferences such as the one upon which we are now embarking serve many useful purposes. This particular Conference is of special value inasmuch as it acts as a means of direct communication between the poultry industry and the Institute. The fact that it is being held at Harper Adams College also links up poultry-keeping with general agriculture and enables agricultural students of the College, who later on will have their influence and responsibilities in the agricultural world, to realize the importance of the industry to agriculture.

The poultry industry is to-day very much better organized than it was a few years ago. We have a National Poultry Council which speaks for the industry on questions of national importance, and which is supported by the various poultry societies. The National Farmers' Union is also taking an active interest in the industry, and among recent and valuable developments, I would like to refer to the important influence on the industry and the valuable services rendered by the excellent poultry Press which does such good work among those concerned in the industry.

His Majesty's Government is in many ways showing that it is desirous to help in the development of the industry. Not only have considerable grants of money been made for education and research, but I have no doubt you are all looking forward to that legislation which has been promised which will provide for rating relief, which is to be shared by the poultry farmer in common with other agriculturists.

Grants have been made through the Ministry of Agriculture of nearly £20,000 for capital expenditure for various purposes in connexion with the National Poultry Institute, and we are also making further grants of over £6,500 per annum to meet the cost of maintenance.

Here at Harper Adams I suppose, as far as poultry is con-

cerned, the greater part of your activities are devoted to the discovery of new facts and new principles, and the scientific and practical development of poultry husbandry generally.

It is obviously not sufficient merely to establish new facts and principles. They must be disseminated in such a way that every interested poultry-keeper can reap the advantage. This spreading of the result of research is a task not alone of the Institute nor of the College, but of the poultry Press, and very largely of the Poultry Instructors who work under County Education Authorities. The Ministry of Agriculture provides two-thirds of the cost of these Instructors, who are employed by County Education Authorities. I feel that it is of great importance that the standard of this public service should be maintained at a high level.

I understand that one of the main objects of the Institute is to provide higher education in poultry husbandry for prospective teachers, and at the same time to provide facilities for existing teachers and others to extend their knowledge.

Courses on poultry diseases have been held at the Ministry's Veterinary Laboratory as refresher courses for County Poultry Instructors.

I should like, if I may, to emphasize the importance of closely linking up the work of this Institute with County Education Authorities, poultry societies, and the poultry Press, in order that the full value of the work in the Institute may be made available for poultry-keepers as a whole.

There is one other activity of the Ministry of Agriculture to which I will refer, and that is in connexion with the World's Poultry Congress, which, in accordance with the invitation extended by the Prime Minister during last year's Congress in Canada, is, in the year 1930, to be held in this country. 1930 may appear to be far off, but we are already taking steps to organize the arrangements for this Congress, the first of its kind to be held in this country. It will, I am sure, be of great interest to the National Institute and Harper Adams College, and I trust of benefit to poultry-keepers in this country and to the advantage of poultry husbandry throughout the world.

You have a most interesting programme before you, and I will not attempt to detain you longer, but will conclude by wishing to the Harper Adams Agricultural College, the National Institute of Poultry Husbandry, and to this, your Twelfth Annual Poultry and Rabbit Conference, the greatest possible success.

THE PRACTICAL APPLICATIONS OF METEOROLOGY TO AGRICULTURE*

THE progress, attained since the war, in the technique and distribution of weather forecasts, and in the use of meteorological apparatus adapted to agricultural needs, has convinced the rural population of the advantages which they can derive from the two principal branches of meteorology—weather forecasting and climatology.

Since its formation, in 1921, the French National Meteorological Office has seen, each year, a growth in the demand for information on the part of agriculturists, viticulturists, horticulturists, agricultural syndicates, etc. For the first time in France, the establishment of a close collaboration between agriculturists and meteorologists is in a fair way towards realization. Meteorologists now know exactly what is required by agriculturists, who, in their turn, know more precisely what they may expect from meteorological science.

I. WEATHER FORECASTS

Principles of Weather Forecasts.—Fore-knowledge of the weather of to-morrow and the following days is of the utmost interest to the farmer, especially in certain seasons. The question of weather forecasting has occupied the attention of agricultural circles from remote times, though it was not until the second half of the nineteenth century that it was solved scientifically. In 1857, the French astronomer, Le Verrier, concluded that it would be possible, from daily meteorological charts, to predict some hours in advance the arrival of atmospheric disturbances, and, in consequence, probable changes in weather. The principle of scientific forecasting of weather has made much progress since that time. Wireless, in particular, has allowed the construction of more complete charts, through rapid centralization of observations, not merely from the whole of Europe and Northern Africa, but from ships at sea, especially those in the Atlantic. This last information has the immense advantage of giving information of the arrival of disturbances from the Atlantic, to which France is specially exposed by reason of its geographical situation on the West of Europe.

* Translated and summarized by Mr. W. R. Black (Ministry of Agriculture and Fisheries) from an article by Mons. J. Sanson (Chief of the Climatological Service of the French National Meteorological Office) in *La Grande Revue Agricole*, March, 1928.

There were three principal stages in the successive improvement of the technique of weather forecasting :—

(1) Up to 1914, forecasts were based almost exclusively on the examination of isobar charts. These charts show the zones in which pressure decreases from the outside to the centre (depression) or increases from the outside to the centre (anti-cyclone). The track of depressions or anti-cyclones can be followed on charts drawn up every 12 hours; their position 24 hours later can be deduced, and, in consequence, the weather they will bring to the district under consideration can be forecast. These deductions, unfortunately, are not always correct. The movement of depressions which, in general, takes place from west to east is not always very regular. The track curls and turns back, the speed is variable and, like that of anti-cyclones, the track is influenced by many factors. It is the resultant of all these factors which determines the movement of pressure centres, and the difficulty of forecasting will, therefore, be understood.

(2) During the war, this method was improved by adding to it the method of barometric variations. There are drawn on charts, lines of equal variations, that is to say, lines passing through all the points at which barometric pressure has varied to the same extent during the determined period. These lines show zones of increase or decrease and their track is much more regular than that of depressions or anti-cyclones which they accompany and their speed is fairly constant in each season. A study of their evolution furnishes valuable indications for the forecasting of isobar situations.

(3) There is a striking connexion between the zones of variation of pressure and cloud systems. The study of cloud systems is the latest improvement made in the meteorological services of France for weather forecasting. If cloud charts are drawn up it is seen that clouds are grouped in large extended masses which are well-organized and move in a system known as the cloud system, which has four parts : (a) A front composed of high clouds partly covering the sky. This first part heralds the approach of a zone of low pressure. (b) A centre formed by a uniform veil of clouds of average height accompanied by low clouds giving continuous rain. This centre coincides with the zone of low pressure itself. (c) A tail with the sky alternately almost clear and very cloudy from the debris of clouds at all heights, giving a succession of showers, storms and fine weather. This tail accompanies the arrival of the zone of high pressure. (d) On the borders of this system, there are margins in which there are only high or average clouds. Cloud systems move most often in a series coming from the south-west, from the west or from the north-west. In the interval between two cloud systems the sky is clear or has local clouds which appear in the morning and disappear at night, but continuous fine weather is only experienced in general in zones of high pressure which are not touched by zones of variations.

It is by the combined study of isobar charts, charts of variation in pressure, and charts of cloud systems that rational forecasts of weather can be made.

Distribution of Agricultural Warnings by Wireless.—Once these weather forecasts are made out, they must be brought to the notice of agriculturists as quickly as possible. Great progress

was made in this direction in 1922, when the National Meteorological Office began to distribute its bulletin four times a day by wireless from the Eiffel Tower. These warnings contain, for each of the 12 regions into which France has been divided for the purpose, information on the general character of the weather, wind, rainfall, temperature, and the possibility of dangerous phenomena for agriculture—such as frosts, storms, hail, etc.

Since August, 1927, a further improvement has been introduced into the distribution of these agricultural warnings. The *Compagnie Française de Radiophonie* decided to issue each day, at 7 p.m., an agricultural meteorological communiqué specially adapted to the needs of farmers in the north of France and in the neighbourhood of Paris. This communiqué is drawn up by a group of agricultural experts and practical agriculturists with a high reputation in agricultural circles. They are in daily contact with the forecast service of the National Meteorological Office, and are thus kept in touch with all modifications in the weather situation revealed by the charts mentioned above. Being in full possession of all the facts, they can make such comment on the forecasts drawn up by the National Meteorological Office as will be of use to the rural population, and draw conclusions enabling the latter to employ their time to the best advantage on the morrow (e.g., in cultivations, ploughing, manure-spreading, irrigation, harvesting, etc.). The commentators also report on the need for preventive treatment when the atmospheric conditions are favourable to the development of fungus diseases, or for protective treatment when there is a likelihood of frosts, or for increasing the dressings of certain manures to counteract excessive humidity or drought; the commentators also give advice of a more general kind adapted to the climate of each region—for example, the use of a certain variety of wheat or the possibilities of a catch crop. In short, they give agriculturists, in an assimilable form, the means of drawing the maximum profit from the weather forecasts of the National Meteorological Office.

This innovation could not have been better received in rural circles, and it is hoped, as a result of this initial success, that it will not be long before the regional stations of the National Meteorological Office are provided with sufficient staff and material to enable them to participate in this service. Farmers in all parts of France could thus benefit from communiqués specially drawn up for their respective regions by meteorologists who know the

local climatology well, and who work in the closest collaboration with practical agriculturists of the country.

II. CLIMATOLOGY

(a) **General Application of Climatology in the Improvement of Crops.**—Weather forecasting is not, as generally thought, the only branch of meteorology which can be useful to agriculturists. There is a second—Climatology—of which many agriculturists are unaware, which can, however, render them considerable service. A precise knowledge of climate, that is to say, of the meteorological elements not solely of the air in which we live, but of the air at the surface of the soil and in the soil, can play a capital part in agriculture for the following reasons:—

(1) It will help to increase yields by facilitating the choice of varieties of crops best adapted to the climate; varieties resistant to cold in the east, or drought in the south; early varieties in regions where the heat of July causes "burning" to be feared; varieties of which the critical periods (earring of cereals for example) coincide to the maximum of probability with favourable meteorological phenomena.

(2) It affords a powerful aid in the application of preventive treatment against fungus diseases. Two kinds of conditions are needed for the development of these diseases, those favourable for the fungus and those predisposing the plant to disease. High temperatures, drought, and a high exposure to sunlight are factors propitious to fungi attacking the plant, which is already weakened by a partial withering of its tissues; they form, on the contrary, a powerful obstacle to the development of the propagative organs of the fungus, whose existence they menace. On the other hand, a soft and humid weather favourable to the fungus produces the maximum of turgescence in the tissues of the plant, which is thus better able to resist fungus attack. In order to produce an epidemic it is necessary that these two opposite kinds of conditions must immediately succeed each other, leading, in the first place, to predisposition of the plant to attack, and then to the development of the fungus before the plant can react. Thus at the beginning of the warm weather the plants wither in the day time; now if, in the course of the night, temperature is lower and a mist is produced (an element propitious for the propagation of fungus spores) the fungus attacks the plants, which will not have had time sufficiently to regain their turgescence and the epidemic will break out. On the basis of these data, and from the observation that potato blight always travels from west to east, one can, in certain conditions of temperature and humidity, and with observation posts judiciously placed, announce the probable advance of this disease in a given region and advocate the necessary preventive treatment.

(3) It will sometimes allow measures to be employed to counteract certain atmospheric phenomena which are particularly dangerous at certain times of the year—use of artificial clouds against spring frosts, formation of societies intended to prevent or insure against hail.

(4) It will assist the rational use of manures. It is known, for example, that lack of water in arable soil impedes nitrification. In very dry regions the extensive use of easily soluble manures may

remedy this to a certain extent. In districts with abundant rainfall, where fungus diseases and storms are particularly to be feared, dressings of potassic and phosphatic manures will be increased. These same manures will induce vegetative activity in regions where winter cold and spring frosts lead to the risk of damage to advanced crops. The climatology of the country will be also utilized to fix the dates of spreading manures; for example, the application of potassic manures will be the earlier the drier the climate, that of nitrogenous manures on grass will be carried out as far as possible on dry days at the end of February when rain is imminent. Liming and marling will be done in the dry periods of autumn.

(5) It is indispensable when new crops are tried. Thus, in France, an increase in the area under sugar beet is very desirable. Before this crop is grown in certain departments, their climatology must be known; in particular, whether the distribution of average quantities of rain over the summer months will permit of the advantageous acclimatization of this crop. Sugar is produced as much through the water in the soil as from the carbonic acid in the air. Evaporation from the leaves of beet is considerable, and may reach 350,000 to 500,000 gallons of water per acre, corresponding to a rainfall of about 20 in., which must be spread over half a year (May to October). It must be ascertained, therefore, that the rainfall can satisfy the need of this crop for water.

(6) Finally, certain meteorological data can be instanced which are of service to agriculturists, *e.g.*, the monthly and annual distribution of rainfall and the amount of maximum falls, in the case of the construction of cisterns; the system of winds in the case of the installation of a mill or an air-wheel; and extremes of temperature, duration of frosts and their intensity, in the case of heating in glasshouses.

(b) Study of a Particular Climatological Factor, *e.g.*, Influence of Rain in Agriculture.—Among the climatological phenomena having an important effect on agricultural production, rainfall seems to take first place, and it seems useful by way of example to study, in some detail, the role of rainfall in agriculture. The amount of rainfall is expressed in inches, a precipitation of 1 in. corresponding to 4.7 gallons of water (*i.e.*, 47 lb.) per square yard, *i.e.*, 22,500 gallons per acre. In France, the average quantity of rain received annually varies according to district, the minimum in the neighbourhood of Paris and the maximum in the neighbourhood of the mountains.

Fertilizing Effects of Rainfall.—The physical and chemical effects of rainfall are well known. Minerals in the soil are rendered soluble, without which they cannot be utilized for the formation of plant tissues. It is, also, through rainfall that fermentation indispensable to plant life takes place in the soil. There is one point to which particular attention must be called, namely, the fertilizing effect of rainfall due to the ammoniacal or nitric nitrogen which it contains in quantities far from negligible. Determinations carried out in France and Belgium have shown that rain contains, on the average, .0002 per cent. of ammoniacal nitrogen and .00007 per cent. of nitric nitrogen. Winter rainfall is, in general, richer in nitrogen than summer rainfall. It is seen that rain brings

in an average year some 13 lb. of nitrogen per acre in the region of Paris and more than 26 lb. in the wetter districts of the country. In Germany and in Italy, the average quantity of nitrogen brought per acre by rainfall has been found to be about 10 lb., and in England about 7 lb., of which three-quarters are ammoniacal nitrogen and one-quarter nitric nitrogen, while, in the United States, it is as large as 20 lb., of which 13 lb. are ammoniacal nitrogen and 7 lb. nitric nitrogen. Rainfall is about 10 times richer in nitrates in tropical regions than in temperate climates. The proportion of ammonia is also much higher, which explains the luxuriant vegetation on certain African soils which, from their composition, would be considered as poor. These quantities of nitrogen furnished by rain are much superior to those given in manures, especially in France.

Thus, in some degree, rainfall supplies manure, but the reverse is sometimes the case, and manure can, at least in part, replace water. In order, for example, in the case of wheat, for the plant to manufacture 1 gr. of dry matter it has been established that 0.53 pints of water are necessary in unmanured soil and only 0.35 pints in the same soil with average manurial dressings. The transpiration of cereals is, in fact, diminished by the use of manures, and, varying with the dressing of the latter and the nature of the soil, the quantity of water required to produce 33 bushels of wheat per acre, weighing 71 lb. per bushel, has been reduced from 24 in. to 8 in.

Disadvantages of Excessive Rainfall.—(1) Potash salts are retained by the absorptive power of the soil and suffer only insignificant losses from rainfall. No loss is to be feared so far as concerns soluble phosphatic manures. It is different, however, with nitrates, which are in danger of being lost in drainage water through abundant rainfall in autumn and winter. This point must, however, not be exaggerated. The loss of nitrates in the sub-soil is much less rapid than is often imagined; thus after a rainfall of half an inch, it was found that nitrate only descended a few tenths of an inch in the soil, while the humidity produced by this rain falling on a dry soil had penetrated in one day to 2½ in. Further, in warm weather nitrate may be brought back quite quickly by capillarity from a considerable depth to the surface. Nitrate 10 in. deep in the soil was thus returned to the surface in a fortnight. During this season, capillarity causes the water in the soil to rise to replace that lost in evaporation. This water brings with it dissolved products deep in the soil, products which thus come to be concentrated in the neighbourhood of the roots of plants. Too deep a burying of nitrates following rain need not be feared when the manures are applied in spring, even if they are ploughed or harrowed in. As, however, nitrates are subject to denitrification in very humid soils, it is advisable, where too heavy rains or a high humidity are to be feared, to replace nitrates by ammoniacal manures. Sulphur, and, above all, lime, are lost through rainfall in larger quantities than any other manurial element. Losses of lime, naturally more important in a rainy climate than in a dry district, attain on the average in France 3 to 4 cwt. per acre per annum; in very rainy years they have even reached 4½ cwt. The practice of liming is, therefore, absolutely necessary, as lime is an indispensable element in the nutrition of plants equally with nitrogen, phosphoric acid, and potash.

(2) Soils which are too wet, *i.e.*, which contain more than 40 per cent. of their weight of water, are, in general, impermeable to air, and thus any gaseous exchange between the soil and the

atmosphere is rendered impossible. There results a stoppage of respiration of plant roots, leading to asphyxiation of the plants and a lowering of the temperature of the soil harmful to their growth. The water (which is a bad conductor of heat) remaining in the top layers of the soil is not replaced by air, and, in consequence, these layers, although superficially warm in spring, cannot transmit this warmth to the lower layers, which remain cold. There results, among other things, from this lack of warmth, the impossibility of production of carbonic acid gas in the soil, an indispensable element in the development of the plant, as a complement of carbonic acid gas in the atmosphere. Soils which are too wet lack air and are cold, but it is possible by drainage to aerate and warm them. Experiments have shown that the average temperature of a drained soil can be 6° C. higher than that of an undrained soil.

(3) The substances necessary for the nutrition of plants, concentrated in the neighbourhood of the root hairs, penetrate these latter with the soil water by capillarity and endosmosis and ascend through the plant cells under the impulse of these forces. Their ascension and their absorption are considerably increased by transpiration, which leads to the consumption of an enormous quantity of water compared with that strictly necessary for the tissues. Thus fertilizing elements from the soil reach right to the leaves. If the soil is too dry, transpiration is greater than absorption and plants wither, but, if the soil is saturated, the plants are "gorged" with water and their vegetative apparatus is developed to the detriment of their reproductive apparatus. In this latter case, in effect, the substances in the soil are diluted to too large a degree with liquid, and, since the roots can only absorb a certain volume of water, the plants are deprived of a certain amount of their nutrients, notably phosphates, without which it is impossible for them to live normally. On the other hand they have other nutrients at their disposal in greater quantity, particularly nitrogen brought down in the rainfall. There results an exaggerated growth of the vegetative organs, a diminution of precocity and a marked tendency to the invasion of fungus parasites. This can be remedied by increasing the potassic and phosphatic dressings.

(4) The year 1927 showed once more that, while abundant summer rain has not always a bad effect on the quantity, it has on the quality of the crop. For wheat, in particular, it has been established that rain at harvest does not lead to the germination of the grain in the sheaf unless accompanied by a sharp fall in temperature such as is produced at the time of a storm. Such fall of temperature is not an obstacle to germination as one would be tempted to think, but, on the contrary, the determining cause. The damage to the crop is the greater the longer the temperature remains below the normal after rainfall; and inversely the damage is the smaller the more rapidly the thermometer regains the average for the season. In regions where rainfall is abundant during the months of July and August, it is to the interest of farmers to select varieties of wheat which are resistant to this special effect of summer rains.

Correlation Between Rainfall and the Yield of Wheat.—The preceding considerations show the important part played in agriculture by rainfall. It has long been known (it is found for instance in the Bible) that harvests are intimately dependent on rainfall. For the central region of France, in particular, the following rules have been drawn up on the relation between

rainfall in the quarter April, May, June and the yield of the wheat crop :—

- (1) If the rainfall during these three months is below average, the yield will be above average so long as the temperature is not more than 1° C. above the average. If the temperature is more than 1° C. above average, the crop is damaged by burning.
- (2) If the rainfall during these three months is above average, the yield of wheat is below average.

Analogous conditions have been found in the north of Italy and in Ohio, where a diminution of rain in the spring is accompanied by an increase in the yield of wheat. On the contrary, in the south of France and the southern part of the Italian Peninsula, the effect of rainfall is quite the opposite.

III. RADIO METEOROLOGICAL INSTALLATION OF AN AGRICULTURAL HOLDING.

The preceding considerations suffice to show the importance for the agriculturist on the one hand of the reception of short-term weather forecasts, and on the other of a knowledge of climatological elements not only for his region, but also for the precise spot where his holding is. He can thus take account of the repercussion of atmospheric factors on his crops and seek for means to diminish the disastrous effects of certain of them.

It is indispensable in the first place that wireless receiving sets should be multiplied in country districts, for agriculturists can thus receive, beside the regional weather forecasts sent out each day at a fixed hour, special warnings of atmospheric conditions favourable to the development of fungus diseases, of spring frosts, or of particularly violent hailstorms.

In the next place, every important holding should have, besides a barometer, the variations of which will complete the forecast data, a small meteorological installation comprising several simple pieces of apparatus which stand rough usage, which cost little, and which give sufficiently precise data. Until 1927, such instruments did not exist. This regrettable gap has now been filled by the National Meteorological Office on the demand of a seed selection society in the Paris district which desired to possess a meteorological station; and at the present time agricultural meteorological "posts" on that Office's model are being multiplied throughout the country. The installation comprises :—

- (1) A screen of very small dimensions containing maximum and minimum thermometer, psychrometer* and evaporimeter.
- (2) A rain gauge.
- (3) An actinometer for the determination of the intensity of solar radiation, and sunshine recorder.

* A combination of two thermometers, the bulb of one of which is coated with muslin kept moist with water. The difference in the readings is used in the calculation of the humidity of the atmosphere.

(4) An outside evaporimeter to determine evaporation at the level of the plant.

(5) A maximum and minimum thermometer placed a few centimetres above the soil in order to obtain the temperature at the soil level.

(6) A soil thermometer to measure the temperature at 40 cms. depth.

(7) Three special soil thermometers to determine the temperature of the soil at depths of 30 cms., 60 cms. and 1 metre.

The whole of this apparatus costs about 1,500 francs,† but for many agriculturists a smaller installation would be sufficient; that employed in the Department of Seine-et-Oise, with the collaboration of the Meteorological Commission of that Department, may be instanced as especially interesting. On a dozen holdings, there has been installed a meteorological "post" comprising only a rain gauge, outside evaporimeter, maximum and minimum thermometer to measure the temperature of the open air at a few centimetres above the ground, and a soil thermometer at 40 cms. depth. A meteorological post, composed of these four pieces of apparatus, gives very complete information on the temperature of the air and the soil in the layers affecting plants, as well as of rainfall and evaporation—which are two phenomena which ought not to be separated. The price is only 200 francs, since rain gauges are generally lent free by the Departmental Meteorological Commissions to persons who express the wish to have them, the only condition imposed being that they undertake to carry out observations regularly every day and forward a summary every month.

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OPTIMUM WEIGHTS FOR FATTENING OFF CATTLE, SHEEP AND PIGS

JAMES WILSON, M.A., B.Sc.,

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It is often said that the pig is the most economical animal on the farm, and, if the animal which produces a pound of increase on the smallest quantity of food be the most economical, what is said about the pig is, in the main, correct; for, with foods appropriate to its breed and moderate live weights, the average pig puts on a pound of increase with about 4 lb. of barley equivalent, while the sheep needs 5 to 5½, and the bullock 5½ to 6½. Stated in another way, it can be said that, beyond what is necessary for mere maintenance, the pig needs about 2½ lb. of barley equivalent per pound of increase, while the sheep needs about 3, the bullock about 3½. Since hay and straw must be grown, however, and the pig can do nothing with either, while the sheep can do very little with straw, the animal which can turn into meat and

† At present, £12.

manure, not only hay, but both hay and straw, may be more economical than the quantity of food consumed to the quantity of meat produced would indicate.

But the pig and the sheep and the bullock are not fed with equal economy at all times. Their economy depends upon their live weight and the rate at which they are producing. The bullock's is the simplest example. If capable of putting on, say, 2½ lb. of increase a day, and fed well enough to do so, the quantity of food required to produce that rate of increase remains the same; but, since the bullock's live weight and the food required for maintenance are constantly rising, the proportion of the maintenance portion of the ration to the whole ration, or to the productive portion, is constantly rising; and, at the same time, the bullock is declining in economy. It is different with the pig and the sheep, however, for, though both need more for maintenance as they grow heavier, their rates of increase themselves increase, and the production portions of their rations increase more than the maintenance portions, till the well-fed sheep is 100 to 120 lb., the pig 150 to 160 lb., live weight. Thus, both animals increase in economy till near these weights.

The following table shows the food required for maintenance and production by well-fed pigs, sheep and cattle at progressive live weights, and the approximate weights at which each is most economical of its food:—

THE PIG.						
Live weight	Increase per day	Time required to put on 10 lb.	Maintenance per day	Maintenance while putting on 10 lb.	Total food	Proportion of maintenance to total food
lb.	lb.	days	Barley equivalent lb.	Barley equivalent lb.	Barley equivalent lb.	per cent.
40-50	.76	13.16	1.08	14.21	39.21	36.3
50-60	.91	10.99	1.23	13.52	38.52	35.1
60-70	1.08	9.26	1.36	12.59	37.59	33.5
70-80	1.23	8.13	1.5	12.19	37.19	32.8
80-90	1.38	7.24	1.62	11.73	36.73	31.9
90-100	1.51	6.62	1.72	11.39	36.39	31.3
100-110	1.62	6.17	1.79	11.04	36.04	30.6
110-120	1.72	5.81	1.83	10.63	35.63	29.8
120-130	1.80	5.55	1.87	10.39	35.39	29.3
130-140	1.86	5.37	1.9	10.20	35.20	28.9
140-150	1.89	5.29	1.92	10.16	35.16	28.9
150-160	1.90	5.26	1.94	10.20	35.20	28.89
160-170	1.90	5.26	1.95	10.26	35.26	28.9
170-180	1.89	5.29	1.96	10.37	35.37	29.2
180-190	1.86	5.37	1.97	10.58	35.58	29.7
190-200	1.82	5.44	1.98	10.77	35.77	30.0
200-210	1.75	5.71	1.99	11.36	36.36	31.0
210-220	1.63	6.13	2.05	13.57	38.57	34.9
			2.19	14.33	39.23	36.5

THE SHEEP.

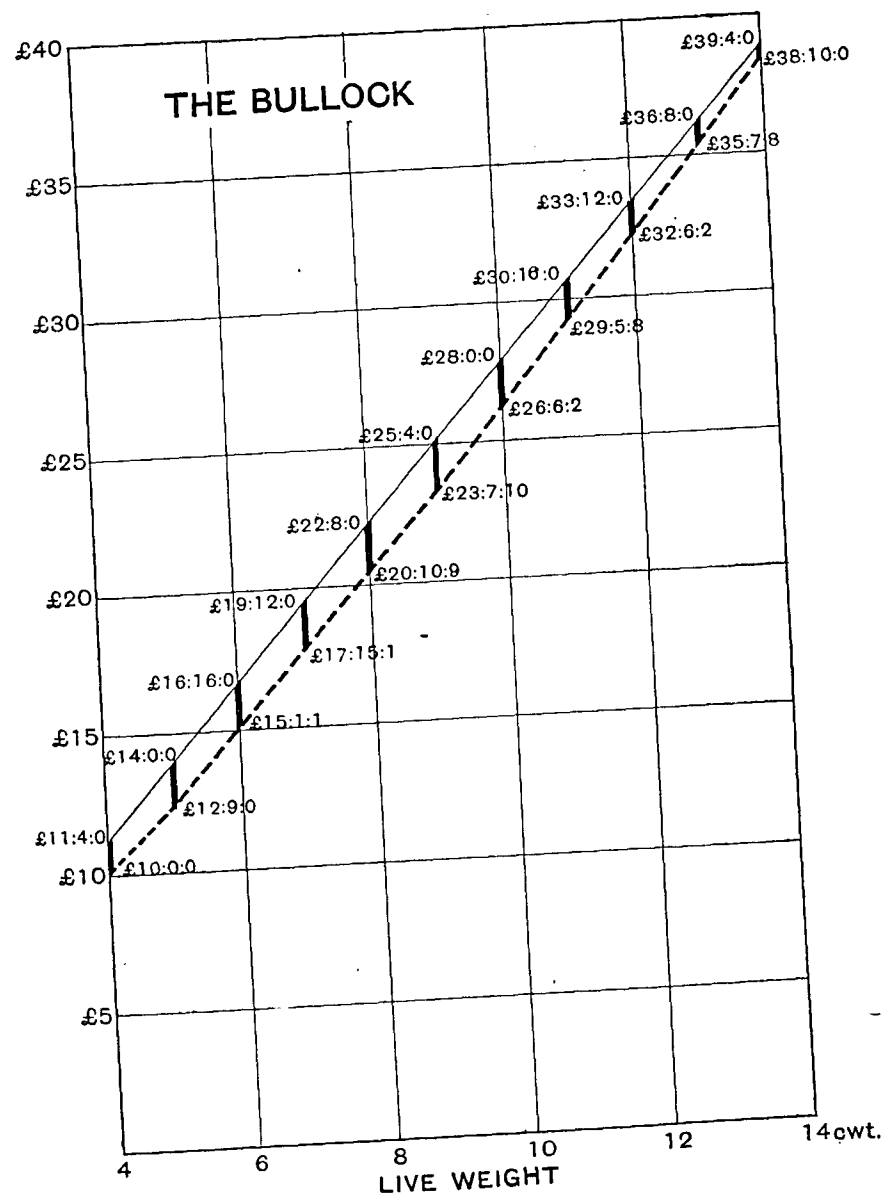
Live weight	Increase per day	Time required to put on 10 lb.	Maintenance per day	Maintenance while putting on 10 lb.	Total food	Proportion of maintenance to total food
lb.	lb.	days	lb.	lb.	lb.	per cent.
50-60	.21	47.6	.68	32.37	62.37	51.9
60-70	.29	34.5	.75	25.87	55.87	46.3
70-80	.37	27.0	.86	22.14	52.14	42.4
80-90	.43	23.3	.89	20.74	50.74	40.5
90-100	.47	21.3	.96	20.45	50.45	40.5
100-110	.50	20.0	1.03	20.6	50.6	40.7
110-120	.52	19.2	1.10	21.12	51.12	41.3
120-130	.53	18.8	1.16	21.81	51.81	42.1
130-140	.54	18.5	1.22	22.57	52.57	42.9
140-150	.53	18.8	1.28	24.01	54.01	44.4
150-160	.52	19.2	1.34	25.73	55.73	46.4
160-170	.50	20.0	1.40	28.00	58.00	48.2
170-180	.47	21.3	1.45	30.89	60.89	50.5

THE BULLOCK.

Live weight	Increase per day	Time required to put on 10 lb.	Maintenance per day	Maintenance while putting on 10 lb.	Total food	Proportion of maintenance to total food
cwt.	lb.	days	lb.	lb.	lb.	per cent.
3-4	2½	4	3.8	15.2	50.2	30.3
4-5	2½	4	4.6	18.4	53.4	34.5
5-6	2½	4	5.21	20.8	55.8	37.3
6-7	2½	4	5.71	22.8	57.8	39.5
7-8	2½	4	6.15	24.6	59.6	41.3
8-9	2½	4	6.54	26.2	61.2	42.8
9-10	2½	4	6.88	27.5	62.5	44.0
10-11	2½	4	7.18	28.7	63.7	45.1
11-12	2½	4	7.46	29.8	64.8	46.0
12-13	2½	4	7.72	30.9	65.9	46.9
13-14	2½	4	7.95	31.8	66.8	47.6

According to these tables, the bullock declines in economy from the beginning, while the pig increases till it weighs about 1½ cwt., the sheep till it weighs nearly 1 cwt. Nevertheless, the weight at which it uses its food with the greatest economy is not the weight at which the animal may be fattened off with the greatest profit. If that were so, the bullock, even well fed from birth, would have very little chance of leaving any profit at all; for profit accumulates, day by day, till the cost of the food* consumed per day exceeds the value of the meat produced per day.

* It is assumed that the value of the manure balances labour and other costs.



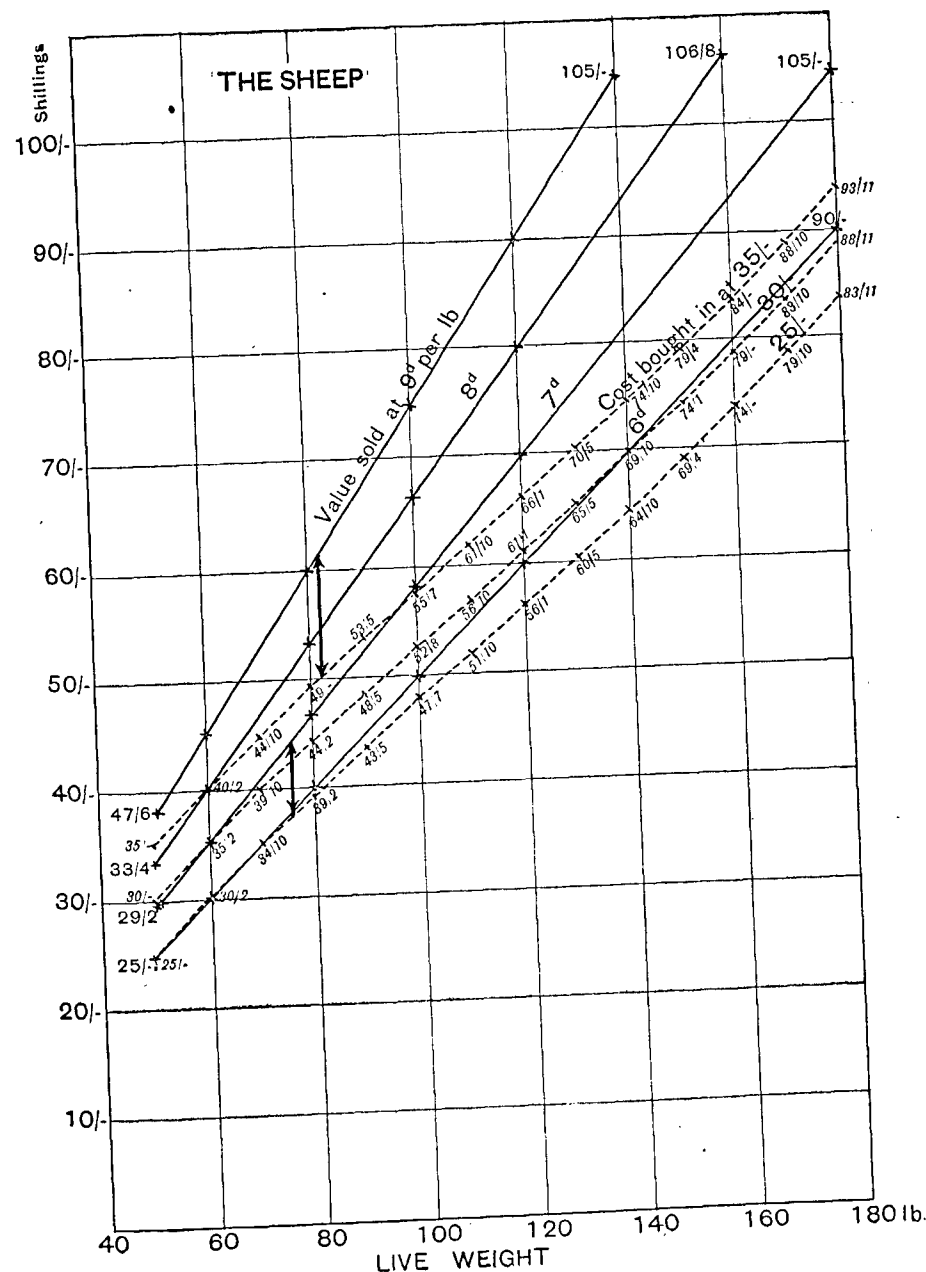
The following diagrams will indicate the approximate weights at which well-fed pigs, sheep and cattle may be fattened off with the greatest *profit*. The cost of the food is shown by the dotted lines, the value of the product by the continuous lines. The profit is found by subtracting the cost at any weight from the value at the same weight. Food is charged at 1d. per lb. of barley equivalent—the approximate average price for some time recently.

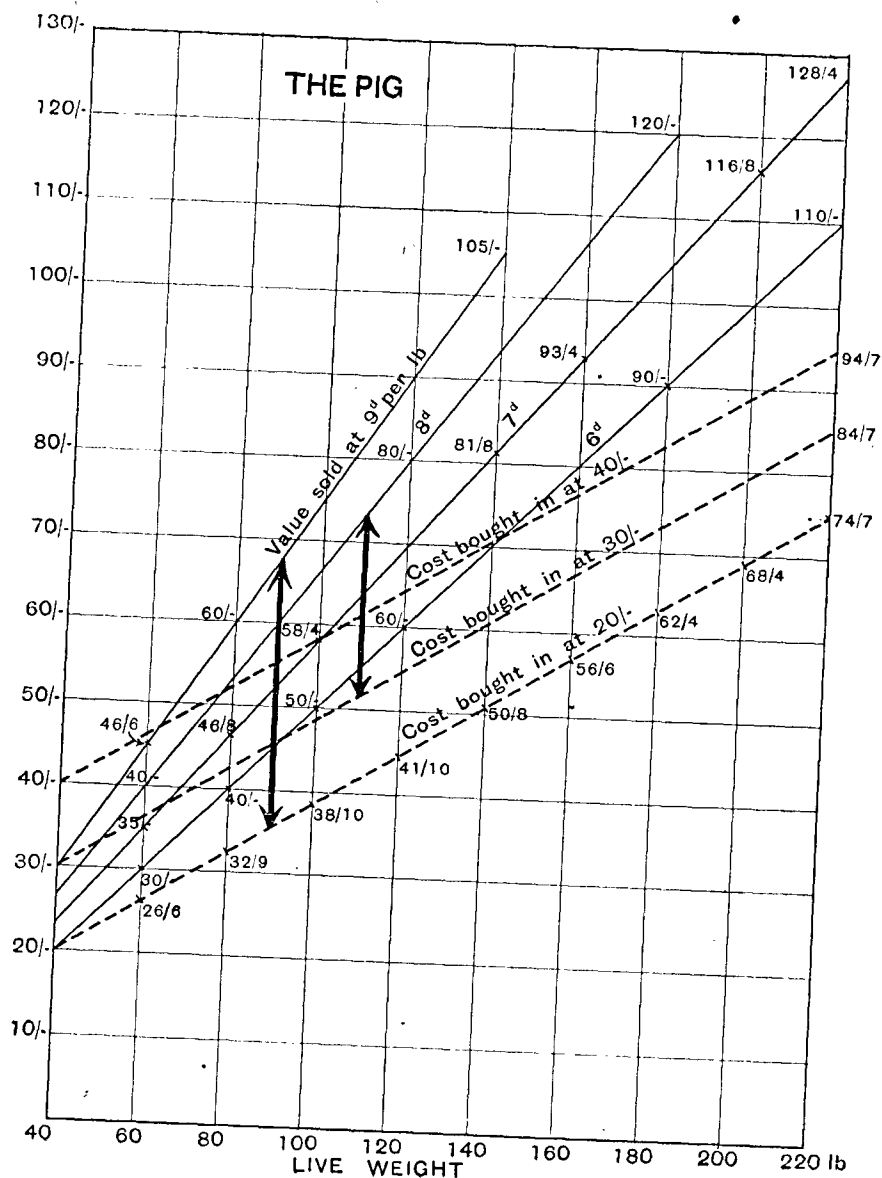
Because it is not complicated by assuming varying buying-in prices and different selling-out prices per-pound for different live weights, the bullock's diagram is the simplest and is put first. It is assumed that a 4-cwt. bullock is bought in at £10 0s. 0d., puts on $2\frac{1}{2}$ lb. a day, and, at all progressive weights afterwards, is worth 6d. per lb. live weight. On scanning the diagram, it will be seen that the bullock yields the maximum profit when fattened off between 8 and 9 cwt. If the bullock were to put on more than $2\frac{1}{2}$ lb. a day, his live weight for optimum profit would be increased; if he were to put on less than $2\frac{1}{2}$ lb., decreased.

In the pig and sheep diagrams, three different buying-in and four different selling-out prices are assumed. This is necessary chiefly because of the difference between the prices of lamb and mutton, on the one hand, and pork and bacon on the other.

The diagrams show that, at ordinary selling-out prices—say, 6d. to 7d. per lb.—the sheep's optimum weight for profit is about 180 lb., the pig's somewhere over 200 lb. As, however, the bacon curer is generally unwilling to buy a pig weighing over 200 lb., we may take it that the farmer is likely to get his optimum profit when the pig weighs about 200 lb. The diagrams also show that profits are much smaller when the animals are small: indeed that, unless they are bought in very cheap as stores or sold at a high price per pound, small sheep and pigs cannot leave very large profits.

The problem reduces itself to this: If the farmer may assume that certain prices and, therefore, profits are likely, when his animals reach their optimum weights, what must he get for them, if they are sold at smaller weights, so that he shall have approximately the same profits? The diagram shows that, when mutton is 6d. a pound, a 50-lb. sheep bought in at 25s. leaves a maximum profit of about 6s. when fattened off at 180 lb. live weight. By looking to the left of the diagram, it will be seen that, if the same sheep is to be fattened off at 75 lb., and leave the same profit, it must be





sold at 7d. a pound live weight. A 50-lb. sheep bought in at 35s. leaves a maximum profit of 11s. when mutton is 7d. a pound, and it is sold at 180 lb. live weight. By looking to the left of the diagram, it will be seen that the same sheep would yield about the same profit when its weight is just over 80 lb. and lamb 9d. a pound.

The pig diagram indicates that, when bacon is at 6d. per lb. live weight, a 40-lb. pig, bought in at 20s., leaves a profit of 31s. 6d. if fattened off at 200 lb. If fattened off at 90 lb. the pig would need to be sold at 9d. a pound, to leave the same profit. With bacon at the same price, a 40-lb. pig bought in at 30s. leaves a profit of 21s. 6d. at 200 lb. live weight. If fattened off at 110 lb. it would need to be sold at 8d. a pound to leave the same profit. A glance at the points where the value and the cost lines cross indicates that, unless the difference between their selling prices per pound be great, the pig fattened off at a small weight is likely to be less profitable than the one fattened off at a larger weight.

N.B.—It has been assumed that for "production" the pig needs $2\frac{1}{2}$ lb. of barley equivalent per pound of increase, the sheep 3, and the bullock $3\frac{1}{2}$. These are average figures with average-sized animals and efficient rations. It is probable that slightly less is required when the animals are younger and making more flesh than fat, slightly more when the animals are older and putting on more fat than flesh. The difference, however, were more accurate figures known and used, would not be very serious.

The weight for optimum profit is increased by lower prices of food and a higher rate of production, and decreased by the reverse.

VARIETIES OF CEREALS FOR AUTUMN SOWING

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It is a bewildering number of varieties of the different farm crops that seed merchants offer year by year to the farmer. One of the principal aims of the National Institute of Agricultural Botany is to help the farmer to make the proper, in other words the most profitable, choice between them. The Institute has been engaged upon careful trials of the leading varieties for some years, and summaries of the results obtained with cereals up to the end of 1927 were published in this JOURNAL in December, 1927, and January, 1928. It is only in such trials that relative yield and quality can be accurately determined; on the other hand, they necessarily demand so much time and labour that it is physically impossible to deal with all the competing varieties in this way within any reasonable period. The Institute accordingly began last season to grow in observation plots most of those varieties about which reliable information was still lacking, with a view to separating the sheep from the goats. The most promising will be carefully tested later, but the following notes on autumn-sown cereals are now published in the hope of helping farmers in the coming season.

Thirty-six wheats and nine oats were grown in 1927-28 at six trial centres:—

Cambridge.—Gravelly loam, over gault, 90 ft. above sea level.

Good Easter, Essex.—Boulder clay, over London clay, 180 ft. above sea level.

Cannington, near Bridgwater.—Silty loam, over red sandstone, 10-60 ft. above sea level.

Long Sutton, Hants.—Clay loam, over drift clay and chalk, 400 ft. above sea level.

Newport, Salop.—Heavy loam, over red clay, 200 ft. above sea level.

Sprowston, near Norwich.—Medium loam, over boulder clay and brick earth, 100 ft. above sea level.

Six barleys were grown at Good Easter only. Reports on East Suffolk plots of nine of the wheats were also received from Mr. A. W. Oldershaw. At the Institute's trial centres the plots were $\frac{1}{10}$ acre each, and between each variety was

a $\frac{1}{10}$ acre plot of a variety chosen as control, being Squareheads Master for the wheats, Bountiful for the oats, and Carter's Six-row for the barleys. The season was an excellent test of winter-hardiness, but there was no real test of strength of straw; many varieties which stood in 1928 would be liable to lodge in a normal season. Though the notes that follow are in many cases based simply on these single plots, and are the result of one season's work only, they are the summary of observations made almost daily throughout the season by trained Recorders at six different centres, and as far as they go may be accepted with some confidence. They do not, however, pretend to apply to the north of England.

One or two general observations may be made. Extravagant claims in catalogues unsupported by good independent authority should be disregarded. Not only are these often without foundation, but sometimes descriptions of such obvious characters as colour or type of chaff or grain are wrong. Again, the paying of a high price will not guarantee that the seed is true to type or of good vitality. The former defect does not show itself until harvest, but germination can and should always be tested before the grain is sown.

Winter Wheats.—The whole of the 36 varieties grown by the Institute in 1927-28 were winter-hardy. Seven of them are not yet on the market, and are not further mentioned here. Nothing was observed which might lead one to amend the recommendation made in December, 1927, that farmers should confine their choice to one of the following: Wilhelmina, Yeoman II (for land in good heart), Little Joss (on the lighter soils), Iron III (when sown early on heavy land), Weibull's Standard (on heavy land), and Squareheads Master. On heavy land in the south and under adverse conditions Rivett, though the latest of the wheats, will yield a large bulk of poor quality grain.

Some of the other varieties, nevertheless, show promise. Chevalier seems the best yielder of the recent Swedish wheats. Ideal might be described as a red-chaffed, white-grained Yeoman. Bacton Masterpiece has a very stout straw and might repay high farming. Setter may be well worth growing on light land. Starling II has some quality and did well on heavy land in Hampshire.

Of the others, Croxton Champion differs so little from Iron III, Twenty-One from Weibull's Standard, and Stormproof from Fenman, that they need no further mention. Victor

is of much the same character as Wilhelmina and there is probably little to choose between them. On present evidence, there is no good reason for continuing to grow, as ordinary farm crops in the Midlands and South of England, Benefactress, Crown, Fox, Bacton Champion, White-chaffed Browick, Cambridge Browick, Premier, Renown, Steel (a very late wheat), New Red Bearded, White Wonder, Millenium or Million III.

Winter Oats.—Last season showed conclusively that Grey Winter is the only winter-hardy oat; even this variety was killed in unusually exposed places. Its quality is excellent and its yield steady, but its straw is, unfortunately, very weak. It should be preferred to Black Winter, which resembles it in straw and yield, on the ground of hardiness and quality. Farmers who must have a stiff straw should choose Bountiful, a good-yielding black oat of moderate quality, which is hardy on the lighter soils, but may fail on heavy soil in a severe winter. There is no winter-hardy white oat, but the hardiest is Plentiful. Quite Content and Viking are two other new white varieties for which the introducers claim some hardiness, but, in fact, these two are no better in this respect than the spring varieties Victory and Golden Rain, which were included in these plots. Farmers with sheltered, well-drained land who like a speculation will probably do as well with Victory and Golden Rain as with any other white oat, though Marvellous, a large-grained white oat with coarse, strong straw may also be recommended in similar circumstances.

Winter Barleys.—The growing practice of sowing two-row barleys in the autumn lends interest to the observations made on a set of barleys sown at Good Easter in November, 1927. There were three two-row barleys—Plumage-Archer 1924, Spratt-Archer and Sunrise—and three six-row barleys, one a stock from Messrs. Carter & Co., and the others distinct new varieties not yet on the market. All six resisted the severe frosts well, though evidence from another district suggests that Spratt-Archer and Sunrise may be less hardy than the other four. These two were four days, and one of the new six-row varieties was eight days, longer in ripening than the other three. There was no lodging. Plumage-Archer 1924 not only looked to be the best yielder but was easily first for quality. No difference could be discerned between the yield of the others, but Spratt-Archer and Sunrise (in that order) were good malting samples, and one of the new

varieties showed signs of a quality not hitherto associated with six-row barleys. These observations bear out the results of earlier trials; farmers who wish to sow barley in autumn may safely be advised to choose Plumage-Archer 1924, except for exposed situations and ill-drained soils.

NOTE.—Acknowledgment is gladly made to several seed merchants, almost all of whom provided seed for these plots free of charge. The notes on the varieties tested, although compiled by the writer, are, in fact, a summary of work carried out by the Institute's Recorders:—Mr. G. E. Furse, Mr. W. C. Grandi, Mr. G. N. Herington, Mr. H. E. F. Maddrell, Mr. G. D. Stevenson, and Mr. E. G. Thompson; they owe a great part of such value as they possess to the Institute's Manager of Field Plots, Mr. S. F. Armstrong. The Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge, will be glad to furnish descriptive notes of the varieties on application, or to give fuller information about any of them.

* * * * *

BREEDING RECORDS FOR A DAIRY HERD

STEPHEN BARTLETT,

National Institute for Research in Dairying, University of Reading.

It is well known that breeding records are a necessity to the breeder of registered cattle and also to those who are "grading-up" their herd for entry in a herd book, but the value of records to the non-pedigree breeder is often not realized, and still more often not utilized. The farmer who takes the trouble to visualize his ideal cow and buys the best bull he can afford in order to breed to that ideal, will derive considerable benefit from properly kept breeding records of his stock. Among other advantages is the fact that the herd record book is an excellent place to keep summarized notes regarding such details as dates of birth or purchase, dates of calving, milk records, etc. The great deterrent from keeping a breeding register is the labour involved in starting, but any lover of cattle, having made a start, will find that breeding records are extremely interesting, and that very little further work is involved in their continuation. The book should be started with the herd, but it is quite

easy to commence at any time after the herd has been established. It should be realized that breeding records cannot be memorized indefinitely with safety, and that only a satisfactorily written register is quite reliable.

Assuming that it has been decided to commence keeping records of breeding, the problem arises "What is the best type of Record Book to keep?" Before deciding this question it is advisable to see and compare as many different breeding registers as possible in order to weigh up the advantages and disadvantages of each. It is impossible to imagine a book which would meet with universal approval, but there are many excellent record books on the market, some very simple, and others very elaborate. The usual design is a book which allows one page or sheet to each animal, and entries on that page are made of all the information which is necessary or desirable. The binding of the book should be strong and durable, since it is likely to be used for many years; the great improvements made, during recent years, in the loose-leaf type of book have increased its popularity, and the loose-leaf book possesses two distinct advantages over bound books. First, the leaves can be placed in any order, and can therefore be classified in alphabetical order, or according to families, which facilitates the finding of particulars relating to any desired animal; and secondly, the book can be made up to the exact size required and can be gradually increased to almost any extent, thus avoiding the necessity of two or three books. When choosing a breeding register, the chief point to consider is which details shall be recorded and which omitted without seriously reducing the value of the record; and, in order to assist this decision, a discussion of the particulars which are often kept in pedigree records and their probable use may be of value.

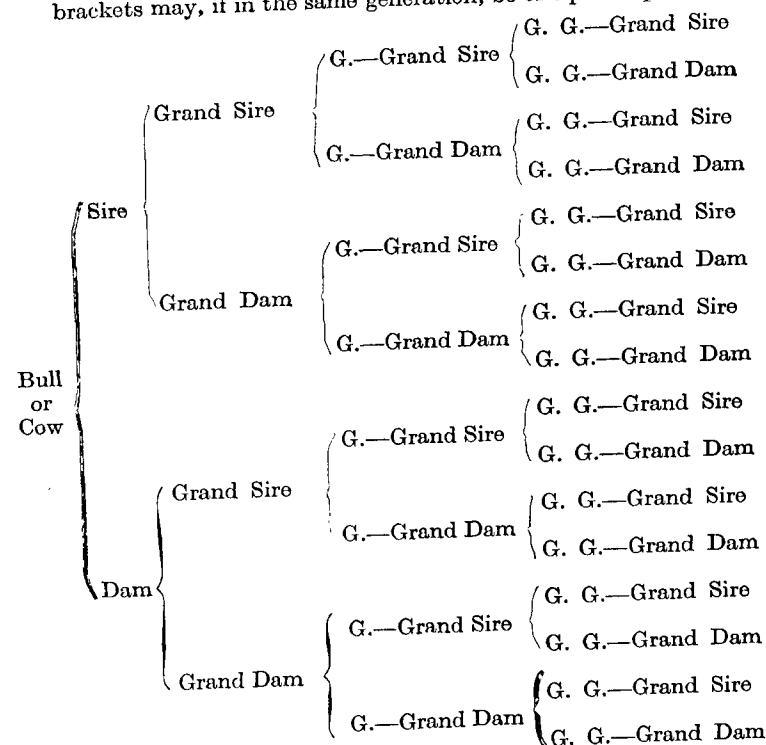
(1) Ancestors.—A record of ancestry is the first essential of a breeding record. There are two methods of recording ancestry in common use. One traces the ancestry on the female side only, while the other is often termed "extended pedigree," and records every animal in the ancestry for two, three or more generations.

In his book on *Dairy Cattle* Mr. Mackintosh sums up the situation as follows:—

"Pedigrees, as recorded in the different herd books, provide information on the ancestry of individual animals, and are of incalculable value to all breeders. It is only by a study of pedigrees that a breeder can obtain the information necessary

to enable him to follow a system of line breeding. The usual method of writing a pedigree, however, is incomplete and misleading. It is customary to trace the descent only through the female side, and very frequently an animal is described by a family name when it traces its ancestry on the female side to some famous cow, though this cow may be only one of four great-grand-dams, or even one of eight great-great-grand-dams. The dam and grand-dams of the sire are just as important as the dam and grand-dams of the dam, and an increase of the practice of writing pedigrees in the extended form, *i.e.*, giving the ancestors on the male as well as the female side, is much to be desired."

DIAGRAM, showing four generations of ancestors as given in an extended or complete pedigree. Only those connected by the black line brackets are mentioned in a pedigree as usually traced through the female side; those connected by the thin line brackets may, if in the same generation, be of equal importance.



(2) Progeny.—Records of progeny may be termed the second essential of a breeding record, and such details as dates of calving, sex and description of calf, name and number of calf, and its disposal, are usually included.

The naming of calves according to a definite system is a helpful practice, the basis of such a system being that the name of each animal will provide a clue which will assist the owner in remembering the pedigree. A common method is to give all one family of cows the same name, and to add a number to individualize each fresh calf as born; thus the first female calf from Duchess would be Duchess 2nd, and the next female progeny from either of these animals would be named Duchess 3rd, and so on. Another system is to use the same initial letter or syllable for the names of all the progeny of one bull, or the progeny of all animals purchased from one breeder; alternatively, the last syllable or letter in names may be used to connect families of similar breeding. A third system is to use names which are associated in some manner, *e.g.*, one family may be named after flowers, another family after precious stones, etc.

Prefixes or affixes are usually employed by owners of pedigree cattle, and are sometimes used also for non-pedigree animals; in a herd which is being graded up, the reserving of the use of prefixes only for animals of full pedigree is a convenient method of dividing pedigree from non-pedigree cattle.

In the most simple types of breeding registers the above two points, ancestry and progeny, are the only details which are recorded. Of the other points which are sometimes kept, some are included because the register is the most convenient place for recording them, while others are definitely helpful in deciding the utility value of the animals concerned.

(3) Milk Records.—The inclusion of a summary of the milk yield of a cow throughout her life is now considered essential in the breeding records of a dairy herd, but differences of opinion may exist as to the most concise method of summarizing milk yield. It is advantageous to have both yearly and lactation yields of each cow.

When the milk records of every cow are available in a summarized form, it is an easy matter to keep a watchful eye on the inheritance of milk and to discover quickly which bulls and cows are producing the best milking progeny. A comparison between the milk yields of the dams and of their daughters by a certain bull is very desirable before that bull has been disposed of, since it has been shown repeatedly that nothing can indicate the real value of a bull better than his progeny.

(4) Record of Type.—It is by no means an easy matter to record faithfully the qualities which are usually classed under

the term "type of animal," but it is very desirable to have permanent records of such points, *e.g.*, whether the bone is fine or coarse, whether the udder is large or small, well balanced or pendulous. The best basis for such notes is a good photograph, the value of which can scarcely be over-estimated. Even an inferior photograph usually conveys a much clearer impression than the most fluent description. For animals of high value, a professional photographer may be engaged, but a simple camera in the hands of a careful novice can give results quite useful for ordinary records.

Another excellent method of recording type is by means of a simple score card, such as the specimen shown below.

Name of cow : Duchess 5th.

Date examined : January 4, 1928, by E.G.T. and R.M.

	Maximum Points	Points Awarded	Notes : Chief defects
Udder ..	10	8	Small forequarters
Body ..	6	4	Lacks depth
Bone ..	6	4	Coarse hips

By means of this system the good and bad points of a cow are noted, and the score shows whether weaknesses are pronounced or slight.

Any systematic notes regarding type are of great assistance to breeders and to their successors, either as a supplement or an alternative to photographs or score cards. For such breeds as Friesians and Guernseys a record of the colour markings is of value (in the absence of photographs), since these markings form part of the records which have to be submitted for the herd-book registration of these breeds. The markings are noted by drawing them on the outline of a cow which can be printed on the pedigree record sheet.

(5) General Information.—(a) *Dates of Service* must be kept somewhere, but whether they are of most value in the breeding record book or in a special "service book" is a debatable point. There is no doubt that a "shy breeder" should be noted as such in her pedigree records, but to include every date of service may lead, in many instances, to the overcrowding of a breeding record.

(b) *Tests for Tuberculosis, Abortion, etc., and Inoculation.*—In some herds, records of this information are of considerable value, and will be found especially useful when any animals are to be sold. As regards the method of recording this information,

Milk Recording Society Number ..A.H. 1423 Name of Cow .."RUBY" Breeder ..University College, Reading
 Private Number ..54 Colour and Markings ..Red Date of Birth ..April 2, 1913
 ..D.S.A. Herd Book No. ...851 Vol. 1, p. 173. Purchased From ..University College, Reading, on October 1, 1921
 Class. C.

PEDIGREE			
BREEDER	Herd Book No. or Ref. of Dam	DAM	BREEDER
University College, Reading	D.S.A. 666 Vol. 1, p. 162	DAM Redcap (43) A.H. 514	Mr. J. H. Large, Malmesbury
Unknown		G.D. Redcap (21)	Messrs. R. W. Hobbs & Sons
		3.D.	
		4.D.	
		5.D.	
		6.D.	
		7.D.	
		8.D.	
		9.D.	

PHOTOGRAPH OR NOTES



Sire		Dam	
G.S. PRINCE 13th (92,871) Red and white—May 7, 1905—G. T. Date	G.S. JEDDAH (86,263) Red—March 12, 1902—P. Jenkins	PACIFIER (109,595) Dark Roan—Nov. 20, 1910—J. H. Large	
G.D. ROSY LIPS 2nd (Vol. 55, p. 861) Roan—December 15, 1905—J. H. Large	G.G.D. CONSTANCE 8th (Vol. 50, p. 503) Red and white—Mar. 2, 1896—G. T. Date	G.D. REDCAP (43) D.S.A. 666, Vol. 1, p. 162. Red and light white—October 4, 1910— U.C.R.	G.G.S. MASTER WALTON (83,585) Roan—June 24, 1901—H. Baker
G.S. MARSHAL NEY 4th (99,559) Roan—Nov. 15, 1907—R. W. Hobbs & Sons	G.G.D. ROSY LIPS 3rd (Vol. 52, p. 861) Roan—January 2, 1901—J. H. Large	Dam	G.G.S. MAJOR MOSS 10th (89,217) Red—March 30, 1904—R. W. Hobbs
G.D. REDCAP (21) Red 1906—Breeder unknown	G.G.D. SPRIGHTLY 7th (Vol. 52, p. 795) Roan—August 23, 1902—R. W. Hobbs	1st calf, April 2, 1913 (Average milk yield 6th calf, May 13, 1918 { in first 6 lacta- tions, 7,554 lbs. Had 3 quarters only and was sold barren, February, 1919.	G.G.S. Unknown

Notes, Disposal, etc.—GENERAL APPEARANCE: Good type of Dairy Cow, rather large bone and horn. Excellent constitution.
 UDDER: Good shape and well balanced. Teats became large in old age. H.R. quarter lost in seventh lactation.
 DISPOSAL: Not served after ninth calf. Sold for March 7, 1925. Reason: Udder troubles.

Milk Recording Society Number ..A.H. 1,423 Name of Cow .."RUBY" PRODUCE

DATE OF SERVICE	BY WHAT BULL	DATE CALF BORN	SEX, COLOUR AND MARKINGS	TATTOO MARKS		HERD BOOK NO. AND REF.	NAME OF CALF	BREEDER OF CALF	REMARKS, DISPOSAL, ETC.
				M.R. SOC.	PRIVATE				
Feb. 6, 1916	Radiant (122,277)	Nov. 26, 1915	B.C. Red	—	—	—	Not named	U.C.R.	Sold as calf.
Feb. 1, 1917	do.	Nov. 15, 1916	C.C. Roan	—	—	D.S.A. 2,519 Vol. 2, p. 236	do.	U.C.R.	Calves died
Feb. 1, 1917	do.	Nov. 25, 1917	C.C. Roan	A.H. 3,188	—	—	Ruby 2nd	U.C.R.	Kept
Feb. 14, 1918	Golden Star (131,255)	Dec. 27, 1918	B.C. Roan	—	—	—	Not named	U.C.R.	Sold for stock
Mar. 14, 1919	Underley Hero 38th (146,036)	Jan. 1, 1920	C.C. Roan	A.H. 10,109	—	D.S.A. 7,440 Vol. 4, p. 422	Ruby 3rd	U.C.R.	Kept
Mar. 19, 1920	do.	Dec. 31, 1920	C.C. Red	A.H. 4,669	—	7,441 Vol. 4, p. 422	Ruby 4th	U.C.R.	Kept
Apr. 19, 1921	Larkrigg Dandy (173,257)	Jan. 27, 1922	(B.C. Red and lt. white	—	—	—	Not named	N.I.R.D.	Sold as steer.
June 1, 1922	Burghfield Baronet (169,784)	Mar. 17, 1923	C.C. Red	A.H. 17,733	64	D.S.A. 15,792 Vol. 6, p. 596	Pearl	N.I.R.D.	do.
Aug. 25, 1923	do.	June 7, 1924	C.C. Red and lt. white	A.H. 13,318	94	20,548 Vol. 7, p. 660	Pearl 2nd	N.I.R.D.	Kept

LACTATION MILK RECORDS

NO. OF LACTATION	CALVING DATE	NO. OF DAYS THE COW		SUMMARY OF BUTTER FAT		REMARKS	FOR YEAR ENDING OCTOBER 1	NO. OF DAYS THE COW		REMARKS	YEARLY MILK YIELD, LB.
		Month	Year	Was recorded (excl. suckling period)	Suckled a calf			Was recorded (excl. suckling period)	Suckled a calf		
1	Nov. 26, 1915	4	65	7,854	—	—	1916	285	4	21	7,854
2	Nov. 15, 1916	4	91	8,267	—	—	1917	277	4	84	8,267
3	Nov. 25, 1917	4	98	8,890	—	—	1918	298	4	63	8,890
4	Dec. 27, 1918	6	67	9,952	—	—	1919	271	6	88	9,795
5	Jan. 1, 1920	4	91	10,610	—	—	1920	297	4	65	10,773
6	Dec. 31, 1920	4	124	8,465	—	—	1921	264	4	97	8,465
7	Jan. 27, 1922	5	64	8,254	7	341	1922	242	5	118	7,313
8	Mar. 17, 1923	6	40	7,693	—	do.	1923	295	6	64	6,575
9	June 7, 1924	4	—	6,338	—	Milked thrice daily from 10/6/24 to 7/7/24	1924	322	4	40	5,639
	Sold						1925	157	—	—	2,739
							Sold				

YEARLY MILK RECORDS

NO. OF LACTATION	CALVING DATE	NO. OF DAYS THE COW		REMARKS	FOR YEAR ENDING OCTOBER 1	NO. OF DAYS THE COW		REMARKS	YEARLY MILK YIELD, LB.
		Month	Year			Was recorded (excl. suckling period)	Suckled a calf		
1	Nov. 26, 1915	4	65	7,854	—	285	4	21	7,854
2	Nov. 15, 1916	4	91	8,267	—	277	4	84	8,267
3	Nov. 25, 1917	4	98	8,890	—	298	4	63	8,890
4	Dec. 27, 1918	6	67	9,952	—	271	6	88	9,795
5	Jan. 1, 1920	4	91	10,610	—	297	4	65	10,773
6	Dec. 31, 1920	4	124	8,465	—	264	4	97	8,465
7	Jan. 27, 1922	5	64	8,254	7	341	5	118	7,313
8	Mar. 17, 1923	6	40	7,693	—	do.	6	64	6,575
9	June 7, 1924	4	—	6,338	—	Milked thrice daily from 10/6/24 to 7/7/24	4	40	5,639
	Sold						—	—	2,739

M.A. Certificate of merit for 3-year average

it is very difficult to systematize the entries, since the tests vary from time to time, and the inoculations against disease can be so numerous and varied that possibly a small blank space, left for the purpose of writing notes regarding tuberculin tests, etc., is the best arrangement for recording such information.

(c) *Reasons for the Disposal* of every animal in a herd are of some importance, e.g., failure to breed, udder troubles, replaced by better milking cow, etc. The tabulation of these reasons draws the attention of the owner to the chief weaknesses of the herd, or to the management, and it is well known that realization of a fault or mistake is the first step to its elimination.

(6) **A Specimen Herd Record Book.**—The tables on pp. 642 and 643 show a typical leaf (both sides) from a herd record book, and will serve to illustrate many of the points already discussed. For clarity, the whole has been set in type, although the information to be written in by the farmer, as distinct from the printed headings of the leaf, will be fairly apparent on examination.

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THE WORK OF THE RESEARCH AND EDUCATION DIVISION OF THE MINISTRY IN THE YEAR 1926-27

This report, which is signed by Mr. H. E. Dale, Principal Assistant Secretary, deals with the Ministry's work in agricultural research, education and horticulture. Previous reports of the kind have formed part of the periodical reports of the Ministry's Intelligence Department, but, following Sir Daniel Hall's retirement from the post of Director-General of the Intelligence Department, it has been decided that each Division shall in future issue separate reports. Incidentally, a high tribute is paid to the value of Sir Daniel's services in the past, and it is observed that research and education in this country owe an incalculable debt to his wide vision, his vast knowledge and his powers of expression both in speech and writing.

The report on the work of Research Institutes, which includes a statement of maintenance grants paid by the Ministry for the three years ending 1927-28, shows that, during this period, little change was made in the total amount of annual grants paid to the research centres. Substantial supplementary assistance has, however, been forthcoming from the Empire Marketing Board, whose grants to the Research Institutes are administered by the Ministry. Large

scale investigations aided by the Board are in progress at Bristol University, Cambridge University, East Malling Research Station, the National Institute for Research in Dairying (Reading), and the Waltham Cross Research Station. The number of advisory officers stationed at advisory centres has now reached 67, including four veterinary officers. The summarized account of their work indicates the numerous directions in which the service is being made of value to practical agriculture. The biggest development here has been in the field of dairy bacteriology, and a testimony is paid to the value of the dairy bacteriology advisory service, particularly in connexion with the campaign for clean milk production.

The progress of many special schemes of research and investigation is indicated in the report. These schemes include the correlation of meteorological and crop data obtained at numerous centres under the supervision of a special Committee, with Sir Napier Shaw as Chairman; the extensive series of sugar-beet demonstrations in progress throughout the country with the aid of a grant made by the sugar-beet factories; the crop variety testing scheme which is now carried out at five stations with a total trial plot area of 93 acres; and the scheme for the testing of agricultural machinery instituted in 1925. In the latter connexion it is mentioned that certificates have already been issued in respect of a stationary oil engine, three spraying machines and a land drill, while the tests in progress comprise a cream separator, a butter churn, two milking machines, a milk measuring and bottling machine, an agricultural tractor and a sugar-beet lifter. Reference is also made to the progress of the research into foot-and-mouth disease under the direction of the Committee appointed in 1924.

The brief survey of agricultural education shows that steady progress is being made, although attendance at teaching centres shows a tendency to decline, probably owing to the depressed state of agriculture during the period under review. Gradually, however, the higher educational institutions are being better equipped for their work and gaps in the county schemes are being filled. The short practical courses provided by Farm Institutes are maintaining their popularity. The county instructional and advisory service is developing; and the number of whole-time instructors and instructresses employed on this work has risen from 339 to 344 since last year's report was issued.

Special reference is made to the position of rural continuation classes for boys and girls between the ages of 14 and 16. Such classes may now be aided by the Ministry, whereas, until recently, the responsibility rested entirely with the Board of Education. It appears that several Local Authorities have given the matter serious consideration, but it is clear that the problem has not yet been seriously attacked over the country as a whole. To quote from the report: "It is to be hoped that in course of time adequate provision will be made so that agriculture may not lose its natural recruits through the neglect of the needs of children immediately they leave the rural schools."

Much consideration is being given to the question of the special needs of women and girls in the scheme of agricultural education. A Sub-Committee of the Inter-Departmental Committee of the Ministry and the Board of Education investigated this matter very thoroughly, and its report has been published.* The report will afford a valuable guide to future development in regard to the adequate training of women for rural occupations.

The scholarship scheme for the sons and daughters of agricultural workmen, introduced as an experimental measure in 1922, has proved its worth, and, with slight modifications, it has now been introduced as a permanent feature in the system of practical instruction in agriculture. The scheme now consists of two main grades of scholarship, junior and senior, and the awards cover the payment of all fees for tuition, supervision and examination and the full maintenance of the students, while at the educational institutions. During 1927, 119 scholarships were awarded. A statement of the present occupations of previous scholarship holders under the scheme shows that the results have been most encouraging and that the scheme has definitely fulfilled its objects.

In dairying, prominence is given to the great development which has taken place in educational work in clean milk production, this comprising various forms of activity, especially the competitions for milkers and the county clean milk competitions. As an ancillary to this scheme, short courses of instruction at educational centres have been arranged for the special benefit of sanitary inspectors; the courses have proved very popular and attracted an attendance of no fewer than 329 inspectors during the year under review.

* *The Practical Education of Women for Rural Life.* H.M. Stationery Office, Adastral House, Kingsway, W.C.2. Price 6d. net.

Educational work in regard to poultry and other small live stock continues to show satisfactory progress. The National Poultry Institute Scheme is now in full operation. A minor scheme, which is having very useful results, is the Stud Goat Scheme. This is administered by the British Goat Society with the aid of a grant from the Ministry. Milch stock kept by small holders, cottagers and similar persons may be served by valuable stud goats at nominal fees, the Society paying a subsidy in respect of approved services. The scheme has been gradually extended, and has proved a valuable aid to the improvement of the ordinary type of milch goat stock.

The third section of the report is devoted to horticulture. In the account of the present position of horticultural education, an interesting reference is made to the value of county demonstration plots as a means of bringing improved varieties to the notice of local growers. In Hampshire and Cornwall, for example, demonstrations of French varieties of broccoli have shown the superiority of these for many purposes, compared with those ordinarily grown by local market gardeners.

The activities of the National Food Canning Council in developing the industry for the canning of fruit and vegetables in this country are commended. During 1927, nine new factory installations, with the most modern plant and equipment, came into operation, all provided by private enterprise, and the Council, having brought the industry to the stage when all that is required for further expansion is an increased demand, is now undertaking an extensive publicity campaign.

Amongst other, newer activities, which the Ministry has undertaken in regard to horticulture, is the institution of schemes for the inspection and certification of strawberry plants and of black currant bushes. These have been placed on a voluntary basis, and the support so far received shows that the work is appreciated by growers. The potato purity inspections have, of course, been a feature of the Ministry's work for several years; over 4,000 acres of the new varieties were inspected during 1927.

Finally, an account is given of the Ministry's administrative activities under the Destructive Insects and Pests Acts. To the Orders previously in existence made under the Acts have been added the Destructive Insects and Pests (Amendment) Order of 1927, designed to deal with the Chrysanthemum

Midge; the Importation of Raw Cherries Order of 1927; and the Sale of Diseased Plants Order of 1927.

In a brief review it is only possible to indicate a few of the numerous activities dealt with in the report. For fuller information readers should peruse the report itself, which is published by His Majesty's Stationery Office, price 2s. 6d. net.

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PRACTICAL HINTS FOR HOUSING THE INCUBATOR

JOHN H. DOWDEN.

THE disparity in results, as between the early and late hatching of chickens, may be overcome, to a very large extent, by giving proper attention to the housing of the incubator. Whether the objective be the raising of table poultry, or of pullets for winter egg-production, better financial results are undoubtedly obtained when early hatching is practised. The fact that many farmers generally find incubating results to be better after February than in the three preceding months, leads them to postpone (far too late, in many cases) the incubating branch of their operations, with the result that the pullets produced do not come into profitable laying until the spring of the following year. If present-day commercial egg farming is to be a profitable occupation, eggs must be produced before Christmas.

The practical running of an incubator has been fully and frequently discussed, and nothing much remains now to be said about it. It is a simple matter to follow the maker's instructions for the correct management of the machine. Its adequate housing, however, is left to the discretion of the individual poultry owner, for whom advice on the matter is rarely available. On several occasions, when called in to investigate incubating troubles, I have been assured by the poultry farmer that the incubator temperature has not varied by more than a degree or two, which goes to confirm my experience that, however well a machine may be running, good results cannot be obtained unless it is well and properly housed.

That an incubator can be successfully operated in almost any kind of situation, seems to be a fairly widespread idea; and many instances could be cited in which, while no expense was spared in installing the most efficient incubating plant, but scant attention was paid to the housing of it. Considerable loss, through poor hatches, with a large percentage of chicks

dead-in-shell, was, consequently, experienced; and the chicks obtained were, almost inevitably, weak and difficult to rear. Obviously, it is unfair to the makers to expect that an incubator will give satisfactory results if housed under conditions which tend to nullify all the careful thought and scientific study expended in perfecting the machine. The incubator house should, in fact, be looked upon as part of, and of equal importance to, the incubator itself.

On many farms, buildings probably exist which may be adapted most admirably for incubating purposes. The essentials are a building in which ventilation can be easily controlled and in which an even temperature can be maintained. A cellar, in some cases, may be quite suitable; most cellars, however, are quite useless because they contain stagnant air and are very difficult to ventilate. In my early poultry farming days, I experimented very disastrously with a cellar in the latter category.

Where an ordinary weather-boarded and tiled roof building exists, it may be converted into an excellent incubator house by lining it with asbestos cement sheeting, and putting in, at a height of about 7 ft. 6 in. from the floor, a false ceiling of the same material. For the benefit of those who propose to erect a special building for incubating purposes, the accompanying illustrations may prove of some assistance. In a well-insulated house, such as that illustrated, it is possible to maintain a steady room temperature with, what is even more important, a correspondingly adequate degree of humidity. It is, of course, well known that the warmer the atmosphere the greater its capacity for retaining the moisture so essential to successful incubation. Ventilation, therefore, should not be overdone; a temperature of 60°, or preferably 65° F., gives the best results. It should certainly never be allowed to drop below 60° F.

Care must be taken, also, not to overtax the cubic capacity of the incubator room. It is clear that adequate ventilation is very necessary, and this should be provided in the roof by means of sliding shutters which can be adjusted to suit the interior temperature and the external climatic conditions. The false ceiling, correspondingly, must also be fitted with sliding, adjustable shutters. Floor ventilation should be entirely eliminated. The windows should be of the hopper type, opening inwards from the top, with side cheeks of wood or metal to prevent a downward rush of air. An even better arrangement is the double hopper, with two separate

and distinct sashes, one opening outwards from the top and the other inwards from the bottom, both furnished with side cheeks to prevent down draught. When closed in bad weather, the double layer of glass, with air space between, gives very effective insulation.

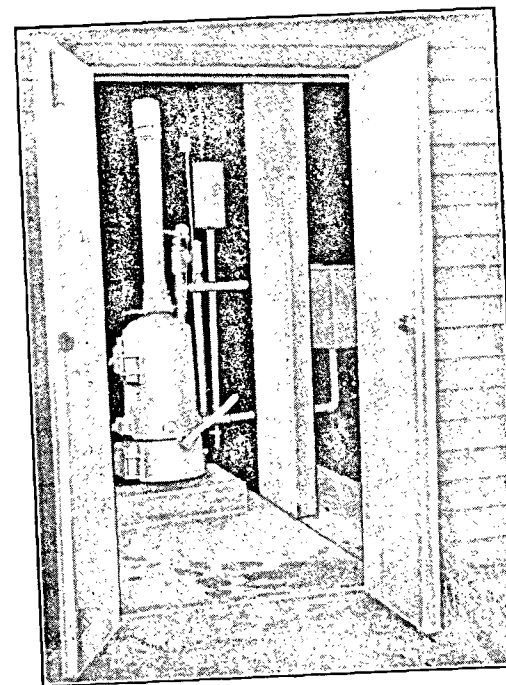
A mammoth incubator requires a room not less than 16 ft. wide. This is sufficient to permit of ample gangways down either side of the machine. The interior walls of the incubator house on my farm at Heathfield (the one depicted in the illustrations) are fitted with hinged brackets to take portable shelves, which can be placed opposite any section of the machine which is being filled or emptied. When not in use, the brackets are folded back against the wall. There are also shelves overhead for the storage of chick boxes. The interior of this house is 60 ft. long by 16 ft. wide by 8 ft. high from the floor to the false ceiling, and the machine has a capacity of nearly 10,000 eggs.

The hollow walls are of feather-edge weather-boarding, over a layer of felt, on a framework of 4 in. by 2 in. studding, the inside being lined with asbestos sheeting over a layer of felt. This arrangement is found to give most effective insulation, the asbestos sheeting having the additional advantage of being non-absorbent. In the case of the false ceiling, which also has a layer of felt between it and the rafters, additional protection against cold air striking down from the roof is given by a 4 in. layer of sawdust placed above it.

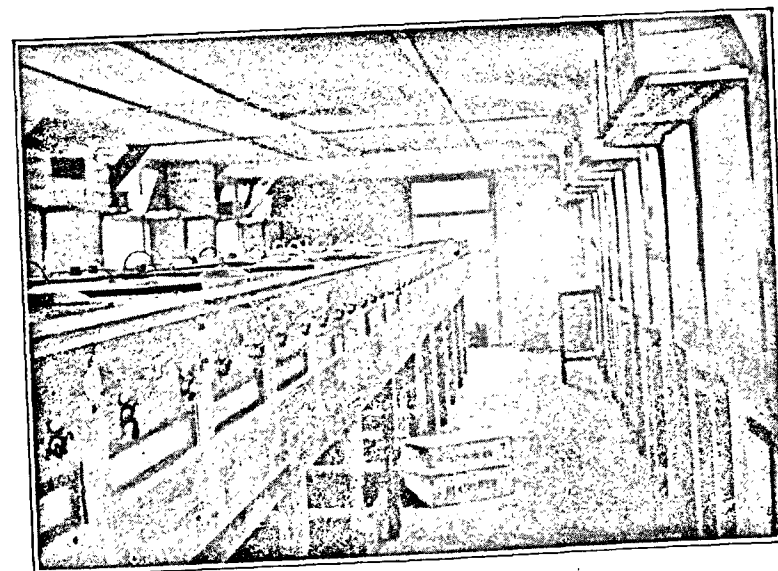
The floor is of concrete, and, running under the whole length of the machine, a shallow tray has been formed in the concrete. This tray is filled with peat moss, which is kept saturated with water. It is very difficult to overdo moisture in the incubator room.

The anthracite stove, which heats the machine, is placed in a separate compartment at one end of the incubator building. This compartment is divided from the incubator room by a partition across the full width of the house, and the entrance door to the incubator room is in this dividing partition. This door is kept closed, and so protects the machine from any fumes which might arise from the stove; while, as the incubator room is entered through the stove compartment, the risk of cold air entering is also avoided.

The incubator, which is of British make, is remarkably economical to run both as regards labour and fuel; the anthracite coal costs about 9d. per day, and, even when the machine is full, the whole of the work in connexion with



Showing section of the incubator house, divided off to accommodate the anthracite stove. The dividing door is open, and a corner of the incubator can just be seen.



Interior view of the incubator house at "Heydown" farm, showing the mammoth incubator. Note the trough-shaped arrangement underneath the incubator, containing peat moss, also the brackets on the right hand side, for holding working bench. These are of 2 in. x 2 in. timber, and hinged to fold back against the wall when not in use.

running it can be completed inside an hour a day, excepting, of course, when the eggs are being put in or the chicks taken out. The whole of the 10,000 eggs are turned mechanically by means of a small sliding arrangement fitted in each drawer, and operated from one end of the machine by simply turning a handle.

The building of such a house may seem rather a formidable proposition, but the trouble and expense will be more than justified by the vast improvement in the hatching results, and by the longer life of the machine. The advantages are numerous. Those who have tried incubation under makeshift conditions know well what annoyance and trouble is caused, and what losses result, possibly amounting to nearly an entire batch of eggs. The continual anxiety, and the need for constant attention at all hours of the day and night, are obviated if a properly insulated building is used. Considering the kind of weather usually prevalent when incubation is in progress; the impossibility (despite wireless forecasts) of foretelling its next vagary; and the rapidity with which the temperature changes or gales arise, the importance of a house which is impervious to external climatic changes can hardly be over-estimated.

The type of house here described can be adapted to suit individual needs, provided the main principles are always borne in mind, *viz.*, adequate insulation, the elimination of draughts, adequate and adjustable ventilation, and the maintenance of an even temperature and sufficient humidity.

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BRITISH FINCHES : THEIR ECONOMIC STATUS*

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The Linnet: *Carduelis cannabina cannabina* (L.).—The Linnet is one of our commoner birds, but is not nearly so conspicuous as the Chaffinch, nor is it so familiar in its breeding habits. Now and then, a pair may be found nesting in a gooseberry bush in a cottage garden, or in a shrubbery close to a house, but such cases are comparatively few. The best way to study its habits in the breeding season is to visit the nearest

*A previous article appeared in this JOURNAL, September, 1927, p. 528. dealing with the Hawfinch and the Greenfinch.

good-sized gorse covert. The big commons of East Anglia, and many of the fox coverts in the Midlands, swarm with these birds. The thin, piping calls of the males may be heard in all directions, and as the birds are not shy, one soon gets a clear view of a cock, perched on a spike of gorse, with the sun shining on his rose-tinted breast. A short search will probably flush his mate from a neatly-lined nest in a bush close at hand. In a large covert, 15 to 20 nests may be found in this way without difficulty, for the Linnet is a sociable species and likes to breed in company.

In many respects, it is like a small edition of the Greenfinch, but is a much more attractive and lighter built bird, lacking the heavy bill and ugly, penetrating notes of the Greenfinch.

Regarded from the economic point of view, it stands in much the same position as the Chaffinch, but is less generally distributed, and, from the strong preference it shows for certain types of breeding ground, more local. The young, as in so many species, are fed entirely on animal matter. Dr. Collinge records remains of beetles (two cases), larvæ of some small moth, larvæ of flies, aphides and spiders. The adults feed both on animal and vegetable matter, but the bulk of the food consists of seeds of weeds. Of these the most plentiful in Dr. Collinge's analysis are Charlock (*Sinapis arvensis*), which occurred in 23 cases; Groundsel (*Senecio vulgaris*), 15 cases; Common Sorrell (*Rumex acetosa*), 9 cases; Chickweed (*Stellaria media*), Ragwort (*Senecio jacobæa*), Mouse-ear (*Hieracium*), Self-heal (*Prunella*), Knotgrass (*Polygonum*), etc.; while Florence includes *Ranunculus*, *Cerastium*, *Plantago*, etc. A few grains of corn are picked up from time to time, but not enough to be of consequence. The only trouble which can arise from the presence of a colony of Linnets is to newly-sown turnips, rape, flax, hemp, and cabbage, and also where any of these are grown for seed. Unless a pair happen to be nesting in the garden, they are less likely to visit the seed beds than the Chaffinch, but in the open fields, Linnets may do considerable damage if there should be a large expanse of gorse within easy reach of the newly-sown field.

Animal food forms a large portion of the diet of adult as well as young birds: chiefly small caterpillars of moths.

Summarizing from the above stated facts, it is evident that, from the economic point of view, in the great majority of cases the Linnet should be classed as neutral or harmless, the little damage done being offset by the destruction of injurious insects and weeds. There are, however, possible cases, though

few and far between, where some thinning may be advantageous, and owing to the sociable habits of the birds, this should be readily effective.

The Tree Sparrow: *Passer montanus montanus* (L.).—This species is undoubtedly confused by nearly everyone except a sprinkling of ornithologists and bird-lovers, with its far more obnoxious relative, the House Sparrow. It is curiously local in its distribution, and, being a naturally rather shy bird, often escapes notice even from those who take rather more than a passing interest in bird life.

Even the least observant must know the sexual differences in plumage in the House Sparrow. The cock with his grey crown, black lores, conspicuous black chin-patch, and chestnut nape, can hardly be confused with the uniformly coloured yellowish-brown hen. The male Tree Sparrow bears a strong resemblance to the male House Sparrow, but the most striking difference in marking is the presence of a very distinct roundish patch of dark brown on the cheek, and the chestnut instead of grey crown. The Tree Sparrow is also a rather smaller, more slightly built bird, less addicted to town life, and so often cleaner and brighter in colouring. The hen Tree Sparrow, however, is almost an exact replica of her mate, and bears no likeness to the plain, dowdy-looking female House Sparrow. This sounds a very simple method of identifying the two species, but though one can always make sure of identifying House Sparrows of both sexes, the Tree Sparrows, till one gets to know their haunts and habits, have an awkward knack of keeping a branch just between us and themselves. When once a colony has been located and their characteristics mastered, it is easy to find many little distinctions in notes, habitat, nesting habits and character.

One habit, which has a great influence on its distribution, is the strong disinclination of the Tree Sparrow to nest anywhere except well down inside a hole. It is true that the House Sparrow will also breed inside holes in thatch or under eaves, and will proceed to make the holes in the thatch for itself as required, but it has no scruples against building a huge, untidy mass of straw in the upper branches of any medium-sized tree, as a glance at the trees in many London squares when the leaves have fallen will testify. On the other hand, the Tree Sparrow steadily refuses to nest except in a hole. Now suitable holes in large numbers are not always forthcoming, and it is evidently because they fulfil a long-felt want that pollard willows are such a favoured haunt of the Tree Sparrow. Where

these are lacking, some substitute must be found, and it is evidently the difficulty of finding natural sites which has caused the rush on nesting boxes in the North of England where the pollard willow is comparatively scarce. I have seen gardens in the outskirts of Sheffield and Manchester, where every artificial nesting place was occupied by Tree Sparrows, but, if it were not for this peculiarity, their presence in numbers would hardly have been suspected.

It may be laid down as an axiom, then, that this species cannot exist unless suitable holes for breeding are to be found. There are, of course, a few possible places in most orchards, but there is competition for these with the Tits. In Berkshire, I was puzzled for some time to account for the presence of this species about farms on higher ground, where there were no willows, but the problem was solved when it was found that the Lesser Spotted Woodpeckers had bored into the dead apple branches in the orchards, and the Tree Sparrows had taken possession of the old workings.

Where suitable holes are available, the Tree Sparrow will nest on farms, and in such cases becomes almost as much a parasite as the commoner bird. Many colonies in the Thames Valley spend quite half the year in the grass meadows by the river, and it is only in the winter that the flocks move any distance afield and come into the stackyards. In the big towns and suburbs of the North of England little corn is grown in the fields, and here again these birds are comparatively harmless. When resident on a farm they undoubtedly pick up a good deal of grain, but are not so destructive to thatch as the House Sparrow. Dr. Collinge, writing of the House Sparrow, strongly advocates the desirability of making all buildings sparrow-proof, in order to diminish nesting facilities. This is, of course, quite possible in Yorkshire, where most farm buildings are of brick or stone and slated or tiled, but for the south country farmer, with a huge expanse of high, thatched buildings and ivy-covered trees close at hand, it is a counsel of perfection impossible of attainment. We may, however, adapt the advice to some extent: ivy can be cut down from buildings and trees near farms; thatch can be worked over with a ladder from time to time during the spring, and dead wood should be cut out of the orchard trees in the winter months. On grass farms, the presence of the Tree Sparrow can be ignored.

In the spring, the young are fed on insects, chiefly larvæ of lepidoptera, also diptera (flies), and arachnida (spiders). Adults feed partly on insects (diptera, coleoptera, neuroptera,

larvæ of lepidoptera) as well as spiders and their eggs, but also largely on seeds of weeds (greater plantain, and many others). When in flocks during the winter, and also in company with the House Sparrow in the harvest fields in late summer, it undoubtedly takes grain in some quantities, but being numerically much inferior to its relative, and a somewhat smaller bird, the damage is not nearly so appreciable. On the whole, this is a species whose numbers are already strictly controlled by natural causes; in many cases it is harmless for the greater part of the year, and only a nuisance when vagrant flocks join up with other species in the stackyards. In the event of any great increase in numbers, it would not be difficult to effect control by restriction of possible nesting sites, but at present such activities are hardly necessary.

The House Sparrow: *Passer domesticus domesticus* (L.)—It is not proposed to discuss here the economic position of this bird, for it is already sufficiently well known. A few hints on the best methods of reducing its numbers may, however, be useful. It is quite a common sight to see a farmhouse, covered with ivy, close to a stackyard. Naturally every yard of the ivy is full of the untidy, straw-built nests, and however diligently the ivy is "combed," some broods will inevitably escape. *All ivy should be cleared off buildings and trees near stackyards.* To stop sparrows from breeding in old thatch is almost impossible, but something may be done to keep the increase within bounds by regularly searching the holes with the help of ladders. Always, however, some broods will escape, much valuable time is wasted, and the breeding stock is untouched. The wire "Catch-'em-alive" traps are sometimes very effective. Shooting rapidly produces extreme wariness on the part of the Sparrow, and ceases to produce any tangible results. The offering of rewards for eggs or young is practically useless. Every nest destroyed in this way is replaced by the birds within a week, so that a single pair of birds may easily produce 60 eggs in this way during the season. It will readily be understood that the taking of a few hundred eggs from a good-sized colony means little. In corn-growing districts, the birds assemble in flocks after the breeding season and take to the fields, where it is difficult to get within range, but in the winter, when they return to the yards, steady shooting is effective and lessens the breeding stock for next spring.

The Twite: *Carduelis flavirostris flavirostris* (L.)—This is a very local bird, closely allied to the Linnet, but distinguished from it by its yellow bill, and the absence of the pink on the

breast. In England, it is a bird of the moorlands on the spurs of the Pennine Chain, and has no economic importance. To the crofter on the Hebrides or in the Orkneys and Shetlands it is, on the other hand, a very serious menace to his scanty plots of turnip and cabbage seed. Here it is the most characteristic bird of the countryside and may be met with almost everywhere, so that practically close watching of the crops is the only remedy.

The Lesser Redpoll: *Carduelis linaria cabaret* (P.L.S. Mull.).—This is another local species, commoner in the North of England, but it has established itself in small numbers in many southern counties. A dingy-looking little brown bird, with peculiar high-pitched metallic notes, and showing at close quarters a black chin-patch and deep crimson crown, which it erects slightly from time to time, it is nowhere common enough to have any economic weight. In the south it is generally to be met with in the river valleys and low ground, often breeding on the eyots in the Thames, and similar places. In the north it is more generally distributed, though nowhere really plentiful.

Its food consists of both animal and vegetable matter. Insects noted include beetles (*Curculionidæ*), larvæ of microlepidoptera (*Tortrix*) and eggs of insects, while it has been seen feeding on the catkins of the alder (*Alnus*), and on the seeds of the common bulrush and *Achillea millefolium*, etc. It is not a garden-haunting species, and, as far as is known, has no bad qualities to counteract its good ones. There need be no hesitation in pronouncing it absolutely harmless.

SOME NOTES ON THE BULB MITE

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ALL commercial growers of the narcissus and hyacinth are only too familiar with the occurrence of badly rotted bulbs, which on close inspection are found to be swarming with mites that bear a strong resemblance to the common cheese-mites. A microscopical examination of one of the mites would reveal it to be, almost invariably, the bulb mite, *Rhizoglyphus echinopus*. The occurrence of mites in rotten bulbs, both in the field and in store, is common, but their significance is a matter of keen controversy among both commercial growers and scientific observers.

In the past, numerous observers considered that the mites were primarily responsible for the decay of infested bulbs.

More recent opinion inclines to regard the presence of the mites as secondary, in that their attack is on bulbs originally rendered unsound by some other organism, by mechanical injury, or by being subjected to unsuitable conditions. Experiments, notably those by Buckhurst,* have tended to show that this latter impression is correct.

In view of the divergence of opinion, it was determined to undertake a detailed study of the life-history of the bulb mite, and to carry out a number of experiments, with the object of obtaining definite information. Observations and experiments were carried out during the four years 1924-27, and, in the course of the work no fewer than 500 bulb samples were examined in the laboratory. The samples, each consisting of from 6 to 24 individual bulbs, were sent for examination by commercial growers, principally from Devon and Cornwall, but also from other areas in the British Isles, and from Holland. It is of interest to note that bulb mites, in greater or lesser numbers, were found in no fewer than 95 per cent. of all the bulbs examined.

Life History.—The mites are rarely found as isolated individuals, for, wherever conditions are favourable for their occurrence, large colonies are rapidly formed. That they are by no means particular regarding the nature of their food is indicated by the fact that, in the literature, they are reported as being found on no fewer than 21 different species of plants, ranging from avocado pear seed in the tropics to vines, celery, and narcissus in more temperate regions. Reproduction takes place by means of eggs, and although, under observation, only 59 eggs have been recorded from one female, it is possible that, normally, this number is greatly exceeded. In the south-west of England, egg-laying takes place throughout the year, but proceeds at a much slower rate during the winter months.

A peculiarity of certain mites, including the one under discussion, is the ability to form a travelling stage nymph, or hypopus. This stage of the mite does not always occur in the life-cycle, and in the bulb mite appears principally during the warmer months of the year. Hypopi are dark brown in colour, and are considerably harder and more shiny than the other stages of the mite. They do not feed, and their principal function is to distribute the species to fresh breeding-grounds. This distribution is effected by their readiness to clutch hold of, and cling to, any moving object which passes near them.

*Buckhurst, A.S. This JOURNAL, XXXII, No. viii, Nov., 1925, pp. 734-736; This JOURNAL, XXXIV, No. 1, April, 1927, pp. 4-6.

Once arrived at a suitable breeding-ground, the hypopi moult, assuming the more usual nymphal form, and rapidly become adults capable of reproducing the species. The period of the year at which most hypopi are to be found coincides with that during which the various species of bulb flies are on the wing, and it has been found that the hypopi frequently utilize the flies as a means of transport. The flies moving from bulb to bulb, in the process of laying eggs, carry numbers of the mites with them, and this is, undoubtedly, the chief means by which the mites are spread amongst growing bulbs.

When bulbs are stored in bulk, mites continue to breed in infested bulbs until these are destroyed. Then numbers of mites, in all stages of development, wander off and settle down on other bulbs, thus spreading, in a very short time, throughout the whole mass. As soon as the bulbs are planted in moist soil, rapid breeding of the mites recommences.

The length of time occupied by the complete life-cycle of the mite, from egg to adult, varies enormously, depending upon the time of year, the quantity of food available, and numerous other factors. In an active colony, during the warmer months, the time occupied was found to vary from 45 to 108 days. The life cycle is, however, considerably longer when a hypopal stage occurs, as hypopi have been kept alive for at least four months, which period would have to be added to those mentioned above.

A Natural Enemy of the Mite.—During the course of work on the life-history of the bulb mite, an active and somewhat larger mite was frequently found in company with the former species. This mite proved to be a species of *Gamasid*, and observation showed that it preyed extensively on bulb mites. The *Gamasids* wander about on the mite colonies and at frequent intervals seize individuals, choosing usually half-grown ones, which they carry about, while sucking out the contents of their bodies. The empty skins are eventually discarded, and fresh mites are seized. It was found possible to breed the *Gamasids* with ease on an exclusive diet of bulb mites, and the frequency with which they occur suggests that they are of considerable value in reducing the numbers of the mites.

Experimental Work.—Many experiments were carried out, in order to obtain information regarding the ability of the mites to attack healthy and previously damaged and diseased bulbs, under varying conditions. The majority of the experiments were carried out with narcissus bulbs, but in a few cases onions and tulips were also employed.

It is not proposed to enter into a detailed account of the experiments, as this is being published elsewhere. It will be sufficient for the present purpose to summarize the results obtained. Approximately 700 bulbs were used during the course of the experiments. Two modes of infecting bulbs with mites were employed: (1) in some cases mites were placed actually on the bulbs by means of a camel-hair brush, while (2) in others, portions of moist paper covered with mites, were placed on or near the bulbs. Both methods were found to be quite effective, and no damage resulted to mites handled on the brush, provided that reasonable care was exercised.

It may be stated at once that every effort to obtain damage to healthy bulbs, by means of mite infestation, failed. Mites lived for as long as 13 months on the outer dead portions of growing bulbs, without causing appreciable injury, even in cases where the bulbs had been "hot-water treated" and kept out of the soil for abnormally long periods. Healthy narcissus and tulip bulbs, heavily infested with mites under storage conditions, and subsequently planted, remained entirely undamaged, although mites were still present on them 10 months later. Mites confined in glass tubes, actually in contact with healthy narcissus and onion bulbs, likewise failed to cause any damage.

As opposed to the above, it was found that healthy bulbs, artificially damaged, were frequently entirely destroyed by mites, but that damaged bulbs usually recovered when kept free from mites. Bulbs already infested with bulb eelworm and bulb fly larvæ were destroyed more rapidly when also infested with mites. This occurred both with growing and stored bulbs. Healthy "hot-water treated" bulbs remained undamaged, but numbers originally badly damaged by eelworm and bulb fly were destroyed by mites subsequent to treatment. Again, similar bulbs kept free from mites were found to recover eventually.

The Practical Importance of the Mite.—The experiments clearly indicate that healthy bulbs, under normal conditions of culture and storage, do not suffer direct injury from the presence of the mites. At the same time, it has been shown that the hypopal stage is freely distributed annually by bulb flies, while, in store, mites wander readily from bulb to bulb. In all probability the mites frequently carry spores of injurious fungi amongst the bulbs, and for this reason alone it is desirable to reduce their numbers as far as possible.

The mites can effect the destruction of bulbs originally damaged by mechanical means, or by some other organism;

apart from the mites, many such bulbs would stand a very good chance of ultimate recovery. "Hot-water treatment" does not in itself render bulbs more liable to mite damage, but treated bulbs having extensive injured areas will be destroyed in the same way as those mechanically injured.

The bulb mite cannot be considered a primary pest, owing to its inability to destroy healthy bulbs which have been kept under hygienic conditions. Much loss and injury occurs, however, amongst bulbs which, for a variety of reasons, may not be entirely sound, but which would recover ultimately in the absence of mite infestation. It is therefore highly desirable that the mite population in bulb-growing areas should be reduced to a minimum, and this may best be effected by the following measures.

Control Measures.—*Lifting.*—Bulbs should be lifted with care. Badly-cut bulbs will provide breeding-grounds for mites, and will, in all probability, not recover from the attack. They should, therefore, be discarded and destroyed.

Destruction of Rotted Bulbs.—Every cut or rotted portion of bulb left in the ground will harbour mites. "Hot-water treated" bulbs planted over such bulbs will be liable to mass infection by mites, which may result in extensive losses. All damaged bulbs must be collected and destroyed.

Storage.—Bulbs should be stored under hygienic conditions, and looked over periodically, all soft bulbs being picked out and destroyed. Fungus storage rots may easily be spread by wandering mites.

Hot-water Treatment of Bulbs.—The hot-water treatment of bulbs for the control of bulb eelworm and bulb fly larvæ is widely practised, and descriptions of the process are easily obtainable. The treatment also kills all mites in the bulbs, but it must be remembered that injured bulbs are liable to mite damage subsequent to treatment. Care must be taken to prevent re-infection by mites until the bulbs have had sufficient time to make a good recovery from their previous injuries.

Early Treatment of Eelworm-infested Bulbs.—Early diagnosis and treatment of eelworm-infested bulbs is essential in order to avoid serious losses from mite attack subsequently.

Fumigation.—Fumigation of bulbs with para-dichlorobenzene will destroy all mites. A method of fumigation for the control of the lesser bulb flies has been briefly described by the writer.* The dosages there recommended will serve equally well to destroy mites.

* Hodson, W. E. H. *Bull. Ent. Research*, xvii. Pt. 4, June, 1927, p. 382.

OCTOBER ON THE FARM

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Seasonal Notes.—The month of October is generally marked by heavy rainfall; but after a comparatively dry summer the soil is capable of absorbing a considerable quantity of moisture before it becomes saturated. It is not easy to appreciate the fact that this is on the average the wettest month of the year; indeed, farmers frequently have to delay the sowing of their wheat on account of the soil being in their opinion too dry for satisfactory germination.

On grassland, October conditions are materially different from those of the summer months: the hours of daylight available for grazing are shortened; the duration of bright sunshine is small, so that the herbage is not rid of the morning dew before it becomes damp again; and there is a marked fall in temperature, with occasional night frosts, under the influence of which the coats of cattle begin to assume their winter appearance. As regards the character of October in any particular year, tradition holds that a warm month indicates a cold winter, whereas the occurrence of much frost and snow at this time of the year is the forerunner of a mild winter.

The annual cycle of farm operations is conveniently regarded as beginning at Michaelmas, which is, in fact, a common term date on arable farms. Modern farmers are not bound by a calendar of operations, however; neither are the seasons marked by abrupt changes. The cultural operations for the new farm year begin before the current year's cereal harvest has been completed, and the young corn may be above ground before the adjoining fields have been cleared of the root crops.

Potato Lifting.—In contrast with the dead and shrivelled appearance of the tops at this date last year, potatoes this year are still green and vigorous and probably digging will not begin so early as in 1927. October, however, is a busy month; potato digging makes heavy demands on the labour supply, and the work is very dependent on suitable soil and weather conditions. For these reasons it may not be wise to delay commencement of the work until the last rosette of leaves has died down and the skin of the small as well as of the large tubers has become quite firm. The problem here is similar to that in the commencement of hay or corn harvest: the first field may have to be harvested on the early side in

order to avoid loss at the latter end of the work. Tubers lifted when in the somewhat unripe state, however, require special care in clamping; the clamps should be made narrow—not more than 3 ft. 6 in. wide—and the tubers given ample opportunity to become dry and cool before being soiled over. When covered temporarily, old straw may be used but never potato tops, as these are liable to spread disease in the clamp. Good dry straw is essential in the final covering up, damp material being conducive to frost damage.

Mangold Lifting.—October is for several reasons the best month for harvesting mangolds; September is too early, as the crop has not by that time completed its growth, while leaving the work until November involves risk of frost damage and injury to the soil by untimely carting. Earlier lifting also favours the chances of satisfactory wheat-sowing on the same land, and it enables the farmer to realize a greater proportion of the nutritive value present in the mangold tops.

The weight of tops produced by an average crop is about a quarter of the yield of roots, *i.e.*, 5 tons per acre. If the nutritive matter present in this quantity of tops could be realized, it would be worth upwards of £3 per acre, apart from the manurial residues. It is impracticable to spread the lifting over a period sufficiently long to allow of all the tops being consumed as cut from day to day; but where autumn keep is scarce, the surplus of tops may be conserved for a few weeks in a simple earth pit or silo.

The use of mangold tops for feeding purposes is often criticized on the grounds of their laxative properties, and it is indisputable that they may under certain conditions have scouring tendencies. There is difference of opinion as to whether the specific cause of the laxative nature of tops is their content of oxalic acid or of soluble inorganic salts or the bacterial infestation of the leaves. It should also be borne in mind, however, that tops are a watery, non-fibrous food; hence they should not be fed to either cattle or sheep without being supplemented with long, dry fodder. The addition of 2 or 3 oz. of chalk dust or limestone powder to each hundred-weight of tops is a practicable astringent measure when feeding them to cattle indoors. Where sheep are being run over the mangold “stubbles” to consume tops and small bulbs, the flock should be removed to dry grassland for the night, a rack of hay being provided as the chief preventive of scouring.

Autumn Sowings.—Land available for sowing in October may be drilled with wheat, oats, barley, rye, beans, vetches,

or a mixture of cereal and pulse grains for thrashing or for forage. Clean land is ordinarily sown with wheat, if in sufficiently good heart, or with winter oats when the preceding crop has been corn. Rye is grown only where the soil is too sour or too poor for even grey winter oats. Winter barley is not grown very extensively but is cultivated for feeding purposes on land that is too dry for wheat or winter oats. Beans are a cleaning crop if drilled in rows wide enough to permit of horse hoeing, and are frequently taken on land where young “seeds” have failed.

As a general rule it is wise to sow that kind of autumn grain which ordinarily yields the heaviest weight of marketable corn on the class of land in question; another consideration may be the standing power of the straw. This year, however, the value of wheat has fallen to such a low level compared with oats and barley that many farmers will doubtless extend their sowings of the latter grains at the expense of their wheat area. In view of the estimated supplies available in the chief wheat-growing countries, it would seem to be unlikely that prices of this cereal will rise appreciably before next harvest.

Archer barley appears to be coming into favour as an autumn-sown grain crop in the Eastern Counties. The advantages of sowing in autumn are those of an earlier harvest and therefore a better market for good malting samples. As regards weeds, the autumn-sown crop is better able to suppress charlock and other annuals that trouble spring-sown barley; on the other hand, couch and similar perennial weeds are apt to spread under autumn sowings.

The increase in cost of protein-rich foods during the past year has improved the position of the bean crop relative to other grains. Winter beans, while suitable for heavy soils, are not so dependent on strong soil texture as is commonly thought. Where beans alone are not a reliable crop, however, they should be mixed with cereal grains as explained by Mr. J. C. Brown in the issue of this JOURNAL for June, 1928, p. 236.

Live Stock.—Dairy cows in full milk now require concentrated rations nearly equal to those of mid-winter: the grazing saves hay rather than corn. While the green herbage lasts, however, and even while supplementing the grazing with kale, cabbage or mangold tops, maize and other carbohydrate foods may form the bulk of the concentrates.

Towards the end of the month the herd will begin to lie indoors at night; but it is important to keep the sheds cool

at this time of the year to prevent loss of hardness, as this would necessitate restricted ventilation later in the winter. Provided that the land is dry and the lanes and gateways are not too muddy, it is desirable not to commence housing at night until perhaps the middle or end of November. Weather conditions and not the calendar should decide the date. Before the period of winter management begins, the sheds should be cleaned down and white-washed, excepting the lower third of the walls, which are the better tarred.

Where winter fattening is practised, the bullocks recently purchased now begin to be brought on to indoor rations. Doubtless after the experience of last winter and after weighing up the prospects of the current season, feeders will be inclined to fatten rather more cattle than they had last winter. Stores are somewhat dearer than a year ago, and some concentrates are appreciably higher in price. On the other hand, the value of beef is also higher, while as regards feeding stuffs, recent work at the Norfolk Agricultural Station proves that it is not necessary to use such large quantities of protein-rich cake as are still customarily fed. With the aid of a little hay of this year's quality, hay having a special value for fattening purposes, the consumption of oil cake need not exceed about 2 lb. per head per day.

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NOTES ON MANURES

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The New Act.—The Fertilizers and Feeding Stuffs Act, 1928, is now in operation, and some of the more important changes affecting the sale of fertilizers may be brought to the notice of farmers. It will suffice to mention the alterations which have been made in the method of stating the percentages of fertilizing constituents, and certain additional guarantees which must now be given where none was required before. The most important change, and one to which farmers and merchants will take some little time to accustom themselves, is in the method of declaring the phosphatic content of fertilizers. The old method of stating the percentage of phosphate of lime has now been dropped in favour of the percentage of phosphoric acid. This applies to the water soluble phosphate of superphosphate and compound fertilizers as well as to the total phosphate of basic slag and rock phosphates. Since 2·18 parts of phosphate of lime or tricalcic phosphate are chemically equivalent to 1 part of phosphoric acid, the grades of phosphatic

fertilizers expressed under the new scheme are reduced in this ratio: 26 per cent. basic slag becomes 12 per cent. basic slag, and so forth. These, of course, are two different methods of stating the same thing and imply no actual change in the quality or nature of the phosphatic manures themselves. This change now puts our method of stating phosphatic fertilizers in line with the procedure in other countries. It is, also, less cumbrous and artificial than the old method. Probably farmers will still find, in addition to the legal statement in terms of phosphoric acid, the percentage of phosphate of lime on their invoices. This is not essential, but may be convenient in the transition stage.

Coming now to guarantees which were not previously in force in the case of basic slag and rock phosphates, we find that a statement of the fineness of grinding in terms of the amount passing through a standard sieve is compulsory. This merely makes necessary what was customary in the past. The sieve prescribed under the Regulations is practically identical with the so-called 100-mesh sieve already familiar to farmers.

Sulphate of ammonia must now be accompanied by a statement of the percentage of free acid, expressed in terms of sulphuric acid, in addition to the usual guarantee of nitrogen content. In the case of neutral sulphate of ammonia, now by far the commonest form, the maximum amount of free acid has been stated by producers in the past.

Lime products are now to be sold on guarantee, and this will be a great advantage to purchasers, who will now be able to obtain a much better idea than formerly of the relative values of these substances. Quicklime, or ground lime, must be accompanied by a statement of the percentage of free lime (CaO). Slaked lime, or calcium hydrate, must be declared in terms of calcium hydroxide (Ca(OH)₂), and the equivalent in terms of calcium oxide is also to be given. Ground chalk and dried carbonate of lime will be sold on content of calcium carbonate (CaCO₃) and the equivalent of calcium oxide will be stated, while ground limestone will carry the above guarantees, and also a statement of the amount which passes the prescribed sieve, as for basic slag and rock phosphates. It will be noted that all forms of lime are to be stated in a common measure, *i.e.* calcium oxide, a procedure which will facilitate comparisons on a basis of cost per unit of lime equivalent. This is helpful, but it should be borne in mind that the various forms of lime are not strictly interchangeable in practice,

and, for certain purposes, it might be preferable to use a carbonate of lime, even although it might cost slightly more per ton of calcium oxide equivalent than a sample of burnt lime.

The amount of nitrogen in dried blood for fertilizing purposes is now to be declared.

Under the new Act, farmers are to receive more information with regard to their purchases than formerly, although certain points about which there is not yet general agreement, or which present special difficulties, have not been incorporated. There is, for instance, at present no requirement to declare the citric solubility of basic slags or to distinguish between the availability of forms of nitrogen which may have widely different agricultural values. Provision has been made that any alteration which seems to be necessary in the light of further experience or scientific advances may be carried into the Schedules of the Act or the Regulations. An Advisory Committee has been appointed whose duty it is to advise the Ministry of Agriculture in these matters.

Fertilizer Prices.—Attention has been directed, from time to time in these notes, to the relatively low prices of the standard fertilizers. Price reductions continued during the past season, and a recent publication* gives the general index for artificial manures, for the period September, 1927, to March, 1928, as only 3 per cent. above the pre-war level. This is to be compared with the corresponding figure of 13 per cent. for each of the two previous seasons. Hence the artificials used for the crops just harvested were purchased at very favourable rates. The position has not materially altered since March, although nitrate of soda continued to fall in price, and, in July, was just below the pre-war level, while basic slag has also been reduced. Sulphate of ammonia costs the same this autumn as last, and calcium cyanamide, although slightly dearer per ton, has been increased in nitrogen content and is sold at about the same unit price as before. Fertilizers will, therefore, continue to be a relatively cheap item in the cost of crop production. Their application makes little additional demand on labour, which is, by comparison, so expensive, forming the biggest charge against the crop. A judicious expenditure on fertilizers is money well spent. To stint the land of plant food will result in the loss of the few extra bushels or hundredweights per acre, which, taken over the farm, makes a real difference in the year's accounts.

* *Agricultural Statistics, 1927-28, Part II.*

It often happens that the land is ready for seed but the manures have not arrived. The best plan is to estimate and order the autumn requirements, for the arable land at any rate, well in advance, and thus have the fertilizers ready for favourable opportunities as they arise.

Calcium Cyanamide.—The guaranteed grade of this fertilizer has recently been raised from 19 per cent. to 20·6 per cent. of nitrogen. It has still the attraction of providing combined nitrogen at the lowest unit price (about 9s. per unit N. according to October prices), and on this account it deserves the consideration of farmers. Against its cheapness, and the fact that it restores an appreciable quantity of lime to the soil, must be placed its dusty character, which renders distribution rather unpleasant; also the fact that cyanamide has not yet been tried under as wide a range of soil conditions as the older forms of nitrogen. Those who have not had experience with cyanamide should give it a trial on a small acreage and compare the result with their normal treatment. On the Continent, cyanamide is frequently applied for winter cereals before sowing, especially on retentive soils. On medium soils, one half of the cyanamide is applied in autumn, leaving the remainder for an early spring top-dressing, while, on light open soils, it is inadvisable to apply cyanamide or any kind of nitrogenous fertilizer in the autumn. It is probable that the above practices would be successful in this country, especially in districts of low rainfall, but there is little published information on this point. Farmers who are sowing winter corn, under conditions where nitrogen is certainly needed, could lay down a trial area under the above scheme for observation, using cyanamide at about 1 cwt. per acre. The fertilizer should be evenly applied, preferably with a distributor, and if possible a few days before drilling the seed.

Some Autumn Dressings.—The notes below are intended for general guidance only and should be modified both in quantity and type of nitrogen, phosphate or potash to suit special circumstances of soil and previous manurial treatment.

Winter corn on stiff land may receive 2 cwt. per acre of superphosphate or high soluble basic slag. Where the land is known to be in poor heart, a little nitrogen may be applied, up to 1 cwt. per acre, either as cyanamide or sulphate of ammonia.

Beans and tares may have phosphates as for cereals, and, on lighter soils, 1 cwt. of muriate of potash, or its equivalent of the lower-grade salts, in addition. Where potash is required for

autumn-sown crops, it is good practice to give it before sowing, as on all but the lightest of soils the absorption of potash is practically complete and no loss need be feared. Rotation grasses in their first autumn may receive their phosphatic and potassic manures as soon as the nurse crop is carted, presuming

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named and are net cash for prompt delivery.

Description (see special footnote)	Average price per ton during week ending September 12				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%)	..	..	10 10	10 7	13 5
" " lime (N. 13%)	..	..	..	11 7½	17 6
Nitro-chalk (N. 10%)	7 0f	7 0f	7 0f	7 0f	14 0
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%)	11 19g	11 3h	..	..	..
Sulphate of ammonia:—					
Neutral (N. 20.6%)	10 0*	10 0*	10 0*	10 0*	9 9
Calcium cyanamide (N. 20.6%)	9 2†	9 2†	9 2†	9 2†	8 10
Kainit (Pot. 14%)	3 7	2 17	2 18	2 18	4 2
Potash salts (Pot. 30%)	5 2	..	..	4 14	3 2
" (Pot. 20%)	3 17	3 5	3 10	3 8	3 5
Muriate of potash (Pot. 50.53½%)	9 10	9 0	9 5	8 12	3 5
Sulphate " (Pot. 48.51½%)	11 10	11 0	11 7	10 10	4 4
Basic Slag (P.A. 15½%)||	3 1s	2 8s	2 9s	2 19s	3 9
" (P.A. 14%)||	2 16s	2 3s	2 4s	2 14s	3 11
" (P.A. 11%)||	2 7s	1 18s	1 19s	2 5s	4 2
Ground rock phosphate (P.A. 26.27½%)	2 8||	2 7||	..	2 5a	1 8
Superphosphate (S.P.A. 16%)	3 0	..	3 1	3 0	3 9
" (S.P.A. 13½%)	2 15	2 8	2 15	2 15	4 0
Bone meal (N. 3½%, P.A. 20½%)	8 15	8 10	8 12	8 7	..
Steamed bone flour (N. ¾%, P.A. 27½-29½%)	5 17†	..	6 0	5 15	..

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

* Delivered in 6-ton lots at purchaser's nearest railway station. 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.

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

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

§ Prices for 6-ton lots delivered to purchaser's nearest railway station. The prices quoted under Bristol relate to deliveries in Somerset, under Hull to Yorkshire, under Liverpool to Lancashire, and under London to Middlesex.

|| Fineness 80% through standard sieve.

f Delivered in 6-ton lots at purchaser's nearest railway station.

g F.o.r. Gloucester.

h F.o.r. Goole.

Special Note.—The percentage of phosphate has been discontinued and the percentage of phosphoric acid substituted, with a consequent alteration in unit values. To convert phosphoric acid to equivalent in tribasic phosphate divide by 0.458.

that these fertilizers have not been applied to the cover crop in sufficient amount to benefit the young seeds. On heavy soil, phosphate alone will generally be sufficient. From 50–100 lb. of phosphoric acid per acre would constitute a dressing, the actual quantity depending on the response of the soil to phosphate and its previous manurial history. Superphosphate, or high soluble basic slag, would be suitable forms of phosphate, the former for calcareous soils, the latter for soils not abundantly supplied with chalk. Potash will give its best results on sandy, chalky, or peaty soils. On other types it may or may not be needed, and a simple trial is the best guide. From 30–50 lb. of potash (K_2O) should be supplied in whichever form happens to be providing potash at the lowest unit price.

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NOTES ON FEEDING STUFFS

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The Composition and Manurial Value of Sugar Beet Pulp.—

In the Notes for last month reference was made to the investigations which have been carried out recently at Cambridge into the composition and nutritive value of sugar beet pulp. The results which were obtained in the analysis of representative samples of dried sugar beet pulp and molasses-sugar beet pulp are recorded in Table I.

TABLE I.—COMPOSITION OF DRIED SUGAR BEET PULP AND MOLASSES-SUGAR BEET PULP.

	DRIED SUGAR BEET PULP.		MOLASSES-SUGAR BEET PULP.	
	On basis of dry matter Per cent.	On basis of 10% moisture Per cent.	On basis of dry matter Per cent.	On basis of 10% moisture Per cent.
Crude protein..	9.88	8.89	11.98	10.78
Crude oil ..	0.71	0.64	0.41	0.37
Carbohydrate ..	65.69	59.12	64.72	58.25
Crude fibre ..	20.28	18.25	16.80	15.12
Ash ..	3.44	3.10	6.09	5.48
True protein ..	9.60	8.64	8.20	7.38
"Amides" ..	0.28	0.25	3.78	3.40
Lime (CaO) ..	1.36	1.22	1.35	1.22
Phosphate ($P O_5$) ..	0.20	0.18	0.19	0.17
Silica (SiO_2) ..	0.34	0.31	1.45	1.31
Potash (K_2O) ..	0.66	0.59	1.49	1.34
Soda (Na_2O) ..	0.27	0.24	0.34	0.31

Comments on Table I.—Numerous determinations were carried out, on different days, of the moisture content of wet sugar beet pulp as it leaves the pressers in the factory. The values for the percentage of dry matter ranged from 13.90 to

16.74 per cent., the mean value of all the determinations being 14.70 per cent. It may be inferred therefore that, on an average, wet sugar beet pulp will contain round about 15 per cent. of dry matter.

A knowledge of the moisture content of dried sugar beet pulp is of obvious importance when purchasing this feeding stuff, since the percentage of moisture may vary within the wide limits of 5 and 16 per cent. The sample used in the Cambridge feeding trials contained 13.87 per cent. of moisture. A well-dried and well-stored sample, however, should contain no more than about 10 per cent. It is to be recommended (although the writer is well aware of the difficulty of putting the recommendation into practice) that the drying process should be so regulated that the moisture content of the pulp *at the time of weighing into the sacks* should always be in the neighbourhood of 10 per cent. A 1 cwt. sack of dried sugar beet pulp would then always contain approximately the same weight of *dry* substance, and this would obviously be unaffected by moisture taken up during storage or transport. A similar recommendation has recently been urged by the writer in connexion with the drying of flaked cooked maize.

Sugar beet pulp contains in its dry matter no more protein than does an average sample of meadow hay. It is also seriously deficient in mineral substances. Obviously, therefore, beet pulp can only give satisfactory results in the feeding of stock when due attention is paid to the necessity for including in the ration other feeding stuffs which are rich in protein and ash. Almost the whole of the nitrogen of sugar beet pulp is present in the form of true protein, the soluble "amide" substances originally present in the beet having been removed almost entirely during the process of extraction of the sugar.

As a source of oil, sugar beet pulp is of negligible importance. Its content of crude fibre, on the other hand, is very high, and in this respect it is sharply distinguished from mangolds, which, on the basis of dry matter, contain less than 8 per cent. of crude fibre. The value of sugar beet pulp as a feeding stuff will therefore depend largely on the ability of ruminant animals to digest and utilize the fibrous constituent. This, in turn, will be determined by the degree of lignification of such fibre, a question which will be dealt with fully in the Notes for next month.

Sugar beet pulp is essentially to be regarded as a source of carbohydrate, the dried product, on the basis of a 10 per cent. moisture content, containing as much as 59 per cent. of this

constituent. It is of interest to inquire into the chemical nature of the carbohydrate which remains in the pulp after removal of the sugar. Sugar beet pulp always contains small quantities of sugar which fail to be extracted during the diffusion process. The amount so remaining will obviously depend on the efficiency with which the extraction is carried out. It varies from 1 to 6 per cent. in the dried beet pulp. Determinations carried out on the sample employed in the Cambridge experiments showed that it contained 2.6 per cent. of sugar.

The carbohydrate of sugar beet pulp, however, consists mainly of the so-called pectic substances, which are grouped by the chemist in the class of carbohydrates known as polysaccharides, a class to which compounds like starch and cellulose also belong. As the chemistry of the pectic substances is still incompletely understood, the writer will not attempt more than a brief reference to their properties and chemical nature. Some knowledge of these peculiar compounds is, however, essential, if the feeding properties of sugar beet pulp are to be appreciated intelligently.

In its insoluble form, pectin constitutes, in loose chemical association with cellulose, the middle lamella of the cell walls of many plant tissues, such as those of fleshy roots, stems and fruits like turnips, beetroot, rhubarb stems, apples, cherries etc. To this insoluble form, the name of pectose has been given. Under the influence of a plant ferment known as pectosinase, the insoluble form is converted into a soluble form known as pectin. This change occurs during the ripening of succulent fruits, and is accompanied by tissue disintegration. Pectose can also be transformed very readily into pectin by chemical means.

By the action of a second plant ferment known as pectase, which is abundant in lucerne, clover and carrots, pectin is transformed into methyl alcohol and a gelatinous material called pectic acid. A third ferment, pectinase, occurring in germinating barley, possesses the power of breaking down pectin into sugars like arabinose and galactose. The capacity of pectin to give rise to sugars furnishes the clue, therefore, to its value as a food for farm animals. Pectin has considerable technical significance in the making of jam, its presence in fruits being responsible for the setting of the final product. It also has the peculiarity of being able to impart, when present in small amount, a jelly-like consistency to strong solutions of sugar containing traces of acid. For that reason,

it is extensively employed in the manufacture of fruit jellies. Preliminary experiments, conducted by the writer in collaboration with Mr. A. J. Codling, have shown that more than 30 lb. of crude pectin can be extracted by chemical means from 100 lb. of dried sugar beet pulp. It follows that this feeding stuff may, at some future date, be used as a source of pectin for technical purposes.

From the standpoint of feeding value, it is of obvious importance to know: (1) the degree to which pectose can be digested and utilized by farm animals; (2) the nature of the mechanism whereby an animal is able to digest pectose; and (3) the type of product which becomes available for absorption into the organism during the digestion of pectose. These matters will be dealt with in the Notes for next month.

From the standpoint of mineral composition, sugar beet pulp, containing only 3 to 5 per cent. of ash on the dry matter basis, must be regarded as deficient. Lime is the most abundant mineral contained in the ash, potash coming next in amount, whereas phosphate and soda are present in quite small proportions. On the basis of the data recorded in Table I, and employing the unit values: nitrogen = 9s. 11d., phosphate = 3s. 10d., and potash = 3s. 3d., one ton of dried sugar beet pulp containing 10 per cent. of moisture possesses a manurial value of 9s. 0d.

The data for the composition of molasses-sugar beet pulp (see Table I) display the characteristics which would be anticipated from a knowledge of the method of manufacture of this feeding stuff. Beet molasses contains on an average about 22 per cent. of moisture, 11 per cent. of crude protein (of which only about 0.5 per cent. consists of true protein), 60 per cent. of carbohydrate (mainly beet sugar with about 3 per cent. of another sugar called raffinose) and 7 per cent. of ash. The last-named constituent is rich in alkaline salts, particularly those of potash, but contains very little lime and no phosphate.

The molasses-sugar beet pulp used in the Cambridge trials was a well-dried sample, containing only about 8.2 per cent. of moisture. As would be expected, its composition differed from that of ordinary beet pulp in the following particulars. It was somewhat poorer in true protein, but much richer in respect of "amide" substances; it contained a smaller percentage of fibre, but a higher percentage of ash; the mineral fraction, moreover, was much richer in respect of

potash. The manurial value per ton of such molasses-beet pulp, on the basis of a 10 per cent. moisture content, works out at 12s. 4d.

In the Notes for next month, the writer hopes to discuss the results which were obtained in the sugar beet pulp digestion trials carried out at Cambridge.

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	10 2
Maize	81	6.8	9 0
Decorticated ground nut cake	73	41.0	13 5
" cotton cake	71	34.0	12 0

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

The cost per unit starch equivalent works out at 2.45 shillings, and per unit protein equivalent 2.29 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, 1927, 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	9 18
Oats	60	7.6	8 4
Barley	71	6.2	9 8
Potatoes	18	0.6	2 5
Swedes	7	0.7	0 19
Mangolds	7	0.4	0 18
Sugar Beet Pulp, dried	65	5.2	8 11
Beans	66	20.0	10 7
Good meadow hay	31	4.6	4 6
Good oat straw	17	0.9	2 4
Good clover hay	32	7.0	4 14
Vetch and Oat silage	13	1.6	1 16
Barley straw	19	0.7	2 8
Wheat straw	11	0.1	1 7
Bean straw	19	1.7	2 10

MISCELLANEOUS NOTES

THIS Scheme, which has for its object the improvement, by means of breeding, 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 commenced on September 1, 103 stud goats have been registered and are standing at 101 centres in various parts of the country. 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.

Stud Goat Scheme

* * * * *

THE general level of prices of agricultural produce during August was 44 per cent. above 1911-13, or one point lower than in July, and only two points above the figure recorded a year ago. A continuance of the fall in prices of fat cattle and sheep accounts almost solely for the decline in the index number, while other commodities, with the exception of barley, cheese and eggs, which were dearer, and oats, wheat and potatoes, which were cheaper, varied little from July values.

The Agricultural Index Number

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13					
	1923	1924	1925	1926	1927	1928
January	67	60	71	58	49	45
February	63	61	69	53	45	43
March	59	57	66	49	43	45
April	54	53	59	52	43	51
May	54	57	57	50	42	54
June	49	56	53	48	41	53
July	50	53	49	48	42	45
August	52	57	54	49	42	44
September	52	61	55	55	43	—
October	50	66	53	48	40	—
November	51	66	54	48	37	—
December	55	65	54	46	38	—

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	9 12	0 13	8 19	72	2 6	1.34	9.6
Barley, British feeding	—	—	10 0*	0 10	9 10	71	2 8	1.43	6.2
" Canadian No. 3 Western	37 6	400	10 10	0 10	10 0	71	2 10	1.52	6.2
" Persian	35 6	"	9 18	0 10	9 8	71	2 8	1.43	6.2
" Tunisian	35 6	"	9 18	0 10	9 8	71	2 8	1.43	6.2
Oats, English, white	—	—	9 10	0 10	9 0	60	3 0	1.61	7.6
" black and grey	—	—	9 7	0 10	8 17	60	2 11	1.56	7.6
" Canadian No. 2 Western	32 6	320	11 7	0 10	10 17	60	3 7	1.92	7.6
" " 3 "	29 9	"	10 8	0 10	9 18	60	3 4	1.78	7.6
" Argentine	28 3	"	9 18	0 10	9 8	60	3 2	1.70	7.6
" Chilean	32 0	"	11 3	0 10	10 13	60	3 7	1.92	7.6
Maize, Argentine	38 9	480	9 0	0 10	8 10	81	2 1	1.12	6.8
Beans, English, winter	—	—	10 13†	1 4	9 9	66	2 10	1.52	20
Peas, Japanese	—	—	23 10§	1 1	22 9	69	6 6	3.48	18
Dari	—	—	11 10§	0 11	10 19	74	3 0	1.61	7.2
Rye, home grown	—	—	9 10	0 12	8 18	72	2 6	1.34	9.1
Millers' offals—	—	—	—	—	—	—	—	—	—
Bran, British	—	—	7 15	1 2	6 13	42	3 2	1.70	10
" broad	—	—	8 15	1 2	7 13	42	3 8	1.96	10
Middlings, fine, imported	—	—	10 5	0 15	9 10	69	2 9	1.47	12
" coarse, British	—	—	9 2	0 15	8 7	58	2 11	1.56	11
Pollards, imported	—	—	8 10	1 2	7 8	60	2 6	1.34	11
Meal, barley	—	—	11 5	0 10	10 15	71	3 0	1.61	6.2
" maize	—	—	11 10	0 10	11 0	81	2 9	1.47	6.8
" germ	—	—	10 10	0 16	9 14	85	2 3	1.20	19
" locust bean	—	—	10 0	0 7	9 13	71	2 9	1.47	3.6
" bean	—	—	12 15	1 4	11 11	66	3 6	1.87	20
" fish	—	—	20 10	3 7	17 3	53	6 6	3.48	48
Maize, gluten feed	—	—	10 7	0 19	9 8	76	2 6	1.34	19
" cooked flaked	—	—	11 10	0 10	11 0	85	2 7	1.38	8.6
Linseed—	—	—	—	—	—	—	—	—	—
" cake, English, 12% oil	—	—	13 7	1 9	11 18	74	3 3	1.74	25
" " 9% "	—	—	12 12	1 9	11 3	74	3 0	1.61	25
" " 8% "	—	—	12 7	1 9	10 18	74	2 11	1.56	25
" " 5% "	—	—	11 15	1 17	9 18	69	2 10	1.52	36
Cottonseed cake, English—	—	—	—	—	—	—	—	—	—
" Egyptian, 4½% "	—	—	8 0	1 7	6 13	42	3 2	1.70	17
" " 4½% "	—	—	8 0†	1 7	6 13	42	3 2	1.70	17
Coconut cake, 6% oil	—	—	11 5	1 4	10 1	79	2 7	1.38	16
Ground-nut cake, 7% oil	—	—	10 10*	1 7	9 3	57	3 3	1.74	27
Decorticated ground-nut cake	—	—	—	—	—	—	—	—	—
" 7% oil	—	—	13 5*	2 0	11 5	73	3 1	1.65	41
Palm kernel cake, 4½-5½% "	—	—	10 0†	0 17	9 3	75	2 5	1.29	17
" " meal, 4½% "	—	—	10 10†	0 17	9 13	75	2 7	1.38	17
" " meal, 1% "	—	—	9 10†	0 18	8 12	71	2 5	1.29	17
Feeding treacle	—	—	6 0	0 8	5 12	51	2 2	1.16	2.7
Brewers' grains, dried ale	—	—	8 7	0 18	7 9	49	3 0	1.61	13
Malt culms " " " porter	—	—	7 17	0 18	6 19	49	2 10	1.52	13
" " " "	—	—	7 15*	1 7	6 8	43	3 0	1.61	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 August 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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. 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 1.29d. A similar calculation will show the relative cost per lb. of starch equivalent in 1 unit, the cost per lb. of starch on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 8s. 10d.; P₂O₅, 10s. 10d.; K₂O, 8s. 3d.

Grain.—Wheat, at an average of 10s. 5d. per cwt., was 5d. per cwt. cheaper than in July, and oats declined by 1s. 6d. per cwt. to an average of 10s. 5d. Barley advanced by 1s. 9d. per cwt. to an average of 12s., the increase being attributable to the higher prices realized for the new crop. Wheat in August was 30 per cent., barley 58 per cent., and oats 49 per cent. dearer than pre-war, as compared with 56, 64 and 43 per cent. respectively a year ago.

Live Stock.—A further decline of about 3s. 6d. per live cwt. was recorded in the average price of second quality fat cattle, and fat sheep realized $\frac{1}{2}$ d. per lb. less than in July, with a resulting fall in the index numbers of 4 and 7 points respectively to 40 and 59 per cent. above the level of the base years 1911-13. Fat cattle were, however, still somewhat dearer than in August, 1927, when the index figure stood at 34 per cent. above pre-war, while fat sheep at that time realized prices which were only 45 per cent. above pre-war. There was practically no alteration in price of fat pigs during August, and the decline in the index numbers is due to the fact that normally a slight rise in values occurs at this period. As regards store stock there was scarcely any alteration in the prices or index numbers for dairy cows and store pigs, whereas store cattle and sheep sold more cheaply, the former being 29 per cent. and the latter 55 per cent. above pre-war, as compared with 31 and 67 per cent. respectively in July.

Dairy and Poultry Produce.—Milk prices generally remained stationary during August at 55 per cent. above 1911-13, while butter advanced 2d. per lb., and cheese was about 10 per cent. dearer than in the preceding month, the relative index numbers rising by 4 and 18 points to 54 and 84 per cent. above pre-war. Eggs realized 4 $\frac{1}{2}$ d. per dozen more than in July, and at 55 per cent. above the base years the index number was 19 points higher on the month as compared with a rise of 13 points to 44 per cent. in the corresponding period of 1927. Prices of poultry were lower as a rule and resulted in a fall of 9 points to 54 per cent. above pre-war.

Other Commodities.—As is usual in August the prices of first early potatoes showed a considerable fall from those recorded in July, and the index figure declined to 35 per cent. above the base years. In August, 1927, potatoes sold at prices averaging 30 per cent. above pre-war. There was very little alteration in hay quotations during August from those ruling in the previous month, but as a decline in clover hay was recorded in July-August, 1911-13, the index number shows a slight rise.

Vegetables as a rule were much cheaper, averaging only 30 per cent. above pre-war as against over 100 per cent. in July, while as regards fruit, apples sold at 50 per cent. and plums at 100 per cent. above the average of 1911-13. A year ago plums realized 150 per cent. more than pre-war prices, but apples were at about the same level as in August of this year. Wool prices remained very steady during the month under review, and the index number was little altered at 76 per cent. above the base years.

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

Commodity	1926	1927	1928			
	Aug.	Aug.	May	June	July	Aug.
Wheat	69	56	40	38	34	30
Barley	52	64	41	46	37	58
Oats	33	43	74	69	58	49
Fat cattle	43	34	48	47	44	40
Fat sheep	52	45	90	83	66	59
Bacon pigs	79	36	42	43	41	36
Pork pigs	83	43	40	38	34	33
Dairy cows	37	25	33	32	34	33
Store cattle	33	26	26	26	31	29
Store sheep	63	48	50	55	67	55
Store pigs	139	70	26	22	25	26
Eggs	49	44	35	38	36	55
Poultry	55	43	51	52	54	45
Milk	60	55	53	53	55	55
Butter	56	38	52	54	50	54
Cheese	43	57	85	91	66	84
Potatoes	11	30	120	125	37	35
Hay	11	16	14	13	11	13
Wool	24	42	72	75	78	76

* * * * *

THE Council of the National Institute of Agricultural Botany have awarded the Snell Memorial Medal for the year 1927 to Professor Paul A. Murphy, of the Albert Agricultural College, Glasnevin, Dublin.

The Snell Memorial Medal, 1927

The medal is given annually to mark eminent work in the sphere of potato husbandry, and it has been awarded to Professor Murphy in recognition of his valuable contributions to the study of the virus diseases of the potato.

At the annual Convention of Displaymen, held at Southampton on September 10-12, the Empire Marketing Board assisted to the extent of erecting six "Shop Windows" for use in connexion with Window Dressing Competitions, and also offered prizes for the best display of Empire Produce. The Ministry, in collaboration with the National Farmers' Union and associated organizations, arranged for a supply of commodities for dressing two of the "Windows," which were allocated to home produce. The "Windows," which were dressed during the Convention by various competitors, attracted considerable attention, both from the delegates attending the Convention and from the public who were admitted during certain hours. Canned fruit, bacon and hams, eggs, cheese (Cheddar, Cheshire and Crustless) and canned and dried milk were the home-produced commodities placed at the disposal of competitors for the purpose.

* * * * *

ARRANGEMENTS are being made, as in previous years, for members of the Rothamsted Experimental Station Staff to give a few lectures, during the coming winter, upon the Station experiments, to Chambers of Agriculture and Horticulture, Farmers' Clubs, Farm Workers' Associations, Agricultural Societies, etc.

Rothamsted Winter Lectures

The lecturers will give their services without fee, but any association engaging them will be expected to defray travelling and hotel expenses and to make any necessary arrangements for holding the lectures. As far as possible, the wishes of associations in regard to dates and subjects will be met, provided adequate notice is given. Not more than one subject can be dealt with in a single lecture. Communications regarding lectures, indicating subject or subjects and suggested date or dates, should be addressed to the Secretary, Rothamsted Experimental Station, Harpenden, Herts. The list of subjects and lecturers is as follows:—

LECTURES BY MR. H. V. GARNER, M.A., B.Sc.,
GUIDE DEMONSTRATOR.

- (1) Artificial Fertilizers and their Use in the Rotation.
- (2) Recent Experiments on Potatoes and Sugar Beet.
- (3) The Manuring of Cereal Crops.
- (4) The Use of Fertilizers on Meadows and Pastures.
- (5) Chalking and Liming.
- (6) The Management of Farmyard Manure.

- (7) The Rothamsted Field Experiments, 1843-1928.
- (8) Modern Tendencies in the Fertilizer Industry.

OTHER LECTURES

- (1) *Soil micro organisms (bacteria, protozoa, etc.)* }
 Lucerne Inoculation Mr. H. G. THORNTON, B.A.
 Life in the Soil }
 Biological Aspects of Partial Sterilization } Mr. D. W. CUTLER, M.A.
- (2) *Agricultural Botany*
 Weeds of Arable and Grass Land Dr. WINIFRED E. BRENCLEY, F.L.S.
- (3) *Agricultural Chemistry*
 Liming and Chalking of Soils }
 Basic Slag and Mineral Phosphates: their Value in Agriculture } Dr. E. M. CROWTHER, F.I.C.
 } Mr. H. J. G. HINES, B.Sc.
- (4) *Soil Physics*
 Is the Tractor an Economic Investment? }
 Can the Cost of Cultivation be Reduced? } Dr. B. A. KEEN, F. Inst. P.
 The Art and Science of Cultivation }
 } Dr. F. TATTERSFIELD, F.I.C.
- (5) *Insecticides and Fungicides* Dr. F. TATTERSFIELD, F.I.C.
- (6) *Entomology*
 Insect Pests Dr. A. D. IMMS, M.A.
 Bee-Keeping Mr. D. M. T. MORLAND, M.A.
- (7) *Mycology*
 Potato Disease (Wart, Virus, Blight, etc.) }
 Plant Diseases: their Causes and Control } Dr. W. B. BRIERLEY, F.L.S.
 Soil Fungi and Plant Growth }
 Fungus Pests of Crops }
 Virus Diseases of Plants Dr. J. HENDERSON SMITH, B.A.
 Plant Diseases: their Causes and Control }
 Fungus Pests of Crops } Mr. R. H. STOUGHTON, B.Sc.

* * * * *

THE Ministry is informed that, as a result of a Conference called at Washington in June last by the Federal Horticultural Board of the United States Department of Agriculture to consider the advisability of placing further restrictions on the Importation of Fruit and Rose Stocks into the United States of importation of fruit and rose stocks, Apple, Pear, Quince and Mazzard Cherry Stocks will be excluded from entry into America

the United States on and after July 1, 1930.

No additional restrictions on the entry of rose stocks will be imposed until another Conference has been called at some

future date to consider the sufficiency of domestic supplies. English exporters of Manetti and other rose stocks will accordingly be free for the present to continue their trade as heretofore, subject, of course, to the usual permit being obtained by the importer and the consequent examination and certification of the stocks by the Ministry's Inspectors prior to shipment.

* * * * *

PROGRESS continues to be made in the establishment of the National Mark Scheme for fruit. In the August issue of this JOURNAL, there appeared an outline of the Scheme as it is to be applied to apples and pears, with definitions of the grades, packs and packages to which the National Mark may be applied.

National Mark Scheme for Fruit

Specimens of the National Mark labels which are to be used by registered growers or packers have now been issued. These labels are simple but effective in design, and are printed in attractive colour combinations. The coloured background is used as a grade indicator, in addition to the printed word, and labels of various sizes and designs are provided to cover the various grades, packs, and types of packages which may be used. A specimen set of labels is illustrated on the plate opposite, on the reverse side of which are photographic views of the first consignment of National Mark apples and pears received at Covent Garden Market on September 1, 1928.

* * * * *

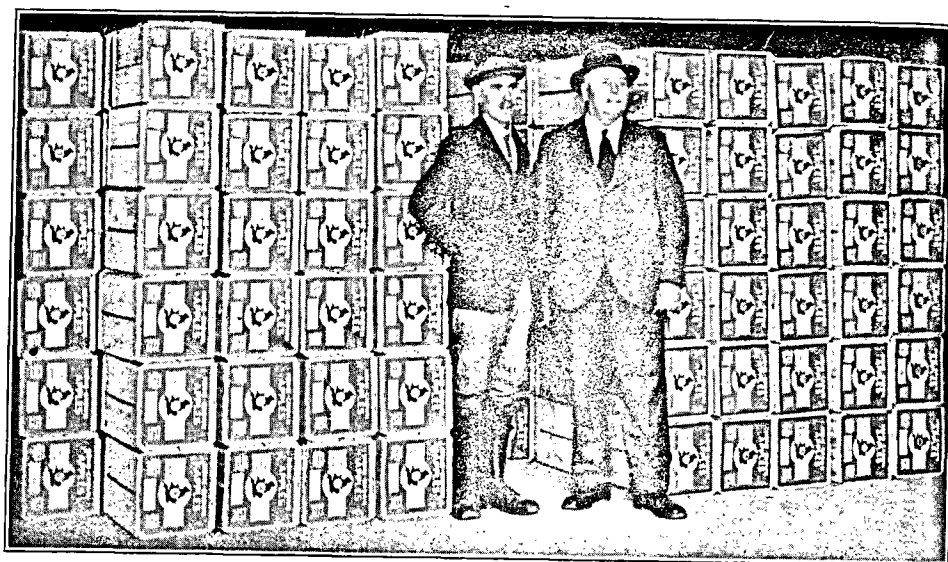
As a result of representations made by the Ministry through the Foreign Office the Spanish Government has modified its recent decree which required imported potatoes to be accompanied by an official certificate that the potatoes were grown at a place not less than 20 kilometres from any land infected with

Export of Potatoes to Spain

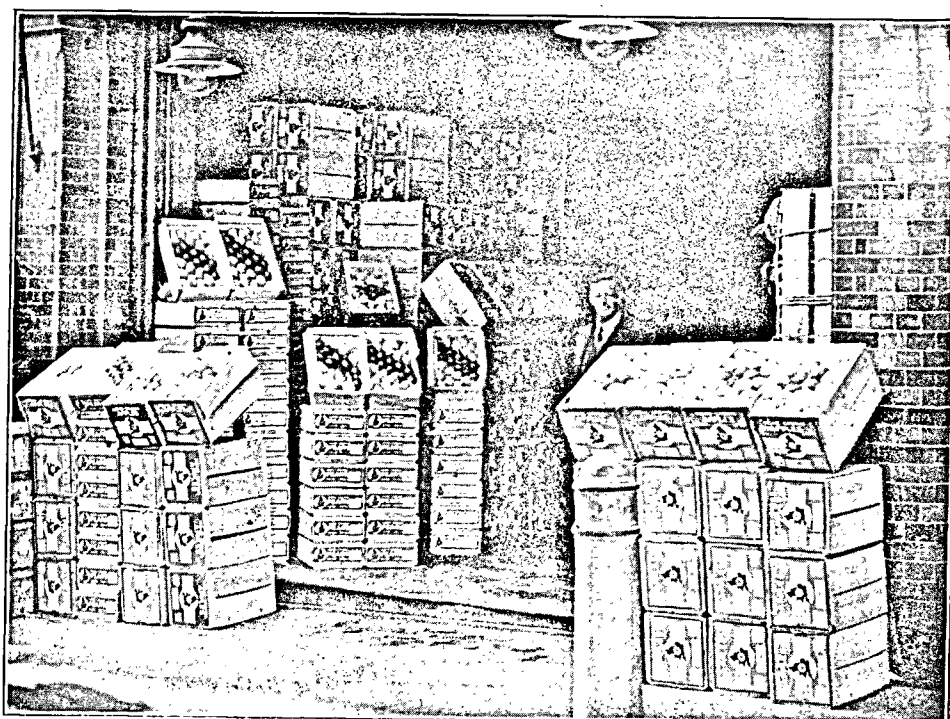
Wart Disease. Potatoes which have been grown in a district in the United Kingdom not less than 5 kilometres from any area affected with the disease will be admitted into Spain provided that they are accompanied by an official certificate of health issued after an examination of the actual consignment. This concession has been granted subject to the condition that on examination on arrival the potatoes are found to be in a satisfactory condition.



Set of National Mark Labels for Apples and Pears.



Consignment of boxed apples sent to Covent Garden, August 31, 1928, by Mr. H. Barton, of Hollesley Bay, Suffolk, who is seen (right) with his manager, Mr. Walker.



First Consignment of National Mark Apples and Pears on show at Covent Garden, on September 1, 1928.

THE number of candidates for scholarships this year was 479, and 111 scholarships have been awarded. The awards

Scholarships for the Sons and Daughters of Agricultural Workmen and Others

comprise 7 Senior Scholarships for either degree or diploma courses in agriculture, or an allied subject, at Universities and Agricultural Colleges; 96 Junior Scholarships for short courses, not exceeding one year, at Farm Institutes; and 8 Extended Junior Scholarships for courses of further instruction at Farm Institutes.

The origins of the successful candidates are :—

Sons and daughters of agricultural workmen	..	..	..	35
" " " " working bailiffs	..	..	..	8
" " " " smallholders	..	..	..	29
" " " " other rural occupations (e.g., blacksmith, wheelwright, saddler, etc.)	..	..	..	12
Candidates who qualified on their own account as <i>bona fide</i> workers in agriculture	..	..	..	27
				111

The value of the scholarships is such as will enable recipients to attend the various courses without cost to their parents.

* * * * *

THE following special research grants for the academic year 1928-29 have been awarded by the Ministry on the recommendation of the Development Commissioners' Advisory Committee on Agricultural Science :—

(a) RENEWALS

Institution	Subject	Investigator.
University College of North Wales, Bangor	Liver Rot Treatment with Carbon Tetrachloride.	R. F. Montgomerie.
School of Agriculture, Cambridge.	Good and Bad Fields of Wheat.	G. A. Stevenson.
Do.	Grassland Investigations (to include both English and Scottish work).	
East Malling Research Station.	Incidence and Control of Apple Scab and Mildew.	M. H. Moore.
Liverpool University.	Deaths in Ewes at lambing time.	Prof. S. H. Gaiger and K. D. Downham.
Manchester University.	Slug control.	To be appointed.
South Eastern Agricultural College, Wye.	Virus Disease of Hops.	Prof. E. S. Salmon.

(b) NEW APPLICATIONS

University College of North Wales, Bangor.	Kemp in Fleece of Welsh Mountain Sheep.	R. G. White.
Oxford University.	Breeding of Oats for Resistance of Frit Fly.	N. Cunliffe.
Rothamsted Experimental Station.	Examination of data collected under Ministry's Meteorological Scheme.	To be appointed.
South Eastern Agricultural College, Wye.	Survey of Parasitic Worms.	S. G. Brade-Birks.
Do.	Life History, distribution and control of Capsid Bug and Currant Capsid.	M. Austin.
Do.	Publication of Vol. 3 of Prof. Theobald's book on British Aphides; payment to publishing firm.	F. V. Theobald.

A case of some interest to English potato growers came before the Sheriff Court, Forfar, recently, when a Scottish potato merchant was fined £2 for supplying to an English firm a consignment of seed potatoes not in accordance with the declaration as to size and dressing given at the time of sale. The tubers were invoiced as "1½ inch × 2 inch," but an examination by one of the inspectors of the Ministry showed that over 60 per cent. were incapable of passing through a 2-inch riddle.

The Seeds Act, 1920, requires every seller of seed potatoes to give the purchaser a written statement as to the class and variety of the seed as well as of the size and dressing.

REALLY good crops of strawberries can be obtained only from strong and healthy plants, and growers are well advised to take every precaution when laying down new or replacing old beds to ensure that they plant only runners taken from reliable parents. The attention of those proposing to obtain supplies of runners for planting this autumn is drawn to the recently issued register of growers to whom certificates have been granted this summer under the Ministry's voluntary scheme for the inspection and certification of plants from which runners are intended to be taken for sale.

These certificates, which have been issued only to growers whose stocks have been found on inspection to be true to type,

vigorous, and not obviously affected with disease, are of two kinds: (a) "super" certificates, issued to growers who have undertaken to limit the numbers of young plants allowed to develop on each parent, and (b) "ordinary" certificates, issued in cases where no such limitation has been observed. Copies of the register can be obtained free of charge on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

Enforcement of Minimum Rates of Wages.—During the month ending September 15, legal proceedings were instituted against 12 employers for failure to pay minimum and overtime 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 concerned
		£	s.	d.	£	s.	d.	£	s.	d.	
Lindsey	Scunthorpe	5	0	0	2	0	6	25	10	0	3
Salop	Oswestry	*			—			3	19	6	1
"	Bishop's Castle	—			2	12	0	22	0	5	2
"	Chirbury	1	0	0	0	10	0	9	0	0	1
"	"	1	0	0	0	10	0	12	0	0	1
"	"	1	0	0	0	10	0	17	0	0	1
"	"	2	0	0	1	0	0	17	16	1	2
"	"	3	0	0	1	10	0	46	5	0	3
Yorks, N.R.	Flaxton	—			—			—			1
Carmarthen	St. Clears	—			—			—			1
Glamorgan	Cowbridge	1	0	0	2	2	0	4	0	0	1
Radnorshire	Clyro	†			0	8	6	6	11	6	1
		£14	0	0	£11	3	0	£164	2	6	18

* Proceedings were also taken against the defendant in this case under Section 9 (3d) of the Act (giving false information), and a fine of £5 0s. 0d. was imposed, in addition to the payment of £1 10s. 9d. costs.

† Dismissed under Probation of Offenders Act.

Merchandise Marks Act, 1926.—The hearing of the application for an Order-in-Council to require the marking of imported rose trees has been fixed for October 9 and 10, 1928.

Foot-and-Mouth Disease.—An outbreak was confirmed on September 16, at South Dalton, Beverley, Yorks, East Riding, and the usual restrictions were applied to an area of approximately 15 miles round the infected premises. Three further outbreaks, on premises in close proximity to the original case, have since occurred, two on September 19, and the other on September 21.

No further outbreak having occurred in the Lancashire infected area—referred to in the September issue of this JOURNAL—the restrictions in that area were withdrawn on September 6.

One hundred and eleven outbreaks in all have been confirmed since January 1 last, involving 15 counties and the slaughter of 3,340 cattle, 4,526 sheep, 1,677 pigs and 6 goats.

APPOINTMENTS

THE following list of Specialist Advisory Officers is a continuation of the lists of provincial officers connected with agriculture which have been published in this JOURNAL for April, May, August and September. The series will be completed by the publication in an early issue of the staffs of the Agricultural Research Institutes. The functions of Advisory Officers are, briefly, to conduct research on matters of local rather than national importance, in their own particular subject, and to advise farmers thereon, either directly or through the agency of the County Agricultural Organizer, who should always be consulted in the first instance. The Agricultural Organizer and the Advisory Officer may be regarded as connecting links between the farmer and the Research Institutes. For a fuller description of the advisory scheme the reader should consult Leaflet No. 279 (*Technical Advice for Farmers*).

SPECIALIST ADVISORY STAFFS

1. NORTHERN PROVINCE (Cumberland, Westmorland, Durham, Northumberland)

Armstrong College, Newcastle-on-Tyne

<i>Agricultural Chemistry</i>	B. THOMAS, M.Sc.
<i>Dairy Bacteriology</i>	D. W. HENDERSON
<i>Agricultural Economics</i>	D. H. DINSDALE, M.A.
<i>Entomology</i>	R. A. HARPER GRAY, M.A., M.Sc.
<i>Mycology</i>	F. T. BENNETT, B.Sc.
<i>Veterinary Science</i>	W. L. STEWART, M.R.C.V.S.

2. YORKSHIRE

Agricultural Department, The University, Leeds

<i>Agricultural Chemistry</i>	H. T. JONES, B.Sc.
<i>Agricultural Economics</i>	A. G. RUSTON, D.Sc.
<i>Entomology</i>	T. H. TAYLOR, M.A.
<i>Mycology</i>	W. A. MILLARD, B.Sc.

3. MIDLAND PROVINCE (Derby, Leicester, Lincoln (Lindsey), Nottingham, Rutland)

Midland Agricultural and Dairy College, Sutton Bonington, Loughborough

<i>Agricultural Chemistry</i>	H. T. CRANFIELD
<i>Agricultural Economics</i>	A. JONES, B.Sc.
<i>Entomology</i>	A. E. ROEBUCK
<i>Mycology</i>	H. H. STIRRUP, M.Sc.

4. EASTERN PROVINCE (Bedford, Cambridge, Essex, Hertford, Huntingdon, Isle of Ely, Lincoln (Holland and Kesteven), Norfolk, Soke of Peterborough, Suffolk)

School of Agriculture, The University, Cambridge

<i>Agricultural Chemistry</i>	F. HANLEY
<i>Dairy Bacteriology</i>	C. D. OXLEY, N.D.A., N.D.D.
<i>Agricultural Economics</i>	J. A. VENN, M.A.

<i>Entomology</i>	F. R. PETHERBRIDGE, M.A.
<i>Mycology</i>	W. A. R. DILLON WESTON

5. SOUTH MIDLAND PROVINCE (Northampton, Oxford)

School of Rural Economy, Parks Road, Oxford

<i>Agricultural Chemistry</i>	G. R. CLARKE, M.A., B.Sc., A.I.C.
<i>Agricultural Economics</i>	A. BRIDGES, B.A.
<i>Entomology</i>	N. F. CUNLIFFE, M.A.
<i>Mycology</i>	R. WOODWARD, B.Sc., Ph.D.

6. SOUTH EAST PROVINCE (Kent, Surrey, Sussex)

South Eastern Agricultural College, Wye, Kent

<i>Agricultural Chemistry</i>	W. GOODWIN, M.Sc., Ph.D.
<i>Dairy Bacteriology</i>	H. BARKWORTH
<i>Agricultural Economics</i>	J. WYLLIE, B.Sc., N.D.A.
<i>Entomology</i>	F. V. THEOBALD, M.A., F.E.S.
<i>Mycology</i>	PROF. E. S. SALMON, F.L.S.

7. SOUTHERN PROVINCE (Berkshire, Buckingham, Dorset, Hampshire, Isle of Wight, Middlesex)

The University, Reading

<i>Agricultural Chemistry</i>	H. H. NICHOLSON, M.A.
<i>Dairy Bacteriology</i>	J. MCCLEMONT, B.Sc., N.D.A., N.D.D.
<i>Agricultural Economics</i>	E. THOMAS, B.A., B.Litt.
<i>Entomology</i>	S. G. JARY, B.A.
<i>Mycology</i>	W. BUDDIN, M.A.

8. SOUTH WEST PROVINCE (Cornwall, Devon, Isles of Scilly)

Seale Hayne Agricultural College, Newton Abbot, Devon

<i>Agricultural Chemistry</i>	A. BLENKINSOP, B.Sc.
<i>Dairy Bacteriology</i>	C. S. MORRIS, N.D.A.
<i>Agricultural Economics</i>	W. H. LONG, B.A.
<i>Entomology</i>	W. E. HODSON, A.R.C.Sc.
<i>Mycology</i>	A. BEAUMONT, B.A.

9. WESTERN PROVINCE (Gloucester, Hereford, Somerset, Wiltshire, Worcester)

Bristol University, Agricultural Advisory Office, 22 Berkeley Square, Bristol

<i>Head of Advisory Department</i>	PROF. J. A. HANLEY, Ph.D., A.R.C.S.
<i>Agricultural Chemistry</i>	A. W. LING, M.Sc., N.D.A.
<i>Dairy Bacteriology</i>	C. A. MACEacharn, B.Sc.
<i>Agricultural Economics</i>	C. V. DAWE, M.Com.

Agricultural and Horticultural Research Station, Long Ashton, Bristol

<i>Entomology</i>	L. N. STANILAND, A.R.C.Sc.
<i>Mycology</i>	L. OGILVIE, M.Sc., M.A.

10. WEST MIDLAND PROVINCE (Salop, Stafford, Warwick)

Harper Adams Agricultural College, Newport, Salop

<i>Agricultural Chemistry</i>	W. M. DAVIES, B.A., B.Sc., A.I.C.
<i>Dairy Bacteriology</i>	E. L. CROSSLEY, B.Sc., A.I.C.
<i>Agricultural Economics</i>	F. S. DENNIS
<i>Entomology</i>	Vacant
<i>Mycology</i>	NORMAN C. PRESTON, B.Sc.

11. NORTH WEST PROVINCE (Cheshire, Lancashire)

Victoria University, Manchester

Agricultural Economics and Head J. ORR, M.A.
of Advisory Department

<i>Agricultural Chemistry</i>	A. M. SMITH, Ph.D., A.I.C.
<i>Entomology</i>	H. W. MILES, M.Sc., N.D.A.
<i>Mycology</i>	E. HOLMES SMITH, B.Sc.

Department of Veterinary Pathology, The University, Liverpool
Veterinary Science K. D. DOWNHAM, B.V.Sc.,
M.R.C.V.S., D.V.H.

12. NORTH WALES PROVINCE (Anglesey, Carnarvon, Denbigh, Flint)

Agricultural Department, University College of North Wales, Bangor

<i>Agricultural Chemistry</i>	Prof. G. W. ROBINSON, M.A.
<i>Dairy Bacteriology</i>	Miss P. M. HICKSON, N.D.D.
<i>Entomology</i>	W. M. DAVIES, B.Sc.
<i>Mycology</i>	T. WHITEHEAD, Ph.D., M.Sc., A.R.C.Sc.
<i>Veterinary Science</i>	R. F. MONTGOMERIE, B.Sc., Ph.D., F.R.C.V.S.

13. MID-WALES PROVINCE (Brecon, Cardigan, Carmarthen, Merioneth, Montgomery, Pembroke, Radnor)

Agricultural Department, University College of Wales, Aberystwyth

<i>Agricultural Chemistry</i>	T. W. FAGAN, M.A., F.I.C.
<i>Dairy Bacteriology</i>	S. B. THOMAS, M.Sc.
<i>Agricultural Economics*</i>	A. W. ASHBY, M.A.
<i>Entomology</i>	J. R. W. JENKINS, B.Sc.
<i>Mycology</i>	D. W. DAVIES, B.Sc.

14. SOUTH WALES PROVINCE (Glamorgan, Monmouth)

University College of South Wales and Monmouth, Cathays Park, Cardiff

<i>Entomology</i>	H. W. THOMPSON, M.Sc.
<i>Mycology</i>	J. REES, B.A., B.Sc.
<i>Veterinary Science</i>	N. BISSETT, M.R.C.V.S.

APPOINTMENTS : CHANGES AND CORRECTIONS

County Agricultural Education Teaching Staffs, England.

Berkshire : Mr. F. A. COX, B.Sc., has been appointed Assistant Instructor in Agriculture, vice Mr. R. A. Sullivan.

Cumberland and Westmorland (Joint Staff) : Miss H. B. PIRRIE, N.D.D., has been appointed Instructress in Dairying at the Newton Rigg Farm School, vice Miss D. Morrison.

Gloucestershire : Mr. E. A. KING, Assistant Instructor in Poultry-keeping, has been appointed Instructor in Poultry-keeping, vice Mr. L. G. Price. Mr. G. W. MORLEY has been appointed Assistant Instructor in Poultry-keeping.

Lancashire : Mr. G. F. KINGSTON, B.A., has been appointed Assistant Lecturer in Agriculture, vice Mr. V. Liversage.

Yorkshire (University of Leeds, Agricultural Department) : Mr. W. E. GELLING, B.Sc., N.D.A., has been appointed District Lecturer in Agriculture, vice Mr. W. D. D. Jardine.

* The Agricultural Economics Department of the University College of Wales functions for the whole of Wales in this subject.

Mr. C. E. MARSHALL, M.Sc., Ph.D., has been appointed Assistant Lecturer in Agricultural Chemistry, vice Mr. G. Milne.

Mr. V. LIVERSAGE, M.Sc., B.Sc., N.D.A., has been appointed Assistant Lecturer in Agricultural Economics, vice Mr. C. V. Dawe.

County Agricultural Education Teaching Staffs, Wales.

Caernarvonshire : Mr. EDWIN JONES, Assistant Organizer and Lecturer in Agriculture, has now qualified as M.Sc.

Glamorganshire : Mr. A. D. HARRISON has been appointed to fill the vacant post of Horticultural Instructor.

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NOTICES OF BOOKS

Rothamsted Memoirs, Volume XIII. (Royal 8vo. Half calf. Pp. 1123. (Price 34s. 6d. net, inland post free. Foreign postage extra.)

This Volume is now ready for distribution and can be obtained on application to the Secretary, Rothamsted Experimental Station, Harpenden, Herts, England. It is requested that, where possible, remittances be sent with order. The volume includes 68 Memoirs covering the period from 1925 to 1927. The edition is strictly limited.

Great Britain : Essays in Regional Geography.—By 26 authors, with an Introduction by Sir E. J. Russell, D.Sc., F.R.S. Edited by A. G. Ogilvie, O.B.E., M.A., B.Sc. Pp. xxx+486. (Cambridge : The University Press, 1928. Price 21s. net.)

It is inevitable that a book of the sort under notice should recall, particularly to readers with an agricultural interest, the series of county surveys which was undertaken by the short-lived Board of Agriculture about the end of the eighteenth and the beginning of the nineteenth centuries. Regional geography, as it is at present understood, is, of course, very different in its aims and purposes from the single-minded enthusiasm which stimulated Sir John Sinclair and his co-members of the old Board of Agriculture to undertake what is perhaps the earliest survey covering a whole country. The intention of the old Board was that they should obtain a series of reports on the agriculture of the country; but although the county reporters were instructed to deal with agriculture, they necessarily included a great deal of information on the nature of soils in the various districts, and made many observations upon the influence of the character of the soil upon the life of the people, especially of the farming people who dwelt upon its surface. The purpose of regional geography is, as the writer of the introduction says, to describe the regions of a country and to discover the causes which have made them what they are. Such a story is of interest only as showing how it affected the lives of the people who lived in these regions both during the formative period and to-day.

In the middle of last century Buckle attempted to determine the influence of environment, climate and other factors of physical geography upon the divergence of races and the characteristics of peoples, but, in spite of his great learning, the limitations of scientific knowledge and the lack of a real acquaintance with the story of geology in his day inevitably curtailed his success. Moreover, he was unable to complete the work which he had planned because it was altogether outside the scope of possibility for one man. The range of human knowledge has widened enormously since Buckle, but his work must be either consciously or sub-consciously at the back of the minds of many of our modern workers. It may be said that work of this comprehensive and widespread character was stabilized in

1910 when Jean Brunhes published his *La Géographie Humaine*. Before then detailed work had begun in many places. In 1902, *Britain and the British Seas*, by Sir Halford Mackinder, appeared, an example of a closer specialization, which has developed into so close a specialization as is exemplified in the 26 essays which compose this volume.

The first essay in the book deals with the climate of Great Britain, and is by Professor H. R. Mill. It is the only general essay. Each of the other sections deals with the geological development of a part of Great Britain, and gives some indication of the human history which was a consequence of that geological development, being completed by a short exegesis upon the modern conditions of life within the area. The areas treated are natural rather than administrative: they are admittedly open to criticism and some are quite arbitrary, but this arrangement is certainly preferable to the use of the administrative county as a unit for this purpose. The agriculture of each district is closely treated, and the development of industrialism in its relation to mineral deposits, in particular places, is carefully described.

While this book can hardly be said to have an immediate practical interest for farmers, it will, of course, undoubtedly be popular with, if not compulsory for, all students in Agricultural Colleges and University Departments of Agriculture.

Leaf Mining Insects.—By James G. Needham, Stuart W. Frost and Beatrice H. Tothill. Pp. viii+351. (London: Baillière, Tindall & Cox, 1928. Price 27s.)

Insects which mine in the tissues of leaves belong to several different Orders, but the leaf-mining habit is so definite and specialized that it forms a very convenient ecological division; and although this book deals primarily with American insects, it will nevertheless be of considerable interest to European readers.

The authors have attempted to appeal both to the general reader interested in Natural History and to the working entomologist, and while they have not completely succeeded in this difficult task, the book unquestionably contains much of interest for both classes of readers. The entomological student may, perhaps, feel that he would have liked to know more of the authors' views on such subjects as adaptation and specialization of form in connexion with the leaf-mining habit, and he may regret that the great amount of work done by Dr. Martin Hering on the ecology of leaf-mining insects receives only scanty reference. He will, however, find a useful bibliography and comprehensive lists of American leaf-mining insects included for his benefit.

The book opens with a general account of leaf-mining insects, in which the insects themselves, their life-histories, and the types of mines they construct, are briefly discussed. Hints on the collection and rearing of leaf-miners are also given, and the chapter closes with a table for the determination of the Order to which the mining larvæ belong. The extent of the leaf-mining habit, and the economic importance of leaf-miners, are dealt with in the next chapter. In the following chapters leaf-miners of the various Orders are described in detail. A general account of the miners in the Order is first given, and this is followed by more detailed descriptions of the various families, and in some cases of individual species. In the chapter dealing with the Diptera, a useful key to the commoner North-American species, based on the type of mine produced, is included.

A large number of line drawings and several photographic plates, as well as an adequate index, are included in the book.

Practical Cheesemaking.—By C. J. Walker-Tisdale and Walter E. Woodnutt. Revised Edition. Pp. 204. (London: George Allen & Unwin, Ltd. 1928. Price 4s. 6d. net.)

The previous editions of this book, published in 1917 and 1919, are widely known among dairy students, cheesemakers and factory managers. The present revised and enlarged edition, therefore, is worthy of attention for, while several comprehensive books dealing with cheesemaking are available, this is perhaps the only one dealing particularly with cheesemaking conditions in this country. It does not attempt to treat the subject in an exhaustive manner, but rather aims at including practical points of value to cheesemakers and factory managers, whilst the dairy student will find the information set out in a simple and accurate sequence.

The sections deal briefly with the general principles of dairy buildings, the composition, examination and analysis of milk, the use of pure culture starter, rennet and annatto, and with the various items of equipment found in the farm and factory cheesemaking centres. Further sections give detailed information concerning the making of different types of cheese in this country, and useful information is embodied concerning the chief defects which may be encountered. The book is well illustrated and contains useful tables for the cheesemaker and student, and a complete index, all of which should make an appeal to a wide circle of readers.

Economic Farm Buildings. By C. P. Lawrence, F.S.I., with an introductory note by Sir Thos. Middleton. Pp. xxii+194. (London: The Library Press, Ltd. New Edition, 1928. Price 8s. 6d. net.)

The most valuable feature of this book is the author's insistence on the necessity of ordered arrangement rather than casual and unsystematic stringing together of buildings, to which farmers are prone. He is, however, much better at defining the needs than at transmuting them into concrete form, and a north-country bias (quite natural in one whose experience appears to have been chiefly in the Lake District) is pretty generally discernible. Notwithstanding these reservations, however, the trend of the book is thoroughly sound; on the question of additions and alterations, for instance, "Before proceeding to spend money on even minor alterations . . . it is advisable to draft an entire scheme for remodelling . . . so that the works to be undertaken in the present may be a unit in the formation of an improved whole in the future." In the adaptation plans (very sketchy) shown, the wise course is commonly adopted of making a new cowhouse and grading up existing buildings, which is generally preferable to tinkering with an existing, poor cowhouse, with indifferent final result and no increase in accommodation for the money expended. Both in plans for new and adapted work, however, the author shows a tendency to place his cowhouses among other buildings, often in undesirable contiguity to manure dumps or yards. Though the Milk and Dairies Order, 1926, is reproduced at length, the original text is not sufficiently revised in relation thereto, and it seems hardly appreciated that, in effect, the cubic-feet-per-cow-standard is practically abandoned and cleanliness of approach and good ventilation substituted. The author seems ignorant of tubular cow fittings and spaced (or Yorkshire) boarding, but apart from this his chapters on materials and construction are both sensible and sound. He wisely advises that "where requirements are considerable and funds are limited, it is often wise, and the truest economy, to build more largely and less substantially, than to do heavy work and little of it. All structures must be regarded as a means to an end, viz., to increase the

yield of the land to the utmost by the keeping of more cattle, the preservation of the manure, and the housing of an increased crop." This is the application of factory economics to farm buildings—farming as a business rather than as a gentlemanly employment. Its observance will, it may be feared, fail to beautify the countryside, but should help both the land and the annual balance sheet.

Agricultural Progress.—The Journal of the Agricultural Education Association. Vol. V, 1928. pp. 144. (London: Ernest Benn, Ltd. Price 5s. net.)

The majority of the articles in this journal are abridgments of papers read at the two meetings of the Agricultural Education Association held in 1927: they deal mainly with broad aspects of agricultural research.

Two articles are part of a series which review recent advances in particular branches of agricultural science. Professor Comber discusses the chief results of recent soil investigations, and Mr. Godden deals with recent advances in animal nutrition.

The agriculture and agricultural investigations of North Wales receive special treatment, the summer meeting of the Association having been held at Bangor. The general descriptive paper by Professor White and those by his colleagues on virus diseases in potatoes, pastures, wool improvement and liver fluke were read at that meeting.

The Journal of the Royal Agricultural Society for England, Vol. 88, 1927. (London: John Murray. Price 15s.)

This latest issue of the *R.A.S.E. Journal*, the first edited by Mr. C. J. B. Macdonald, is a comprehensive record of the extensive work of the Society during the past year, and in addition to the usual official reports, etc., contains a number of special articles of interest. Sir Henry Row writes on "The Output of English Farming," and shows that it may be fairly claimed that, not only has English agriculture held its own through the troublous times of the past two decades, but that on the whole the gross production per acre has increased. The Editor contributes an important paper on "Meat Production in the Grass Counties," designed to stimulate inquiry and study of the intricate and complex problem presented. Mr. James S. Gordon writes on "The Improvement of Cattle in Northern Ireland," and Mr. Daniel Twomey on "Cattle Improvement Schemes in the Irish Free State." Professor Barker discusses "The Cider Industry and the Farmer," Sir Hugh Beevor "The Immediate Advancement of Silviculture," and Mr. E. R. Pratt "The East Anglian Timber Willow," while there is a long and informative article on "The Hop Control, Part II," by Mr. G. Foster Clark, dealing mainly with the agricultural side of the control.

Condensed Milk: A Study of Condensed, Evaporated and Powdered Milk. By Atsushi Miyawaki, B.S., M.S., Professor of Dairy Science, Hokkaido Imperial University. Pp. x + 380. (New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1928. Price 22s. 6d.)

Although condensed and dried milks are not made to any great extent in this country, considerable attention has been given to these articles in connexion with their use as a substitute for liquid milk.

In certain countries, particularly Holland, Denmark and America, the preservation of milk in the form of condensed or dried products is an industry of great importance and one of a highly technical nature. The author, who received his training in America, has since carried out considerable investigations in Japan, and has travelled widely in

order to gain further contact with technical processes in other parts of the world.

The book deals in a comprehensive manner with the condensing and drying of milk and its by-products in different parts of the world. There is an excellent chapter dealing with the chemistry of the industry followed by a detailed technology of the various processes involved. The chapter concerning powdered milk deals in an interesting manner with different processes in use, and sets out clearly the relative advantages of each process.

The volume is well illustrated and indexed and contains a series of useful appendices. Its price, 22s. 6d. in this country, may seem somewhat high, but, for those who are really interested from a commercial or technical point of view in this aspect of dairying, the work contains a wealth of valuable material.

The Evolution and Classification of Soils. By Dr. E. Ramann; translated by C. L. Whittles, Ph.D. Pp. xii + 128. (Cambridge: W. Heffer & Sons, Ltd. 1928. Price 7s. 6d. net.)

There is a growing tendency to regard the study of soil as a distinct branch of natural science. This has been especially marked in the work of Russian investigators, who have been largely responsible for building up the science of Pedology. Such a science requires a comprehensive classification of the individuals with which it is concerned. In the past, systems of soil classification have been based on agricultural characteristics, the physical and chemical properties of the soil, or the geological origin of the parent rock.

The limitations of these schemes of classification were revealed when soil studies were extended to wide areas of undeveloped land. More recently there has been evolved, especially in Russia, a classification based on the factors that determine the evolution of soils. The results of the Russian work were not accessible in other countries, owing to language difficulties, until the publication of a German translation of Glinka's monograph in 1914, and of Ramann's book in 1917. The interest caused by the newer methods of approach has been reflected in the scientific journals and especially at the International Soil Congress at Washington in 1927, but until quite recently there has been no comprehensive treatment of the subject in English. A translation of the late Professor Ramann's brief monograph will therefore be welcomed.

Professor Ramann has succeeded in compressing into a small volume the main facts concerning the more important soil types of the world, always emphasizing the dominant part played by climate in their formation. He avoids detailed descriptions or analyses of particular soils, and does not discuss at any length the relative merits of alternative schemes of classification. The purpose of the book is well served by these omissions, and it forms an admirable starting point from which to approach the complicated problem with which it deals. The division of soils into humid and arid types is the first stage in their classification. The two classes are clearly defined, and extend over distinct climatic zones of the earth's surface. No gradual transition is observed from humid to arid soils; but, in regions where soils are subjected during the year to definite climatic changes, the seasons have a marked influence on soil development, giving rise to "semi-humid" or "semi-arid" types according to whether the soil activities preponderate in the dry or moist season.

These four great groups are further subdivided according to the climatic zones in which the soil has been found. Dr. Ramann distinguishes cool, cool-temperate, subtropical, and tropical zones.

These zones, and the more important soils found in them, are described in the second half of the book. The influences of "local factors" are discussed in some detail. The descriptions are brief, but they give the reader a clear impression of the connexion between soil formation and climate, and of the processes by which the different types are evolved.

A useful bibliography is included, to which the translator has added references to some of the more important papers that have appeared since the original publication of the book in 1917.

Lime Resources of Northamptonshire. By Beeby Thompson, F.C.S., F.G.S. (Published by the Northamptonshire County Council, County Council Offices, Northampton. Price 1s.)

The preparation of this report was undertaken by Mr. Beeby Thompson at the instance of the County Council, and the value of such county surveys can be readily envisaged, more particularly when they are carried out with the knowledge and care which have gone to the making of this.

The need for lime in many parts of the country is a matter that has been fully discussed, but, in general, the discussion has been to some extent in the air. An actual measure of the need can only be made through a careful survey of soils, and the possibility of filling the requirement from local sources can only be ascertained by an examination of the geology of the district and its resources, the cost of the product, and its suitability for the proposed purpose.

In the report prepared by Mr. Beeby Thompson all these factors are considered, and it should prove of interest not only to the farmers of the county immediately concerned, but to those who may undertake to supply their requirements in lime, and to farmers in other counties who might benefit by similar local investigations.

Cambridge University Agricultural Society Magazine. Vol. II, No. 2. 1928. Pp. 80. (Copies obtainable from the Editor, School of Agriculture, Cambridge. Price 2s. 6d.)

A further issue of this attractive Magazine has just been published. It contains excellent contributions from such well-known authorities as Messrs. A. Amos ("The University Farm"), H. Hunter ("Winter Oats"), J. A. Hanley ("The Management of Grassland"), Sir John Gilmour ("The Government and the Land"), Sir William Hardy ("Science and the Food Industry"), J. A. Venn, A. Walton, and others. It is certainly a most useful production, and by no means loses in interest by the fact that it contains excellent skits on certain sides of food production.

Grass and Fodder Crop Conservation in Transportable Form.—By A. N. Duckham, B.A., Dip. Agric. (Cantab.). Rowett Research Institute, Aberdeen. Pp. 44. (London: H.M. Stationery Office. 1928. Price 1s. net.)

Prepared at the request of the Empire Marketing Board, and published as Memorandum No. 8 of the Board, this report emphasizes, with the support of figures, the importance of grassland products, and the need for properly exploiting the large grassland areas in Imperial territory. At the present time, a vigorous campaign of research into grassland problems is being conducted in all parts of the Empire, the mineral contents of soils, best methods of manuring, and the production of improved strains of pasture plants being among the questions receiving careful study.

Recent investigation has shown the high nutritive value of young grass compared with that of hay; and this has, naturally, led to a consideration of the possibilities of conserving young grass in some form that will be suitable and convenient for stock feeders. The author, surveying these possibilities, discusses the relative merits of grass meal, baled grass and grass cakes; and inclines to the last-named on account of their freedom from dust, high nutritive value and convenience for transport, particularly as regards the "drought" areas of the Empire.

Drying and compressing processes and plants are described, and the question of cost is also considered. The fact that such processes, as applied to young grass, can hardly be regarded as having proceeded beyond the experimental stage, only permits of rough estimating. The author gives a tentative figure of £6 as the cost of producing a ton of grass cakes or briquettes, assessing a value of £9 per ton to them on the basis of the prices of feeding stuffs last autumn (1927), i.e., twice the value of hay, with twice the starch equivalent and three times as much digestible protein. As a ton of these cakes occupies less than 50 cubic feet of space, this form of compressed feeding stuff would appear to offer great advantages in the matter of long-distance transport. It is pointed out, however, that, while there appears little doubt that the highly digestible young fodder crop can be successfully cut, dried and compressed into a marketable form, there is need for further research to discover economical methods of handling the wet grass immediately after cutting, and the most suitable apparatus for drying it. The development of strains of fodder plants, specially suitable for the proposed treatment, would also seem to be desirable.

The Memorandum includes a number of interesting analyses of hay, with estimates of cost and value of hay and dried young grass, and transport charges in different parts of the Empire.

Malting Barley. Rothamsted Conferences No. VII.—Pp. 48. (London: Ernest Benn, Ltd. Price 2s. 6d. net.)

Out of a conflict of views, a united opinion may possibly emerge: this is the justification for the Rothamsted Conferences, the seventh of which is reported in this volume. The publication of a full report of the Conferences enables the conclusions of the speakers, their points of agreement and the measure of their opposition to be considered and appreciated by a much wider audience than could possibly attend the meetings. The present small volume is, therefore, sure of its welcome, especially because the shrinkage of the area under barley during the past decade has formed one of the most remarked phenomena of our agriculture. Between 1920 and 1927 the area under the crop decreased by over three-quarters of a million acres, although the 1928 figure shows an increase of 138,000 acres over 1927.

Such a conference could not be held without the question of a tax on foreign barley being raised, and we find Mr. John Joyce confidently stating his opinion that the best stimulant for the growth of malting barley would be such a tax. Mr. Robert Reid, a past president of the Institute of Brewing, however, explains that the use of a small proportion of foreign sun-dried barley is an absolute necessity in the manufacture of such a beverage as the public now demands, but he agrees that this kind of barley should be grown here if possible. Experiments towards this end are at present in progress.

Every angle of the subject was approached by one or other of the speakers at this Conference. The brewer, the grower and the scientist each contributes his quota, and all emphasize the necessity for co-operation between the interested parties.

The grower is given some indication of what the buyers are looking

for (pp. 7, 25, 41, 45). The story of the production of the modern varieties and some of their respective merits are described, and the regulation of the seed supply is suggested. The influence of our eccentric climate on quality and yield is studied. The cultivation and treatment of the crop, as practised in the Vale of Taunton, and on Lincoln Heath, are set out in detail, and the results of the five years' experiments on the growth of barley, fostered by the Institute of Brewing and conducted under the control of Rothamsted, are given.

This summary of the contents is indeed a recommendation of the publication, which calls for no emphasis by the addition of adjectives: it may, however, be said that we have here in a concise and comprehensible form the latest information on the subject.

Hertfordshire County Egg-Laying Trials.—By D. W. Ferguson, N.D.P. (Hons.). Publication No. 212 of the Herts. Institute of Agriculture, Oaklands, St. Albans.

The Hertfordshire Institute of Agriculture has recently issued an interesting booklet which gives a record of two years' work on the County Egg-Laying Trials. Detailed information is given on the management of the trials, feeding, health of the birds and egg yield, of which the following is a brief summary: In 1925-26, 147 birds (48 light breeds and 99 heavy breeds) were accepted for the trials, and in 1926-27, 186 birds (63 light breeds and 123 heavy breeds). The ration consisted of wheat, oats and kibbled maize in equal parts; half an ounce per bird was given in the morning and 1½ ounces per bird in the evening. The mash mixture was composed of three parts by weight each of bran, Sussex ground oats, and maize meal, nine parts of middlings and two of fish meal; 2-2½ oz. per bird were supplied daily. Mortality averaged 4.5 per cent. during the two years, 50 per cent. of this mortality being due to ovarian and digestive disorders, other deaths being accounted for by tumorous growths, cardiac and respiratory troubles. An interesting analysis of the egg yield is given which brings out clearly the fact that the heavy winter-layer makes the biggest annual contribution to the egg basket. The average yield over the two years in the 48 weeks of the trials was 174 (light breeds 180 and heavy breeds 166). The average egg production of the birds which commenced laying in October-November was 179, as against an average production of 123 in the case of birds which commenced to lay as late as February-March. Similarly, birds which produced 50 eggs or over between October 15 and January 6 averaged a total production of 196, while birds which produced not more than 10 eggs in the same period averaged a total production of only 135. On the financial side it is shown that the gross income per bird in the two years was approximately 25s. a year. Feeding costs averaged out at approximately 9s. per bird. The booklet is clearly written and contains many interesting statistical tables and illustrations. Copies of the Report can be obtained from the Principal, Mr. J. Hunter Smith, at the Institute at Oaklands, St. Albans.

The Journal of the South-Eastern Agricultural College, Wye, Kent.—Published at the College. Price 8s. 6d. post free. To residents in Kent and Surrey, price 4s. 6d. post free.

This issue of the Journal contains the reports of the work of the various Departments of the College for the session 1926-27, and reports on investigations during that year and the following year as well. There are over 40 different reports and papers in the publication and it is impossible to mention them individually. Suffice it to say that no important branch of farming is overlooked, though, naturally, fruit-growing, horticulture and hop-growing receive special attention.

ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

- Ogilvie, A. G. (Edit.)*.—Great Britain; Essays in Regional Geography. (486 pp.) Cambridge University Press, 1928, 21s. [55:91].
- Johnstone, Mary, A.*—Plant Ecology. The Distribution of Vegetation in the British Isles, arranged on a Geological Basis. (174 pp.) London: J. M. Dent & Sons, 1928, 5s. [58.3.]
- Garratt, G. T.*—Hundred Acre Farm. (142 pp.) London: Longmans, Green, 1928, 5s. [63 (022); 63.191.]
- Lawrence, C. P.*—Economic Farm Buildings. Systematic Planning, Improvement, Construction. Second Edition. (194 pp.) London: Library Press, 1928, 8s. 6d. [69.]
- Report of the Committee on Land Settlement in Scotland. (1928.) [Cmd. 3110.] (83 pp.) London: H.M. Stationery Office, 1928, 1s. 6d. [325 (41).]
- Northamptonshire County Council (Education Committee)*.—Lime Resources of Northamptonshire, by *Beeby Thompson*. (86 pp. + 3 pl.) Northampton, 1928, 1s. [55; 63.15.]
- Food Research Institute*.—Fats and Oils Studies. No. 1—The Fats and Oils, a General View, by *C. L. Alsberg* and *A. E. Taylor*. (103 pp.) Stanford University, California, 1928, \$1.50. [664.3.]
- Merchandise Marks Act, 1926.—Report of the Standing Committee set up by the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department, and the Secretary of State for Scotland on *Oats and Oat Products*. [Cmd. 3118.] (11 pp.) London: H.M. Stationery Office, 1928, 3d. [343.53; 63.314.]
- Greger, J.*—Mikroskopie der landwirtschaftlichen Unkrautsamen. (117 pp.) Berlin: Paul Parey, 1927. [63.1951; 63.259.]
- Hungarian Ministry of Agriculture*.—Die Landwirtschaftliche Produktion der Welt im Jahre, 1927. (425 pp.) Budapest, 1927. [31.]
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NOTES FOR THE MONTH

SUFFICIENT time has elapsed since the inception, on September 1 last, of the National Mark Scheme for Apples and Pears, to enable progress to be

National Mark reviewed.

Scheme for It must be remembered that, in the
Apples and Pears first year, permission to use the Mark is being granted only to growers or packers whose total output of apples of approved varieties exceeds 1,000 bushels, or whose output of approved varieties of pears exceeds 500 bushels (250 bushels in the case of the variety Doyenne du Comice). The number of applicants for permission to use the Mark has consequently been restricted ; nevertheless, the response has been steady, and it is gratifying to report that some of the most prominent and progressive growers and packers in the country have been quick to appreciate the larger purposes of the scheme and to apply for enrolment. More growers will, no doubt, apply for registration as soon as their main-crop apples are picked.

The National Mark Committee and its advisory Trade Committee have met frequently during the past few weeks to receive applications and to consider the general working of the scheme. Up to the beginning of October, 34 certificates of authorization to use the Mark had been granted as regards apples and eight certificates as regards pears, representing an estimated production of about 200,000 bushels of apples and 30,000 bushels of pears. It will, of course, be realized that these total quantities will not actually be marketed under the scheme, as only fruit reaching prescribed standards of quality can receive the imprimatur of the Mark. It may be said that the growers participating in the scheme have taken great pains to grade well up to requirements. To assist them in the task, the Ministry has issued special grading and packing instruction cards for use on packers' premises.

That National Mark fruit, properly graded and packed to national standards, has met a long-felt want, is proved by the reception given to it on the various wholesale markets. In a number of cases, salesmen have not been able to obtain sufficient National Mark fruit to meet the demand, and, as

retailers have been keen to obtain supplies, satisfactory prices have been realized by the growers.

In the early stages of the scheme, publicity has been directed, by the Ministry, mainly to growers and distributors. The scheme has been explained to growers by leaflets, Press notices, public meetings and many personal visits, with the object of ensuring that good supplies of National Mark produce will be forthcoming. In the same way, the scheme has also been brought prominently before wholesalers and retailers in order to enlist their interest and support. An attempt is now being made to appeal to the consuming public. Very full references to the scheme have already been made over the wireless, and future references have been arranged for. Window bills, bearing a reproduction of the Mark, which was illustrated in this JOURNAL, have been prepared by the Ministry and distributed for display by retailers to indicate that they sell National Mark produce.

It is, of course, too early to speak with certainty, but the signs are encouraging and there is every prospect that the Apple and Pear Scheme will prove to be a constructive and permanent success in the field of practical marketing.

* * * * *

THE Report on "Markets and Fairs in England and Wales, Part III—Northern Markets" has been issued by the Ministry of Agriculture and Fisheries as No. 19 of its well-known Economic Series—the "Orange Books."* A general commentary on market conditions in this country has already been presented in Part I (Economic Series, No. 13), while Part II (Economic Series, No. 14) was devoted to a survey of the markets in the Midlands. In the Report now issued, the markets in the six counties from Lancashire and Yorkshire northwards to the Scottish border are dealt with on lines similar to those followed in Part II. In all, no fewer than 496 markets and auction marts and 150 fairs in the Northern counties are dealt with. The Report is divided into three main sections:—

Section I gives a general view of the Northern markets as a whole. Information of a general nature is given regarding the markets for each class of commodity sold, including butter and cheese, corn and provender, eggs, poultry, fruit and vegetables, live stock, meat, hides and skins, wool and fish. A short summary

* H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price 6d., post free 9d.

of the position with regard to rents, stallage and tolls is included; only general notes are included in this summary, but detailed information regarding the charges ruling in any market can be obtained by those interested on application to the Ministry. A short review of the agricultural fairs still in existence, with special reference to horse, sheep and cattle fairs, concludes this Section; as in the Midlands, these fairs are generally declining in importance.

Section II of the Report reviews the markets of each County in relation to their agricultural environment. Brief sketches of a number of markets are included to indicate prevailing types, or, it may be, to emphasize unusual features.

Section III, which is well illustrated with photographs and diagrams, contains detailed descriptions of some of the more important markets, classified according to situation in producing areas or consuming centres. In view of the large industrial population in the region covered by the Report, considerable space is devoted to markets in the large towns. The markets described are selected as illustrating points of special interest.

Appendices give much useful information, including complete lists of markets and fairs in the Northern area arranged alphabetically by counties, giving, for each market, the market days, market occupier, the covered and uncovered areas, commodities sold, methods of sale and other data, and, for each fair, its date and the commodities dealt in. For the live stock markets, the total numbers of stock of each class sold in a recent typical year are given.

Although the Report is mainly descriptive, the descriptions are directed towards illustrating the adequacy or otherwise of the markets to perform their function of assisting in the marketing and distribution of agricultural produce. Read in conjunction with Part I (Economic Series, No. 13), it should provide a useful basis for the investigation of problems connected with the organization, administration and management of market undertakings. In fact, like its predecessor, it should be a valuable guide and reference book to the live stock and produce markets of the North, and, as such, of assistance not only to market owners and members of market committees, both within and without the Northern counties, but to producers and distributors generally. Such a comprehensive survey has never before been attempted.

With the aid of the grant made to the Ministry by the Empire Marketing Board, the Report is being put on sale at a nominal price.

THIS year's National Rat Week will commence on Monday, November 5, and the Ministry has addressed a circular letter to all local authorities vested with powers and duties under the Rats and Mice (Destruction) Act, 1919, emphasizing the desirability of organizing concerted measures during that week for the destruction of these pests.

National Rat Week, 1928

There is, to-day, a wider recognition of the immense loss inflicted on the country by the depredations of rats, both directly, in the destruction of foodstuffs and material, and indirectly, as the agents and carriers of disease germs. From reports received by the Ministry upon last year's Rat Week, it is evident, however, that, while many local authorities are displaying great activity in coping with the rat menace, there are others who have not yet grasped the importance of rat destruction. Only by systematic action on the part of all occupiers of lands and buildings, and on the part of local authorities responsible for the execution and enforcement of the Act, can any marked improvement be effected. The Ministry trusts, therefore, that the whole-hearted co-operation and support of all local authorities concerned will be given in furthering this year's campaign.

As regards possible measures for concerted action, a number of suggestions were put forward in the circular letter referred to which it was hoped that local authorities would consider and adopt in conjunction with any other methods of procedure which they might consider specially suitable or applicable to conditions in their respective districts. The authorities have also been supplied with copies of a pamphlet giving the names of firms prepared to supply rat destructive materials, with some simple suggestions for their application, and this pamphlet they are at liberty to print or multigraph for circulation in their respective areas.

While the suggestions for concerted action in regard to rat destruction have been issued to local authorities primarily in connexion with the National Rat Week, the Ministry cannot urge too strongly upon private owners or occupiers of infested property, the desirability, whenever necessary, of taking immediate steps to rid their premises of rats. In this connexion, useful suggestions and advice will be found in the Ministry's Leaflet, No. 244, on *The Destruction of Rats*. Single copies of this leaflet are supplied free of charge on application, while additional copies may be had at the rate of

1d. each, 9d. per dozen, or 4s. per 100, post free. The Ministry has also issued an illustrated pamphlet, Miscellaneous Publication No. 51, entitled *Rats, and How to Exterminate Them*, price 3d., post free.

It may be added that in case of rat infestation presenting features of unusual difficulty, the Ministry is ready at any time to give all the assistance and advice in its power.

* * * * *

THE following notice regarding the export of ponies to the Continent was issued to the Press on September 29: The

Export of Horses and Ponies to the Continent

attention of the Ministry of Agriculture has been called to statements which have appeared in the Press regarding the exportation of ponies to the Continent. It should be clearly understood that ponies, in common with other horses, cannot be exported from this country unless they have been examined by a Veterinary Inspector of the Ministry at the port of shipment and certified by him, immediately before embarkation, to be "fit to be conveyed and disembarked without cruelty and to be capable of being worked without suffering." All the ponies which are exported from this country, therefore, are physically fit to travel and to work.

The consignment of 45 ponies specially mentioned in the Press articles referred to were shipped from Harwich to Antwerp on September 17, and these ponies came from Killingworth, near Newcastle, and from Willington, Durham. They were originally intended for work in the colliery districts in this country, but in consequence of the closing of the mines they had to be otherwise disposed of. These ponies were from 4 to 5 years old and in good condition. An Inspector of the Ministry, after having examined the ponies and passed them as fit to be exported, travelled with them from Harwich to Antwerp. He reported to the Ministry that the animals were embarked without difficulty, travelled comfortably, and were fed during the voyage. They were landed at Antwerp quietly, and were again fed and watered in a shed at the Docks. After being haltered, the ponies were transported by motor vans to the quarantine stables for examination and inoculation, in accordance with the Belgian regulations. They were there again fed with hay, meal and corn. The Veterinary Inspector of the Ministry who accompanied the ponies on the voyage again examined them after inoculation, and reported to the Ministry that they were in splendid condi-

tion, without a scratch or bruise. As a result of his inquiries, the Inspector was satisfied that the ponies were not being imported for slaughter, and this is borne out by the fact that the price of the ponies to the importer delivered in Antwerp was stated to be £10 10s. per head.

The Ministry is satisfied that the ponies which have so far been exported were of the high standard of fitness demanded by the existing Regulations, and that all steps have been taken for the comfort of the animals in their voyage to the Continent.

* * * * *

A CERTIFICATE course in rural science for women was inaugurated three years ago at the East Anglian Institute of Agriculture, Chelmsford. It was specially

Rural Science Course for Women designed to meet the requirements of the farmer's daughter, and instruction is provided in all subjects, connected with the management of the farm, usually under-

taken by the farmer's wife. The course has proved very successful, but experience has led to modifications designed to make it still more valuable. These modifications include practical instruction in poultry-keeping on an excellent poultry farm, as an addition to the lectures given at the Institute; and the inclusion of domestic science as one of the subjects. The course now covers :—

- (1) *Poultry Husbandry*, including lectures from 2 p.m. to 4 p.m. on Fridays and practical work at Tanfield Tye Poultry Farm (where there are, approximately, 6,000 head of poultry) from 9 a.m. to 4 p.m. on Thursdays.
- (2) *Dairy Technology*, including lectures on Mondays from 3 p.m. to 4 p.m., and practical work in the Institute Dairy, in the making of butter and cheese and the handling of milk, on Monday and Friday mornings.
- (3) *Horticulture*.—This includes lectures from 9.30 a.m. to 10.30 a.m. and practical work from 10.30 a.m. to 12.30 p.m. on Tuesdays. The course is confined to the growing of fruit and vegetables in the farm garden, and of flowers and shrubs for beautifying the homestead.
- (4) *Domestic Science*.—A special course of lectures and demonstrations has been arranged on Tuesdays from 3 p.m. to 5 p.m. This course deals with the practical study of foods in relation to their value and general use in household dietaries; the working of dietaries under various conditions; the purchase, storage and preservation of foodstuffs; and general household management.
- (5) *Accountancy*.—The farmer's wife and daughter frequently take an active part now in the business side of farm management; accountancy has, therefore, been included in the course to enable farmers' daughters to give attention to this side of the business, which is too often neglected on account of other

demands on the principal's time. Special instruction in this subject is provided on Wednesdays from 11.30 a.m. to 12.30 p.m.

- (6) *Animal Husbandry*.—The modern farmer's daughter, like her father, is always interested in stock, and no course would be complete without the inclusion of the subject of animal husbandry. Instruction is provided in the management of the dairy herd, calf rearing, milk production, pig-keeping, horse management, and the care of sick animals, this last being a branch of farming for which the farmer's daughter shows a special aptitude. Instruction in these subjects is given on Tuesdays and Thursdays from 9.30 a.m. to 10.30 a.m.

Practical demonstrations are occasionally given on some of the best Essex farms, where the whole system of farm management in operation is explained, including that section under the direction of the farmer's wife. These excursions are under the personal direction of the Institute Principal.

* * * * *

It must be admitted that, in spite of vigorous fanning by enthusiastic propagandists, agricultural co-operation in this country has been a somewhat sporadic and fitful flame. Many causes may, doubtless, be held accountable for this, but perhaps the most fundamental is the farmers' lack of experience in this difficult field of economic effort. If this is so, careful and realistic study of the causes of success and failure is obviously necessary in order that the movement may derive the fullest benefit from the experience of the past. This, in fact, is the aim of Messrs. J. Morgan Jones, M.A., and R. Harding Wynne, N.D.A., of the Agricultural Economics Department of the University College of Wales, Aberystwyth, in their recently published report on "Agricultural Co-operation in North Wales,"* and the authors are to be congratulated on the manner in which they have accomplished their task.

As the general historical sketch shows, the movement in North Wales provides a close parallel with the development of agricultural co-operation in England. Beginning in 1904, progress was at first slow but steady. Those societies which survived the sudden shock of war conditions thrived during the period 1914-18 and immediately after, when, as the authors state, "it was almost inevitable that the universal craze for establishing businesses on the flimsiest foundations should have extended to the co-operative movement."

* Marketing and Co-operation Pamphlets, No. III. (Aberystwyth: Agricultural Economics Department, University College of Wales. Price 1s.)

Difficult times for the movement returned with the fall in prices from 1921, and many newly-hatched enterprises as well as several older societies succumbed.

In 1926, there were 48 societies operating in North Wales, the majority of which were requisite societies, only nine being devoted primarily to the sale of farm produce. The total membership was upwards of 10,000 and total sales amounted to over £400,000. Taking requisite societies alone, it is estimated that membership represents more than one-third of the total of farmers and smallholders who are not themselves traders.

The requisite societies have, on the whole, been fairly successful, only nine, mostly small concerns, making losses in 1926. The authors note with approval the action of one group of societies in effecting the joint purchase of requirements.

As in other parts of the United Kingdom, some of the requisite societies also undertake to sell produce for members, but, of the produce societies proper, eight are dairy societies and one an egg and poultry society. In view of the potentialities of co-operation in the marketing sphere, it is fitting that considerable space should be given to an analysis of the experience of these enterprises. In the account which is given of the growth and decline of the co-operative cheese factories in North Wales, illuminating comparisons are made between successful and unsuccessful societies in regard to finance and business management. Some of the problems connected with the organization of a co-operative cheese factory as a going concern—such as the supply of skilled labour, the seasonality of manufacture, the organization of a collection service, policy as regards payment for milk, the utilization of whey—are also illustrated with reference to the North Wales societies. In the light, however, of the type of farming practised in North Wales, and other considerations, the authors hold that it is to butter-making that the co-operative dairy movement must look for its extension in that area.

The chapter on the Anglesey Egg Collecting Depot is also noteworthy for the penetrating economic analysis which lays bare the rocks on which so many businesses—both private and co-operative—come to grief. Brief mention is also made of other interesting ventures in agricultural co-operation in North Wales.

Emphasis is laid on the fundamental point that “co-operation cannot succeed unless societies are created to fulfil a

conscious want and are capable of providing better service than existing machinery offers.” In this connexion, the success of the requisite societies is contrasted with the failures in the field of co-operative dairying. Stress is also laid upon the necessity for the harmonious inter-relation of production policy and marketing; here, again, the experience of the cheese societies, which “failed primarily because they robbed the farm of a milk by-product which was believed necessary for the production of store stock,” provides a case in point.

This “study in experience” commends itself to the attention of all interested in agricultural organization on co-operative lines as a helpful piece of constructive criticism.

* * * * *

A TENANT on one of the Ministry's Farm Settlements affords an interesting example of the benefit of a small holding to a man, of limited means and farming experience, who has made up his mind to work hard. Before the War, this man worked in a colliery. On discharge from

the Army in 1920, he had a year's instruction in agriculture at this Settlement, and, at Lady Day, 1921, took a holding of 49 acres. He had then about £400 capital, and obtained the loan of a further £300 under the Ministry's guarantee. The holding was increased to 69 acres in 1923, and, at Lady Day this year, the tenant quitted in order to take over a mixed farm of 142 acres. By that time he had paid off the whole of the £300 loan; and, in addition to cash at the bank, owned 7 milking cows, 17 head of store cattle, 66 sheep and lambs, 4 horses, 17 pigs, together with some poultry and all the necessary implements for working the farm.

* * * * *

SOME interesting comments on the condition of holdings on the Ministry's Sutton Bridge and Holbeach estates (Lincs) are given in the judges' report in connexion with prize competitions, instituted by the Ministry this season, for the best-managed holdings on these farm settlements. Regarding the competition at Sutton

Bridge the judges state that:—

“The first of the classes comprised fully-equipped holdings exceeding 21 acres. There were nine entries in this class, and each of the tenants can be congratulated on the appearance of his holding.

"The corn crops were looking well, and some pieces were exceptional; the yield should be above the average. Nearly all the potatoes gave promise of a heavy yield, and those on some of the holdings were remarkable for their healthy appearance, colour and growth. With so little pasture, it is not possible for the tenants to keep a large head of stock, but we should like them to increase the numbers, if possible. Mr. Cave, however, has a good lot of stock for his size holding; it has meant that he has had to erect, at his own expense, quite a number of buildings to accommodate it all.

"It has not been an easy task to place the different holdings in their order of merit, but in our opinion the appearance and cultivation of Mr. Goodwin's and Mr. Brumble's holdings stand out as patterns of what can be done, and of how tidy holdings can be kept. Others run them very close in this direction. So favourably impressed are we with several others that we are asking the Ministry to give 'Cards of Merit' to Mr. Cave, Mr. Skate, and Mr. Law, as, in our opinion, they deservedly have won this recognition. The remaining competitors are to be commended, also, on the result of the hard work they must have expended on their holdings to have got them in such good order."

The class at Holbeach was for equipped holdings of any size. There were six entries, the largest holding being between 18 and 19 acres, and the smallest between 10 and 11 acres. Concerning them the judges say:—

"Here, again, we found the crop of each entry looking remarkably well, and the tenants are to be congratulated on the appearance of their holdings at the dates of our inspections. We found some difficulty in judging holdings where a quantity of fruit and bulbs were grown with those where the crops were confined to potatoes and corn; and we should like, another year, for the Ministry to consider the advisability of making two classes, one for tenants who specialize in horticultural crops, and another class for those who confine themselves to growing ordinary agricultural crops.

"In this class, we have awarded the First Prize to Mr. Taylor. We are asking the Ministry to give two Second Prizes, as we consider Mr. Cox's and Mr. Elsey's holdings of equal merit. Mr. Thompson's holding is also worthy of

recognition, and we are asking the Ministry to issue a 'Card of Merit' in his case."

In reference to a class for allotment holders, the judges remark that the exhibitors of several of the allotments are to be congratulated on the success of their efforts, and that it was exceedingly gratifying to see such a wonderful amount of produce grown on such small areas.

In addition to cash prizes, two championship silver cups were offered, the winners this year being Mr. T. I. Goodwin (Sutton Bridge) and Mr. O. A. Taylor (Holbeach). The Ministry has adopted the recommendations of the judges in regard to the awards of additional prizes and Cards of Merit.

* * * * *

THE bread-making qualities of English wheat flour were again on trial at the Bakers and Confectioners' Exhibition held at the Royal Agricultural Hall, London, during the second week of September. A new feature this year was the competition for the best All-

All-English Bread

English milk loaf made only from home-grown wheat flour and fresh liquid milk. The prizes in this class were provided by the Empire Marketing Board at the Ministry's suggestion. The entries were very level in quality. The flavour, texture and general characteristics of the bread were exceptionally good, and the judges were very favourably impressed with the commercial possibilities of this type of All-English loaf.

The prize awarded annually by the National Farmers' Union for the best All-English plain commercial loaf attracted a large number of entries. Though the quality of the loaves in the running for the prize was astonishingly good, the entries as a whole varied considerably in quality and appearance.

The millers' competition for All-English wheat flour seemed to indicate that the small country miller could produce a better flour from English wheat than his larger confrère. The bread-baking test for the various flours showed good and comparatively even results. An examination of the wheats used in preparation of the bread flours, entered in this competition, showed that in every case practically nothing but Yeoman wheat was used.

The experience of the exhibition points to the conclusion that a milk loaf made from All-English wheat flour is a reasonable commercial proposition, and that if Yeoman wheat is used as the basis of the miller's grist very regular and reliable results can be obtained.

THE International Committee for Phytopathology and Economic Entomology are offering two prizes for the best memoirs, giving an account of new and original work in the two following subjects: (1) Investigations on Rust (Uredineae) diseases of cereals (wheat, oats, barley or rye); and (2) Investigations on the role played by insects or other invertebrates in the transmission or initiation of virus disease in plants. The value of each prize will be 1,000 Swedish crowns (approximately £55 British). The competition is open to entrants of all nationalities. The memoirs must be written in English, French or German, and three typewritten copies of each memoir must be sent so as to reach the Secretary of the Committee, Mr. T. A. C. Schoevers, Wageningen, Holland, on or before May 1, 1930. The author's name must not appear on the memoir itself, but each memoir must be marked with a pseudonym or motto, and be accompanied by a sealed envelope (bearing the same pseudonym or motto) containing the author's full name and address.

The adjudication of the prize for the first subject (Rust) will rest with a jury consisting of Professor Dr. Jacob Eriksson, Dr. E. C. Stakman and M. Et. Foëx. The jury for the second subject (Virus) will be announced later. The decisions of these juries will be final and will be announced at the Fifth International Botanical Conference, to be held at Cambridge (England) from August 16 to 30, 1930. The copyright of the prize memoirs will become the property of the Committee, who will endeavour to secure publication of them in a suitable existing periodical, or, failing that, procure publication in some other way. Other memoirs submitted will be returned to their respective authors. The Committee reserve the right to withhold the prizes should none of the memoirs submitted be deemed of sufficient merit by the respective juries.

Further particulars, if required, may be obtained on application to the Secretary at the address given above.

THE ECONOMIC POSSIBILITIES OF RICE GRASS (*SPARTINA TOWNSENDII*).—I

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THE subject of the present article is *Spartina Townsendii* (commonly known as Cord or Rice Grass), a tall grass inhabiting maritime muds. It was first recorded in this country, on the Southampton salt marshes, near Hythe, in 1870. By 1880, it was recognized by the brothers Henry and James Groves for a new and distinct species, and given by them the name which it now bears. Since those days, when it was still quite a rare plant, it has continually spread into all the waters of Southampton and the Isle of Wight, along the Solent to Keyhaven, and westward into Christchurch and Poole Harbours; eastward it has made its way into Portsmouth and Chichester Harbours, Pagham, and as far as Rye, where it was recorded in 1922. Of all these localities, Poole Harbour is the most spectacular and convenient for investigation. The first specimen was found in 1899, whilst to-day the plant occupies many square miles, filling many of the harbour bays and shallow areas between the channels and "lakes." Nor is the invasion yet complete, as every visit to the locality shows some fresh advance.

Public attention was first drawn to the spread of *Spartina* by Lord Montagu of Beaulieu, in the evidence which he gave before the Royal Commission on Coast Erosion (*Min. Roy. Comm. Coast Erosion*, i., 11,290-300, 11,341-362, 1907), 21 years ago. This led, at the instance of the Director of the Royal Botanic Gardens, Kew, to a scientific inquiry into the matter by Dr. Otto Stapf, Keeper of the Herbarium; and, from that time to the present, close touch has been kept with the spread of this plant.

In 1906, *Spartina Townsendii* was recorded for the north coast of France in the Baie des Veys at Carentan, since which time it has spread from one estuary to another, so that there is hardly a river discharging into the Channel between Cherbourg and the Seine which is not being invaded. Further north, it has been recorded for the River Conche (1922), discharging at Paris-Plage near Etaples, and in the Slack, near Wimereux (1926). In addition to these Channel stations, *Spartina* has also found its way to the mouth of the Elorn at Brest in Brittany. Of these French localities, the mouth of the Vire and the mouth of the Seine (north bank, near Havre)

are the most impressive, eclipsing the best English localities. The Seine is especially notable, as the plant is there extending its area with rapid strides. Into all these localities *Spartina* has found its way without deliberate human interference: that is to say, by currents, shipping, and, it may be, transport by birds.

By the vigour and celerity of its spread in these tidal waters, *Spartina* recalls certain other plants which have made spectacular appearances, such as *Elodea canadensis* in rivers and canals of Britain, and later of the continent of Europe, in the middle of the 19th century; of the Water Hyacinth (*Eichhornia crassipes*) in certain North American, Indian and Australian rivers, to the great inconvenience of navigation in more recent times. Another case is that of the Prickly Pear (*Opuntia inermis*) in Australia, especially Queensland and New South Wales, where 25,000,000 acres of grazing land have been overrun and rendered inaccessible to stock. *Spartina*, however, differs from these and other cases in that the ground it occupies so rapidly and readily consists of soft, sticky, tidal mud, which, except in some cases by *Zostera* (Eel Grass), have been bare of vegetation throughout historic times. These bottomless muds, though they stood empty of vegetation and invited colonization, probably for thousands of years, found no plant capable of solving the problems of invasion and establishment till *Spartina Townsendii* came and made light of the task.

The qualities demanded of *Spartina* include (1) a capacity to sink deep its anchoring roots and to provide for their oxygenation in the impenetrable mud; (2) a capacity for rapid spread; and (3) adaptation to the special tidal conditions obtaining in the waters of Southampton and Poole Harbour.

The first requisite is provided by the continuous system of intercellular spaces which reaches from end to end of the plant; the second by its quick-growing runners or stolons, which radiate in all directions from the parent plants, supplemented by a capacity to produce and scatter seed so that tidal and other currents may be utilized for more distant dispersal. The third pre-requisite, adjustment to the long tidal immersion of these particular waters, it shares with such other halophytes as frequent these foreshores—a margin of adjustment which all such plants possess.

The plant is a robust, tall-growing, rather rigid grass, raising its haulms 2 ft. 6 in. above the mud, with creeping rhizomes just below the surface. These and the bases of the erect shoots produce roots of two kinds: short, branching, surface roots for

nutrition, and deep, anchoring roots which penetrate the mud to a great depth. By August, it displays its forking spikes of flowers, 5 to 10 in a bundle. The flowers are made conspicuous by the large white velvety stigmas which receive the pollen discharged by the later appearing anthers. The spikelets are one-flowered, and the covering glumes carry short stiff hairs. The length of the spikelet ranges from 15 to 20 mm. (say 0.6 to 0.8 in.) averaging about 18 mm. (about 0.7 in.).

Other Species of Spartina.—It will be convenient, here, to say something about certain other species of *Spartina*. America, and especially North America, is the headquarters of the genus. Two species are frequent on the Atlantic seaboard. One of these, *Spartina alterniflora* (or *glabra*), the Salt Thatch of New England shores, is a tall grass from 4-6 ft. high, occupying positions on the muds from the high-water mark of ordinary tides to about half tide, and frequent as a narrow fringe on the edge of the marsh away from the land, and along the creeks. A second species on these marshes is *S. patens*, or Fox Grass. This occurs at a higher level than the preceding form, nearer to the back of the marsh. It is an important component of what is called the marsh hay zone. It is cut for hay and exploited in other ways. An inland species is *S. michauxiana*, known as Slough Grass. It is a freshwater plant, and was at one time used in the manufacture of low-grade paper. Another American species is *S. juncea*.

In Europe there is one indigenous species, *Spartina stricta*, known for 300 years in south and south-east England, in France, Portugal and Morocco, as well as in the Mediterranean at the head of the Adriatic. It is a member of the salt marsh formation, a stiff scrubby grass, patchy in distribution, not exceeding 1 to 1½ ft. high in England, and of little importance. In southern latitudes it grows to a greater height (2 ft.) and forms extensive, pure stands—as on the Comporta marsh in South Portugal, where it covers several square miles.

Of the American species, two have found their way to Europe, *S. juncea* to the Mediterranean, and *S. alterniflora* to Southampton (record 1829), and to the southern extremity of the Bay of Biscay at Bayonne (River Adour), where it was reported in 1807, and at the Spanish frontier at Hendaye-Fuenterrabia on the River Bidassoa. This appearance of *S. alterniflora* at the European stations was commented on by A. De Candolle in his *Géographie Botanique* (1855) and attributed to shipping from America.

When the new form, *Spartina Townsendii*, was recognized at Southampton in 1880, and its counterpart (named *S. Neyrautii*) at Fuenterrabia in 1894, the only points at which *S. stricta* and *S. alterniflora* are known to occur together, the hypothesis that the new form was a natural hybrid of these two was widely accepted, though it was not then, nor has it since been, proved. Be this as it may, *S. Townsendii*, which has been discovered nowhere else in the world, except at the two points of its supposed creation and those to which it has spread since, is making a wonderful record for itself as a pioneer colonist on soft muddy, tidal flats. Already many scores of square miles are thus occupied, and by the middle of the present century there are likely to be hundreds. In the long run it seems destined to occupy all the available coastal mud in the temperate zones of both the northern and southern hemispheres.

Entry and Establishment.—The mode of entry and establishment of *Spartina Townsendii* into a new locality is much the same in all cases. Seeds, or it may be fragments of runners, find their way into an estuary in the tidal drift and effect an anchorage at some spot. Suppose a single seed to have germinated on the upper muds, just below the strip of marginal saltings which is covered by the higher tides only—a very usual position. In its first season, a plant will arise a few inches in diameter and 10–12 in. high, attached to the mud by a tassel of deep penetrating roots, and forming at the surface a circlet of short branched feeding roots. Just below the surface level the plant tillers, *i.e.*, forms a number of stout buds, some of which grow erect into leafy branches, whilst others creep horizontally in the mud, sending up, in the second year, numerous leafy shoots. In this way by the second summer the patch will be a foot across, and by the third perhaps a yard. The erect shoots are closely crowded, reaching a height of 2 ft. 6 in. and, by the third year, it will be covered with finger-like, divided, flowering spikes. If no seed ripens the peripheral spread by tillering will continue indefinitely. Usually, however, seeds ripen and are scattered—in some years much more freely than in others; they drift and, becoming anchored near by, give rise to hundreds of tufts. These tufts will all expand in the manner indicated above, and, ultimately making contact, they will convert the mud flat into a continuous *Spartina* meadow, save for a few narrow creeks which the ebb and flow of the tide keeps open.

From the stage of a few scattered hummocks to continuous meadow is the work of relatively few years—15 to 20 usually

suffice. Thus, the locality at the mouth of the Vire, near Carentan in Normandy, contained a few scattered tufts in 1906. Seventeen years later a block of four square miles was fully meadowed. In Holes Bay, Poole Harbour, an interval of 18 years (1906–24) produced a like result.

The phenomenon of spread is to be seen to-day in full activity, and on the largest scale, on the north side of the Seine estuary, a few miles east of Havre, over against the medieval town of Harfleur. The sight presented there is probably the most remarkable of its kind in the world to-day.

Nor does *Spartina* confine its attention to unoccupied muds. It can invade and overrun the already settled turf of saltings which lies between its zone of establishment and the margin of the estuary. This it does by advancing up the little creeks which traverse these saltings and then pushing its rhizomes horizontally six or eight inches below the established vegetation. Here these rhizomes form a plexus from which aerial shoots are pushed up right through the turf, whilst its roots everywhere descend into the mud beneath. Overshadowed above, extermination of the previous turfy vegetation follows rapidly. It is very rare to find any plant which can compete with so crafty an invader.

A Mud Binder.—An immediate effect of the occupation of a mud flat by *Spartina* is the raising of the level by silting. Mobile mud and other drift is held, and the vegetation as a whole rises. The mud occupied is also bound, so that where previously a man walking would sink to the knees or waist, he can now go without inconvenience.

The change in scenic effect on bare muds is profound. To what had been a boundless mire, there has succeeded a covering of tender green taking wonderful tints from sun and sky. The meanest place is thus ennobled. The effect on the fauna is no less striking, but the matter cannot be pursued here. The haulms remain on the roots right through the winter until April, when they come away, to be replaced by new growth two months later.

In certain exposures, the rise of a *Spartina* bed brings about its own destruction by wave erosion. This is liable to happen where isolated banks far from the shore have been colonized and the level raised. Such banks invite wave impact which may wash the mud away from the edge, which then forms a disrooted fringe tossed this way and that. Eventually this mat separates and the waves cut further into the field, driving a gulley right through. Once a throughway has been established, the scour

cuts back the flanks right and left and the whole field may be destroyed. In sheltered arms and bays there is no such liability, and, if watch be kept on exposed places, the danger can be averted by the timely erection of sheltering hurdles or the like.

Spartina is thus a natural and active reclainer of muddy foreshores and, wherever the climate is not too extreme, it will doubtless be used all over the world to pave the way for making land. Already quantities of cuttings have been exported—in Europe to Ireland, Holland and Germany, and overseas to the Antipodes and elsewhere. Of the Dutch results some account is given in a later paragraph.

Another purpose *Spartina* seems fitted to fulfil—that of protecting banks and seawalls from scour and erosion by raising and holding the mud in front. Many owners of land fronting on tidal waters are experimenting with it in this country with this object in view, and their results should contribute materially to its further exploitation.

As Feed for Stock.—In another direction, there are also great possibilities. Anyone who has knowledge of farm practice adjacent to a *Spartina* area, such as Poole Harbour, is well aware that all farm animals eat the grass greedily, even going down to the meadows to graze as the tide runs off. In this they are all alike—cattle, pigs, sheep, goats, horses, donkeys and rabbits. Farmers feed the grass to stock either fresh or as hay, and with the best results. Remaining on its roots through the winter, *Spartina* is convenient as a reserve feed and one that can be cut as required.

It is in this direction that the recent investigations carried out by the East Anglian Institute of Agriculture at Chelmsford are likely to be of special value. The staff of this well-equipped Institute have had the happy inspiration that *Spartina* might be the very plant for which the Essex marshes have been waiting, and have encouraged local farmers and others interested in the tidal marshes to make numerous experimental plantings. The idea is to see how this plant will mingle with the other marsh herbage, supplementing, or even replacing it. By means of this pioneer work, under the guidance of experts in the practical field, a technique will be elaborated. It must not be forgotten that the cultivation of *Spartina* as a farm crop (for that is what it comes to) has never previously been attempted. Once upon a time wheat, maize and potatoes were new things, their place in agriculture was only gradually discovered, and still there remains much to be ascertained.

So it is with *Spartina*. We are at the very beginning of its exploitation as a fodder-grass.

Hand in hand with the introduction of *Spartina* into Essex farms, the Institute are investigating the chemical composition of the plant and are making detailed feeding experiments so that a critical opinion of its value may be possible. Of the preliminary results of these investigations some account will be given in the next issue of this JOURNAL.

The immediate practical matters for decision are :—

- (1) How best to introduce and grow *Spartina* in the Essex marshes with the object of improving the available food for stock.
- (2) How to use it, whether by grazing in the open, or as hay or silage. The times of cutting and how to treat the cut. Whether possibly a part of the rhizomes could be dug or raked out and fed to stock, without injury to the stand.
- (3) The determination of the special value of *Spartina* in feeding; for what kinds of animals and in what combinations.

A proper practice in these matters can be determined only by experience, which needs time. The results at first will be applicable solely to farming in maritime districts. Even by itself, this is no trifling objective, as anyone can realize who has observed the prosperity conferred upon quite limited districts by some single factor, such as rich pasturage. In the case of *Spartina*, growing under *the best natural conditions*, a yield of nearly eight tons of hay to the acre has been recorded.

At a later date, when and if *Spartina* makes good, it should be possible to improve the strain. There are eight or nine species available among the world's *Spartinas*, and some future Biffen, by intercrossing and selection, should be in a position to offer agriculturists strains of *Spartina* suited to different requirements. Then there is the problem (for which many inquiries are received) of a *Spartina* capable of holding its own away from salt water.

Eight years ago, I suggested that what was required was a *Spartina* Institute to investigate fully all matters relevant to this remarkable plant. The East Anglian Institute of Agriculture is rapidly bringing this idea into the realm of accomplished fact.

Other Uses.—In addition to the fixing and raising of tidal muds for security and reclamation, and to its introduction as

a component of marsh herbage for feeding purposes, there exist other possible lines of exploitation.

During the war, experiments in paper-making were made, especially at the mills of Messrs. Thomas & Green at Wooburn, Bucks, where the late Mr. Roland Green took a great interest in the matter. The dried *Spartina* contains 40 per cent. of fibre, and a good deal was learnt as to methods of harvesting and cleaning the grass. Its chief defect, as a raw material for the manufacture of fine paper, was the great expense of bleaching the pulp by current methods. Personally, I think its use for paper-making is unimportant in comparison with the primary uses indicated above. The matter may well rest until much larger areas become occupied than at present, and the paper trade finds itself in need of a new raw material.

Other applications the future may discover, more particularly in the way of chemical exploitation, but these at present have no interest for agriculture.

Botanical Desiderata.—In the purely botanical field, we need to know much more about *Spartina* than we do at present. Especially are we ignorant of its genetical status. Its origin is unknown, and experiments in crossing its supposed parents (*S. alterniflora* and *S. stricta*), by growing them together, have, from a variety of accidents, so far led to no result. If *S. Townsendii* is a hybrid, it is remarkable that no segregates should have been discovered during the 50 years that have elapsed since the original record.

A striking feature of *S. Townsendii* is its long period of flowering—alike in the English and the French Channel stations. Beginning in late July and August and culminating in September, flowering is prolonged to the end of December, whilst as late as February and March occasional spikes unfold their flowers.

In southern England, the seed harvest is to be expected in November and December, the actual ripening of the grain (when it separates from the spikes) being spread over a period of weeks. The seed harvest varies from year to year, both in abundance and in viability. The ripe spikes are recognized by the whitening of the uppermost sheathing leaf and are picked by hand. In most years, less than half the grains are fertile—sometimes barely a quarter.

As with other plants, there come to *Spartina* occasional bumper years with maximum yield, and these no doubt hold the greatest possibilities of future spread. Systematic records

on these matters, and of the approach to acclimatization of the plant in new stations, are much required.

Planting.—For export to a distance, seed has obvious advantages over cuttings, though for propagation in this country and the adjacent shores of Europe, the planting of rooted cuttings taken between January and March is the surest means. Mr. Bob Cartridge, of Poole, a local fisherman, has for years made a special study of *Spartina*, with the idea of supplying the requirements of correspondents. He has, for many years, attended to these export requirements, and his long practical experience has taught him just which plants are best for the purpose, and the necessary precautions in packing the consignments.

Where seed is used, each seed should be pushed into the mud just deep enough to ensure its not being washed away by the tide; subject to this, the shallower it is laid the better. Where filamentous green algæ clothe the surface of the mud, it is generally sufficient to place the seeds underneath this surface mulch.

Cuttings are laid into nicks in the mud cut with one stroke of the spade and closed up by treading. The rhizomes should not be more than 2-3 in. from the surface, the leaves of course projecting.

The proper position for planting is on the muds just below the marginal strip of salt marsh turf. The cuttings should be ranged in rows parallel to the shore and, for small plantations, not more than 3 ft. apart. In the successive rows, the plants should alternate, with 3 ft. between the rows. Five thousand plants would suffice to cover an acre, though in practice *Spartina* is planted in much smaller blocks—the gaps being filled in by natural spread. By the orderly arranging of the original plants the progress of the plantation can be judged at a glance, and fresh plants set out as circumstances demand.

***Spartina* in Holland.**—Notwithstanding that a number of small trials of *Spartina* had been started in this country, it was soon apparent that the shores of England (having regard also to England's economic position) did not offer full scope for a major demonstration of the capacities of *Spartina Townsendii* as a binder of tidal mud. It was, therefore, with satisfaction, that I heard from my friend, Dr. J. P. Lotsy, the well-known Dutch botanist, that he was attracted by the idea that the plant might be of use to the Dutch Government in connexion with the reclamation of muds and poldering* operations which

* Reclaiming land from sea or tidal river.

are always in progress in Holland. In November, 1923, we visited Poole Harbour and Southampton Water together, with the outcome that a trial batch of 50 *Spartina* cuttings went to Holland in May, 1924. These cuttings were planted in the tidal mud of the Sloe, about one mile south of the railway embankment which joins the islands of Walcheren and S. Beveland. In subsequent years, much larger consignments were sent to Holland from Poole, the material being collected and packed by Mr. Bob Cartridge.

In Holland, through the good offices of Dr. Lotsy, the development of the *Spartina* plantations was placed by the Government in the hands of Mr. A. G. Verhoeven, of Middelburg, Maritime Engineer in charge of the Domeines in Zeeland (reclamation works, etc.). Under his direction, numerous experimental plantings, some of great extent, have been made along the Scheldt and elsewhere, and as these had, this year, reached a stage of great interest, Dr. Lotsy was good enough to suggest that I should go over and see for myself what was being done. The visit was arranged for the early part of September, and, in company with Dr. Lotsy and Mr. Verhoeven, I was able to inspect a number of the plantings—a privilege which I very much appreciated.

The present notice is confined to a few general observations arising out of what I saw at the Sloe plantations, near Middelburg, and at the Kreekrak Polder (also in the Scheldt) a few miles south of Bergen op Zoom. These, no doubt, are typical of the whole.

It may be remarked here that *Spartina* has been handled in Holland as a plant which might profoundly modify current practice in poldering, and, as confidence grew with experience, the plantations, which from the first had been laid out on ground suitable for reclamation, have been gradually extended with that object. In other words, without superfluous experiments, the plant was set directly to its allotted task. The cultivations, which owe everything to the bold strategy, judgment and technique of Mr. Verhoeven, are now in a most thriving and promising state, and from a spectacular point of view without parallel in their field.

As a point of detail, it appears to me highly desirable that the present state of some of these plantations, showing diagrammatically the unit clumps, should be placed on record by means of aerial photographs; in a few years as they meadow this phase will pass away.

All plantations were started by dibbling into the mud small offsets in rows. In later years, as these expanded, the established plants became the source of fresh "inoculations," and as plants came into seed-bearing in the second and third year, and seedlings arose spontaneously, these seedlings were transplanted to extend the lines. As a rule, plantations were started in front of the dyke in lines at right angles thereto; or isolated banks of mud (islands) were treated in the same way; whilst from year to year the lines were extended on the virgin mud.

The largest and most spectacular plantation, and also the most accessible, is the one established in the Sloe immediately south of the railway embankment, and extending out into the Sloe a distance of some hundreds of yards. As the total area of this plantation alone is 1 sq. kilometre, the grandeur of the scale of Mr. Verhoeven's operations will be realized. Seen from the embankment the rows of circular tufts of *Spartina* seem to fill the whole horizon. Such a view, taken from the east end of the Sloedam looking south-west, is given in Fig. 3. Many of the tufts here, dating from 1925, are 6 ft. to 7 ft. in diameter, whilst in the foreground are numerous seedlings. A second view, taken some 60 yards east of the above, and looking south, is given in Fig. 4. Here also, on the right, are plenty of one-year seedlings. A third view (Fig. 5) is taken across the middle of this plantation, where the tufts are younger and the lines do not reach so far out. As this plantation will begin to meadow (i.e., make contact between the units) in 1929, and should have meadowed completely by 1930, it is taking the Dutch five years to accomplish what nature, unaided, requires from 15 to 20 years to do.

Thus, to take the case of Holes Bay, Poole Harbour. A photograph by Mr. R. V. Sherring, taken in 1912 (Fig. 1), shows our plant actively invading the muds; 13 years later, I took another photograph at the same spot when meadowing was complete (Fig. 2). The period for the whole phenomenon may be computed at about 18 years.

In the mouth of the Vire (Baie des Veys), Normandy, MM. Corbière and Chevalier discerned "a few plants" in 1906, whilst in 1921 there was a meadowed block of about 4 sq. miles of *Spartina*—15 years. Spread is no doubt more rapid in such a warmer latitude; still, the Dutch get credit for having by their methodical procedure reduced the period for meadowing from 15 years to five—a matter of cardinal importance

where *Spartina* planting is destined to accelerate actual reclamation or poldering.

A second thriving plantation occupies a mud island to the south of the Sloedam ; whilst yet another island further south, on the east side of the Sloe, is also the scene of active operations. This locality is of special interest from the fact that here was planted the pioneer row of offsets in 1924. The units now average about 10 ft. in diameter, and, being planted at 3 metre intervals, are practically in contact. A view of part of this historic line is given in Fig. 6. It shows well the way the mud rises to the tufts—the furrows between depend on the scour of the tide running through the row. In the case of more extensive plantings the rise of mud (accretion by silting) is uniform from tuft to tuft. Mr. Verhoeven takes a very favourable view of the powers of *Spartina* to hold silt, and proved to me conclusively in several localities a rise of 18 in., 20 in., or even more, in two or three years. These are very remarkable figures, and indicate that *Spartina* will have an important application in preparing the way for dyking.

The same picture (Fig. 6) shows the establishment of many seedlings under the shelter of the *Spartinas*, and, taken in connexion with what was seen at the Kreekrak Plantation, it appears that once *Spartina* has got a footing on soft virgin mud, other halophytes (esp. *Salicornia* and *Aster*) appear spontaneously from scattered seed. If such plants can follow up *Spartina* so quickly in mud, which though sheltered is still highly viscous, is it not probable that *Spartina*, itself, owes its capacity to subjugate such places not so much to any mysterious power to live in a medium to which other halophytes are intolerant, but rather to the rapidity with which it penetrates the mobile mud zone and gets an anchorage with its deep, searching roots ?

In the Kreekrak locality, *Spartina* had been put to a further severe test. When the dyke closing off an adjacent polder of recent construction was built, the method adopted was as follows : Fronting the site of the proposed dyke, the tide was excluded by a temporary enclosure, and when the mud within had dried sufficiently to be dug it was used to build the dyke. The deep holes and trenches thus resulting are often hard to fill, and *Spartina* planted for this purpose is reported to have accelerated the filling up operation in unprecedented fashion. Our plant is to be put to further tests of a novel character, but as these are not yet in operation it would be premature to pursue the matter here.



FIG. 1.—Early *Spartina* stage in Holes Bay, Poole Harbour, 1911.



FIG. 2.—The same view as in Fig. 1. Taken in 1924, after meadowing.

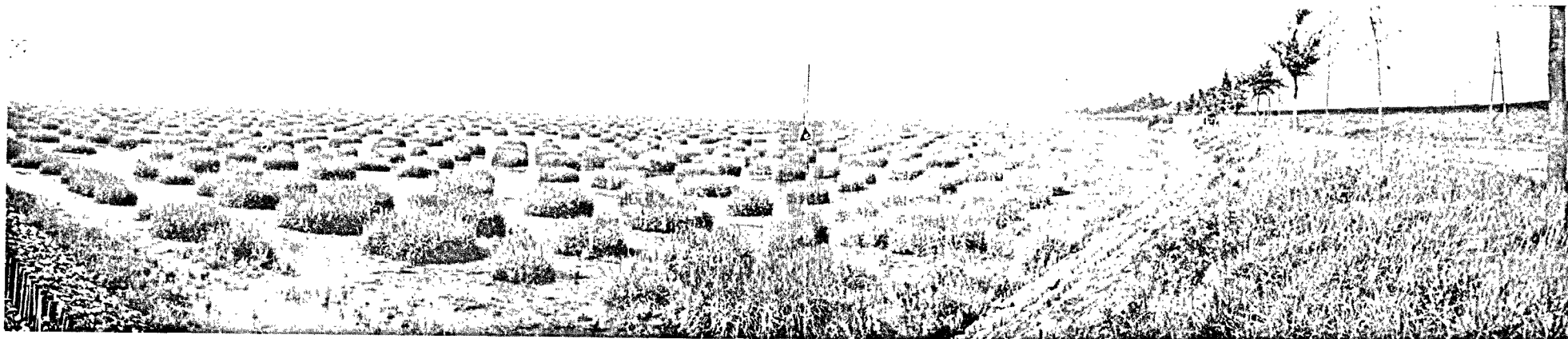


FIG. 3.—The Sloedam (Zeeland, Holland) Spartina Plantation, from E. end of embankment, looking S.W., in its 4th year (1928). Unit plants about 7 ft. in diameter. Seedling Spartinas in foreground, left.

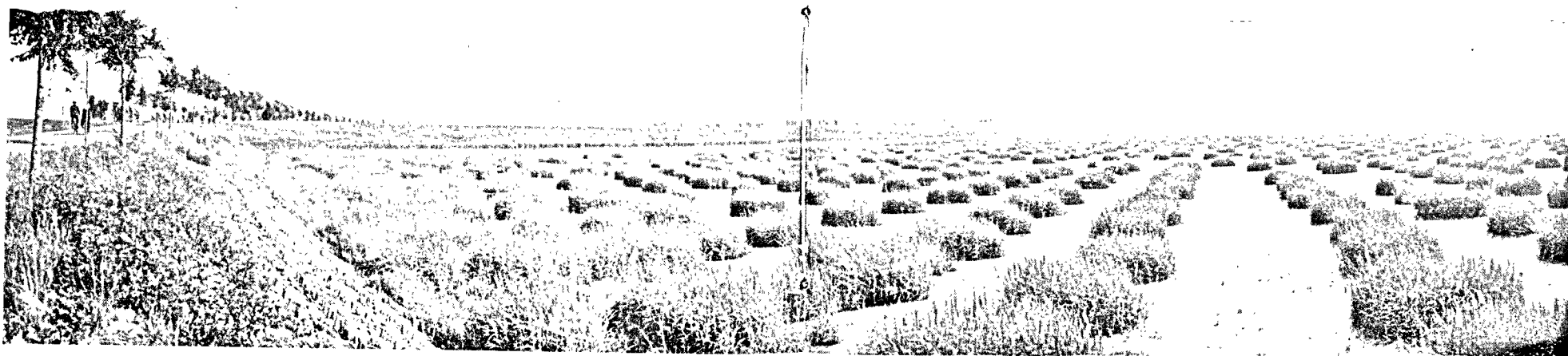


FIG. 4.—The same plantation from point on embankment further W., looking S. Note seedlings arising between the tufts on the right.



FIG. 5.—Younger portion of same plantation in 3rd year, the lines not reaching so far out. Standing by hedge, Dr. J. P. Lotsy ; and by edge of bank, the Engineer, Mr. A. G. Verhoeven.

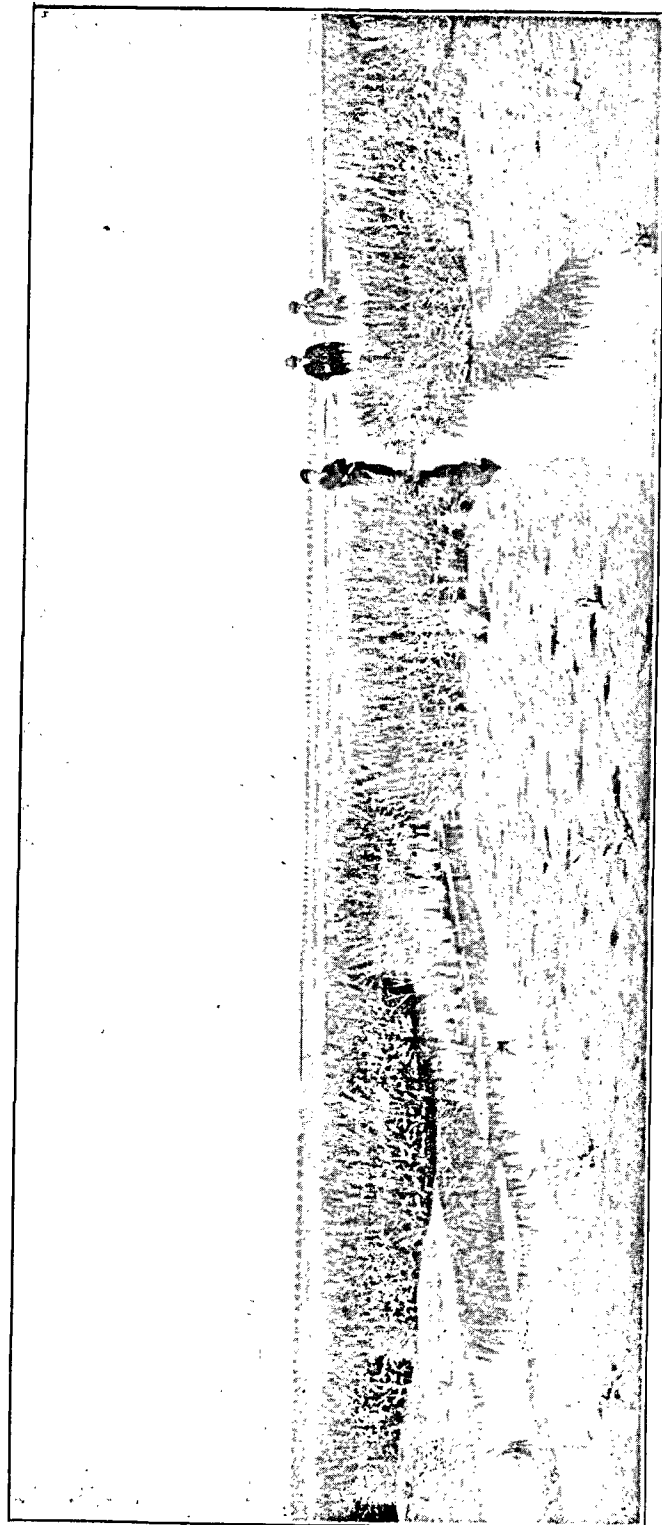


FIG. 6.—Portion of first line of *Spartina* plants, about 1 mile S. of the Sloedam, Zeeland, Holland. Planted as offsets from Poole in 1924, the tufts are now (1928) about 10 ft. in diameter. Note especially (on the left) the mud rising to the tufts, and other halophytes (*Salicornia*, etc.) growing under the shelter of the *Spartinas*. Central figure, Mr. Verhoeven, with Dr. Lotsy to the right.

In the development of the different plantations, varying spacing of the unit sets has been tried, with the result that a distance apart of 3 metres (both ways) has been found to give the best results. It has also been found that one-year seedlings transplanted give better results than vegetative sets.

The points wherein *Spartina* proves satisfactory include easy settlement in the very soft muds; rapid expansion of units; conspicuous flowering from the second year with good production of viable seed. The haulms attain a height greater than I had ever seen, especially at the Kreekrak locality, where they exceeded a metre. Mr. Verhoeven appeared well satisfied with the silting powers of the plant, and on a conservative estimate expected, with its assistance, to accelerate poldering by 10 years. That is to say, ground which, left to the play of natural agencies would be ready to dyke in n years, should now be ready in $n-10$ years. Such acceleration being cumulative, the next polder outside should be ready 20, and the third, 30 years earlier.

Much more could be added; but enough has been said to justify the hope that at no distant date the first *Spartina*-polder may come into being. Personally, I have never doubted that this plant would make good as a reclaiming agent, given a proper trial; but in Mr. Verhoeven's hands it has eclipsed the highest expectations. The matter is important, not only for the future of Holland, but for all countries where land can be built up out of the sea. For the first time it is being demonstrated, and under the most exacting conditions, that a preliminary treatment of bottomless muds by planting is feasible and likely to advance to a notable extent the date at which reclamation will become possible and the ground can be handed over to the farmer.

SUPER-ENGLISH OR BABY BEEF

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DURING the past six years, "baby beef" has been produced from most of the bull calves born in the dairy shorthorn herd maintained on the farm attached to the Herts Institute of Agriculture. It was felt that the subject of "baby beef" production, so long discussed in vague terms, merited further investigation; and that the rearing of well-bred dairy calves for this purpose would give results of special significance. Apart from the broad principles involved, these calves, which are really an unwanted by-product where the main object in view is milk production, have served to provide information on their suitability for conversion into a useful product. Preliminary results, published in this JOURNAL in December, 1925, indicated that, even with this class of stock, it was possible to produce well-finished beasts, weighing 9 cwt., at 16 months old. Further, at the prices realized, there was a small margin of profit.

From the experience gained it has been possible to arrive at certain tentative conclusions with regard to the feeding of the animals throughout their short lives, and to correlate the feeding with age and weight. These particulars, as well as a summary of the system of feeding and the cost of production, are set out in detail in Table I. It is proposed first to examine these figures in some detail and thereafter to discuss the cost of production, the returns, and to conclude with a passing reference to the important question of marketing.

TABLE I.—"SUPER" ENGLISH BEEF.

(1) Mths.	(2) Age wt.	(3) Suggested standards		(4) Rations	(5) Cost of ration per day	(6) Total quantity of food in successive periods			
		Max dry mtr.	Min. Stretch eqv. Dig. prot.			Period Mths.	Con. lb.	Hay lb.	Roots lb.
1	1	lb.	lb.	Milk 10 lb. Oats (with a little fish meal) 1 "	13-1d.	0-2	60		
3	2	2	2½	Septd. milk 10 lb. Oats 1 " Linseed cake 1 " Hay 3 "	6-3d.	2-4 (2)	120	180	
5	3	5	3½	Septd. milk 5 lb. (or linsd. cake ¾ ") Oats & lin. cake 3 " Hay 4½ " Roots 10 "	7-4d.	4-6 (2)	180	270	600
		8	5						

(1) Mths.	(2) Age wt.	(3) Suggested standards		(4) Rations	(5) Cost of ration per day	(6) Total quantity of food in successive periods			
		Max dry mtr.	Min. Stretch eqv. Dig. prot.			Period Mths.	Con. lb.	Hay lb.	Roots lb.
7	4	10	5½	Oats & lin. cake 3 lb. Maize gluten feed 1 " Hay 6 " Roots 10 "	7-5d.	6-8 (2)	240	360	600
9	5	13	6½	As above 4 lb. Middlings 1 " Hay 7½ " Roots 15 "	9-6d.	8-10 (2)	300	450	900
11	6	15½	8	As above 5 lb. Palm kernel cake 1 " Hay 9 " Roots 20 "	11-7d.	10-12 (2)	360	540	1200
13	7	17½	9½	As above 6 lb. Wheat 1 " Hay 10 " Roots 20 "	13-2d.	12-13½ (1½)	315	450	900

In this portion of the table, i.e., from the age of 1 to 13 months or from a weight of 1 to 7 cwt., it is assumed that the animal puts on weight at the average rate of 1.84 lb. per day.

14½	8	18½	10½	As above 7 lb. Barley 1 " Hay 9 " Roots 30 "		13½-15 (1½)	360	405	1350
							1815	2520	5100
16	9	19	11	As above 8 lb. Hay 8 " Roots 40 "		15-16½ (1½)	360	350	1800
							2175	2895	6750
17½	10			As above 8 lb. Maize 1 " Hay 7 " Roots 40 "		16½-18 (1½)	405	315	1800
							2565	3225	8550
19	11	19	12	As above 9 lb. Maize 1 " Hay 6 " Roots 40 "		18-19 (1)	300	180	1200
							3000	3510	10350

In this portion of the table, i.e., from the age of 13 months to 19 months, or from a weight of 7 to 11 cwt., it is assumed that the animal puts on weight at the average rate of 2.45 lb. per day.

The average rate of growth for the two periods and for the whole period is as follows:—

	Age		Weight		Live weight increase	
	Months	cwt.	Months	cwt.	lb.	lb.
1st period	1-13	1-7	1-13	1-7	1-84	
2nd period	13-19	7-11	13-19	7-11	2-45	
Whole period	1-19	1-11	1-19	1-11	1-9	

Age and Weight.—In columns 1 and 2 are set out the anticipated weights of the animals at various ages. These figures have been based on an expected weight of 9 cwt. at 16 months of age, comprising a live-weight gain of 1.84 lb. per day from birth to 13 months of age, and a corresponding gain of 2.45 lb. per day from 13 to 19 months.

With dairy-bred calves, a weight of 9 cwt. at 16 months of age has been so consistently obtained with continuous indoor feeding that it is assumed there is no great difficulty in securing such a result. It is not claimed that at each stage in the animal's life a rate of growth exactly corresponding to these figures will be obtained, but slower progress at one period should be balanced with more rapid growth at another. Under the system of feeding and management at this Institute it has been found that growth was more rapid after the age of 12 months than before, and that the most difficult period of all occurred, consistently, between the ages of 1 and 6 months.

Feeding Standards and Rations.—The feeding standards set out in column 3 were compiled after a consideration of the recommendations of Kellner, Armsby, and other American workers, and Wood. Practical experience confirms the soundness of these standards as a guide to making-up the rations (column 4). It has, however, seemed desirable to look on the figures for dry matter as maxima, and those for protein and starch equivalent as minima. The main points which call for comment on the selection of feeding stuffs and the quantity fed may be summarized as follows:—

- (1) The calf is reared on the minimum quantity of whole milk (25-30 gallons), replaced gradually after one month by separated milk and crushed oats, to which a very small quantity of fish meal is added.
- (2) The oats are later supplemented with linseed cake till half and half are being used. By this time, the concentrates have assumed the nature of a "balanced" dairy ration.
- (3) Further additions are made to the concentrated food, retaining the balance as for dairy cows, till the animal is about 12 months old. The quantity fed is almost consistently at the rate of 1 lb. of concentrates per cwt. live weight.
- (4) After the animal is a year old, the concentrates continue to be fed at the rate approx. of 1 lb. per cwt. live weight, but the ration is made more starchy by the addition of foods like wheat, barley, or maize.
- (5) From an early age hay is fed at the rate of $1\frac{1}{2}$ lb. per cwt. live weight up to a maximum of 10 lb., after which it is gradually reduced. At the same time roots are introduced in increasing quantities.

Thus, the feeding of young cattle indoors is assisted by rules corresponding to those used in the feeding of dairy cows (so many lb. of concentrates per gallon of milk produced, but limiting the total quantity of dry matter fed). There are, however, no means of measuring daily the production of fattening cattle as is done in milk recording. It is necessary to assume a figure, and check it at intervals by the weigh-bridge or by eye. Without claiming precise accuracy for the recommendations, it may be stated that they do actually give the feeder a useful guide on which he can safely base his feeding. As is the case with all such general standards, there remains wide scope for the exercise of judgment in the daily management of the stock.

Limitation of Bulk.—In recent years, great emphasis has been placed on the limitation of the total weight of dry matter fed to the dairy cow. The limit for the cow of average size is considered to be between 30 and 36 lb. of dry matter daily. Making this assumption, the problem of feeding a high-yielding cow becomes one of providing sufficient matter and energy (which may be measured in terms of starch equivalent) within the limit of dry matter.

In a recent article,* J. A. Murray has adduced evidence that the capacity of male fattening cattle has been greatly over-estimated, and that it is far below that of cows. He concludes that "the capacity of steers is subject to a nearly uniform acceleration of 40 lb. per month, per month from birth up to the age of 12 or 14 months, after which it remains approximately constant." "The upper limit was about 18 lb. total dry matter per head per day."

Such a conclusion, if it be correct, is of the utmost importance in the fattening of steers, whether as "baby beef" or more mature animals. The starch equivalent per 100 lb. *dry matter* in a mixture of the best concentrates usually fed to cattle is about 80. The maximum consumption of starch equivalent according to Murray's figure of 18 lb. dry matter is therefore 14.4 when the animal is entirely on concentrates; if a portion of the ration is of hay or straw the figure is lower. The maintenance requirement of a full-grown 9 cwt. steer *at rest* is, according to Kellner, 6 lb. starch equivalent. For an animal moving about, it is probably much higher, so that the surplus starch equivalent available for production is not likely to exceed 7 lb. This would provide for a maximum

* *Journal of Agricultural Science*, October, 1926: The Food Capacity of Cattle.

live weight increase of about $1\frac{1}{2}$ to 2 lb. daily in the case of a mature animal; of about 2 to $2\frac{1}{2}$ lb. for a 2-year-old; or of about $2\frac{1}{2}$ to 3 lb. for a year-old animal. Such estimates are certainly close to figures actually obtained by feeders.

In Table II are set out a few typical foods, together with their starch equivalent per 100 lb. of *dry matter*.

Food	TABLE II.		
	Dry matter Per cent.	Starch equivalent Per cent.	Starch equivalent per 100 lb. dry matter
Milk	12	16.8	140
Linseed (whole)	93	120	130
Maize germ meal	89	85	95
Maize meal	87	81	93
Barley	85	71	84
Linseed cake	89	74	83
Palm kernel meal	90	71	79
Fine middlings	87	69	79
Week-old pasture grass (Woodman)			62 to 74
Oats	87	60	69
Swedes	12	7	58
Mangolds	12	6.5	54
Bran	87	42	48
Cotton cake	88	40	45
Silage (oat and tare)	25	11	44
Hay (good)	86	31	36
Oat straw	86	17	20

Comments on this table are hardly necessary, but it may be pointed out that cotton cake, very good hay, and silage are about equally efficient in the provision of starch equivalent per lb. of dry matter, that young grass takes a place among the better concentrates, and that the very best concentrates fall far below whole milk.

Turning to the columns in Table I, setting out the suggested standards, it will be seen that, at the beginning of the calf's life, the starch equivalent necessary for maintenance and rapid growth actually exceeds the (assumed) dry matter capacity of the animal's stomach. Accordingly, only foods containing much fat can really lead to satisfactory growth at this stage. Unfortunately, with the exception of milk, few oily foods are satisfactory for the young calf, so that this, in the absence of milk, is one of the critical stages in the production of baby beef.

Later on, there is a margin between dry matter and starch equivalent, a margin which is at its maximum between 7 and 14 months. After the latter age (assuming the food capacity has reached its maximum), owing to the higher dry matter content of the live weight increase as the animal grows older, the difficulty of supplying sufficient starch equivalent gradually

increases, and it becomes necessary to limit bulky foods such as hay and to increase foods with a high starch equivalent per lb. of dry matter.

Costs and Returns.—The points mentioned in the preceding paragraph have an important bearing on the question of costs and returns. Early in the animal's life, the live weight increase is 75 per cent. water, and can therefore be produced at a low cost in starch equivalent. In the case of the mature fattening animal the live weight increase is about 30 per cent. water and nearly four-fifths of the rest may be fat. Accordingly, this increase is produced at a high cost in starch equivalent.

In column 5 of Table I, the cost of each ration is shown. An examination of these figures brings out very strikingly how, after the milk period is over, the cost of feeding per day gradually increases. In fact, if at 5 months of age an increase of 2 lb. per day is achievable, the cost of food per lb. live weight increase is only $3\frac{3}{4}$ d., whereas, at from 14-18 months, a similar daily increase is obtained at more than double this cost. It is, therefore, financially a sound policy to "do" the animals as well as possible in the early months, or, in other words, to find ways and means of getting the maximum possible increase in weight in the first few months of the animal's life. (The difficulty at this stage is to find substitutes for milk which will supply sufficient starch equivalent without exceeding the capacity of the animal's stomach).

In the summary of costs, given in Table III, various assumptions have been made. The value given to the calf at birth is approximately 32s., and of the milk consumed (whole and separated) 45s. Labour is put at from £3 15s. 0d. to £4 10s. 0d. per beast, or 1s. 1d. per week, and it should be borne in mind that no credit has been taken for manurial residues. On the income side, certain values have been put on the foods consumed: modifications of these to suit local circumstances may make very substantial differences to the account. On the basis of these assumptions, a 9-cwt. beast, fed as suggested and kept indoors throughout its life, has been produced at a cost of 55s. per live cwt., and an 11-cwt. beast would cost 57s. per live cwt. It is interesting to note here that the average cost of all the "baby beef" animals produced at this Institute during the years 1923-26* is 57s.

*See Bulletin No. 4: A Review of Four Years' Cost Accounts, issued by the Institute.

TABLE III.—SUMMARY OF COSTS.

1. COST OF SOLID FOOD :—

(a) To 9 cwt. Live Weight	Tons	Price	Cost
		£ s. d.	£ s. d.
Concentrates (2,175 lb.) ..	1	10 0 0	10 0 0
Hay (2,895 lb.) ..	1½	3 10 0	4 7 6
Roots (6,750 lb.) ..	3	18 0	2 14 0
			£17 1 6

(b) To 11 cwt. Live Weight

	Tons	Price	Cost
		£ s. d.	£ s. d.
Concentrates (3,000 lb.) ..	1½	10 0 0	13 6 8
Hay (3,510 lb.) ..	1½	3 10 0	5 5 0
Roots (10,350 lb.) ..	4½	18 0	4 1 0
			£22 12 8

2. COST OF PRODUCTION PER CWT. LIVE WEIGHT* :—

Items of cost	To 9 cwt.	to 11 cwt.
	£ s. d.	£ s. d.
Solid food	1 18 0	2 1 6
Calf	3 6	3 0
Milk	5 0	4 0
Labour	8 6	8 6
Cost per cwt. live weight	£2 15 0	£2 17 0

* The customary credit for manurial residues should cover incidental expenses, risks, and insurance.

per cwt., and that, during this same period, the average selling price of the animals was 64s. per live cwt. It is now appropriate to consider whether these costs can be reduced and whether such returns can be maintained.

Reduction in Cost.—At the present time, a cost of 55s. to 57s. per live cwt. makes very little appeal to the farmer. It is small consolation to be told that, even at present selling prices, such production is less unfavourable than the fattening of stores. How, then, can the costs be reduced? Various possibilities may be mentioned.

- (1) Where milk is cheaper, it may be possible to use more, and to make higher gains in live weight in the early life of the animal. There is room for comprehensive experiments on the economics of alternative methods of rearing and feeding cattle during the critical period from birth until 6 months old.
- (2) With animals bred for beef, or with a beef strain on one side, it might be possible to hasten fattening so that 9 cwt. live weight is reached at 15 months of age instead of 16. Alternatively, prime condition might be

secured at a lower age. Every step towards securing the finished article in less time brings about economy in production.

- (3) A most hopeful line of investigation is to secure an advance on the rate of growth of 2 lb. per day. It is the verdict of numberless feeding trials, and of farming practice generally, that yard-fed animals are doing well when they put on 2 lb. per day. Yet it is said that bullocks on grass may give a return up to 4 lb. per day, and that dairy cows can add 2 lb. to their live weight per day, while producing three or more gallons of milk. With the baby beef animals at this Institute, although the average has been 2 lb. per day from birth to slaughter, some of the animals have averaged 3 lb. increase per day for periods extending over several months. Here, then, is a direction in which to promote still earlier maturity, and it is hoped to investigate this aspect of the subject in more detail at an early date.
- (4) The most obvious direction in which to attempt to reduce costs is the substitution of a period of grazing for indoor feeding. Nothing would contribute so much to the success of baby beef production as the ability to utilize the ever-extending areas of grassland in the process. It has not yet been possible to test such a system at this Institute, but efforts are being made to start a comprehensive investigation of the subject in the near future.

Selling Prices.—No one will care to produce an article of special value unless there is a reasonable prospect of selling it at an enhanced price. Here the crucial point with regard to the prospects of baby beef production is reached. Without doubt, well finished baby beef supplies the small and tender joints which the public favour. It is, moreover, a product superior to the best imported beef.

Good-class butchers appear to recognize the position, as higher prices have regularly been offered for the animals produced at this Institute than those current for prime bullocks. It is true that these offers have usually been made subject to a regular supply, and it is just this reservation that makes the position so difficult. A regular supply is beyond the reach of individual farmers, with consequent disappointment and a tendency to look on baby beef production as a non-commercial fad.

Marketing.—Apart from some co-operative effort with regard to marketing, there are two features of the trade which are worth bearing in mind. (1) The best seasons in which to market baby beef are May-July and Christmas. At both of these times, prices are usually in the seller's favour, and the indoor system of feeding lends itself to taking advantage of these market tendencies. In the summer, also, preference is given to animals which are not too fat. (2) It is good advice to sell young fat animals on a dead weight basis if only for the reason that neither butchers nor farmers are quite accustomed to estimating accurately the weight of such cattle.

The future of all beef production in England, however, would appear to depend very largely on the introduction of improved marketing methods. English beef is at present obtained from bulls, cows, and beef animals of all ages: it is a mixture of the best and the worst. As an article of commerce it is, on the average, very second-rate. The tendency is for the lower grades to act as a drag on the better grades. Apart from "Scotch" beef, which has established a reputation for quality and uniformity, and consequently commands a higher price, there is little differentiation between the prices paid for English-fed bullocks. Specialization in the production of quality, outside Scotland, has scarcely begun, and has small chance of success till it is supported by specialized marketing. It is only specialization that opens up any reasonable prospect of competing successfully with standardized imported beef. Such specialization must be comprehensive, including the breeding of better and better cattle, even if this involves some measure of control, earlier and ever earlier maturity, and the final grading and standardization of the carcasses produced. Then it will be possible to advertise special grades of English beef as the best in the world.

It is only reasonable to expect each class of English beef to stand on its own merits. Cow beef will take a position inferior to imported supplies; beef from mature cattle must meet the full force of competition from foreign supplies produced under ranching conditions; but early maturity cattle can defy competition—they should be the monopoly of the home producer.

THE LONG ASHTON TAR-DISTILLATE WASH: FIELD EXPERIMENTS, 1927-28

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and

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Previous field trials with tar-distillate washes, by the Long Ashton Research Station, had dealt solely with commercial brands of these washes, and it had been realized for some time that standardization of tar-distillate washes was much to be desired from all points of view.

Mr. L. E. Smith⁹ * carried out investigations at the Station in connexion with tar-distillate spray fluids, with the aid of a grant from the Ministry of Agriculture and Fisheries. The purpose of the work was to investigate the various factors concerned in the preparation of clear, concentrated tar-oil fluids and of stable, dilute tar-oil emulsions; and to determine to what extent the toxic properties of the fluids could be correlated with various constituents. The latter part of the work was not completed, but considerable advance was made with chemical work in connexion with the behaviour of preparations of the total tar-distillate.

Mr. F. Tutin, Biochemist at the Station, in the course of a study of these washes during 1927, was able to produce a standard wash which, as a result of laboratory tests, gave promise of being superior to any of the commercial brands of tar-distillate washes so far tested. The object of the trials described in this paper was to verify the conclusions arrived at in this manner. This spray was tested against a commercial brand of wash which had, in all previous experiments, given consistently good results.

Mr. F. Tutin's work,¹⁵ referred to above, consisted primarily in the emulsification of the various products present in tar-distillates. Each separate emulsified product was tested on Winter Moth eggs on a considerable scale. The results of these tests showed conclusively that the neutral material boiling from 280° to 360° C. was more effective than a mixture of this product with the "tar acids." The next problem was to find means of emulsifying the "high neutral" product in the absence of "tar acids." This was finally

* These numbers refer to the Bibliography at the end of the article (p. 740).

accomplished by means of two products, viz., two sulphonated oils known as Agral W.B. and Agral A.X. respectively.

The emulsification is effected by dissolving in every 10 parts of the "high neutral" tar-distillate one part of Agral W.B. or A.X. This gives a concentrate which may be finally emulsified by the addition of the required quantity of water and one part of 20 per cent. aqueous caustic soda.

Field Trials with the Long Ashton Spray.—Trials were carried out at three centres in the county of Gloucester, and two washes were tested—the Long Ashton tar-distillate spray and a well-known proprietary brand as a Standard. The special object was to obtain information concerning the effectiveness of these washes for the control of Capsid eggs.

It may not be out of place in this connexion to point out that favourable results have been obtained against Capsid in certain previous trials in the Bristol Province.^{5, 10, 11} In one instance,¹⁰ a commercial control was obtained by the use of a proprietary brand at 10 per cent. strength applied in early March to trees of the variety Newton Wonder. This trial was carried out on the same trees utilized this year at Centre III.

In the 1924-25 trial, referred to above,¹⁰ the fruit from the control trees was so badly marked by Capsid Bug as to be difficult to dispose of, whereas fruit from the sprayed trees, after thinning, obtained a first prize in the barrel section at the Imperial Fruit Show. That such results are by no means usual, may be gathered from a perusal of the literature on the subject and correspondence in fruit journals; and it was for this reason that further work was undertaken at Long Ashton.

Marking.—The system of marking employed was the same as that used in 1925 and 1926. The method, which does not attempt to differentiate more finely than an estimated 10 per cent., is as follows. All the trees in a treatment were inspected as a whole, and each treatment was marked with a number from 0 to 5 according to the following scale:—

0	..	..	..	..	= no pest present
1	..	..	..	..	= pest very slight
2	..	..	..	..	= „ slight
3	..	..	..	..	= „ moderate
4	..	..	..	..	= „ bad
5	..	..	..	..	= „ very bad

In cases of indecision, an intermediate figure was given. All the figures were then doubled; "very bad" thus receiving 10, whilst lesser intensities of attack were allotted corresponding smaller numbers.

Centre I. Cheltenham. Variety of Apple—Newton Wonder (12-year-old trees).

Treatments—(a) *Single sprayings.*

10 per cent. Long Ashton spray—23 trees.	
6 " " " " " " " " " "	10 "
10 " " " " " " " " " "	10 "
6 " " " " " " " " " "	10 "

Date of

Application .. February 8, 1928.

Weather .. Sunny and dry. Practically no rain at night or following day.

(b) *Double sprayings.*

5 per cent. Standard wash followed by 5 per cent. Standard wash.	
5 per cent. Standard wash followed by 10 per cent. Standard wash.	
10 per cent. Standard wash followed by 5 per cent. Standard wash.	
10 trees in each treatment.	

Dates of

Application .. First spraying February 8, 1928.

Second spraying February 22, 1928.

Weather .. Sunny and dry. No rain fell for some days.

(c) *Controls.* Six trees in each control, four times repeated.

Emulsification
of sprays ..

The Standard wash emulsified well. In the case of the Long Ashton spray a considerable amount of the anthracene oils was thrown out. Analysis revealed the fact that this was due to unforeseen quantities of sulphates present in the water used to mix the sprays. This may easily be remedied by increasing the percentage of emulsifier in the spray concentrate. Further comments in connexion with this matter will be found later in this paper. It will suffice to point out here that in spite of the poor emulsion obtained, the results are very gratifying.

The layout of the trial is given in Diagram I, where the arrangement of the blocks of trees is given and the treatment is indicated. The results are also indicated in the diagram by means of different types of shading and also by figures, according to the key attached to the diagram. The layout and results are similarly given for Centre II in Diagram II. The pests present in this trial were Caterpillars and Capsid Bug. Diagram I shows that the intensity of attack of Capsid Bug was rather lower at that end of the trial plot remote from the farm buildings. The results shown in this diagram were obtained on April 23, 1928. A second examination was made on May 7, 1928, and though the damage by the pests was naturally more apparent, the results then obtained were closely in agreement with those given in Diagram I.

DIAGRAM I.

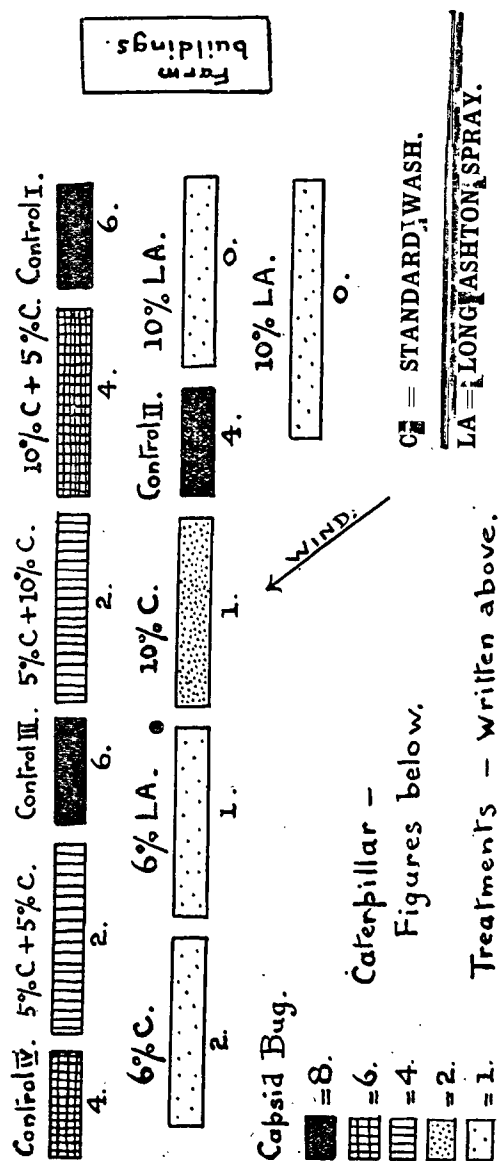
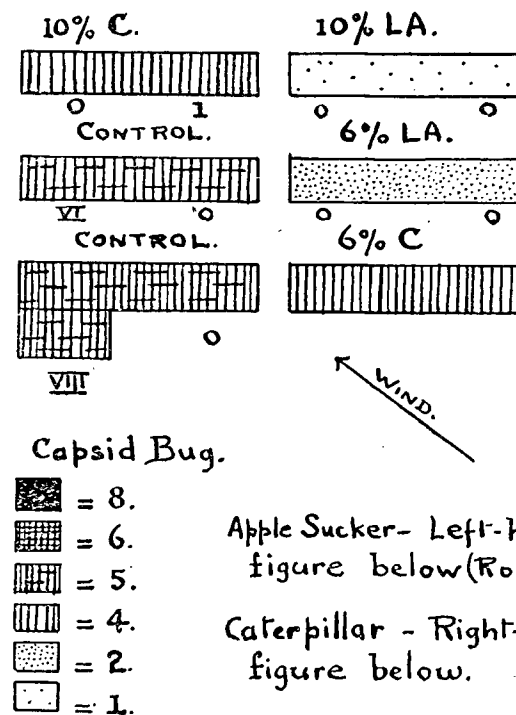


DIAGRAM II.



Treatments above.

C = STANDARD WASH, LA = LONG ASHTON SPRAY.

A third examination was made on June 18, 1928, for fruit markings due to Capsid Bug. On account of frost damage, the crop was poor and very irregular. All the fruit therefore was counted and the percentage of marked fruit determined. All fruits bearing any definite Capsid markings were counted as marked fruit. This is pointed out to make clear that all the marked fruit was not necessarily so badly marked as to become unsaleable. These figures are given in Table I.

TABLE I.

Treatment.	No. of Fruits counted.	No. of Apples marked by Capsid Bug.	Percentage of marked Apples.
Control I	45	38	84
10 per cent. Long Ashton spray	179	35	19
Control II	9	9	100
10 per cent. Standard wash	34	17	50

Control III	..	..	No fruit present.	—	—
6 per cent. Long Ashton spray	..	..	13	1	7
6 per cent. Standard wash	..	..	38	13	33
Control IV	..	..	6	2	33

Centre II. Cheltenham. Variety of Apple—*Newton Wonder* (15-year-old trees).

Treatments—(a) *Single sprayings.*

10 per cent. Long Ashton spray	—	5 trees.
6 " " " " " "	5	"
10 " " " " " "	5	"
6 " " " " " "	5	"

Date of Application .. February 7, 1928.

Weather .. Slight and very intermittent drizzle. Heavy rain during the following night. Further remarks will be made in connexion with these weather conditions.

(b) *Controls.* 13 trees arranged in a roughly triangular block at one corner of the trial. This arrangement was made owing to the presence of an intermittent breeze in order to keep the controls free from spray drift.

Emulsification of Sprays .. Both the Standard wash and the Long Ashton spray emulsified perfectly.

The layout of the trial and the first results obtained are given in Diagram II. The examination was made on April 23, 1928. The pests present in this trial were Apple Sucker, Caterpillars, and Capsid Bug. A second examination was made on May 7, 1928, and fully confirmed the first results obtained. A third examination was made on June 18, 1928, for fruit markings due to Capsid Bug. The crop, owing to more sheltered conditions, was much less affected by frost than at Centre I. Accordingly, all the fruit was not counted, but random samples were taken, except in the case of some trees where the crop was light and all the fruit was examined. The figures obtained at this Centre are given in Table II.

TABLE II.

Treatment.	No. of Fruits counted.	No. of Apples marked by Capsid Bug.	Percentage of marked apples
Control	350	281	80
10 per cent. Long Ashton spray ..	137	21	15
6 per cent. Long Ashton spray ..	100	40	40
10 per cent. Standard wash	244	144	60
6 per cent. Standard wash	64	48	75

Centre III. Arle, near Cheltenham. Variety of Apple—*Newton Wonder* (14-year-old trees).

Treatments—(a) *Single sprayings.*

10 per cent. Long Ashton spray—6 trees twice repeated.
10 per cent. Standard wash—6 trees twice repeated.

Date of Application .. February 7, 1928.

(b) *Controls.*
5 trees twice repeated.

Emulsification of sprays .. Both the Standard wash and the Long Ashton spray emulsified perfectly.

The pests present were Caterpillar and Capsid Bug. The first examination was made on April 23, 1928, and the results obtained are shown in Table III. The averages for each treatment are given, since each treatment was carried out twice.

TABLE III.

Treatment.	Caterpillar.	Capsid Bug.
Control	1	7
10 per cent. Long Ashton spray	0	2
10 per cent. Standard wash	0	2

A second examination made on May 7, 1928, confirmed the above results. Further figures on fruit markings could not be obtained, since owing to frost injury there was no crop.

Discussion: Single Sprayings.—The figures under this heading seem to us so clear as not to need further discussion, except in so far as the infestation in Centre I (Diagram I) in the region of Control No. IV was distinctly less than at the other end. This being so, too much importance should not be attached to results obtained on the immediately adjacent plots. Nevertheless, correspondence is observable between these and similar results at Centre II (Diagram II).

Double Sprayings: Centre I.—The outstanding point is that in no case have any of the double sprayings given such good results as single applications of 10 per cent. washes; this applies both to the commercial and the Long Ashton washes.

It should be noted that two of the double sprayings included a 10 per cent. application in each case, and that the results from these were more comparable with the two applications of 5 per cent. than with the single applications of 10 per cent. We have no explanation to offer for this somewhat anomalous result.

Emulsification and Weather Conditions.—It has already been mentioned that at Centre I a certain amount of the oil

was thrown out during the process of emulsification. In the opinion of Mr. F. Tutin this may have resulted in the application in reality of washes of 6 per cent. strength and 3 per cent. strength respectively instead of 10 per cent. strength and 6 per cent. strength intended.

Previous experience suggests that in the case of Centre II the very adverse weather conditions already described must have exercised an unfavourable influence, and it will be noted that the results at these two Centres agree closely. Nevertheless the results obtained are of a high order.

Summary and Conclusions.—(1) In field trials with (a) a tar-distillate wash made up at Long Ashton, and referred to as the Long Ashton spray, and (b) a Standard wash used at the same strengths, the insect eggs present were Apple Sucker (*Psylla*), Winter Moth and Capsid Bug (*Plesiocoris*).

(2) The strengths used in the case of both washes were 10 per cent. and 6 per cent.

(3) *Psylla* was completely controlled by both strengths of the sprays tested.

In the case of caterpillar, commercial control was obtained in the case of both washes used at 10 per cent. strength, this being particularly marked in the case of the Long Ashton wash. At the 6 per cent. strength there was a slight superiority on the part of the Long Ashton spray.

The 10 per cent. strength Standard wash brought about considerable reduction of Capsid Bug but did not give a commercial control such as was obtained by the use of the Long Ashton spray at the same strength.

At the 6 per cent. strength the Long Ashton spray was still found to be superior to Standard wash, but in this case neither spray could be said to have given a satisfactory control.

The Effects of Tar-Distillate Spray Drift on Undercrops.—

As the result of suggestions, made by certain growers in Worcestershire, that beans sown under plum trees sprayed with tar-distillate washes were adversely affected, it was decided to carry out a small experiment to obtain definite information on this question.

Two small plots of clear land were selected, one of which was sprayed, on April 26, 1927, with an 8 per cent. tar-distillate wash so as to simulate spray drift; the other plot remained untreated. Ten seeds of broad bean (Redcliffe Giant) were then sown in each plot of ground, eight seeds in all in each trial plot. Sowings were made in each plot at the

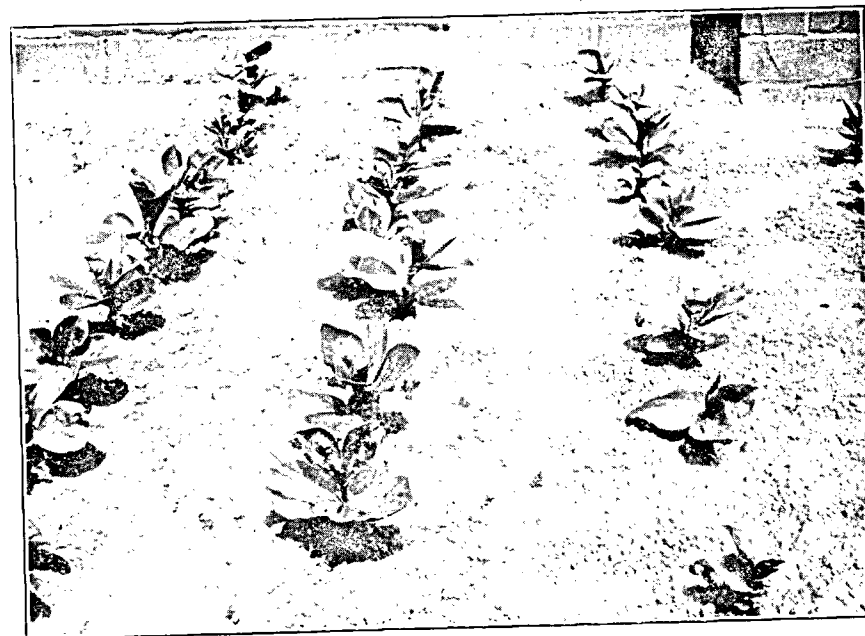


FIG. 1.—Untreated Plot. Dates of sowing (rows, left to right) April 27, April 28, May 1.

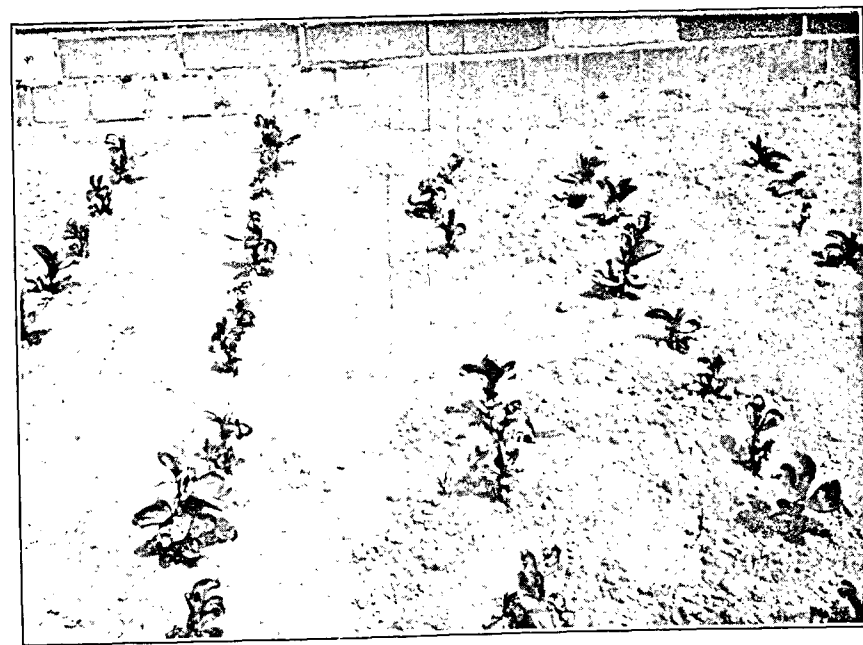


FIG. 2.—Treated Plot. Dates of sowing (rows, left to right) as in Fig. 1.

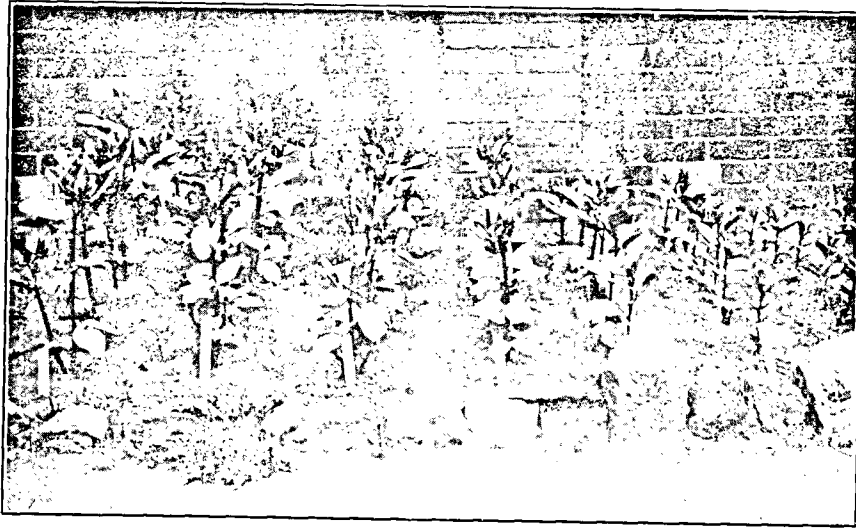


FIG. 3.—Untreated Plot. Dates of sowing (rows, left to right) April 27, April 28, May 1, May 3, May 6, May 9, May 16.

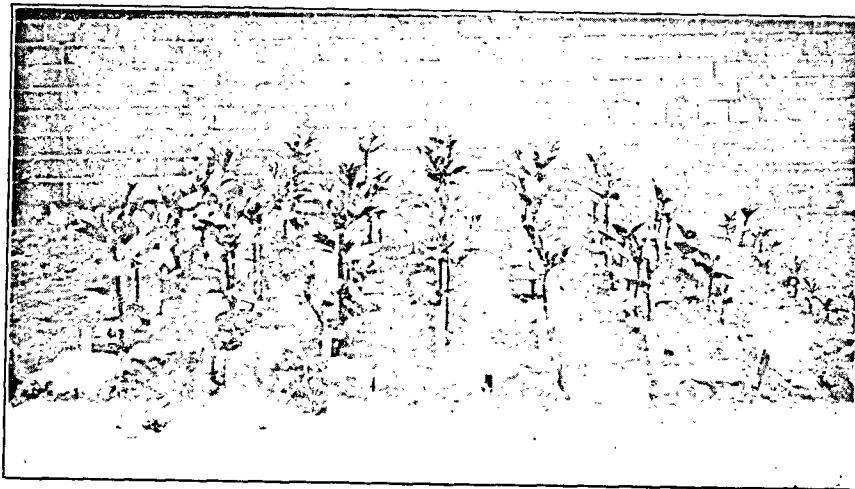


FIG. 4.—Treated Plot. Dates of sowing (rows, left to right) as in Fig. 3.

following dates: April 27, April 28, May 1, May 3, May 6, May 9, May 16 and May 22. Observations were made at regular intervals.

The effect of the presence of the tar-distillate wash in the soil was to cause severe twisting and crinkling of the leaves (Fig. 2). On the sprayed soil, the beans were affected in this way in the first six sowings, *i.e.*, up to and including the sowing made on May 9, which was made 12 days after the spraying of the soil. The germination of the seed was not affected by the spraying of the soil, being equal in both plots. In the case of the untreated soil, the appearance of the beans was quite normal (Fig. 1).

The subsequent behaviour of the beans was of considerable interest. As can be seen in Fig. 2, with the first three sowings of beans the growth was retarded by the tar-distillate wash, the fourth sowing being the most forward of the series. In the case of the beans on the untreated soil, the first and second sowings were the most forward when photographed at the same time as the sprayed plot, and the successive amount of growth is what would be expected from successive sowings (Fig. 1).

By the time the crop was nearly ready for picking, the first three sowings were markedly lacking in vigour, the first sowing being only about one-half the height of the fourth sowing.

The beans became infected with aphid, and it is interesting to note that the attack became very serious on those beans which had been weakened, *i.e.*, the first three sowings on the plot of sprayed ground. The remaining sowings on this plot were not so seriously attacked, and the beans on the untreated ground never had more than a slight infestation of aphid.

It would seem that, in the case of the treated ground, the roots of the beans sown within five days of such treatment were affected, whereas later sowings were affected only in the leaf, and eventually grew normally.

The experiment shows that it is clearly desirable for growers to allow at least a week between the spraying and the time of sowing of beans under fruit trees. The type of damage described is most likely to occur where trees are sprayed exceptionally early or late.

During the trials for 1927-28, at Centre I, a portion of the plot sprayed with Long Ashton wash at 10 per cent. strength was undercropped with cabbage. When visited at a later date these plants were found to have become markedly

chlorotic, some plants being entirely yellowish-white in colour. It is interesting to record, however, that by May 7 they had completely recovered their normal green colour and appearance.

Summary and Conclusions.—An account is given of trials on the effects of tar-distillate washes on undercrops, showing that these effects should be taken into consideration.

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THE PRESENT DISTRIBUTION OF THE BROWN ROT FUNGI: ITS ECONOMIC SIGNIFICANCE

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From time to time articles have appeared in this JOURNAL calling the attention of fruit growers to the ravages caused by the different species of Brown Rot fungi. The most familiar symptom of infection induced by these parasites is the rotting of fruit; the affected parts turn brown and, usually within a few days, the fructifications of the fungi appear on the surface as pustular outgrowths, which the microscope shows to consist of dense tufts of branched fungal threads bearing chains of spores—a type of fructification known as *Monilia*. Other fruit-rotting fungi, it is true, may cause discoloration of the infected tissues, but infection by the parasites under consideration is so general on ripening fruit that the term “Brown Rot” is usually restricted to the destruction caused by these fungi (*Monilia*). Under certain conditions, a second type of fructification, in the form of a stalked cup, develops from the infected, mummified fruit. The production of this higher or “perfect” form of fructification shows that these fungi belong to the genus *Sclerotinia*, but the name *Monilia*, which is descriptive of the more common reproductive phase of the fungi, is still sometimes used. Although rotting of the fruit is, perhaps, the best known form of damage caused by these fungi, yet one of them produces other types of disease which have been referred to as Blossom Wilt, Brown Rot Canker, Wither Tip and Shoot Wilt, respectively.

Whilst studying the Brown Rot fungi, and the different forms of damage caused by them on fruit trees in this country, the writer has collected specimens and cultures of Brown Rot organisms from the various fruit-growing countries of the world, in order that the forms occurring here could be compared with those found abroad. The results have revealed certain facts relative to the distribution of these fungi, which are not without interest from a practical point of view.

Brown Rot diseases are to be found in all the chief fruit-growing countries where the species of *Pirus* and *Prunus* are cultivated, but the fruit-rotting *Sclerotinias* attacking these crops are not the same in all regions; and, since the bionomics and mode of parasitism vary with each parasite, a knowledge of the distribution of these parasites is desirable, so that the necessary precautions may be taken to prevent the

introduction of any one of them into a country in which it has not at present been found.

As the chief types of disease caused by the Brown Rot fungi in this country have already been described in this JOURNAL,¹ it will not be necessary to give a detailed account of them in the present article; but a brief review of the principal facts relating to the diseases is essential to make clear the importance of a knowledge of the distribution of the organisms concerned.

Species of Brown Rot Fungi.—In the British Isles there are two species of Brown Rot fungi that, together, are responsible for considerable loss in the fruit crops every year;² they are known as *Sclerotinia* (*Monilia*) *fructigena* and *Sclerotinia* (*Monilia*) *cinerea*.

(1) *Sclerotinia fructigena* is the common fruit-rot fungus of apples, pears and quinces, on which it produces conspicuous yellowish pustules of the Monilia type, often arranged in concentric circles round the point of infection. As already pointed out in previous articles, this fungus causes infection through the fruit alone, although it sometimes passes from the fruit itself into the fruiting spurs and even into the branches, causing cankers. It is particularly destructive as the fruit approaches maturity. The infected fruit often falls to the ground, and it is not uncommon in certain seasons to see the ground under apple and pear trees strewn with fruit in various stages of decay, bearing numerous pustules from which myriads of spores arise. This particular fungus is only too familiar to growers in this country; but, as it is unknown in certain fruit-growing regions abroad, the accompanying illustrations (Figs. 1, 2, 3 and 4) are presented to enable overseas readers of this JOURNAL to recognize the parasite, and to show how prolific it is in pustule and, consequently, in spore production.

It has recently been shown³ that *S. fructigena* may infect apples at the time of picking, if the fruits receive injuries such as may obtain when they are picked *from* their stalks instead of *with* their stalks. Further, core-rot, with premature fruit-fall, of White Transparent apples, has been found to be

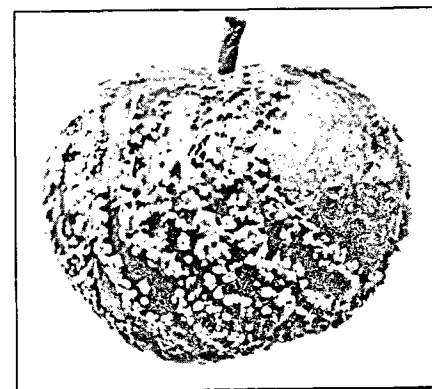


FIG. 1.—Early infection of apple, showing numerous fungal pustules.

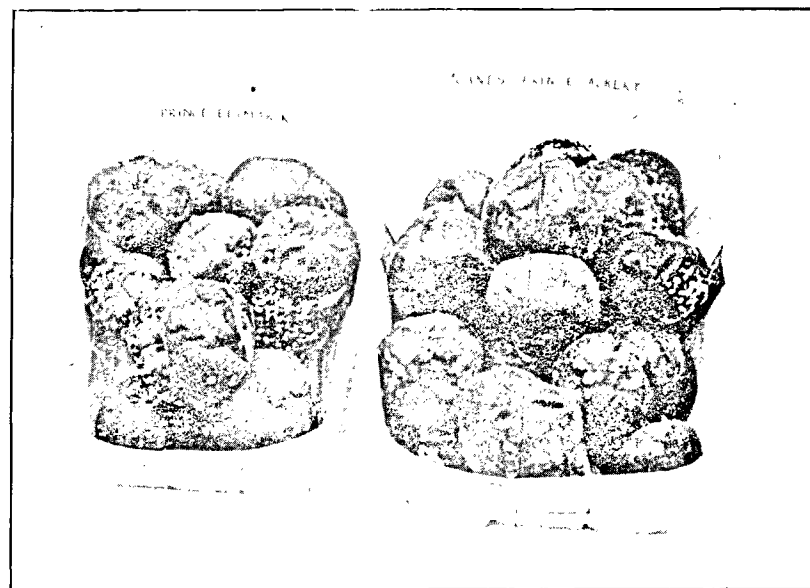


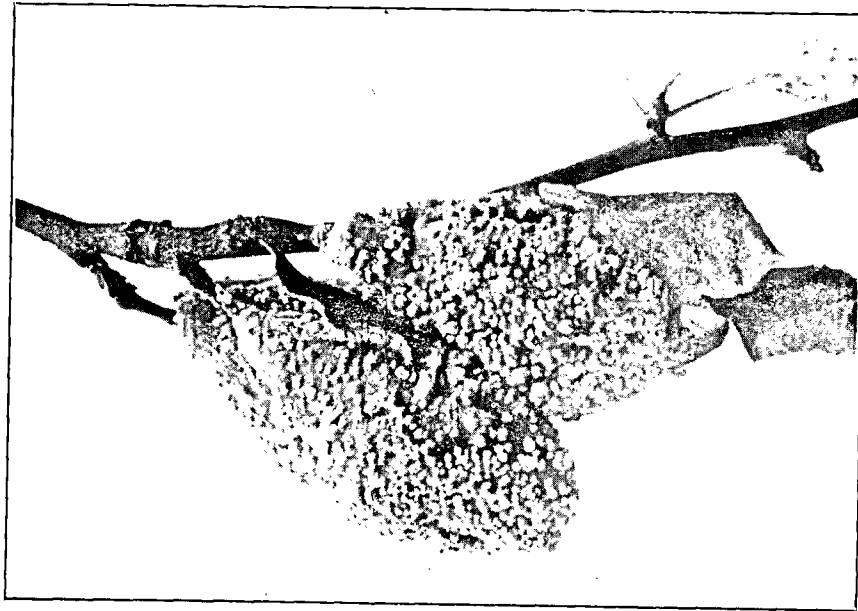
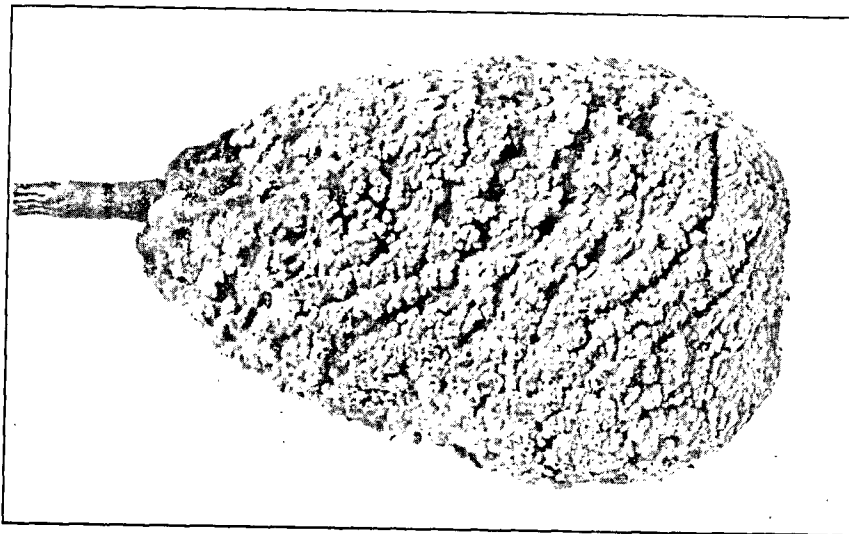
FIG. 2.—Apples from store (October, 1927). These are seen turning black and bearing few pustules.

APPLES INFECTED WITH *Sclerotinia fructigena*. THIS FUNGUS HAS NOT YET BEEN FOUND IN NORTH AMERICA, AUSTRALIA OR NEW ZEALAND.

¹ This JOURNAL, Vol. XXIV, Aug., 1917, p. 504; Vol. XXV, June, 1918, p. 299; Vol. XXVII, March, 1921, p. 1142; and Vol. XXXIV, September, 1927, p. 552. See also the Ministry's Leaflets, Nos. 86 and 312.

² Two other species of *Sclerotinia*, attacking the leaves of the Medlar and the Quince, respectively, have been recorded for this country, but these fungi are of minor importance economically.

³ This JOURNAL, Vol. XXXIV, September, 1927, p. 552.

FIG. 4.—*Sclerotinia fructigena* on plums.FIG. 3.—*Sclerotinia fructigena* on a pear.

associated with infection by the same fungus.⁴ It is also responsible for considerable loss in the early stages of storage of apples, the fruits often turning black in the store.

The perfect, or *Sclerotinia*, stage of this fungus develops from infected, mummified fruit which has fallen to the ground. As compared with the *Monilia* stage, it is very rarely met with anywhere, and it has not yet been found in this country. The fungus, however, can persist without the intervention of this perfect stage. Some of the infected fruits shrivel up and remain on the trees as "mummies" through the winter. The parasite remains quiescent in these mummies until early in the following summer, when it produces a new crop of spores of the *Monilia* type ready to infect the growing fruit.

It has also been observed that the fungus produces *Monilia* pustules on infected spurs, and also cankers, and that these fructifications, too, resuscitate and give rise to new crops of spores in early summer. As soon as the growing fruit becomes infected from these over-wintered sources of infection, the fungus quickly re-establishes itself and, under favourable conditions, is rapidly disseminated.

Judging from the reports of investigators on the continent of Europe, it appears, generally, to have been assumed that *S. fructigena* is almost confined to core-fruits, such as apples and pears, but observations in this country have shown that it causes, in some years, considerable wastage in the plum crop; of other stone-fruits, it also infects cherries and peaches.

The destructive nature of this fungus, in relation to the actual fruit crop, is emphasized here because this particular parasite, which is the principal rot-producing fungus of the apples in this country and on the continent of Europe, is unknown in some of the chief fruit-growing regions in other parts of the world where apples are grown on a large scale.

(2) *Sclerotinia cinerea*, the second of the two principal fungi mentioned, is almost confined to stone-fruits. On plums and cherries, it causes a brown rot similar to that produced by *S. fructigena*, but the fungal pustules which appear on the infected fruit are smaller, and grey, not yellow, in colour. Although fruit-rot, caused by *S. cinerea*, may at times be severe on plums and cherries, the chief importance of this fungus lies in the fact that it infects the flowers, causing

⁴ Dowson, W. J.: On a Core-Rot and Premature Fall of Apples associated with *Sclerotinia fructigena*. Trans. Brit. Mycol. Soc., Vol. XI, 1926, pp. 155-161.

Blossom Wilt; from the flowers it passes into the spurs and, frequently, into the branches, killing them back. Thus, Morello cherry trees are often severely crippled by its attacks. On sweet cherries, although infection of the flowers is sometimes alarming, actual killing back of branches is not common; but some varieties of plums lose many young branches following Blossom Wilt. It also infects the young, green shoots of plums and cherries, producing the condition known as Wither Tip.

A fungus, which is indistinguishable microscopically from *S. cinerea*, as found on plums and cherries, infects the flowers of apple trees, some varieties, such as Lord Derby and James Grieve, being particularly susceptible. This fungus, known as *Sclerotinia cinerea forma mali*, often extends into the branches, forming cankers which girdle and kill them.

(3) Another Brown Rot fungus, which is rife and very destructive in certain parts of the world, does not occur in this country. It is prevalent in North America, and has been named *Sclerotinia americana*.⁵ Microscopically, and in the general appearance of its Monilia fructifications, it is similar to *S. cinerea*. That this fungus can be distinguished by laboratory cultural methods from *S. cinerea*, was first pointed out by the writer in 1917. This has not only been confirmed by American investigators, but evidence is accumulating to show that the two differ in their mode of parasitism. Recently it has been shown that *S. cinerea* also occurs in North America, and it has been possible to compare the two with regard to their parasitism. The consensus of opinion, among American workers who have studied the subject recently, is that *S. americana* is chiefly a fruit-rotting fungus, but that it may also attack flowers and cause cankers, whilst the chief damage caused by *S. cinerea* is infection of the flowers and production of Blossom Wilt. For example, Professor Barss, who has studied the two side by side in Oregon, writes: "It is this ordinary Brown Rot fungus⁶ that causes the severe attacks of fruit-rot of stone-fruits in Oregon. It often causes blossom blight as well. There is, in addition, a closely-related fungus,⁷ common on the Pacific Coast, which

⁵ The nomenclature of the common Brown Rot fungus of America is in dispute. At present, the writer prefers the name *S. americana*, although certain American writers maintain that *S. fructicola* has a prior claim.

⁶ Supposed at the time to be *S. cinerea* but now known to be *S. americana*.

⁷ This fungus, referred to as *S. oregonensis*, has since proved to be *S. cinerea*.

often causes very severe attacks of blossom and spur blight, and twig cankers on all kinds of stone-fruits and on certain varieties of pears, but which causes little rotting of fruit." Another difference between these two fungi is associated with the development of the perfect stage on the fallen, mummified fruit. *S. americana* produces such fructifications freely; they have been found in abundance in the United States and other regions where this fungus flourishes. Of *S. cinerea*, Professor Barss says: "In tests it failed to produce the apothecial (spore-cup) stage under conditions that gave abundant development of this stage with the ordinary Brown Rot fungus." The general inference is, then, as recent research has shown, that the common American Brown Rot fungus (referred to here as *S. americana*) is quite distinct from either *S. cinerea* or *S. fructigena*, the common Brown Rot fungi of Britain and the European continent.

Although *S. americana* sometimes infests apples, inducing fruit rot, the damage it causes to this crop is comparatively small, and Brown Rot of apples is not considered of any great economic importance in those countries where *S. americana* is the only Brown Rot fungus present.

Distribution of the Brown Rot Fungi.—The general distribution of the Brown Rot fungi has been studied with reference to the regions mentioned below. The evidence is based chiefly on the results of an examination, by the writer, of specimens and cultures received from these regions over a period of 10 years.

The Continent of Europe.—Cultures and specimens received from various European countries show that the Brown Rot fungi of the Continent are similar to those found in Britain. *S. fructigena* is the fruit-rotting fungus particularly prevalent on apples and pears, but it is also found on stone-fruits. *S. cinerea* is common in plums, cherries and apricots, not only infecting the fruit but also the flowers. *S. cinerea forma mali* probably occurs on the Continent, since a disease of apple trees, similar to Blossom Wilt and Brown Rot Canker of apple trees in Britain, has been recorded.⁸

The United States.—As already stated, the common Brown Rot fungus of North America is that known as *S. americana*,

⁸ It is doubtful whether *S. americana* occurs naturally in Europe. A culture of this species received from Holland was stated to have been isolated from a Bismarek apple; if this fungus does occur naturally on the Continent, it is surprising that it has not been recorded more than once, as, where found at all in other parts of the world, it is so very prevalent.

a species not found in Britain ; and numerous strains, received from the eastern States, all proved to be of this species. Other strains obtained from California, however, conformed with the *S. cinerea* of Europe, and American workers have found this fungus not only in California but also in the neighbouring State of Oregon.

Canada.—Plums and peaches received from Ontario, and plums from the Fraser Valley, British Columbia, were found to be infected with the Brown Rot fungus, *S. americana*, prevailing in the United States, but cultures isolated from cherries grown in the south of Vancouver Island proved to be *S. cinerea*. The distribution of these two fungi in Canada, therefore, corresponds to that in the United States, *S. americana* being by far the more common form, whilst *S. cinerea* occurs on the Pacific seaboard.

In North America, therefore, *S. cinerea* appears at present to be confined to the Pacific coastal regions. There is no evidence that *S. fructigena* occurs at all in North America.

Australia.—Mummified fruits of peach, nectarine and plum, received from New South Wales, all bore *S. americana*. Cultures, isolated from peach twigs in Victoria, were the same fungus, which appears therefore to be the prevailing Brown Rot organism of this Continent. *S. fructigena* has not yet been found there. The earlier descriptions of a Brown Rot fungus in Australia, said to be *S. fructigena*, were certainly not of this species, because the Australian fungus produced "ash-coloured spores."

New Zealand.—Here again the common American Brown Rot fungus prevails. Specimens received included apricot, peach and plum mummies, and peach twigs ; these all yielded *S. americana* in culture. As in Australia, *S. fructigena* has not been found. Cunningham, who has studied the Brown Rot diseases on the spot, writes : "In New Zealand, *Sclerotinia fructigena* does not occur."⁹

Other Countries.—With regard to other regions, where those fruits which are subject to Brown Rot infection are cultivated, cultures of *S. fructigena* have been received from Japan and Manchuria, and of *S. cinerea* from Manchuria. Brown Rot has been recorded for South Africa, but the climate is too dry for the Brown Rot fungi to flourish there, and little damage is done by them.

⁹ Cunningham, G. H. : Fungus Diseases of Fruit-trees in New Zealand and their Remedial Treatment. Auckland, N.Z., 1925, p. 228.

Before entering on a discussion of the significance of this distribution, it may be well to summarize the foregoing conclusions in tabular form, in order to show clearly the type of damage caused by the respective Brown Rot fungi, and to indicate the regions where each is found ; the absence of one or other species from certain important fruit-growing countries is emphasized.

SUMMARY OF DISTRIBUTION.

<i>Brown Rot Fungi.</i>	<i>Distribution.</i>
<i>Sclerotinia fructigena</i> , the chief fruit-rotting fungus of Europe, is particularly destructive to apples and pears, and also infects the stone-fruits.	Europe. <i>It has not yet been found in N. America, Australia or New Zealand.</i>
<i>S. cinerea</i> f. <i>pruni</i> is chiefly destructive as a blossom-wilt fungus, but on stone-fruit it also causes fruit-rot and infects young shoots.	Europe and the Pacific coastal regions of North America. <i>There is no evidence that this fungus occurs in Australia or New Zealand.</i>
<i>S. cinerea mali</i> causes blossom-wilt and brown rot canker of apple trees.	Europe. <i>The disease has not been recorded elsewhere.</i>
<i>S. americana</i> is primarily a fruit-rotting fungus of the stone-fruits, but flowers are also infected. It causes comparatively little damage to apples.	North America, Australia and New Zealand. <i>It has not been found in Britain, and it is doubtful whether it occurs naturally in Europe.</i>

Consideration of Distribution Features.—The salient features which emerge from a consideration of the table are these :—

(1) North America, Australia, and New Zealand are regions from which apples are exported in large quantities. Brown Rot of apples is not of serious importance in these regions at present, and this is correlated with the absence of the fruit-rotting fungus *S. fructigena*, although another Brown Rot fungus, *S. americana*, is present. What result would follow the introduction of *S. fructigena* into those regions cannot be predicted, but it appears probable, from what we know of the ravages of this fungus in Europe, that it would have an adverse effect, not only on the growing crop but also on the apples during transit. Apples in Britain often become infected with *S. fructigena* at or about the time of being stored, and there is frequently considerable wastage on that account in the early stages of storage. Apples taken from orchards infested with *S. fructigena* would, undoubtedly, suffer similar wastage during exportation, unless extreme care was taken to eliminate

diseased fruit during grading and packing. Cold storage would check the rot, but it would again resume its progress as soon as the temperature of the fruit became more normal.

(2) The Blossom Wilts of fruit trees, caused by *S. cinerea*, are only too well known to growers in this country, especially during wet springs; and in the humid regions of the Pacific coast of North America, where this fungus has also been discovered, similar damage is reported. It is conceivable, therefore, that the introduction of this species into Australia and New Zealand would result in loss from Blossom Wilts.

Blossom Wilt of apple trees, at present known with certainty only in Europe, is destructive on certain varieties, but whether it would be of economic importance on the varieties cultivated in the Dominions and in America cannot be stated. Its introduction into those countries where the apple crop is so valuable is, to say the least, undesirable.

(3) As regards the British Isles, the chief feature of interest, yielded by the investigation, is the absence of *S. americana*, a fungus which is a destructive fruit-rot organism in America, Australia and New Zealand. Whether its introduction to these islands would be of serious moment it is impossible to say, but we know to our cost the havoc wrought by certain other fungi which have been introduced from America, viz., American Gooseberry Mildew and Vine Mildew.

There are very good reasons, therefore, for supposing that the world's fruit crop would suffer in the event of the Brown Rot fungi becoming more widely distributed than they are at present, and the question arises: Is there any serious risk of these fungi being introduced into countries other than those in which they are now found? The three species must be considered separately.

(a) *S. fructigena* is essentially a fruit-rot fungus, and it is obvious, therefore, that it may be carried on the fruit. Since the demand for apples in this country is greater than the supply, it is unlikely that the fungus would be carried on fruit to our Colonies or to the United States, nor are other European countries likely to be a source of danger in this direction. It has been pointed out, however, that this fungus passes the winter on the mummified fruit and sometimes (on soft-wooded varieties of apples) on fruiting spurs and on cankers, and it is possible that in this way the fungus might be carried on nursery trees. This risk is present only when trees which have fruited are exported, so that it is quite safe, as regards

S. fructigena, to export "maiden trees" or even older trees which have not borne fruit.

(b) *S. cinerea* passes the winter on mummified fruits and also on flowering spurs and cankers, so that, again, trees which have not flowered will not, as a rule, carry the fungus. On plum trees, however, and sometimes on cherry trees, the young shoots also become infected (producing the Wither Tip condition), and this may occur on quite young trees which have not flowered; in such cases the fungus passes the dormant season in these withered shoots.

With regard to the possibility of transmitting the Brown Rot fungi of this country to the overseas Dominions or to America, the risk, therefore, appears slight, particularly with trees that have not flowered. Wither Tip is readily diagnosed, and the elimination of trees infected with this disease should present no difficulty. Older trees, which have flowered and are destined for exportation, should be examined for Brown Rot infection, and diseased trees discarded.

(c) Our own position with respect to the common American Brown Rot fungus, *Sclerotinia americana*, must now be considered. The possible means of importing this fungus into Britain are on (1) nursery trees and (2) imported fruit. As with *S. cinerea*, trees that have not flowered may, generally, be considered to be free from Brown Rot. Trees that have flowered should be guaranteed to be free from this disease. Though *S. americana* sometimes infects apples, Brown Rot is not considered a serious disease of this crop in regions where this particular species of Brown Rot fungus is the only one present. The introduction of the organism on imported apples, therefore, though not impossible, is probably not a serious menace, especially as this fungus, like our own *S. fructigena*, shows a tendency to turn stored apples black without developing the Monilia fructifications.

On the other hand, the situation is quite different with regard to the stone-fruits. Plums, cherries and, particularly, peaches are readily infected by *S. americana*, and not only whilst they are on the trees, for there is considerable wastage by Brown Rot during transit, showing that infection occurs during the journey, or that slight infection spots, which may be overlooked when the fruit is packed, develop later into definite rot. The relevancy of this fact to the distribution of the Brown Rot fungi becomes apparent when we consider the present-day methods of dealing with perishable foodstuffs by rapid transit and cold storage, so that it is now

possible to send soft fruit considerable distances. In July, 1927, the writer was able (through the courtesy of Dr. Cyril West and Mr. Tomkins, of the Low Temperature Station at Cambridge) to examine a number of diseased peaches which had been taken from a consignment imported from Georgia, U.S.A. When the writer received the peaches (seven in number) all bore *Monilia fructificationis*, and, by removing a little of the infected pulp from each peach and transferring it to a plate of culture medium, a typical culture of *Sclerotinia americana* grew out in every case, showing that each was infected with the American Brown Rot fungus. The inference is that these diseased peaches had been infected imperceptibly when packed (or that some, at any rate, were so infected and had contaminated others), and that the rot had continued to develop and produce spores *en route*.

Diseased specimens found in a consignment of peaches, which arrived at Covent Garden from Ontario about the middle of October, were also found to be infected with *S. americana*. The importation of stone-fruits in a fresh condition into this country, from those regions where *S. americana* abounds, is therefore fraught with the danger of introducing a new destructive fungus, and is to be deprecated, unless such consignments are guaranteed free from Brown Rot when packed.

Summary.—(1) The chief fruit-rotting fungus of Britain and the Continent of Europe (*Sclerotinia fructigena*) has not been found in Australia, New Zealand, and North America.

(2) The Blossom Wilt fungus of plums and cherries (*S. cinerea* forma *pruni*), also common in Europe, is found in the Pacific coastal regions of North America but not in Australia or New Zealand.

(3) The Blossom Wilt fungus of apples (*S. cinerea* forma *mali*) appears to be confined to Europe.

(4) The Brown Rot fungus prevailing in North America, Australia, and New Zealand (*S. americana*) is not at present found on fruit trees in this country, but it has been found recently on peaches imported from America.

(5) The possibility and consequences of introducing any one of these fungi into a region where it is not found at present are discussed.

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SOME EGG DEFECTS, AND HOW TO AVOID THEM

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A FOWL'S egg, if it is to be readily marketed, must conform to certain conditions unconsciously laid down by the consuming public. It must be reasonably large in size, uniform in shape, have an attractive appearance, and, when broken, show a clean, firm, white and a rich-coloured yolk. In addition, when cooked it must possess a good flavour, and must be free from taint. Many causes operate to prevent the combination of these desirable characteristics in the average egg.

Eggs rejected by the candling test are used for other purposes if possible, but their value is small compared with the breakfast egg. Most of the causes leading to inferior quality in the egg are preventable, and it is the object of this article to indicate how some of these conditions arise, and how they may be obviated.

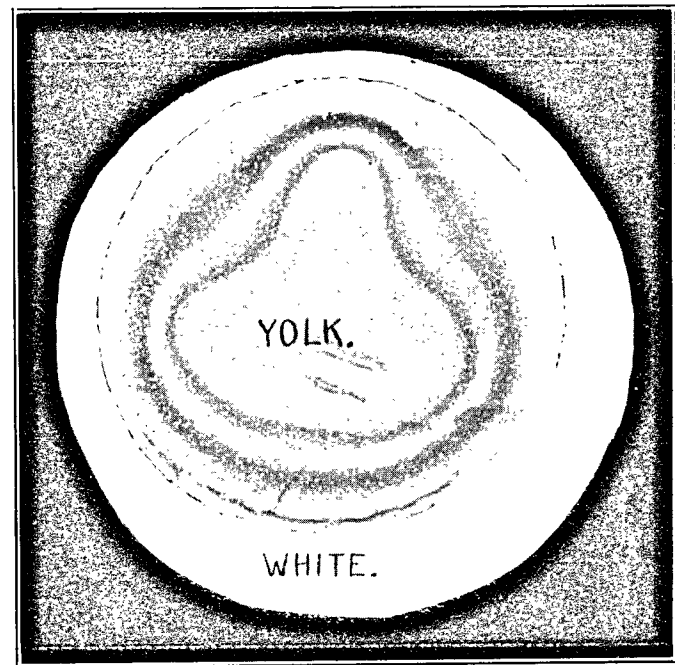
Small Size and Bad Shape.—While, primarily, the small, badly shaped egg is due to the hen that laid it, the fault actually arises from the carelessness of the producer who breeds such a hen. The production of well-shaped, sizeable eggs is one of the easiest problems set to the breeder, since he has only to reject all eggs for incubation which do not conform to standard size and shape in order to breed a strain of birds which, properly fed and managed, will produce a high proportion of large-sized, well-shaped eggs. The presence of large numbers of small, badly-shaped eggs merely shows that the producer does not know his business, and the operation of the ordinary economic laws will soon convince him of his error, or put him out of business. Even in the best-managed flocks, however, a few under-sized and badly-shaped eggs are bound to appear. Such eggs should be used for home consumption or be graded together for sale, since their inclusion with the better class of egg will certainly reduce the value of the whole consignment. In the case of badly-shaped eggs, trap nesting or close observation will reveal the culprits, which should at once be eliminated from the flock.

Colour and External Appearance.—The colour of an egg is a breed characteristic—brown, tinted, or white eggs being produced according to the breed of fowl kept. By careful selection and breeding the colour of an egg can be weakened or intensified within the breed, and whether a brown egg or

a white egg breed is kept should be determined by the demand of the market in which the eggs are sold. Some people are under the impression that a brown egg possesses a better nutritive value than a white egg, and although there is no scientific evidence to support this contention, the producer would be unwise to ignore the point if he can get a better price by producing the eggs which the public desires.

With regard to external appearance, many a consignment of eggs is spoilt through being marketed in a dirty condition. Such eggs become dirty through bad management on the part of the producer ; dirt comes through want of cleanliness in the poultry plant, an insufficient supply of clean chaff in the houses, and lack of adequate, clean nesting material. Quite apart from loss of money due to marketing dirty eggs, a further loss is possible owing to the danger of infection of eggs through bacterial and fungoid attack from the dirt on the shell. It will therefore pay every producer, by devoting strict attention to cleanliness, and by providing adequate amounts of clean floor litter and nesting material, to remove this preventable cause of loss of condition in the eggs he markets.

Bad Yolk Colour.—If a series of eggs be selected haphazard and broken one by one into a plate, the yolks will be found to vary considerably in colour—from a pale anæmic yellow to a rich golden-yellow or orange tint. The public demand an egg with a rich golden-yellow or orange-coloured yolk. The colour of the yolk of the egg is entirely dependent on the foods used, since pale-yolked eggs and rich orange-yellow coloured eggs can be produced at will from the same hen by varying the conditions of feeding. Waite, of Maryland Agricultural Experiment Station, by feeding a ration containing a little over 40 per cent. of yellow maize, obtained deep yellow-coloured yolks, whereas a ration containing wheat or white maize in the same proportion had no such effect. Plimmer, by feeding a ration consisting largely of rice meal, obtained eggs the yolks of which were practically white in hue. Green foods and yellow maize are efficacious in producing that deep yellow colour of yolk required by the public. The explanation of this colour production in egg yolks is quite a simple one. If foods contain fat-soluble pigments, the pigment is transferred with the fatty particles used in the formation of the yolk, and so becomes deposited with the yolk, giving it its characteristic colour. This can be proved by including in the food of a laying hen a fat-soluble dye,



(FIG. 1.)

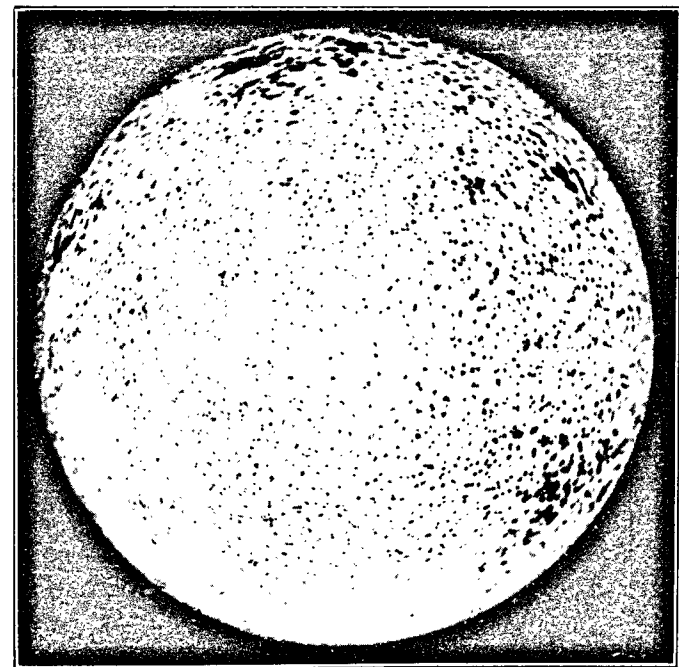


FIG. 2.

SOME EGG DEFECTS AND HOW TO AVOID THEM.

To face page 752.

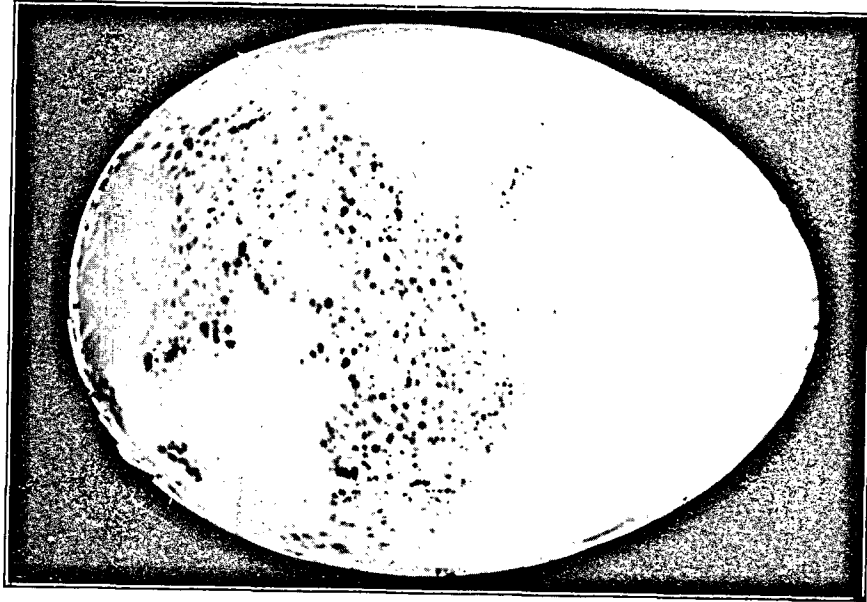
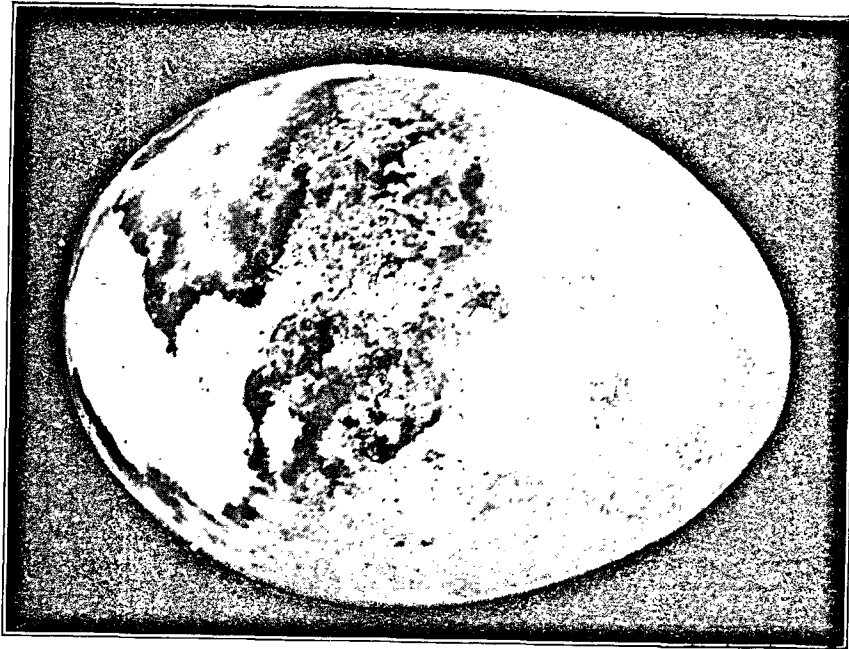


FIG. 4.

FIG. 3.
SOME EGG DEFECTS AND HOW TO AVOID THEM.

such as Sudan III, when the eggs laid later will be found to contain a layer of red colour due to the deposition of this pigment in the yolk layer which was in the process of formation at the time of feeding the dye. Fig. 1 shows the appearance of an egg produced in this manner, two rings of dye being visible. By including green foods, carrots, and yellow maize in the rations of laying hens, we can therefore produce yolks of the rich colour so prized by the consuming public.

Occasionally, through the use of certain food materials, the yolks may take on a colour that renders them abhorrent to the public. Thus, hens fed on acorns will produce eggs the yolks of which will be the colour of tanned leather; yolks produced by hens fed on excessive quantities of linseed meal will, according to Lippincott, be green in colour; and Payne, of Oklahoma, by feeding hens on Shepherd's Purse (*Capsella bursa pastoris*) and Penny Cress (*Thlaspi arvense*), obtained eggs the yolks of which were olive in colour. The production of badly-coloured yolks is therefore due to errors in feeding, and, by attention to the facts given above, it is within the power of every producer, not only to avoid eggs of undesirable colour, but to produce eggs containing yolks of the desirable colour.

Other Colour Defects.—Occasionally producers experience trouble with blood streaks and spots in eggs. Sometimes the trouble is caused through the partial incubation of the germ spot during the time that elapses between the collection and sale of fertile eggs. The remedy for this trouble is an obvious one, *i.e.*, removing the males from the laying flock so that the eggs produced are infertile. More often, however, the trouble is due to another cause, and the remedy is more difficult to apply. In this latter case the trouble is due to internal bleeding taking place through rupture of blood vessels either in the oviduct itself or in the ovary and its membranes. Such eggs when broken either show irregular blood streaks on the yolk itself or the white of the egg is stained a blood colour either in whole or part. The cause of this internal bleeding is not at present known, and the only remedy is to detect the offenders and remove them from the flock—a difficult proceeding in cases where flocks of several hundred birds are kept. Excessive protein feeding has been said to be responsible for the occurrence of this trouble, but no scientific evidence is available in support of this contention.

Taint and Bad Flavour.—Taint and bad flavour in eggs may be due to many causes. Taint in an egg may arise through

errors in feeding, through bacterial or fungoid attack, or through exposure of eggs while in transit or store to strong-smelling foodstuffs. Lippincott states that feeding onions, rape, turnips, and fresh fat fish in excess to hens will impart a strong flavour to eggs. It is quite possible that feeding a high oil content fish meal to hens might cause a fishy flavour, since taint in bacon caused through fishmeal feeding has been shown to be due to the fish oil. In the case of the other foodstuffs mentioned, however, a more likely cause of taint is exposure of the egg to the odours given off by these substances rather than direct contamination through the hen. The reason eggs are subject to taint is because the shell is porous and allows gases to pass through freely. Fig. 2 illustrates quite clearly the porosity of an egg-shell. The specimen there illustrated was prepared by painting the outside of a fresh egg-shell with starch paste and then painting the interior of the shell with alcoholic iodine solution. As the iodine solution passed through the pores, the starch solution was stained dark blue at each pore spot and gave the picture shown in Fig. 2.

It is quite obvious, therefore, that strongly smelling substances, such as onions, oranges, and citrus fruits, will contaminate eggs if placed in contact or even in the same store chamber, since the odoriferous gases easily pass through the pores of the shell and are absorbed by the egg substance. Thus, in one experiment carried out at Cambridge, it was found impossible to impart an orange flavour to an egg by feeding oranges to hens, but if the eggs were kept in an airtight box with oranges, an exposure of a few hours was sufficient to taint the eggs strongly. Similarly, packing eggs in resinous wood shavings or in musty packing material is sufficient to cause definite taint leading to rejection of the eggs.

In the same way, eggs are subject to bacterial and fungoid attack. Bacteria or fungus spores lodge on the outside of the shell of the egg, and, if *the conditions are favourable*, develop and penetrate through the pores into the egg itself. Musty and rotten eggs arise chiefly through the agency of bacteria which have so penetrated through the shell. In the case of foreign eggs, particularly Egyptian eggs, and in the case of English eggs during the harvest season, a peculiar trouble known as "black spot" sometimes occurs. This trouble, which is detected during candling, shows as definite black spots in the interior of the shell. Work by the authors of this article, described fully elsewhere, shows that this trouble is

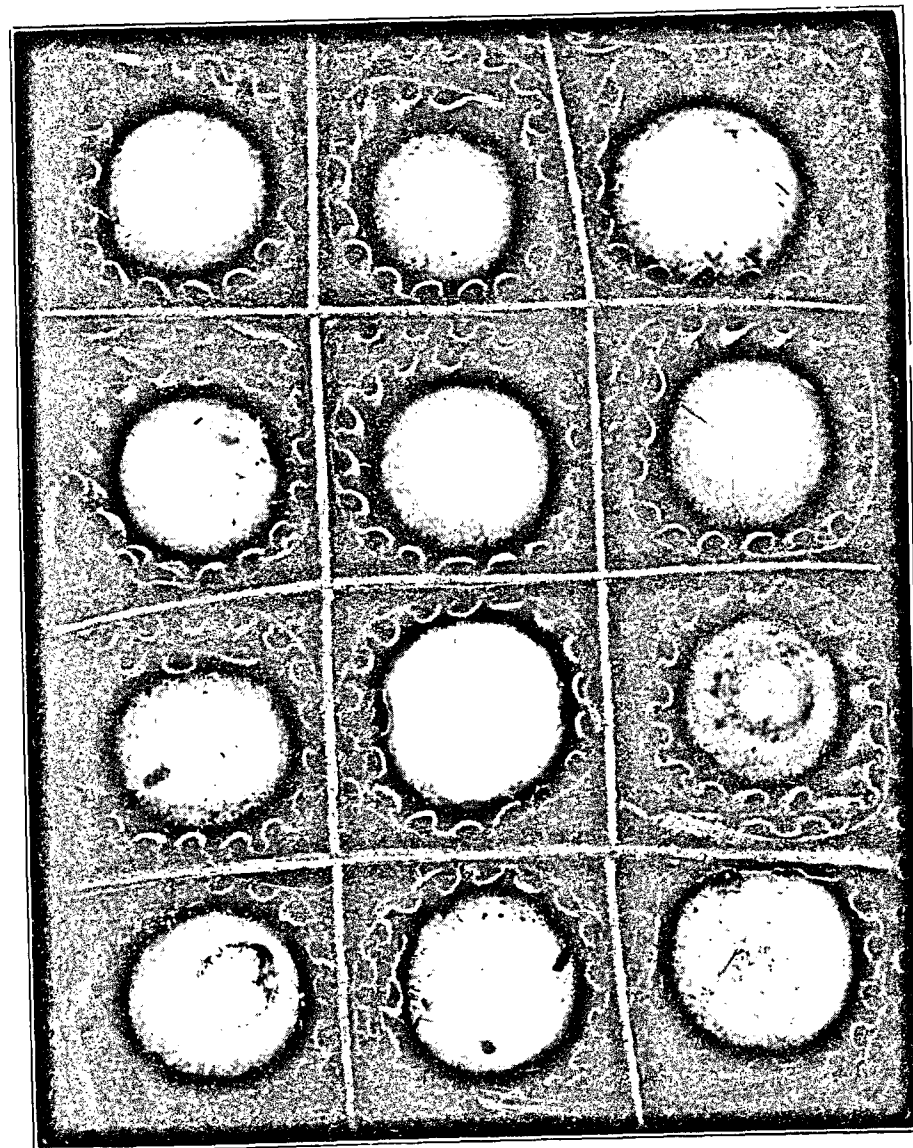


FIG. 5

SOME EGG DEFECTS AND HOW TO AVOID THEM.

generally due to a fungus, a species of *Cladosporium*. Spores of this fungus are commonly present in cereal straw. Eggs are therefore likely to come in contact with spores of this fungus if straw is used as a nesting material or if straw is used as a packing material. Under suitable conditions of temperature and moisture, it was found that such spores germinate, and the hyphæ produced rapidly spread over the shell surface. Fig. 3 shows an egg covered with the mycelium of this fungus. Some of the hyphæ penetrate through the egg-shell, as is seen in Fig. 4, and these form the characteristic "black spot." This fungus takes nine days to penetrate through the egg-shell under favourable conditions.

Mould fungi, such as *Penicillium* and *Mucor*, have also been shown to penetrate eggs and rapidly reduce them to a condition unfit for consumption.

In order to prevent the spoiling of eggs due to fungoid and bacterial attack, the following precautions appear to be desirable. First, the eggs should be produced under hygienic conditions: clean and dry nest material only should be used, and be frequently renewed. Straw should be avoided as packing material, and undue moisture should be avoided in egg stores or containers. Fig. 5 shows the effect of storing eggs in a damp and infected container. Cold-store chambers used for egg storage should not be used for storing other foodstuffs such as oranges, onions, or citrus fruits, and mouldy or musty material should never be used for packing material. If these instructions are followed, losses of eggs due to taint and bad flavour should be easily avoidable in future.

* * * * *

EGG-PACKING STATIONS

CAPITALIZATION AND WORKING EXPENSES

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I.—Capitalization.—The capital requirements of an egg-packing depot in regard to premises and plant (fixed capital), and to working capital, vary according to turnover and local and particular conditions. Fixed capital requirements should be estimated on the basis of the maximum load; the working capital requirements will vary during the year, but, for the purpose of an estimate, may be calculated as a percentage of annual sales. In England and Wales, April is the month of maximum supplies, roughly 15 per cent. of the annual quantities marketed falling within that month. About two-thirds of the

annual supplies are handled in the six months from February to July inclusive.

In Table I are given estimates of the capital required for depots handling turnovers of from 1 to 20 million eggs per annum. It should be emphasized, however, that very little information is yet available in this country on which estimates of this kind can be based with confidence.

TABLE I.—ESTIMATED CAPITAL REQUIREMENTS OF EGG-PACKING DEPOTS.

Turnover in Eggs	1 million £	2 million £	3 million £	5 million £	10 million £	20 million £
Premises	250	250	250	400	1,000	1,500
Office furniture and fittings	50	50	50	75	100	150
Vans	250	500	750	1,000	2,000	4,000
Collecting boxes ..	30	60	90	150	300	600
Candlers and trays ..	10	10	10	15	20	30
Grading apparatus ..	20	20	20	20	40	80
Preliminary and miscellaneous expenses ..	30	40	50	60	100	150
Total fixed capital	640	930	1,220	1,720	3,560	6,510
Working capital ..	310	620	940	1,550	3,100	6,200
Non-returnable boxes	20	40	60	100	200	400
Total	970	1,590	2,220	3,370	6,860	13,110

Fixed Capital.—The estimates of fixed capital relate to an organization having one centralized depot. At the present time, no examples of centralized stations handling turnovers of 5 million eggs and over exist in this country.

(a) **Premises.**—Where suitable buildings already exist and can be rented, capital expenditure under this head will be unnecessary, the rent being an item of current expenditure. Obviously, capital expenditure on buildings will depend on local conditions, as well as on the type of structure selected; but, from the point of view of efficient working, elaborate or costly buildings are not required. A well-built, weather-proof shed about 60 ft. by 20 ft., having plenty of window space, wood flooring, doors at either end, and with ready access to the road, would meet requirements for a turnover of up to three million eggs. These premises would have to house the testing and grading equipment, boxes, and office furniture. For larger turnovers, more spacious accommodation would be required, and might also be justified on other grounds.

(b) **Office Furniture, etc.**—The office furniture required may be very limited, and acquired second-hand. The cost of typewriter, desks, chairs, and the necessary stationery, including files, ledgers, notepaper, etc., should not exceed £50 on a turnover of not more than three million eggs.

(c) **Motor Transport.**—Capital outgoings on motor vans, etc., will depend entirely on the area to be served, its topography, condition of the roads, distribution of senders within the area, and the availability of other means of transport. As a general rule, however, a collecting service for producers' supplies will have to be organized, and it would,

in most cases, be better for the depot to arrange its own collecting service than to hire independent contractors. Moreover, it will usually be economical, especially if trade is done with retailers, to send a proportion of packed eggs away by road rather than by rail; the existing stations do, in fact, appear to distribute the greater proportion of their supplies by road. Roughly, one motor van (25 cwt.) would be required for every million eggs turnover, although economies in the use of motor transport would naturally follow from the intensive development of the area served. For the purposes of Table I the numbers of vans required have been put as follows:—

Turnover	No. of vans
1 million eggs	1
2 „ „	2
3 „ „	3
5 „ „	4
10 „ „	8
20 „ „	16

(d) **Collecting Boxes.**—Suitable, second-hand collecting boxes may be bought for as low a figure as 6d. each, while new boxes of different types range from 2s. 6d. to 12s. 6d., complete with fillers and flats. Fillers and flats cost from 6d. to 1s. per set; “raylite” fittings used by one firm cost 69s. per gross. For the present purpose, the price of 2s. 6d. per box complete with fittings has been taken. The number of boxes required is estimated to be two and a-half times the number required for the maximum weekly turnover. Collection being made from farms only once a week, it would be necessary to have a stock of empties equal to the number out of the depot, and also a margin to allow for breakages, repairs, and increased business.

(e) **Testing and Grading Apparatus.**—Testing and grading apparatus would be a relatively small capital expense. A suitable candling apparatus costs £1 complete, and a “Baker” Grader £20; egg trays are a trifling cost. With continuous working, one 480-egg “Baker” Grader would be sufficient to deal with five million eggs.

(f) **Preliminary Expenses and Miscellaneous.**—This includes registration fees in the case of co-operative packing stations and other expenditure not elsewhere provided for.

Working Capital.—The amount of working capital required depends upon the quantity of unsold stocks, and on the debts due to any particular time, as well as the extent to which provision must be made for recurring expenditure not immediately recoverable from sales. The current assets of certain existing stations amount to about 10 per cent. of sales, but, owing to their cautious policy of accumulating funds at the bank and to the liberal credit allowed in some cases to buyers, it is probable that this figure might be safely halved for the purpose of estimating the average amount of working capital required by future depots. This would amount to rather more than twice the value of the average weekly turnover, which was the amount suggested by the manager of one society. The amount of working capital actually subscribed need, however, be relatively small; the balance may be obtained by short-period credit from suppliers, or by utilizing bank overdrafts. Existing societies adopt either or both of these

methods. In time, reserves and accumulated profits might help to provide the necessary working capital. At the outset, a conservative policy would, no doubt, aim at obtaining a fairly high proportion of subscribed working capital, and at cash or short-credit sales, thus leaving a margin of borrowing power in the hands of the organization to meet extraordinary expenditure. On the other hand, bank overdrafts would probably be the cheapest method of financing the extra business done in the season of maximum supplies.

Non-returnable Boxes.—The cost of these should be considered as part of the working capital, but at present few stations use exclusively non-returnable boxes. The cost may be reckoned to be 2s. per box made-up, inclusive of fittings, or 1s. 10d. in shooks. It is, however, expected that cheaper boxes will soon be obtainable, especially where large quantities are ordered. About a fortnight's requirements should always be kept on hand.

II.—Budget Estimate for the First Financial Year.—In regard to this, Table II can hardly amount to much more than guesswork, but some such estimate is important in determining the expenses margin on which packing depots of varying turnovers are likely to be able to work.

TABLE II.—BUDGET ESTIMATE OF EXPENDITURE AND REVENUE DURING THE FINANCIAL YEAR.

Turnover	1 million	3 million	5 million
A. EXPENDITURE	£	£	£
<i>Salaries and wages—</i>			
Manager	200	300	350
Other staff	75	200	250
<i>Transport—</i>			
Motor expenses	240	670	880
Carriage (rail)	40	100	150
Egg boxes	250	750	1,250
<i>Other expenses—</i>			
Rates and taxes			
Light, heat, etc.			
Insurance			
Repairs			
Printing and stationery	115	160	200
Cheques, stamps, telephones			
Audit fee			
Bank charges			
Bad debts			
<i>Depreciation—</i>			
Buildings and fixtures	20	20	25
Motor vans	50	150	250
Egg boxes	10	30	50
	<u>1,000</u>	<u>2,380</u>	<u>3,405</u>

	1 million	3 million	5 million
B. REVENUE	£	£	£
Margin of 1d. per doz. ..	347	1,041	1,735
" 2d. " ..	694	2,082	3,470
" 3d. " ..	1,041	3,123	5,205
" 4d. " ..	1,388	4,164	6,940

The provision for "other staff" in the salaries and wages group includes graders and testers and clerical staff.

For a turnover of a million eggs, a single, efficient assistant and the manager could undertake all the work of running the depot. For a three-million turnover, three women graders and a clerk (female) would be required; a staff of four testers and graders and one clerk could handle a turnover of five million. Wages would vary with local conditions, but, in country districts, a wage of 6d. per hour for female labour is about the standard rate. Collectors' wages are charged to "motor expenses," and may be placed at from £2 to £3 per week.

According to the above estimates, a margin of 3d. per dozen on eggs sold would enable a society with a turnover of a million eggs to meet expenses, including cost of collection and delivery, and pay interest on capital. On a turnover of three million eggs, a margin of 2½d. per doz. would also allow this to be done, and would leave a fair margin of profit. A margin of 2d. per doz. would suffice to pay working expenses on a turnover of five million eggs.

III.—Relation of Business Organization to Capitalization and Running Costs.—It would seem from Table I that, as far as outlay on fixed capital is concerned, the most economic unit would be a depot handling about 20 million eggs. It is, however, impossible to lay down any universally applicable rule in the matter, since so much depends on the area to be served and the location of markets. In Wales, for example, where production is mainly carried on in the narrow valleys, between which communication is difficult, the large centralized station with wide collecting area is generally unsuitable. In this case, it would probably be more economical to run small local units, autonomous as regards capitalization and working, which would consign their produce to the order of a central selling organization. Another method is that adopted by an English society having a turnover of about 20 million eggs; this operates about 30 depots, at 20 of which eggs are collected, tested, and graded, and sent direct to producers, while the other 10 act purely as collecting stations. The present policy of the society is, however, to centralize packing at a few points, and reorganization is proceeding in this direction. Decentralization often has the advantage of cheapening

collection costs, especially when the area is not very intensely populated; but against this must be placed the disadvantage arising from lack of control of quality and uniformity of grading, and from heavier administration and overhead costs.

The establishment of collecting points within the area of a centralized station is, however, frequently an undoubted economy. For this purpose several societies have made arrangements with Women's Institutes to act as collecting organizations in the villages. In one case, a Women's Institute has become a corporate member of the society by purchasing a share, and is, in this way, able to participate in the profits of the society. The Women's Institute hires a room in a village on market day, where the secretary or other voluntary workers attend to receive supplies, which are afterwards collected by the society's lorry; the work of distributing returns among suppliers is also done through the Women's Institute organization. Work of this kind is usually done voluntarily, but in some cases it might pay the packing station to allow a small premium of, say, $\frac{1}{2}$ d. per doz. to cover the costs of performing the work.

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THE EFFECTS OF INTENSIVE MANURING ON TWO VARIETIES OF WHEAT

Communicated by the National Institute of Agricultural Botany.

SOME trials carried out by the National Institute of Agricultural Botany at Cambridge in the past two seasons suggest that, given typical wheat land and a suitable variety, judicious expenditure on manures for wheat is a profitable investment even at the present low grain values. The facts are here given with a warning that caution is necessary in drawing conclusions from work lasting for two seasons only at a single centre.

Two trials of Yeoman II, with Squarehead's Master as controls, were sown in 1926-27 and repeated in 1927-28, the one normally, the other intensively manured, but otherwise under identical conditions. The accuracy of the trials left nothing to be desired, as the experimental error in no case exceeded ± 1.02 per cent. The soil in both years was a heavy clay with a gault sub-soil; the altitude was 80 ft. The 1926-27 trials followed a crop of mixed seeds hay, the 1927-28 trials bare fallow with a crop of mustard ploughed under in August, 1927. The dates of drilling were, in 1926: normal trial, October 22; intensive trial, October 25. In 1927 drilling for both trials was carried out on November 3. In both years it was found that the

different manurial treatments made no material difference to the times taken by the varieties to ripen.

Ten loads of farmyard manure per acre were applied in August, 1926, to the whole of the 1926-27 trial area. No dung was applied in 1926 or 1927 to the 1927-28 trial area. Particulars of the artificial manures follow:—

1926-27		Normal Manuring Trial		Intensive Manuring Trial	
Date of Application	Manure	Rate per acre cwt.	Cost per acre s. d.	Rate per acre cwt.	Cost per acre s. d.
23.3.1927	Superphosphate	2	6 9	2	6 9
22.4.1927	Superphosphate	—	—	2	6 9
22.4.1927	Kainit	—	—	2	6 0
22.4.1927	Sulphate of Ammonia	—	—	2	25 0
28.4.1927	Nitrate of Lime	1	11 9	1	11 9
20.5.1927	Nitrate of Lime	—	—	2	23 6
Total cost per acre ..			18 6		79 9

1927-28		Normal Manuring Trial		Intensive Manuring Trial	
Date of Application	Manure	Rate per acre cwt.	Cost per acre s. d.	Rate per acre cwt.	Cost per acre s. d.
1.3.1928	Sulphate of Ammonia	—	—	1	11 0
9.3.1928	Ground Rock Phosphates	2	6 2	2	6 2
9.3.1928	30 per cent. Potash Salts	$\frac{1}{2}$	2 3	$\frac{1}{2}$	2 3
22.3.1928	Ground Rock Phosphates	—	—	2	6 2
22.3.1928	30 per cent. Potash Salts	—	—	1	4 6
25.4.1928	Nitrate of Lime	$1\frac{1}{2}$	16 6	$1\frac{1}{2}$	16 6
12.5.1928	Nitrate of Lime	—	—	2	22 2
Total cost per acre ..			24 11		68 9

The results of the trials are summarized in the following table:—

		Total Yields per acre as thrashed:		Dry Weight of grain as percentage of control		Value of thrashed grain per acre at current values		
		Straw cwt.	Grain cwt.			£	s.	d.
1926-27								
Yeoman II	Normal manuring	30.0	24.7	100.7		13	5	5
Yeoman II	Intensive manuring	35.3	31.5	105		16	18	8
Squarehead's Master.	Normal manuring	33.7	24.3	100		13	1	3
Squarehead's Master	Intensive manuring	37.9	29.9	100		16	1	5

1927-28

Yeoman II	Normal manuring	40.0	30.2	99.7	13	19	4
Yeoman II	Intensive manuring.	53.2	39.4	104.3	18	4	5
Squarehead's Master.	Normal manuring	37.1	30.3	100	14	0	3
Squarehead's Master.	Intensive manuring.	54.2	37.9	100	17	10	7
Value of grain taken in 1926-27 at 10s. 9d. per cwt. for both varieties.							
Value of grain taken in 1927-28 at 9s. 3d. per cwt. for both varieties.							

If the cost of application of the extra manures is regarded as balanced by the value of the increased quantity of straw, the financial results may be stated as follows :—

		Additional Cost of Intensive Manuring per acre			Additional Return from Intensive Manuring per acre			Profit on Intensive Manuring per acre		
		£	s.	d.	£	s.	d.	£	s.	d.
Yeoman II, 1926-27	..	3	1	3	3	13	3	0	12	0
Yeoman II, 1927-28	..	2	3	10	4	5	1	2	1	3
Average	..	2	12	7	3	19	2	1	6	7
Squarehead's Master, 1926-27	..	3	1	3	3	0	2	*0	1	1
Squarehead's Master, 1927-28	..	2	3	10	3	10	4	1	6	6
Average	..	2	12	7	3	5	3	0	12	8

* Loss

The additional manuring has paid with both varieties, but Yeoman II has returned 13s. 11d. per acre more than Squarehead's Master. This, however, is not the whole story. The only effect of the manuring on diseases was that mildew and rust were rather more noticeable in the intensively manured than in the normal trial in 1927-28. In 1926-27 Yeoman II stood well in both trials, but 30 per cent. of the Squarehead's Master was lodged in the normal trial and 75 per cent. of it was badly lodged in the intensively manured trial; while, in 1927-28, a year when lodging was remarkably rare, Squarehead's Master was badly lodged in the intensively manured trial, but Yeoman II stood well, except where parts of the adjacent strips of Squarehead's Master had collapsed upon it. Moreover, some injustice has probably been done to Yeoman II by valuing its grain at the same figure as Squarehead's Master; for the Home-Grown Wheat Committee of the National Association of British and Irish Millers, who have made milling and baking tests with the produce of the 1926-27 trials, state in a report,

which will shortly be published, that, so far as the one year's work goes, Yeoman II was improved in quality by intensive manuring, but Squarehead's Master was not.

* * * * *

EGG MARKETING SCHEME PROGRESS OF ORGANIZATION

THE progress that has been made with the organization of the egg marketing scheme is satisfactory and well up to expectations. By October 5, 1928, applications for accrediting packers under the scheme had been forwarded by County Branches of the National Farmers' Union as follows :—

County	No. of Applications forwarded				
Cambridge ..	..	..	..	..	2
Carmarthen ..	..	..	..	..	3
Cornwall ..	..	..	..	..	9
Devon ..	..	..	..	..	3
Essex ..	..	..	..	..	1
Hampshire ..	..	..	..	..	2
Hertford ..	..	..	..	..	2
Kent ..	..	..	..	..	1
Lincs. (Holland) ..	..	..	..	..	1
Lincs. (Kesteven) ..	..	..	..	..	1
Norfolk ..	..	..	..	..	7
Oxford ..	..	..	..	..	3
Somerset ..	..	..	..	..	8
Warwick ..	..	..	..	..	2
					45

Further applications are known to be pending, and it is anticipated that the numbers will be greatly increased in the near future. The premises and equipment have been inspected in each case, and, where necessary, advice has been given as to any alteration or improvement considered desirable.

Modifications in Detail.—At a meeting of the Poultry Advisory Committee held at the Ministry of Agriculture and Fisheries on September 25, 1928, the following modifications were suggested for the Minister's consideration :—

Grade Nomenclature.—That the grade designation "Medium" should be dropped for both hens' eggs and ducks' eggs as being likely to react adversely on the selling capacity of the grade; that, instead, the designation "Pullet Standard" should be adopted for hens' eggs and "Ducklet Standard" for ducks' eggs; that the designation "Special Duck" should be substituted for that of "Extra Duck," in order to bring the grade terms for ducks' eggs into line with

those adopted for hens' eggs; and that the "Small" grade, *i.e.*, for eggs below Pullet and Ducklet Standard, should not be made a statutory grade.

Grade Weights.—That instead of defining the grade weights on the basis of the 120 unit, a minimum egg weight should be specified for each grade, in order to simplify the system and to make possible the accurate application of the grade terms to small quantities. That the minimum egg weights should be as follows :—

	<i>Minimum Egg Weight</i>				
Special	..	..	..	..	2½ oz.
Standard	..	..	..	..	2 oz.
Pullet Standard	..	..	..	..	1¾ oz.
Special Duck	..	..	..	..	2¾ oz.
Standard Duck	..	..	..	..	2½ oz.
Ducklet Standard	..	..	..	..	2¼ oz.

Quantity Qualification.—That, in order to allow for the falling-off in production in August and September, the minimum quantity of eggs which applicants are required to handle weekly in order to qualify as accredited packers should be 20 cases during those months. The quantity qualification as thus revised would be as follows :—

	<i>The equivalent of :—</i>		
January to July (inclusive)	..	..	=30 cases holding 30 dozen
August and September	..	..	=20 cases holding 30 dozen
October to December (inclusive)	..	..	=10 cases holding 30 dozen

N.B.—In the original scheme, the requirements for August and September were the same as for January to July.

The question of modifying the qualifying turnover for accredited packers in favour of co-operative societies with branch depots was considered, but it was recommended that no change should be made.

Packages.—That, in order to facilitate trade with small buyers and also to enable "Specials" to be packed in small units, the National Mark should be permitted to be applied to full, non-returnable cases containing 10 dozen, 15 dozen and 20 dozen eggs, in addition to the 30-dozen size commonly in use in the trade. The Committee reiterated the view that only *new* non-returnable cases should be allowed for packing eggs sent out under the National Mark.

That any concession granted for the use of returnables should only apply to an existing stock of cases.

That fiberite, fibre board and corrugated board containers should be permitted for the packing of eggs under the National Mark, the types of container and the method of packing to be approved by a Sub-Committee of the Poultry Advisory Committee which has been appointed for that purpose.

Cartons.—That the packing of eggs in 1-dozen and ½-dozen cartons of patterns approved by the Ministry should be permitted, and that packers should be encouraged to develop this method of packing, and allowed to use a National Mark label for sealing the cartons.

Date of Packing.—That the date of packing should be marked on all cases.

Marks.—That the regulations to be made under Sections 3 and 4 of the Agricultural Produce (Grading and Marking) Act, 1928, should prescribe that preserved, cold-stored and chemically-stored eggs should be marked with the words "Preserved," "Chilled" or "Cold Stored" and "Sterilized," respectively. The use of the initial letters "P" "C" and "S" as an optional alternative was considered, but disapproved as affording insufficient indication to the public.

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NOVEMBER ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.)

Agricultural Organizer for Derbyshire.

Seasonal Notes.—November is a transition month in the farmer's year; it embraces the end of the grazing season and the beginning of winter rationing, and marks the close of the busy season and the commencement of dead winter-period, when, as regards field work, it is neither possible nor necessary to make much haste. This month is often characterized by evening fogs and rimes, and frequently severe frosts overtake the remnants of the mangold and potato crops. These frosts also complete the mortification of the last tree-leaves, which then blow off on the occurrence of the autumn blasts with which this month is proverbially associated. By the end of the month the normal temperature has fallen to 41° F. in the Eastern and Midland counties, and 43° to 44° F. in the Southern shires. In the latter areas, appreciable growth of grass and young corn—and certain perennial weeds—continues; but in the other districts, where the mercury sinks to 36° F. at night and rises only to 46° F. in the day, little vegetative development can take place. In the matter of sunshine, November ranks, with December and January, as one of the three darkest months.

Late Wheat Sowing.—In remarkable contrast with conditions obtaining a year ago, excellent progress has been

possible this year in the cleaning of stubbles and their preparation for sowing. It is anticipated, therefore, that November drillings will be confined to the land recently cleared of potatoes, mangolds and sugar beet, and such of the lea ground as became too hard and stubborn for team ploughing until softened by the rains of October. The general custom is to allow lea land to lie for a month or so after ploughing. The reasons for this practice are to allow the soil to mellow down and the lea-stubble residues to die and decay. When sown on a recently ploughed grass furrow, winter corn is apt to become root-fallen, a result of the soil settling upon itself as the grass root fibres rot away; the fresh fibrous turf also holds the soil too open for the best resistance of winter weather conditions. Where lea ploughing for wheat has been unavoidably delayed, it is advisable to skim and harrow out the turf, then plough it down under a deep furrow. Under these conditions it would seem desirable to apply a dressing of artificial manures to assist the young plant in establishing itself in the seed bed, which has not had sufficient time for the liberation of an adequate supply of plant food material from the soil reserves.

The preparation of a seed bed for wheat, after green crops, is a matter on which different opinions are held. Discussing the possibility of reducing labour costs in corn growing, Mr. James Wyllie, Advisory Economist at Wye, in his recently issued Report No. VI, asks: Is it necessary to plough at all for wheat after potatoes? This question was the subject of an experiment at Rothamsted in 1915 and 1916. In the first year, wheat drilled on the unploughed potato tilth gave only a bushel per acre less than the ploughed and drilled plot; in the next year, however, there was a difference of eight bushels. Obviously, on land that readily runs together and becomes muddy on the surface, it is advisable to plough down the fine top tilth left by the potato-spinner and to bring up a little material that will lie on the surface in the shape of egg-sized clods. On lighter soils, probably, ploughing would be unnecessary, especially where a disc drill is used; and it is a well-established practice to put wheat in after potatoes by merely broadcasting and covering with a light, three- or four-furrowed skim plough.

Mangold land does not receive the same fine breaking up as that which has been treated with a potato digger. Consequently, tillage of some kind is generally necessary in this case to ensure sufficient covering of the seed. Probably broadcasting the seed and covering it by disc harrowing is as satisfactory as any

of the labour-saving methods of sowing, provided that the mangold tops have been properly spread. In covering seed by discing, however, it is important to remember that the discs throw the soil and seed inwards; and, unless the implement is operated in such a way as to overlap half the width of the previous traverse, the braid will be found to be uneven, with thick and thin strips alternating. One reason for the general preference for ploughing, instead of discing or cultivating the seed in, is the fact that turning the furrow over has a cleaning effect not produced by the other implements, and in some years even the mangold land is not free from weeds after harvest.

Many farmers do not pay the attention to water-furrowing their winter corn which is justified by the assistance which the crop receives from the operation. As in under-draining, it is better to prevent water from running into the lower parts of the field than to remove it after it has arrived there. A few well-planned grips may, therefore, be cut for preventive purposes. The opening of plough-furrows across the headlands is sometimes all that is needed on fairly level ground.

Winter Manuring.—From the point of view of obtaining a good tilth for roots in spring, it is very desirable to apply the dressing of yard manure in the autumn or winter. Where cows and pigs are kept there is a certain amount of recently-made manure available at this time of the year; but, generally, autumn manuring involves the keeping of manure made during the previous winter. Lea stubbles can be manured for wheat when the crew yards are cleaned out in August and September; but to be able to apply a liberal dressing of dung after cleaning stubbles for roots and potatoes, some of the manure has to be left undisturbed in the yards until this time of the year, when the yards are required and perhaps occupied by a new lot of cattle. In some districts it would be regarded as doubtful husbandry to keep manure back for a whole year, instead of using as much of it as possible for the green crops sown in the spring.

That a considerable loss takes place in manure kept through the summer, even when left solid and undisturbed, was shown by Professor Wood's experiment over 20 years ago: storage for six months involved a loss of about one-third of the dry matter and nitrogen present in the dung when made. It would seem, therefore, that there is still room for study and experiment with a view to finding a compromise between the

evils of wasting valuable manurial ingredients by storing through the summer and, on the other hand, the objections to putting long manure into the land in spring under conditions which experience has shown to be unsuitable for this practice. Possibly chaffing the straw before using it as litter would help to accelerate its decay—it certainly facilitates its distribution in the field; but there still remains the fact that it is undesirable to plough heavy land after about the end of February. The application of manure in the drills is practicable only in districts where ridge husbandry is appropriate. Its adoption also prevents close drilling, which is essential for heavy yields of roots; and, without the aid of a mechanical dung spreader for work between ridges, delay as well as loss of soil moisture may be occasioned by the adoption of this practice.

Where, as in the management of cows, the manure is removed from the sheds twice daily, and part of the output is utilized on meadow land, the ideal to be kept in view is the avoidance of storing the manure at all: subject to the limitations imposed by weather conditions (which determine whether it is possible to cart manure on to the land every day in the winter), the barrows or conveyors which bring the dung from the sheds should be emptied direct into a cart or a mechanical spreader for distribution in the field as soon as a load has been accumulated. Chaffing has already been mentioned as a means of rendering the litter easy to spread; it is also a means of economizing straw, which generally is not abundant on dairy farms.

Calf Rearing.—Under natural conditions cows do not bring forth their young at this time of the year; and, as every dairy farmer knows, it is not easy to arrange for a sufficient proportion of autumn and winter calvings. It is necessary, however, to have calves in autumn; and where an endeavour is being made to breed systematically, and to raise young stock bred from the best milkers, rearing has to be continued through the autumn and winter months (when it is both expensive and difficult) as well as in the spring, when milk is cheap and plentiful and conditions are otherwise favourable to the well-being of young animals.

The autumn-and winter-born calves have to conform to the need for economy in the matter of the allowance of whole milk; and unfortunately this stringency in their diet coincides with a time of the year when sunshine and green food—both important sources of essential health factors—are least

abundant. Bearing this in mind, the value for calves, receiving little new milk, of such green food as can be provided and a small daily allowance of cod liver oil, will be readily understood.

It has been abundantly proved, both in experiments and in farm practice, that good calves can be reared without the use of more than 50 gallons of whole milk per head. Under skilful management, even this quantity can be appreciably reduced; on the other hand, there are many who disapprove the policy of reducing the allowance of milk to a minimum, on the ground that parsimony at this stage is afterwards reflected in the health and wearing qualities of the mature animal.

At one time, it was thought necessary to feed the milk substitutes in the form of gruel; and it may be the case that a judicious compromise between the all-gruel and the all-dry method of rearing is the best. There is no doubt, however, that calves can be taught to eat and thrive on dry concentrates at a comparatively early age, and many farmers have adopted the dry method on account of its great convenience, beside the fact that it avoids the need for purchasing expensive calf meals. A typical simple mixture used for this purpose is linseed cake, 2 parts by weight; crushed oats, 3; bran, 1; and fish meal, $\frac{1}{4}$. Palm kernel meal, which gave such good results in the trials carried out by the R.A.S.E. and in subsequent experiments, may form part of the mixture.

Calves begin to eat concentrates at about three weeks old, young ones learning from those a little older; their capacity steadily increases until, at three months old, they are able to consume as much as 5 lb. per head per day, if permitted: this is equivalent to two gallons of milk. The allowance of whole milk is gradually reduced from about 12 lb. per day at three weeks old to 6 lb. at eight weeks, or when the calf is able to eat $2\frac{1}{2}$ lb. of concentrates—the equivalent of 10 lb. of milk. Whole milk is discontinued entirely at 12 weeks. Water and hay are supplied *ad libitum*.

One of the essentials to successful calf rearing is a dry lair. In the case of young calves, bedding is not a matter in which economy can be carried very far.

NOTES ON MANURES

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Basic Slag.—There is no doubt that the outstanding manurial requirement of most of our permanent grassland is phosphate. Phosphatic manures are usually the most promising agents of improvement for pasture which is being treated for the first time, and frequently form the most profitable means of maintaining the better condition. Although bones had been in common use in certain districts for centuries, the wider appreciation of the value of phosphate on grassland came with the discovery in 1885 of a new and very effective source of phosphate in the finely-ground slag from the basic Bessemer steel-making process. The striking effect of basic Bessemer slags as grassland improvers was brought out in a series of classical experiments by Sir Wm. Somerville and his successors. Aided by its spectacular effects on poor clay land pastures, the reputation of basic slag was rapidly made during the 'nineties of last century. Farmers had available a comparatively cheap source of phosphate, which was easy to handle, and which, without assistance from other fertilizers, produced quick, striking and fairly lasting improvement in poor to medium permanent pastures on many of the typical grassland formations. At the same time details of the successful use of basic slag over long periods were being worked out at the Cockle Park experimental station in Northumberland, and certain questions with regard to the best methods of application were being answered. A whole series of trials by the County Authorities bore out the general results. All this was done with a product which is no longer produced in this country. The basic Bessemer process has, in recent years, gradually given place to the open hearth process of steel manufacture, and this has brought about certain changes both in the grade and composition of the resulting basic slags.

Bessemer slags contained as a rule about 18 per cent. of total phosphoric acid, of which 80 per cent. was soluble in 2 per cent. citric acid, and a statement of the amount of citric-soluble phosphate was usual on sale and was recognized under the Fertilizers and Feeding Stuffs Act of 1906. The open hearth slags which represent the whole of the present home output range in grade from about 9 to 16 per cent. of phosphoric acid. Many of these have a citric solubility of the

same order as that of the pre-war slags, but in the manufacture of others fluor-spar is added to the contents of the steel furnace and this has the effect of lowering the citric solubility.

Purchasers of basic slags have therefore available open hearth slags containing from 9 to 16 per cent. of phosphoric acid; some of these have been made with fluor-spar and some without. There is also a relatively small amount of imported basic slag of a grade and solubility very similar to the pre-war Bessemer slags.

The statement of citric solubility ceased to be customary after the war and is not compulsory at present. It nevertheless provides a useful guide to farmers, and basic slags of over 80 per cent. solubility are frequently sold with this guarantee. These open hearth basic slags of high solubility may be regarded, when compared on the basis of equal amounts of phosphoric acid, as equal in their action to the pre-war Bessemer type. They are therefore very valuable phosphatic fertilizers, no matter whether low or high in phosphate content, and the general findings of the earlier work may be applied to them. The fluor-spar slags have proved themselves to be distinctly less effective in the first year or two than the types of high citric solubility. It is understood, however, that the proportion of home-produced slags which show a citric solubility of 80 per cent. or more has increased in recent years. These open hearth slags of high solubility can now be obtained by farmers who make a point of stating their requirements with their orders.

The action of basic slag on grassland is well known. It greatly increases the amount of wild white clover and other leguminous plants in the herbage and also favours the finer grass. The thicker turf produced tends to suppress weeds and conserve the water supply. The soil is deepened and drained by the root action of the more vigorous herbage and a gradual enrichment in nitrogen takes place. These effects are most striking in poor, heavy land pasture which is fairly open in the bottom and carries no impenetrable mat of undecayed residues of vegetation. On such land basic slag may increase the stock-carrying capacity two or three fold, while on pasture of better class the benefit, although quite marked, is naturally not in the same degree. As far as dressings are concerned it has been shown that a fairly large initial application is more rapid and effective than the same weight of slag applied in a succession of smaller doses. Thus, on

unimproved land which needs phosphate, basic slag providing 200 lb. of phosphoric acid per acre is not too large a dressing. This would be provided by 13 cwt. of a 14 per cent. slag or 18 cwt. of a 10 per cent. slag. This treatment should last for 5 or 6 years, and when it is observed that the good effect is beginning to wear off periodic dressings of half the initial amount every 3-4 years will usually maintain the improvement.

A few points are worthy of notice in using basic slag :—

- (1) The slag should be applied when the herbage is short and at a time when the grass is dry.
- (2) Any thick mat of decayed vegetation should be thoroughly distributed with the harrows before sowing.
- (3) When speed of action is required a soluble slag should be used.
- (4) Although slag may be applied at any convenient time of the year, autumn or early winter is the usual season. Basic slag should not be applied when snow is on the ground or when heavy rain is expected, as under these conditions it runs together and the advantage of its fine state of division is lost.

Other Phosphates.—While basic slag was the first phosphatic manure to be used on an extensive scale for grassland, other forms have been the subject of many trials and are valuable alternatives under certain conditions.

Superphosphate was tried alongside basic slag in the well-known Cockle Park Experiments during the first nine-year period. Its effect was very similar to that of slag, particularly when used along with lime. Its value for poor grass land improvement was discounted by the fact that, in the early days, the unit of phosphate was much cheaper in basic slag than it was in superphosphate, and, under conditions where the lime of basic slag was valuable, the lack of available lime in superphosphate was a disadvantage which could only be got over by further outlay. On chalky soils and in dry situations, however, superphosphate is an excellent source of phosphate for grassland.

Ground Rock Phosphates.—In recent years, attention has turned to the use of ground mineral phosphate as an alternative to basic slag. Experimental work in Northumberland, Essex, North Wales and in many other counties has proved the value of ground rock phosphates, particularly those from North Africa, for pasture improvement. At the more favour-

able centres they have often equalled high-soluble slags in their action, but on the whole can be reckoned as about equivalent to the lower-soluble types. The conditions for the success of rock phosphates are not yet well defined, but fine grinding, moist soils, and districts showing a long growing period are favourable to their action. Each case must be taken on its merits, and there are few districts in which the County Agricultural Organizer will not have information with regard to the behaviour of mineral phosphates on the local soil types. An advantage lies in the concentrated nature of the material (27 per cent. phosphoric acid) and the relatively low price of the unit of phosphoric acid, which costs rather less than one-half as much in raw rock phosphate as it does in high-grade slags or water-soluble phosphates. It is to be expected that the action of ground mineral phosphate will be somewhat slower than that of the more soluble sources of phosphate. For this reason the finer grinding to 85 per cent. through the standard sieve should be used when possible.

Phosphate for Hay.—On heavy soils phosphate used alone constitutes, as it were, a complete fertilizer for grazing purposes. Potash is present in the soil in good supply; this with the phosphate enables clovers to make vigorous growth, and the nitrogen thus collected causes a subsequent development of better types of grass in the herbage. Grazing results in a withdrawal of phosphate, lime and nitrogen, but relatively slight quantities of potash. For hay production, however, the case is somewhat different, for in addition to the other elements the drain of potash is considerable. There are soils which can grow fair crops of hay over long periods with phosphate treatment only, but these are rather exceptional types which are strongly in need of phosphoric acid. Thus a yearly dressing of 300 lb. of basic slag has increased the yield of hay from 19½ to 26 cwt. at Cockle Park as an average increase for 31 years of continuous mowing. In 20 years of experiments on hay at Saxmundham, the unmanured plot averaged 10 cwt. of hay, but, by periodical dressing with basic slag, the yield was increased to 24½ cwt., and, by the use of superphosphate, to 22½ cwt. These results may be repeated on soils such as the above, where phosphates produce the most spectacular effects, but on land of rather better natural quality, or on the lighter soils, the hay crop will not usually be improved to the same extent by phosphate manuring. The quality will usually be better, but the gain in yield may be

small. This was brought out by a series of trials carried out by the Agricultural Education Association in the years 1921-24, where the effect of treatment was measured as hay. Out of

PRICES OF ARTIFICIAL MANURES

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named and are net cash for prompt delivery.

Description (see special footnote)	Average price per ton during week ending October 10				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%)	10 2	10 2	10 2	10 2	13 0
Nitro-chalk (N. 10%)	7 0	7 0	7 0	7 0	14 0
Sulphate of ammonia:—					
Neutral (N. 20·6%)	10 2d	10 2d	10 2d	10 2d	9 10
Calcium cyanamide (N.20·6%)	9 4e	9 4e	9 4e	9 4e	8 11
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%)	11 19g	11 3h	..	..	..
Kainit (Pot. 14%)	3 4	2 19	2 17	2 19	4 3
Potash salts (Pot. 30%)	4 19	..	4 14	4 17	3 3
" (Pot. 20%)	3 12	3 9	3 6	3 9	3 5
Muriate of potash (Pot. 50%)	9 7	9 3	8 16	8 15	3 6
Sulphate " (Pot. 48%)	11 9	11 6	10 17	10 15	4 6
Basic Slag (P.A. 15½%)	2 3c	1 17c	..	2 4c	2 9
" (P.A. 14%)	1 19c	1 12c	1 12c	2 0c	2 10
" (P.A. 11%)	..	1 7c	1 7c	..	..
Ground rock phosphate (P.A. 26· 27½%)	2 10||	2 7||	..	2 5a	1 8
Superphosphate (S.P.A. 16%)	3 0	..	3 1	3 0	3 9
" (S.P.A. 13½%)	2 15	2 8	2 15	2 15	4 0
Bonemeal (N.3½%, P.A.20½%)	8 15	8 10	8 12	8 7	..
Steamed bone flour (N. ½%, P.A. 27½-29½%)	5 17b	..	6 15	5 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. 85% through standard sieve.

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.

g F.o.r. Gloucester.

h F.o.r. Goolse.

Special Note.—The percentage of phosphate has been discontinued and the percentage of phosphoric acid substituted, with a consequent alteration in unit values. To convert phosphoric acid to equivalent in tribasic phosphate divide by 0·458.

59 sets of figures derived from 33 grassland centres only 14 gave definite results in marked increases in the hay crop, while the remaining 45 gave no certain increase in bulk, but quite frequently a marked increase in quality.

For hay production in general, therefore, something in addition to phosphate will be needed. On some farms a certain amount of dung will be available, and this may serve to provide the necessary nitrogen and potash to balance the phosphatic manures. Ten tons of farmyard manure, in conjunction with phosphatic fertilizers, providing about 100 lb. of phosphoric acid per acre, could be taken as a basis for three-year hay crops. If farmyard manure is not available, the necessary potash and nitrogen may be applied in the form of artificials. The potash will constitute the winter dressing and can be applied at the same time as the phosphate. About 50 lb. of potash per acre, applied as potash salts, would form a dressing which could be given in alternative years. Where quality in the hay crop is of more importance than bulk, phosphate and potash used alone will frequently give quite satisfactory results.

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NOTES ON FEEDING STUFFS

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The Digestibility of Sugar Beet Pulp.—The Notes for last month dealt with the composition and manurial value of dried sugar beet pulp and molasses-sugar beet pulp. It is now proposed to give a short account of the results which were obtained in the Cambridge investigation into the digestibility of wet and dried sugar beet pulp.

The whole trial was divided into four periods. The first period was necessary in order to determine the digestibility of the sainfoin and rye-grass hay which was to be used with the sugar beet pulp in the rations of the sheep under experiment. The digestibility of dried sugar beet pulp, when given in the dry condition, was determined in the second feeding period. This was succeeded by a further period in which the dried beet pulp was replaced by fresh wet sugar beet pulp. In the final period, the effect of preliminary soaking in water on the dried sugar beet pulp was investigated. The rations which were fed to the sheep in these periods are shown in Table I.

TABLE I.—RATIONS FED TO THE SHEEP IN THE DIGESTION TRIALS.

Period.	Daily Ration.
1.	1,200 gm. of chaffed sainfoin and rye-grass hay.
2.	400 gm. of chaffed sainfoin and rye-grass hay+800 gm. dried sugar beet pulp (fed dry).
3.	400 gm. of chaffed sainfoin and rye-grass hay+4,600 gm. wet sugar beet pulp.
4.	400 gm. of chaffed sainfoin and rye-grass hay+800 gm. dried sugar beet pulp (fed after soaking).

During the carrying out of the digestion experiment on the wet sugar beet pulp, absolutely fresh consignments of this material were transported daily from the Ely Beet Sugar Factory. In period 4, the ration of 800 gm. dried pulp was allowed to soak overnight in 2,000 c.c. of water, this amount of water being easily taken up by the dry feeding stuff. The sheep remained in excellent condition throughout the course of the investigation and consumed the rations eagerly, no food residues of any kind being left in the experimental periods. During the periods in which beet pulp was fed, the animals were given access to rock salt.

Digestion Coefficients.—The mean results for the digestion coefficients in the several periods of experiment are shown in Table II.

TABLE II.—SUMMARY OF DIGESTION COEFFICIENTS.*

Period.	1	2	4	3
	Sainfoin- rye-grass hay per cent.	Dried sugar beet pulp fed per cent.	Dried sugar beet pulp fed after dry soaking per cent.	Wet sugar beet pulp per cent.
Dry matter	57.0	84.0	84.2	83.2
Organic matter ..	58.7	86.5	86.5	86.5
Crude protein ..	56.4	59.4	58.3	61.1
Crude oil	40.7	—	—	—
Carbohydrate ..	64.1	92.0	91.1	91.0
Crude fibre	53.5	87.7	89.7	89.8

A striking feature of the data recorded in Table II is the close agreement between the values of the digestion coefficients in the different sugar beet pulp periods. In the case of the digestion coefficient of the organic matter of the beet pulp, the same value, namely 86.5 per cent., was obtained in all three periods, an extraordinary case of close agreement.

The data reveal clearly the highly digestible character of sugar beet pulp when consumed by ruminants. On account of its high fibre content, beet pulp has hitherto been generally regarded as more nearly related in character to the coarse

* The reader is reminded that the digestion coefficient of a feeding stuff constituent is the number of parts of that constituent which are digested by the animal per 100 parts consumed.

fodders than to the concentrates. This view, however, must obviously be discarded, and sugar beet pulp must henceforward be included in the class of concentrated feeding stuffs, a conclusion which is further emphasized by the comparative data given in Table III.

TABLE III.—DIGESTION COEFFICIENTS OF THE ORGANIC MATTER OF SUGAR BEET PULP AND TYPICAL CONCENTRATES.

Sugar beet pulp per cent.	Barley meal per cent.	Maize meal per cent.	Flaked maize per cent.	Linseed cake per cent.	Palm kernel cake per cent.
86.5	81.7	87.8	95.4	80.1	70.8

It will be noted from Table III that sugar beet pulp is more digestible than plain kernel cake, linseed cake and barley meal. Its digestibility compares very satisfactorily with that of another important carbohydrate food, namely, maize meal. It is also interesting to realize (see Table II) that the process of drying the wet sugar beet pulp in the factory does not depress its digestibility. Further, from the standpoint of digestibility, it is immaterial whether the dried product is included in the rations of ruminants in the dry or the soaked condition, preliminary soaking of the dried beet pulp in water having occasioned no measurable improvement in the degree to which the material was digested by the sheep.

Digestibility of Carbohydrates and Crude Fibre.—It is of special importance to note the extent to which the carbohydrate and crude fibre of the beet pulp were digested by the sheep, since these constituents respectively comprise about 65 and 20 per cent. of the dry matter of the feeding stuff. The digestion coefficients of the carbohydrate were high throughout, being 92.0, 91.1, and 91.0 per cent. respectively in periods 2, 4 and 3. Factory drying, therefore, does not affect the digestibility of this constituent, nor is anything to be gained in this respect by soaking the dried beet pulp before feeding. The significance of these high values is made clear by the data recorded in Table IV.

TABLE IV.—DIGESTION COEFFICIENTS OF CARBOHYDRATE IN SUGAR BEET PULP AND TYPICAL CONCENTRATES.

Sugar beet pulp per cent.	Barley meal per cent.	Maize meal per cent.	Flaked maize per cent.	Linseed cake per cent.	Palm kernel cake per cent.
91.0-92.0	88.7	92.0	97.1	80.5	78.6

It may be concluded from Table IV that ruminants are able to digest the carbohydrate of sugar beet pulp more efficiently than that of concentrates like palm kernel cake and linseed cake. From the point of view of digestibility of

this constituent, sugar beet pulp and maize meal may be regarded as about equal.

The digestion coefficients for the crude fibre of the sugar beet pulp, namely, 87.7, 89.7 and 89.8 per cent. for periods 2, 4 and 3 respectively, are the highest which have so far been obtained in digestion trials at Cambridge for fibre digestibility, being even higher than the best value obtained for the digestibility of the fibrous constituent of young pasture grass, namely, 85.8 per cent. The fibre in sugar beet pulp is very little inferior in respect of digestibility to the soluble carbohydrate fraction, and it is therefore legitimate to conclude that this constituent is present almost wholly in the form of simple cellulose, unmixed with any significant amount of the indigestible lignocellulose.

The Protein Constituent.—The data for the digestion coefficients of the protein constituent of sugar beet pulp present several features of interest. The results may be taken as indicating equal digestion of the protein whether the beet pulp be given in the fresh or the dried condition, and when the dried pulp is soaked in water before feeding. The low values of the protein digestion coefficients, in comparison with those of the fibre and carbohydrate, are particularly noteworthy. Indeed, the protein of the sugar beet pulp is only slightly better digested than the corresponding constituent of the sainfoin and rye-grass hay. In early German investigations into the feeding value of sugar beet pulp, it was recognized that this feeding stuff appears to exert a slight depressing effect on the digestibility of the protein constituent of the ration. That the protein digestion coefficients obtained in the animal trials do not represent the real extent to which beet pulp protein can be digested is apparent from measurements which were made of the solubility of this constituent in pepsin solution containing hydrochloric acid (Stutzer's method of artificial digestion). By this means, the much higher digestion coefficient of 75.3 per cent. was obtained for the digestion coefficient of the protein of sugar beet pulp.

What is the explanation of this curious effect exerted by sugar beet pulp on protein digestibility? It is probable, as will be shown in the Notes for next month, that the digestion of sugar beet pulp is only brought about as a result of unusually intense bacterial activity in the rumen of animals. It may be, therefore, that considerable amounts of the nitrogen in the ration are utilized for the purposes of bacterial development and are thereby transformed into less digestible

forms of nitrogenous material. By such action, the digestibility of the protein of both hay and beet pulp would be depressed.

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	8 17
Maize	81	6.8	9 11
Decorticated ground nut cake	73	41.0	13 5
" cotton cake	71	34.0	12 0

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

The cost per unit starch equivalent works out at 2.33 shillings, and per unit protein equivalent 2.52 shillings.

In accordance with the recommendation of the Departmental Committee on Rationing of Dairy Cows,* 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 Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Roots—			
Kohl Rabi	8	0.5	1 0
Mangolds	7	0.4	0 17
Potatoes	18	0.6	2 3
Swedes	7	0.7	0 18
Turnips	5	0.4	0 13
Green foods—			
Cabbage, drumhead	7	0.9	0 18
" open-leaved	9	1.5	1 5
Kale, marrow stem	9	1.3	1 4
Silage, vetch and oats	13	1.6	1 14
Hay—			
Clover hay	32	7.0	4 12
Lucerne hay	24	7.9	3 16
Meadow hay, poor	19	2.9	2 11
" " medium	31	4.6	4 4
" " very good	40	7.8	5 13
Seeds hay	24	4.9	3 8
Straws—			
Barley straw	19	0.7	2 6
Bean straw	19	1.7	2 8
Oat straw	17	0.9	2 2
Wheat straw	11	0.1	1 6
Grains and seeds—			
Barley	71	6.2	9 1
Beans	66	20.0	10 4
Oats	60	7.6	7 19
Peas	69	18.0	10 6
Wheat	72	9.6	9 12
Sugar Beet Pulp, dried	65	5.2	8 4

* Report obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d. net.

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British.. ..	—	—	9 7	0 13	8 14	72	2 5	1.29	9.6
Barley, British feeding ..	—	—	9 5	0 10	8 15	71	2 6	1.34	6.2
" American	31 6	400	8 16	0 10	8 6	71	2 4	1.25	6.2
" Persian	33 0	"	9 5	0 10	8 15	71	2 6	1.34	6.2
" Tunisian	30 6	"	8 10*	0 10	8 0	71	2 3	1.20	6.2
Oats, English, white	—	—	9 3	0 10	8 13	60	2 11	1.56	7.6
" " black and grey ..	—	—	9 0	0 10	8 10	60	2 10	1.52	7.6
" Canadian No. 2 Western	32 0	320	11 3	0 10	10 13	60	3 7	1.92	7.6
" " " 3	29 9	"	10 8	0 10	9 18	60	3 4	1.78	7.6
" Argentine	28 0	"	9 16	0 10	9 6	60	3 1	1.65	7.6
" Chilian	28 9	"	10 2	0 10	9 12	60	3 2	1.70	7.6
" German	27 6	"	9 12	0 10	9 2	60	3 0	1.61	7.6
Maize, American	43 3	480	10 2§	0 10	9 12	81	2 4	1.25	6.8
" Argentine	38 9	"	9 0	0 10	8 10	81	2 1	1.12	6.8
Beans, English, winter ..	—	—	10 13†	1 4	9 9	66	2 10	1.52	20
Peas, English, blue	—	—	15 0†	1 1	13 19	69	4 1	2.19	18
" Japanese	—	—	21 5§	1 1	20 4	69	5 10	3.12	18
Dari	—	—	11 15§	0 11	11 4	74	3 0	1.61	7.2
Rye, home-grown	—	—	8 15	0 12	8 3	72	2 3	1.20	9.1
Millers' offals—									
Bran, British	—	—	7 10	1 2	6 8	42	3 1	1.65	10
" broad	—	—	8 5	1 2	7 3	42	3 5	1.83	10
Middlings, fine, imported ..	—	—	9 7	0 15	8 12	69	2 6	1.34	12
" coarse, British	—	—	8 17	0 15	8 2	58	2 10	1.52	11
Pollards, imported	—	—	7 17	1 2	6 15	60	2 3	1.20	11
Meal, barley	—	—	10 5	0 10	9 15	71	2 9	1.47	6.2
" maize	—	—	10 10	0 10	10 0	81	2 6	1.34	6.8
" " germ	—	—	9 15	0 16	8 19	85	2 1	1.12	19
" locust bean	—	—	10 0	0 7	9 13	71	2 9	1.47	3.6
" bean	—	—	12 15	1 4	11 11	66	3 6	1.87	20
" fish	—	—	19 10	3 7	16 3	53	6 1	3.26	48
Maize, gluten feed	—	—	10 7	0 19	9 8	76	2 6	1.34	19
" cooked flaked	—	—	11 10	0 10	11 0	85	2 7	1.38	8.6
Linseed—									
" cake, English, 12% oil	—	—	13 7	1 9	11 18	74	3 3	1.74	25
" " " 9%	—	—	12 12	1 9	11 3	74	3 0	1.61	25
" " " 8%	—	—	12 5	1 9	10 16	74	2 11	1.56	25
" " " 5%	—	—	11 15	1 17	9 18	69	2 10	1.52	36
Cottonseed cake, English—									
" Egyptian, 4½ 5% ..	—	—	7 17	1 7	6 10	42	3 1	1.65	17
" " Egyptian, 4¼% ..	—	—	7 7	1 7	6 0	42	2 10	1.52	17
Coconut cake, 6% oil	—	—	11 5	1 4	10 1	79	2 7	1.38	16
Ground-nut cake, 7% oil ..	—	—	10 10*	1 7	9 3	57	3 3	1.74	27
Decorticated ground-nut cake,									
7% oil	—	—	13 5*	2 0	11 5	73	3 1	1.65	41
Palm kernel cake, 4½ 5½% ..	—	—	9 15†	0 17	8 18	75	2 4	1.25	17
" " " meal, 4¼% ..	—	—	10 5†	0 17	9 8	75	2 6	1.34	17
" " " meal 1%	—	—	9 5†	0 18	8 7	71	2 4	1.25	17
Feeding treacle	—	—	6 0	0 8	5 12	51	2 2	1.16	2.7
Brewers' grains, dried ale ..	—	—	8 7	0 18	7 9	49	3 0	1.61	13
" " " porter	—	—	7 17	0 18	6 19	49	2 10	1.52	13
Malt culms	—	—	7 15*	1 7	6 8	43	3 0	1.61	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 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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 19s. per ton. The food value per ton is therefore £9 1s. per ton. 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. 5d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.29d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 8s. 10d.; P₂O₅, 3s. 10d.; K₂O, 5s. 3d.

The Oil in Sugar Beet Pulp.—It was not found possible, by means of animal experiment, to secure figures representing the extent to which the crude oil of the sugar beet pulp was digested. This was scarcely surprising, however, since the dried beet pulp contained only 0.7 per cent. of crude oil in its dry matter, and the amount included in the daily allowance of dried beet pulp was less than 5 gm., an amount far too small to permit of reliable digestibility measurements. It may, however, be concluded that sugar beet pulp, as a source of digestible oil, is of quite negligible importance.

It is hoped to continue this study of the results of the Cambridge investigation in the Notes for next month.

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MISCELLANEOUS NOTES

THE general level of prices of agricultural produce in September was 44 per cent. above the base years 1911-13, or the same as in the preceding month,

The Agricultural Index Number and one point higher than in September last year. Prices of the various commodities, as a rule, have followed their normal course at this season of the year, although in some instances the rise or fall has been more marked than usual.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :—

Percentage increase compared with the average of the corresponding month in 1911-13

Month	1923	1924	1925	1926	1927	1928
January	67	60	71	58	49	45
February	63	61	69	53	45	43
March	59	57	66	49	43	45
April	54	53	59	52	43	51
May	54	57	57	50	42	54
June	49	56	53	48	41	53
July	50	53	49	48	42	45
August	52	57	54	49	42	44
September	52	61	55	55	43	44
October	50	66	53	48	40	—
November	51	66	54	48	37	—
December	55	65	54	46	38	—

Grain.—Wheat averaged 9s. 2d. per cwt. during September, or 1s. 3d. per cwt. less than in August, and the index number declined 8 points to only 22 per cent. above pre-war, as com-

pared with a decline of 8 points to 48 per cent. in the corresponding period of 1927. Barley rose 6d. per cwt. to an average of 12s. 6d. per cwt. in September, but the rise was proportionately less than in 1911-13, and the index number, at 50 per cent. above the base years, was 8 points lower on the month. The reduction in oat prices was very marked, a fall of 1s. 5d. per cwt. being accompanied by a fall of 16 points in the index number to 33 per cent. above pre-war. A year ago, barley averaged 62 per cent., and oats 35 per cent., dearer than in 1911-13.

Live Stock.—A further decline in the prices of fat cattle occurred in September, second quality cattle being about 2s. per live cwt. cheaper than in August, and the relative index number was 4 points lower at 36 per cent. above the pre-war level. Scarcely any alteration took place in the case of fat sheep. Bacon pigs were a little cheaper at 33 per cent. above pre-war, while the index number for pork pigs fell one point to 32 per cent., in spite of the slight seasonal increase in price. Dairy cows were dearer than in August, and the index number advanced one point to 34 per cent. above 1911-13, and store sheep and pigs also were dearer at 66 and 28 per cent. respectively, but a fall of 2 points was recorded for store cattle to 27 per cent.

Dairy and Poultry Produce.—Milk in the north-western area sold under contract at rather higher prices than in August, and the general level of milk prices advanced 10 points to 65 per cent. above pre-war. The index for butter remained unaltered at 54 per cent. above the base years, but for cheese there was a decline of 6 points to 78 per cent. on account of the rise in price being proportionately less than in the corresponding period of 1911-13. For this reason, also, eggs show a fall of 3 points, but, in the case of fowls and ducks, the decreases in price were larger than usual, and poultry as a whole was cheaper at 42 per cent. above pre-war in September, as compared with 45 per cent. in August.

Other Commodities.—Wool prices were steady at 76 per cent. dearer than in the base years, and hay showed an increase of 1 point to 14 per cent. Main crop potatoes realized 60 per cent. above 1911-13, as against 46 per cent. in September, 1927, and 40 per cent. in September, 1926. Vegetables were cheaper than in August at 25 per cent., apples averaged about 50 per cent., and plums more than 100 per cent. above pre-war, while pears sold at practically pre-war prices.

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

Commodity	1926	1927	1928			
	Sept.	Sept.	June	July	Aug.	Sept.
Wheat	50	48	38	34	30	22
Barley	50	62	46	37	58	50
Oats	25	35	69	53	49	33
Fat cattle	39	30	47	44	40	36
Fat sheep	52	45	83	66	59	59
Bacon pigs	79	34	43	41	36	33
Pork pigs	81	41	38	34	33	32
Dairy cows	39	28	32	34	33	34
Store cattle	28	24	26	31	29	27
Store sheep	43	49	55	67	55	66
Store pigs	142	64	22	25	26	28
Eggs	52	54	38	36	55	52
Poultry	46	37	52	54	45	42
Milk	100	65	53	55	55	65
Butter	56	41	54	50	54	54
Cheese	34	59	91	66	84	78
Potatoes	40	46	125	37	35	60
Hay	9	18	13	11	13	14
Wool	31	43	75	78	76	76

* * * * *

THE Pig Marketing Demonstration was given at Whitechurch on September 21 in connexion with the Show and Sale of the North Western Pig Breeders' and Feeders' Association. The demonstration was well attended.

Marketing Demonstrations at Agricultural Shows

Chief interest, however, centred on the auction sale at which pigs were bid for by the score live weight. Thirty-one pens containing an aggregate of 118 pigs were offered for sale. Each pen was weighed by the market checkweighman before the sale and bore a ticket indicating the total weight in scores and pounds of the pigs therein, deduction of four pounds per pig being made as an allowance for the "last feed." The weights shown had to be accepted as correct by the buyers, and, as a matter of interest, have in no case been disputed since.

Bidding commenced warily, although it was apparent that the buyers were not unfamiliar with live weight values. Advances of 3d. per score were made at first but, later, were reduced to one halfpenny. The prices realized compared

favourably with the current Birmingham Market prices, and it can be said that the experiment proved quite satisfactory to all concerned. Further auctions are to be held at Whitechurch in a similar manner, but the organizers realize that this method of sale requires an efficient system of weighbridges and pens.

A fruit marketing demonstration illustrating, in addition to up-to-date methods of grading and packing, the use of the National Mark labels introduced under the Agricultural Produce (Grading and Marking) Act, 1928, was given in connexion with the Wisbech Commercial Fruit Show on October 10 and 11.

The demonstration aroused much interest among growers and others interested in the handling of fruit in this important fruit producing area.

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On the Empire Marketing Board stand at the International Grocers' Exhibition, which was held at the Agricultural Hall, Islington, from September 22 to 28, the

Displays of Home Produce

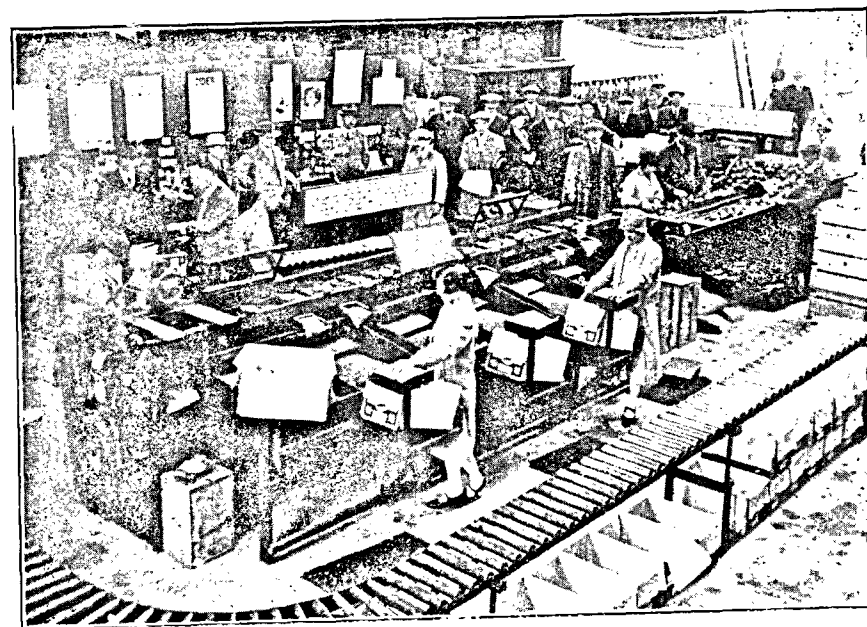
Ministry, in collaboration with the National Farmers' Union and other associations, organized its customary display of home produce. In addition, however, two new stands were arranged, on one of which were boxes of apples and pears, graded and packed in accordance with the regulations prescribed under the Agricultural Produce (Grading and Marking) Act, 1928; and on the other, boxes of eggs designed to illustrate the National grades that will shortly be introduced under the same Act. These two stands were the subject of numerous inquiries and undoubtedly stimulated interest in trade circles.

* * * * *

POULTRY-KEEPERS are reminded that post-mortem examinations of poultry, agglutination tests for Bacillary White Diarrhoea, and other bacteriological work in connexion with poultry, are carried out at the Ministry's Veterinary Laboratory.

Poultry Disease

It is open to any poultry farmer whose birds are dying mysteriously, or who has other evidence of disease in his flock, to avail himself of these facilities to obtain expert diagnosis of the disease and certain other services from the Laboratory. In all cases where heavy mortality occurs suddenly, or where birds die from some obscure cause, it is desirable that specimens, showing typical symptoms of the disease, should be sent for examination and report.



General views of the Fruit Marketing Demonstration, given by the Ministry in connexion with the Commercial Fruit Show, Wisbech.

In order to prevent the introduction of disease amongst healthy stock, newly purchased birds should be isolated for one month and be frequently examined during this period. A memorandum showing the terms and conditions under which these examinations are made will be sent on application to either the Ministry, at 10 Whitehall Place, London, S.W. 1, or the Ministry's Veterinary Laboratory, New Haw, Weybridge, Surrey.

* * * * *

ALL local authorities in England and Wales which operated this Scheme during the past season—with the exception of Rutland—have now furnished their results. The distribution, shown below, may be regarded as satisfactory, when compared with last season, in view of the fact that there was a drop of 10 in the number of counties adopting the scheme, and that 67 fewer distributing stations were established.

Year	No. of L.A.'s operating scheme	No. of stations established	Distribution (in dozens)				Cost
			Eggs	Chicks	D. Eggs	Ducks	
1927	39	281	8,932	3,707	71	28	£1,748
1928	29	214	7,086	4,053	70	9	£260

* * * * *

THE Canadian National Exhibition is held annually at Toronto, and, this year, was open from August 24 to September 8. In the matter of attendance **Canadian National Exhibition, 1928** it is claimed, with some justification, to be the premier annual show in the world—this year, its Golden Jubilee, over 2,000,000 visitors paid for admission. One of the principal attractions was a display organized by the Empire Marketing Board to illustrate its various activities, this being the first occasion on which the Board has visited an overseas exhibition.

A considerable space was allocated to the United Kingdom, in which the Ministry of Agriculture and Fisheries, in collaboration with the Agricultural Departments of Scotland and Northern Ireland, organized an exhibit comprising such commodities as are already exported to North America, or for which there is a potential market there.

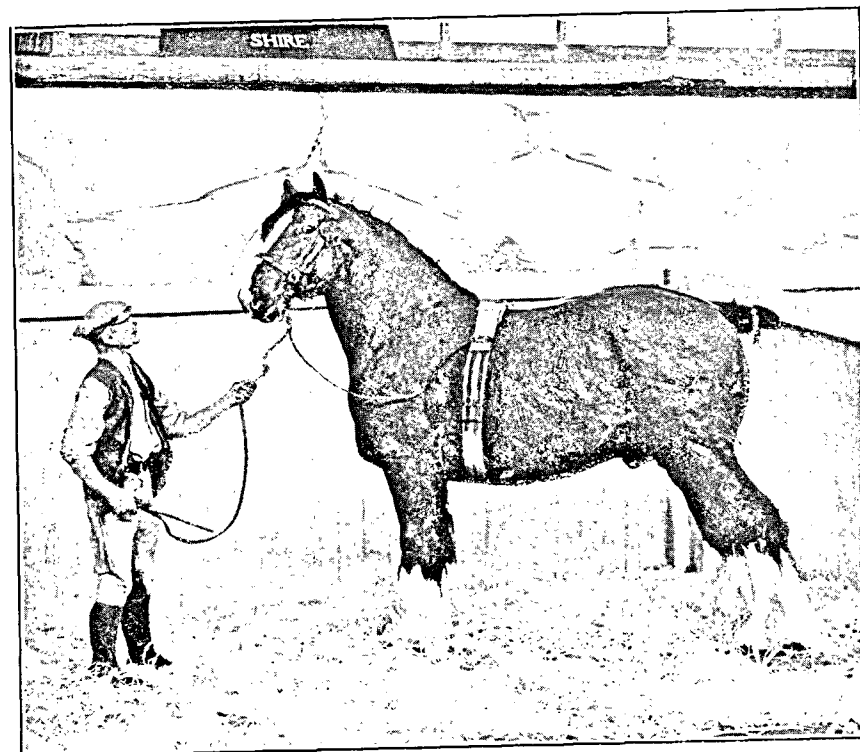
The principal feature was pedigree live stock. A number of models made from life of the various breeds of horses, cattle, sheep and pigs, were staged in an appropriate setting and attracted a great deal of interest. In addition, the Ministry had four "Textaphote" machines on which photographs of every British breed of live stock and many breeds of poultry were shown in rotation. Linked up with this display, there were photographs and a description of the quarantine station recently opened in London in which animals, destined for export to the Dominions and the Colonies, can be isolated for an agreed period before shipment.

An attractive display of rabbit fur and wool garments was lent by *Fur and Feather*. The rabbit industry is growing rapidly in Canada as it is in this country, and it is satisfactory to learn that most breeders in Canada obtain their stock from this side.

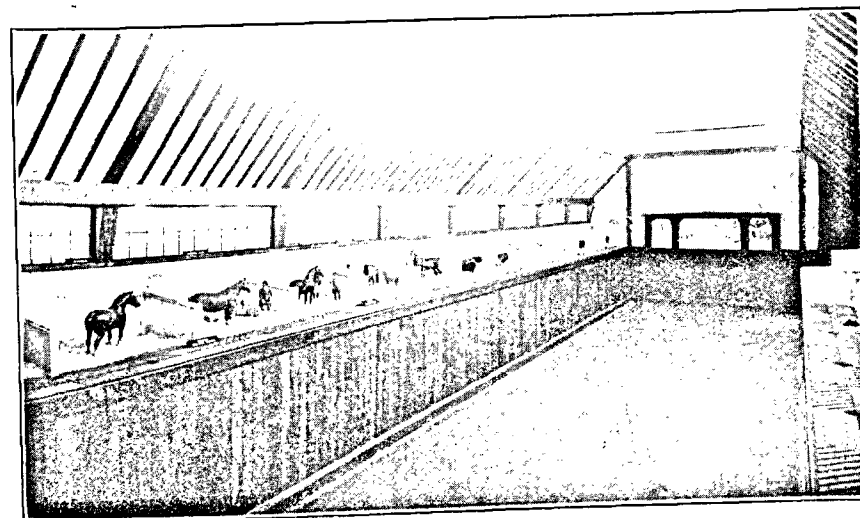
A representative exhibit of Lincolnshire and Cornish flower bulbs occupied another part of the stand and, from the inquiries made of the attendant, it is evident that British bulbs are in great request in North America. Scotland has a growing wool trade with Canada and the U.S.A., and the Scottish Wool Growers, Ltd., and also the Kent Wool Growers, Ltd., sent fleeces and samples of skin wool. The Scottish and Irish Damask Linen Guild are at present conducting a publicity campaign in North America and much interest was shown in the very attractive exhibit supplied by the Guild.

A little-known English product for which there is a good demand in Canada is edible gelatine, and an exhibit of this proved of interest. An exhibit of English cheese comprised trade-marked Cheddar and Cheshire, Stiltons and crustless cheese of various kinds. The latter types are regularly stocked by the principal provision merchants in the big towns and find a ready sale, but English Cheddar and Cheshire have not been stocked for many years, owing largely to the variations in quality which were then experienced. Since there are now good supplies of graded Cheshire and Cheddar cheese, this objection no longer holds good. There is undoubtedly a demand for the best quality English hard-pressed cheese, and it is probable that an export trade will be revived.

To sum up, the results of this new departure appear to have fully justified the event, and it is to be hoped that associations and firms will follow up the impression made by the exhibit in order to develop their export trade,

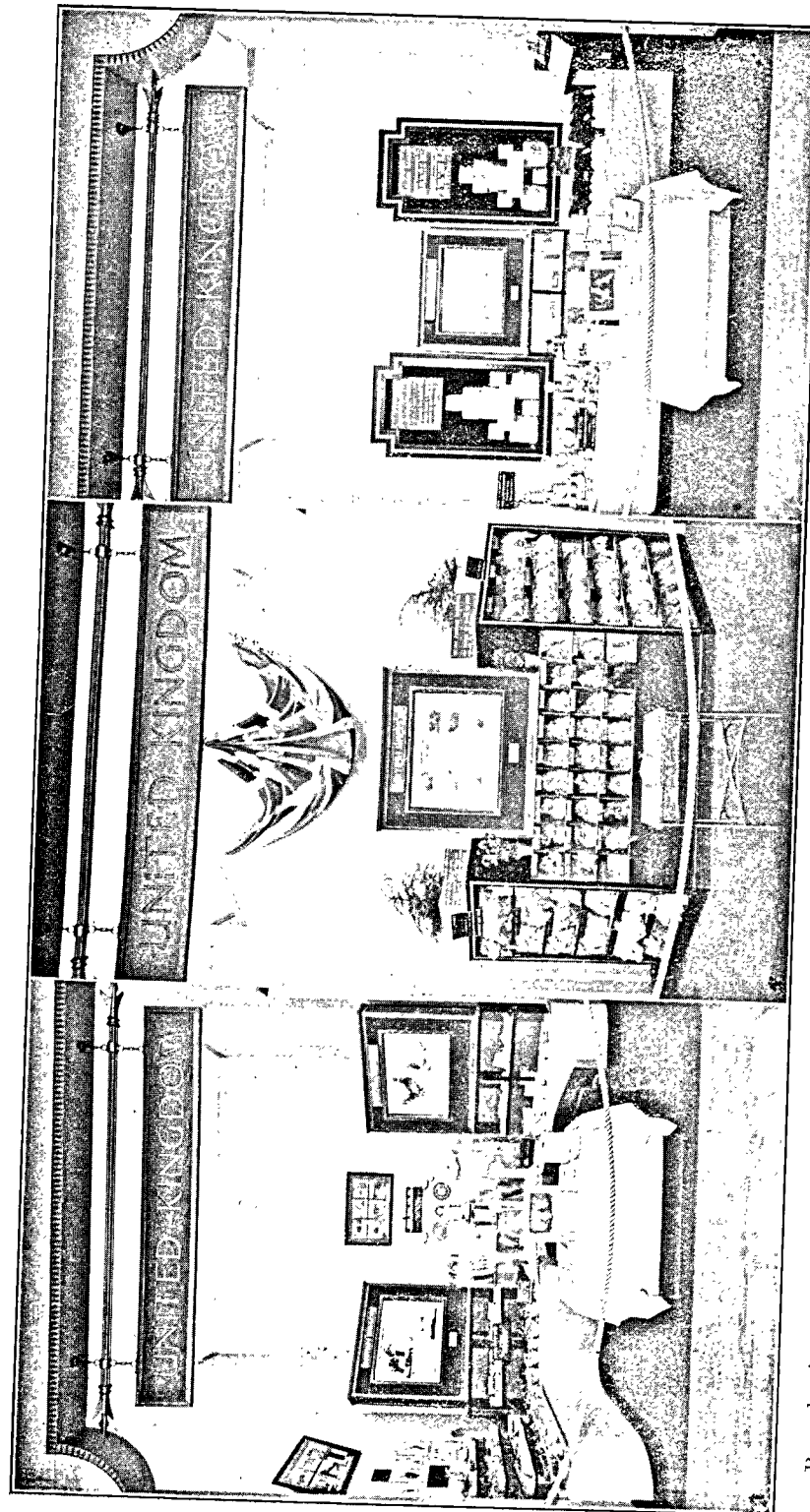


Enlarged view of one of the Models.



General view of Models of British Breeds of Live Stock.

THE CANADIAN NATIONAL EXHIBITION, 1928.



Bay, showing flower bulbs, rabbit wool and fur garments, and Irish linen.

Bay, showing English and Scottish wool.

Bay, showing English cheeses, gelatine, and Scottish linen.

THE UNITED KINGDOM STAND, CANADIAN NATIONAL EXHIBITION, 1928.

Destruction of Weeds.—Proceedings may be taken by or on behalf of the Minister against any occupier of land failing to comply with a notice served upon him under the provisions of the Corn Production Acts (Repeal) Act, 1921, requiring him to cut down or destroy any spear thistle, creeping thistle, curled dock, broad-leaved dock, or ragwort growing on his land.

Authority to lay information on the Minister's behalf has been issued during the last few months in 15 cases in which failure occurred to comply with notices served under the Act, by the agricultural committees of Derby, Kent, Somerset, Surrey, and East Sussex. Convictions were obtained in four instances, and fines of £10 (in two cases), £5, and £1 imposed, in addition to costs. In the remaining cases no reports of the results of the proceedings have yet been received.

The Ministry's attention was also drawn to certain lands at Barrow-in-Furness which were badly infested with weeds to which the Act applies. As there is no agricultural committee for this County Borough, notices requiring the destruction of the weeds within a specified time were served direct by the Ministry on the occupiers concerned, and were duly complied with.

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Sale of Dutch Tomatoes as English.—During the month of August, the Ministry has taken proceedings under the Merchandise Marks Act, 1887, in four cases where Dutch tomatoes were sold as English, the evidence in all the cases being obtained and submitted by the British Glasshouse Produce Marketing Association. Convictions were obtained in each case, the defendants being fined £5 in two instances, and £2 in each of the others.

* * * * *

Horticultural Produce (Sales on Commission) Act, 1926.—A salesman carrying on business in Bolton recently appeared before the Isle of Ely County Bench on two occasions to answer summonses, brought by strawberry growers in the Wisbech area, alleging failure to deliver accounts for strawberries sent to him for sale on commission. In the first case, however, the complainant had failed to comply with the provisions of the Act requiring the consignor to send the salesman an advice note specifying the nature, description and contents of the packages in the consignment, and the summons, therefore, was dismissed, but in the second case a conviction was secured and the defendant was ordered to pay a fine of £4 and expenses amounting to £1 10s. 0d.

The provisions of the Act were summarized in the issue of this JOURNAL for February, 1927, pp. 982-3.

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Quarantine Regulations against Rabies.—A case of special interest to the public occurred early last month of an attempt on the part of an owner of a pet dog to evade the regulations designed to prevent the introduction into this country of rabies by dogs brought from abroad. The owner duly applied for and obtained a licence from the Ministry of Agriculture authorizing the landing of her pet dog from Morocco, subject to the usual condition of quarantine at an approved veterinary establishment for six months. During the transport of the dog from the port of landing to the authorized place of quarantine the owner illegally obtained possession of the dog and disappeared with it, leaving no address, afterwards telegraphing to the veterinary surgeon in charge of the place of quarantine authorizing him to destroy the dog, although at the time the dog was in her own possession.

It was clear that a deliberate attempt had been made to evade the quarantine regulations. The case was the more serious as the dog

had been brought from Morocco, in which country rabies is continuously prevalent. The Ministry of Agriculture thereupon applied for a warrant for the arrest of the owner, which was duly executed by the police, who quickly found both the owner and the dog. The owner was arrested in London on September 13, and detained in custody until 10.40 p.m. on the 14th, when she was released on bail in sureties of £100 for the prisoner and one other person.

In prosecuting, the Ministry's Solicitor explained to the magistrates that by deliberately evading the regulations the owner had exposed the public to the danger of the introduction of the dread disease of rabies, from which this country has been entirely free for some years. It was recalled that, through the smuggling of an imported dog in 1918, rabies had been introduced into Devon and Cornwall and thence spread throughout the South of England and South Wales, affecting a total of no fewer than 319 dogs. It occupied three years to stamp out the disease, and, during this period, large parts of the south of England and South Wales were subjected to the annoyance involved by the imposition of muzzling Orders and quarantine restrictions on the movements of home dogs, and 358 persons were known to have been bitten by affected or suspected dogs. The public was being exposed to a similar risk by the action of the owner of the dog in this case. The Bench of magistrates regarded the case as a serious one and imposed a fine of £20 and £10 costs.

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National Diploma in Dairying, 1928.—The thirty-third Annual Examination for the National Diploma in Dairying was held in September, by the National Agricultural Examination Board, at the University and British Dairy Institute, Reading, for English students, and at the Dairy School, Kilmarnock, for Scottish students. Eighty-five candidates presented themselves (43 at Reading and 42 at Kilmarnock), of which 45 (24 in England and 21 in Scotland) gained the Diploma. Two candidates, Alice P. Hassall (England) and Mary Macfarlane Stewart (Scotland), gained the Diploma with Honours.

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Foot-and-Mouth Disease.—An outbreak was confirmed on October 3, at Charlton Common, Henbury, near Bristol, Gloucestershire, and the usual restrictions were applied to an area of approximately 15 miles round the infected premises, but excluding any country within that radius to the North-West of the River Severn. A further outbreak, on premises contiguous to those on which the first case occurred, was confirmed on October 9.

Two further outbreaks, making a total of six in all, occurred in the Yorks, East Riding Infected Area—referred to in the October issue of this JOURNAL—on September 22 and 23 respectively.

One hundred and fifteen outbreaks in all have been confirmed since January 1 last, involving 16 counties and the slaughter of 3,497 cattle, 4,824 sheep, 1,725 pigs and 6 goats.

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Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on September 25, at 7 Whitehall Place, S.W. 1, the Chairman, 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 into effect the Committees' decisions:—

Gloucestershire.—An Order to come into force on October 7, 1928, continuing the operation of the existing minimum and overtime

rates of wages for male workers, and minimum rates of wages for female workers until October 5, 1929. The minimum rates in the case of male workers of 21 years of age and over are: For head carters, 34s. 6d. per week of 58 hours in summer, and 36s. per week of 60 hours in winter; for head shepherds or head stockmen, 36s. per week of 60 hours throughout the year; for under carters, 32s. 6d. per week of 54 hours in summer, and 34s. 6d. per week of 57 hours in winter; for under shepherds or under stockmen, 34s. 6d. per week of 57 hours throughout the year; and for other male workers, 30s. per week of 50 hours in summer and 48 hours in winter, with overtime in each case at 9d. per hour on weekdays and 11d. per hour on Sundays. 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 force on October 28 continuing the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until October 26, 1929. The minimum rates in the case of male workers of 21 years of age and over are 35s. per week of 50 hours in summer and 48 hours in winter with, in the case of cattlemen and shepherds, an addition of 6s. per week and in the case of horsemen 10s. per week to cover all employment (other than overtime employment on the weekly short day) in excess of those hours. In the case of shepherds additional payments are also to be made in respect of the lambing season. 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.

Somerset.—An Order to come into force on October 1, continuing the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until September 30, 1929. The minimum rate in the case of male workers of 21 years of age and over is 32s. per week of 52 hours in summer and 50 hours in winter, with overtime at 9d. per hour, except in the hay and corn harvests, when the overtime rate is 10d. per hour. The minimum rate for female workers of 21 years of age and over is 6d. per hour for all time worked.

Wiltshire.—An Order to come into force on October 14, continuing the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until October 12, 1929. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours, with overtime at 8d. 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.

Yorkshire (North Riding).—An Order to come into force on October 2, continuing the operation of the existing minimum and overtime rates of wages for male and female workers until further notice. The minimum rate in the case of male workers of 21 years of age and over is 33s. per week of 48 hours in winter and 52½ hours in summer, with, in addition, payment of 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.

Pembroke and Cardigan.—An Order to come into force on October 1, continuing the operation of the existing minimum and overtime rates of wages for male and female workers until September 30, 1929. 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 8½d. 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 employment on Sunday, 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 15, legal proceedings were instituted against 12 employers for failure to pay minimum and overtime 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 con- cerned		
		£	s.	d.	£	s.	d.	£	s.	d.			
Devon	.. Plympton	..	1	0	0	0	17	6	2	16	9	1	
Gloucester	.. Berkeley	..	*			7	4	0	33	1	5	2	
Herts	.. Cheshunt	..	—			3	19	6	35	17	6	14	
Hunts	.. Norman Cross	..	3	0	0	2	2	0	19	2	2	2	
Hereford	.. Ross	..	70	0	0	10	10	0	44	1	2	7	
Lindsey	.. Grimsby	..	0	0	2½	—			107	17	1	5	
Monmouth	.. Chepstow	..	10	0	0	5	0	0	15	10	0	1	
Salop	.. Clun	..	—			—			9	3	4	1	
„	.. Oswestry	..	5	0	0	—			34	0	0	1	
„	.. „	..	5	0	0	—			41	10	0	2	
Westmorland	.. Kendal	..	0	10	0	—			10	16	11	1	
Rads	.. Knighton	..	—			—			8	0	0	1	
			•	£94	10	2½	£29	13	0	£361	16	4	38

* Dismissed under Probation of Offenders Act.

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Leaflets issued by the Ministry.—Since the date of the list given in the April, 1928, number of this JOURNAL, p. 98, the following leaflets have been issued :—

New :—

No. 215. Sheep Feeding.

Revised :—

No. 3. Flea Beetles.

No. 68. Currant and Gooseberry Aphides.

No. 204. Apple Mildew.

No. 309. Suggestions to Allotment Holders for Autumn Treatment of Land.

Re-written :—

No. 179. The Downy Mildew of the Onion.

No. 308. Plum Aphides.

No. 319. Apple Capsids.

No. 362. Selection, Storage and Treatment of Seed Potatoes.

Amended :—

No. 161. The Vapourer Moth.

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APPOINTMENTS: CHANGES AND CORRECTIONS

COUNTY AGRICULTURAL EDUCATION TEACHING STAFFS : ENGLAND

Devon : Mr. D. Rowe, N.D.A., has been appointed District Lecturer in Agriculture, vice Mr. R. P. Hawkins.

Essex : Mr. R. P. Hawkins, B.Sc., N.D.A., has been appointed to fill the new post of District Agricultural Lecturer.

Mr. A. E. Holman has been appointed Instructor in Poultry-keeping, vice Mr. F. Bowers.

Mr. F. Knowles, Lecturer in Agricultural Chemistry and Analyst, has qualified as a Fellow of the Institute of Chemistry.

Hampshire : Mr. W. R. Carter is undertaking the duties of Instructor in Farm Bookkeeping, vice Mr. B. R. Lovell.

Wiltshire : Mr. L. C. Turnill has been appointed Instructor in Poultry-keeping, vice Mr. A. E. Holman.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., ENGLAND

School of Agriculture, University of Cambridge

Mr. T. W. K. Fair, B.A., has ceased to be Demonstrator in Agricultural Physiology. No successor has yet been appointed.

Seale-Hayne Agricultural College, Newton Abbot, Devon

The Staff list, published in this JOURNAL for September, 1928, should read as under :—

Principal D. R. EDWARDES-KER, O.B.E., M.A., B.Sc.

Agriculture

Senior Lecturer T. J. SHAW, M.C., N.D.A.

Lecturer A. NOBLE, N.D.A.

Assistant Lecturer L. R. WAUGH, B.Sc. (Agric.)

Farm Bailiff J. F. CODD

Agricultural Chemistry

Head of Department E. VANSTONE, D.Sc., M.Sc., F.I.C., F.C.S.

Agricultural Biology

Head of Department F. R. HORNE, B.A., N.D.A., N.D.D. (Hons.)

Lecturer C. A. COSWAY, B.Sc.

Agricultural Engineering, Surveying, etc.

Lecturer J. J. FLOWER, B.A., B.A.I., P.A.S.I.

Dairying

Lecturer W. B. V. TRESIDDER, N.D.A., N.D.D.

Horticulture

Lecturer C. T. MACKINTOSH, Dip. R.H.S., F.R.H.S.

Poultry-keeping

Lecturer I. RHYS, N.D.P.

Book-keeping

Lecturer C. C. CATTERMULL, F.I.S.A.

Forestry

Lecturer H. McCLELLAND

The Horticultural College, Swanley, Kent

Mr. D. Wilmshurst and Miss S. Fillmer, Lecturers in Horticulture, have left the staff. Miss W. H. Barker, N.D.H., has been appointed a Lecturer in Horticulture.

Miss A. A. Meickle, N.D.D., N.D.A., has been appointed Lecturer in Dairying, vice Miss V. P. Bruff.

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NOTICES OF BOOKS

Farm Cost Studies in the United States: their Development, Applications and Limitations. By Merrill K. Bennett. Miscellaneous Publications, No. 4, Food Research Institute, Stanford University, California. Pp. ix+289. (Stanford University Press.)

As its title conveys, this book deals solely with agricultural costing in America, and it is not concerned in any way with research work in the same subject elsewhere. In some respects Mr. Bennett travels far beyond that which is regarded by writers of other countries as being covered by his title; in others, he takes for granted much which they regard as calling for discussion and elucidation. Thus, he includes a consideration of the survey method of farm economic study, a method which in England, at all events, is regarded as a subject apart from costing; and he discusses the uses of costing as an aid to price-fixing and tariff-making, whereas few writers in other countries have got beyond the uses to which this work can be applied for the study of efficiency in farm management. On the other hand, Mr. Bennett assumes a consensus of opinion on many questions of principle which are by no means readily conceded elsewhere than in the States, and also a knowledge of book-keeping in general on the part of his readers.

These things are no more than might be expected. Work of this character has proceeded further in America and has been practised over a longer period than in this country, at all events, and a greater measure of agreement has been arrived at amongst the parties to it. In the States, too, questions such as tariffs, which have no practical application in our country, are of vital concern to the agricultural community.

The author throws down the glove to the academic economist and the "theoretical critic." He draws a sharp distinction between theoretical and applied economics, and his comments are wholesome and stimulating. He takes it for granted that allocations must be made of indirect, as well as of direct, costs in arriving at the total product-cost, and that apportionments must be attempted of costs which cover two products (*e.g.*, mutton and wool, corn and straw). The expediency of such attempts has been challenged recently in this country, and it is only fair to say that, while Mr. Bennett regards them as unavoidable and necessary, he recognizes that results obtained by such means must be accepted with a certain amount of reserve.

Much of the work is inapplicable to English conditions of husbandry. We cannot, for example, proceed to alter the farm boundaries and general lay-out, in many cases, even though the results of a farm management study indicate that existing field divisions, roads, buildings, etc., impose a certain handicap on production. Although the book is written by an American for American conditions, it contains much that will be at once interesting and stimulating to any student of agricultural economics, and it should command a wide public in this country.

The Dairy Industry in Latvia.—Pp. 31. Edited by the Butter Control Office of the Latvian Ministry of Agriculture. Riga, 1928.

This interesting little brochure of 31 pages, with the above title, has recently been published, setting forth in brief outline a short sketch of the growth and importance of the dairying industry in the national economy of Latvia. Among other things, it presents a bird's-eye view of the general agriculture of the country and the developments in cattle-breeding, milk production and instruction in dairy-farming, but its main interest, especially from the standpoint of those concerned with the home butter-trade, lies in its review of the increasing importance of Latvia as a butter-exporting country and of the methods adopted to secure markets through attention to the all-important question of high quality.

The War completely disorganized the then existing dairy industry, and in the immediate post-war years the exportation of milk-products was prohibited. This, however, was rescinded in 1922 and a butter-control was established by Statute in that year, under which Regulations governing the export of butter have been enacted. The principal features of these Regulations provide for the registration of all dairies, firms and individuals concerned directly or indirectly with the export of butter, and the compulsory examination and grading of each lot of butter intended for export.

Grading is conducted on a scale of 15 points, and butter earning 7 points or less is not permitted to be exported. Above this, there are two grades, first quality scoring between 11.1 and 15 points, and second quality between 7.1 and 11 points. Both grades must further conform to the conditions that the butter is a natural product, containing neither prohibited chemicals nor aniline dyes, prepared from cream pasteurized at a temperature over 80° C., and with a water-content not exceeding 16 per cent.

The official government marks signifying the appropriate grade are then affixed to the casks, grading and marking being undertaken in the government cold-storage warehouse in the export division of the port of Riga, whence all butter from Latvia is exported.

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SELECTED CONTENTS OF PERIODICALS**Agriculture, General and Miscellaneous**

Features of Nottinghamshire Agriculture. *H. G. Robinson.* (Jour. Roy. Agric. Soc. Eng., 88, (1927), pp. 3-15.) [63 (42).]

The Crofting Problem, 1780-1883: IV, The Size of the Economic Holding; V, Subsidiary Occupations. *Margaret M. Leigh.* (Scottish Jour. Agric., xi, 3 (July, 1928), pp. 261-273.) [63 (09); 63 (41); 63.165; 63.193.]

The English Beet Sugar Industry. *C. D. Adams.* (Jour. Soc. Chem. and Ind., Chemistry and Industry, 47, 26 (June 29, 1928), pp. 179T-185T.) [664.1.]

The Raising of Basket Willows from Seed. *H. P. Hutchinson.* (Ann. Rept. Long Ashton Agric. Hort. Res. Stn., 1927, pp. 169-173.) [63.3412.]

Pulping of Annual Grasses, etc., by the Chlorine Process. *J. L. Somerville and L. R. Benjamin.* (Jour. Council Sci. Ind. Res. (Australia), i, 4 (May, 1928), pp. 217-226.) [676.]

Farm Costs: An alternative method of dealing with Residual Manurial Values and Cleaning Costs with the object of simplifying Farm Costing. *H. W. Kersey and D. H. Brown.* (Jour. S.E. Agric. Coll., Wye, 25 (1928), pp. 27-30.) [657; 63.1624.]

Live Stock Insurance. *A. Jones.* (Scottish Jour. Agric., xi, 3 (July, 1928), pp. 297-303.) [368.5.]

Soils

- The Determination of Exchangeable Calcium in Carbonate-free Soils. *Rice Williams*. (Jour. Agric. Sci., xviii, 3 (July, 1928), pp. 439-445.) [63.113.]
- Further Note on the Capillary Forces in an Ideal Soil. *R. A. Fisher*. (Jour. Agric. Sci., xviii, 3 (July, 1928), pp. 406-410.) [63.11.]
- Soil Survey of Wales: Progress Report, 1925-27. *G. W. Robinson, J. O. Jones and D. O. Hughes*. (Welsh Jour. Agric., iv, (1928), pp. 303-321.) [63.111.]
- An Acidity Survey of the Soils of Two Parishes in Berwickshire. *W. G. Ogg and W. T. Dow*. (Scottish Jour. Agric., xi, 3 (July, 1928), pp. 273-286.) [63.111; 63.113.]
- Soil Profiles in Kent. *S. G. Brade-Birks and B. S. Furneaux*. (Jour. S.E. Agric. Coll., Wye, 25 (1928), pp. 224-234.) [63.111.]
- Nitrogen Fixation by Soil Micro-organisms. *P. G. Krishna*. (Jour. Agric. Sci., xviii, 3 (July, 1928), pp. 432-438.) [576.83.]

Field Crops

- The Significance of Variety in Oats with respect to Yield and other Ancillary Characters under North Wales conditions. *R. A. Roberts*. (Welsh Jour. Agric., iv (1928), pp. 157-170.) [63.314.]
- Field Trials in the Manuring of Malting Barley. *F. Rayns*. (Jour. Roy. Agric. Soc. Eng., 88, 1927, pp. 131-146.) [63.313.]
- A Physiological Study of Varietal Differences in Plants: Part I, A Study of the Comparative Yields of Barley Varieties with Different Manurings. *F. G. Gregory and F. Crowther*, with an appendix by *E. S. Beaven*. (Ann. Bot., xlii, 167 (July, 1928), pp. 757-770.) [63.3; 63.313.]
- Losses on Storage of Farm Crops, 1926-27: (a) Corn (Oats, Barley, Wheat). *W. Goodwin and F. L. C. Scrivener*. (b) Potatoes. *W. Goodwin and H. Martin*. (Jour. S.E. Agric. Coll., Wye, 25 (1928), pp. 195-199.) [63.31-198; 63.512-198.]
- The Improvement of Grassland. *A. E. V. Richardson*. (Scottish Jour. Agric., xi, 3 (July, 1928), pp. 249-255.) [63.33.]
- The Behaviour of Grasses in the Seeding Year, when Sown in Pure Plots: Establishment, Rate of Growth and Palatability. *W. Davies and M. T. Thomas*. (Welsh Jour. Agric., iv (1928), pp. 206-221.) [63.33.]
- An Investigation into the Soil Germination and Yield of Certain Crucifers, Clovers, Italian Rye-Grass and Chicory Sown at Three-Weekly Intervals from May to November, 1925. *W. E. J. Milton*. (Welsh Jour. Agric., iv (1928), pp. 222-242.) [63.33.]
- Sainfoin or French Grass in South Wales. *J. Rees*. (Welsh Jour. Agric., iv (1928), pp. 242-250.) [63.33.]
- The Influence of Seed Rate on the Establishment of Perennial Rye-Grass, Timothy and Rough Stalked Meadow Grass. *W. Davies*. (Welsh Jour. Agric., iv (1928), pp. 250-254.) [63.33.]
- Factors that Influence the Chemical Composition of Hay. *T. W. Fagan*. (Welsh Jour. Agric., iv (1928), pp. 92-102.) [63.60433; 63.33.]
- Some Hay and Pasture Experiments. *W. G. R. Paterson*. (Trans. Highland Agric. Soc. Scotland, xl (1928), pp. 40-50.) [63.33.]
- The Composition of Old Pastures of High Reputation in North Wales. *R. A. Roberts*. (Welsh Jour. Agric., iv (1928), pp. 170-183.) [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., xviii, 3, (July, 1928), pp. 411-420.) [63.33.]
- The Chemical Composition of Mangolds Grown in Mid Wales. *T. W. Fagan and J. E. Watkin*. (Welsh Jour. Agric., iv (1928), pp. 102-113.) [63.332; 63.60433.]
- Sugar Beet Cultivation. *W. Bruce*. (Trans. Highland and Agric. Soc. Scotland, xl (1928), pp. 92-115.) [63.3433.]
- Quality in Potatoes. *W. M. Findlay*. (Article contributed to Scottish Jour. Agric., xi, 3 (July, 1928), pp. 339-344.) [63.512.]
- Investigations on Intervarietal Differences of a Chemical Nature in the Mature Potato Tuber. *T. P. McIntosh*. (Scottish Jour. Agric., xi, 3 (July, 1928), pp. 304-311.) [63.512.]

Fruitgrowing

- Transplanting Fruit Trees: The Principles considered in the light of Recent Research. *R. T. Pearl*. (Jour. S.E. Agric. Coll., Wye, 25 (1928), pp. 166-186.) [63.41-195.]
- Some Observations on Ringing Fruit Trees to Increase Production. *T. Swarbrick*. (Ann. Rept. Long Ashton Agric. Hort. Res. Stn., 1927, pp. 50-55.) [63.41-195.]
- Investigations on Gooseberry and Red Currant Varieties: Progress Report. *J. G. Maynard*. (Ann. Rept. Long Ashton Agric. Hort. Res. Stn., 1927, pp. 56-57.) [63.41.]
- Strawberry Investigations: Progress Report. (Ann. Rept. Long Ashton Agric. Hort. Res. Stn., 1927, pp. 58-71.) [63.41.]
- The Effects of Manurial Treatments on the Chemical Composition of Gooseberry Bushes: I, Effects on Dry Matter, Ash and Ash Constituents of Leaves and Stems of Terminal Shoots and of Fruits; and on Total Nitrogen of Fruits. *T. Wallace*. (Jour. Pom. Hort. Sci., vii, 1 and 2 (July, 1928), pp. 130-145.) [63.41-16; 63.41.]
- Plum Rootstocks: Their Varieties, Propagation and Influence upon Cultivated Varieties Worked Thereon. *R. G. Hatton, J. Amos and A. W. Witt*, with Appendix by *T. N. Hoblyn*. (Jour. Pom. Hort. Sci., vii, 1 and 2 (July, 1928), pp. 63-99+6 pl.) [63.41-195; 63.41.]
- An Analysis of the Effects of Potash Fertilizers on Apple Trees at East Malling. *N. H. Grubb*. (Jour. Pom. Hort. Sci., vii, 1 and 2 (July, 1928), pp. 32-59+7 pl.) [63.41-16.]
- The Relations of Scion and Rootstock: I, Tree Size in Relation to Scion and Rootstock. *B. T. P. Barker*. (Ann. Rept. Long Ashton Agric. Hort. Res. Stn., 1927, pp. 32-41.) [63.41.]
- Some Preliminary Observations upon the Influence of Scion Variety upon the Root Growth of Young Apple Trees. *T. Swarbrick*. (Ann. Rept. Long Ashton Agric. Hort. Res. Stn., 1927, pp. 42-49+3 pl.) [63.41.]

Live Stock and Feeding

- Pig Testing: The Results of Preliminary Work on Bacon Type. *A. Calder and D. A. Buchanan Smith*. (Scottish Jour. Agric., xi, 3 (July, 1928), pp. 318-325+2 pl.) [63.64; 63.752.]
- Rate of Growth in Lambs. *R. Phillips*. (Welsh Jour. Agric., iv (1928), pp. 121-141.) [63.631.]
- The Improvement of Cattle in Northern Ireland. *J. S. Gordon*. (Jour. Roy. Agric. Soc. Eng., Vol. 88, (1927), pp. 50-55.) [63.6 (416); 63.60; 63.62.]
- Cattle Improvement Schemes in the Irish Free State. *Daniel Twomey*. (Jour. Roy. Agric. Soc. Eng., Vol. 88, (1927), pp. 56-64.) [63.6 (415); 63.60; 63.62.]

An Experiment in the Feeding of Bullocks in Yards. *S. T. Johnson.* (Jour. Roy. Agric. Soc. Eng., 88 (1927), pp. 147-160.) [63.62 : 043.]

Meat Production in the Grass Counties. *C. J. B. MacDonald.* (Jour. Roy. Agric. Soc. Eng., Vol. 88, (1927), pp. 33-45.) [63.33 ; 63.604 ; 63.6043.]

Feeding Standards. *J. A. Scott Watson.* (Trans. Highland Agric. Soc. Scotland, XL (1928), pp. 1-22.) [63.6043.]

The Scientific Basis of Rationing Animals. *T. B. Wood and J. W. Capstick.* (Jour. Agric. Sci., XVIII, 3 (July, 1928), pp. 486-495.) [612.394 ; 63.6043.]

The Value of Dried Sugar Beet Pulp in the Production of Winter Beef. *S. T. Johnson* (Norfolk Agric. Stn.) (Roy. Agric. Soc. Eng. Occasional Notes (June, 1928), 15 pp.) [63.60432 ; 63.62 : 043.]

The Composition and Nutritive Value of Sugar Beet Pulp. *H. E. Woodman and W. E. Calton.* (Jour. Agric. Sci., XVIII, 3 (July, 1928), pp. 544-568.) [63.60432 ; 63.60433.]

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NOTES FOR THE MONTH

FOR the fourth successive year, correspondence classes in agriculture were held in England during the winter session of 1927-28. The demand for these classes

Correspondence in the Welsh counties, however, was not **Classes in** sufficient to warrant their continuation. **Agriculture, 1927-28** The number of counties in which classes have been organized in England has varied little during the four years: while one or two have dropped out each session, new counties have taken up the work.

In Lincolnshire (Lindsey) a successful course has been organized each year since the experiment started, and Surrey has held classes for the last three sessions; but Gloucestershire, Lincolnshire (Kesteven), East Suffolk and Wiltshire, after holding classes for two consecutive years, have been obliged to drop them, mainly owing to the claims of other work on the time of the county agricultural education staff. Classes were offered last session for the first time in the counties of Buckingham, Cambridge, Cornwall and Kent.

Most of the courses were much appreciated, and attracted a good number of students, a large proportion of whom completed the syllabus of studies and worked all the papers set. The classes in farm accountancy appeared to be especially popular, and were therefore very successful, the students being regular in working the papers.

Buckinghamshire.—A course on "Foods and Feeding of Farm Live Stock" began on January 1, 1928, and extended over nine weeks. The text-book, Porter's *Stock Feeders' Companion*, was supplied to each student at the reduced price of 6s. Twenty-six students—all farmers' sons or pupils—enrolled, and 20 completed the course. Papers of three or four questions were set weekly, and the students showed an encouraging keenness in their work. There was close competition for the prize presented to the student gaining the highest marks. It is hoped to continue the course this session.

Cambridgeshire.—As an experiment, a course in farm accountancy was given by a member of the Economics Department of Cambridge University, the County authority bearing the cost of advertising and the prizes. The 31

students who enrolled comprised farmers, their sons and daughters and pupils, farm bailiffs, one elementary school headmaster, and a clerk. Twenty-seven completed the course, which consisted of eight fortnightly lessons, on each of which a paper was set. The fee charged was 5s., and 2s. 6d. was returnable to those who completed the course. The students showed great interest in their work and reached a high standard of efficiency. It is hoped that the work will be extended to other counties in the province this winter.

Cornwall.—A course in farm book-keeping was organized by the advisory economist at the Seale-Hayne Agricultural College, in conjunction with the county agricultural staff. The fee payable was 7s. 6d., of which 5s. went towards a prize fund, the balance of 2s. 6d. being refunded on return of the whole series of papers. Eighteen students entered and their papers were highly satisfactory. A second course with 14 students followed the first.

Derby.—No correspondence classes were held in 1927–28, but at the conclusion of the organized classes for farmers' daughters the students were prepared by correspondence for their examinations.

Hertford.—As was the case in 1926–27, a correspondence course in horticulture held primarily for teachers was available for other students, two or three of whom participated in it.

Kent.—The subject selected for study was "Soils and Manures." The text-book, Sir John Russell's *Farm Soil and its Improvement*, was lent to the students, a copy being presented to each of the three best at the end of the course. The 10 students who enrolled comprised farmers, their sons and pupils, a farm labourer, and an elementary schoolmaster. All were keen and expressed their appreciation of the instruction, nine completing the course. A similar course for 1928–29 is in progress.

Lincolnshire (Lindsey).—In this county successful classes have been held each year since the experiment was first started in 1924–25. The subject dealt with in 1927–28 was "Crop Husbandry," the text-book being Somerville's *Agriculture*, and the course extended from October, 1927, to February, 1928. Thirty students joined, and 17 of these sent in answers regularly throughout the course, 15 gaining over 60 per cent. of the maximum marks. Five prizes were awarded, two students gaining equal marks for the fourth place. Several have expressed a desire to take a further course.

Surrey.—Two courses were offered, both starting in December, 1927, and ending in February, 1928. The Ministry's collected leaflets on "Manures and Manuring" were studied for the first course by two students, one of whom sent answers to all four papers set and the other to three. The second course was on the "Feeding of Dairy Cows," the text-book being that on this subject by J. Mackintosh. There were three students, and two completed the course.

* * * * *

**Dairy
Instructors'
Conference,
1928**

THE Fifth Annual Conference of County and College Dairy Instructors and Instructresses in England and Wales, convened by the Ministry, was held on October 25, at the offices of the Ministry of Labour, Montague House, Whitehall, 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 Agricultural Organizers and Principals of Agricultural Colleges, the total attendance being 130. The Conference was opened by the Earl of Stradbroke, Parliamentary Secretary to the Ministry.

Papers on the following subjects had been circulated before the date of the meeting:—

"Clean Milk Production and Co-operation with the Dairy Trade and Public Health Authorities," by Mr. W. A. Stewart, M.A., B.Sc., Agricultural Organizer for Northamptonshire.

"Clean Milk Competition Work in relation to the Cheddar Cheese-making Industry," by Miss M. C. Taylor, N.D.D., Superintendent of Dairying, Somerset.

"Clean Milk Competition Work in relation to the Stilton Cheese-making Industry," by Mr. T. Hacking, LL.B., M.Sc., Agricultural Organizer for Leicestershire.

"Some Experiences of a User of Milking Machines," by Mr. W. Gavin, C.B.E., Lord Rayleigh Dairies.

"Some Observations on the Methods of obtaining Tuberculosis-free Herds," by Mr. T. A. Hole, N.D.A., N.D.D., Ministry of Health.

"Cheese-makers' Associations," by Miss N. Bennion, N.D.D., Chief Instructress in Dairying, Cheshire.

"Butter-producers' Associations," by Mr. C. D. Ross, B.Sc., Agricultural Organizer for Devon.

"Advisory Scheme on the Rationing of Dairy Cows in Suffolk," by Mr. B. A. Steward, Secretary, Suffolk Milk Recording Society.

"Farm Lectures and Demonstrations to Stockmen on the Feeding and Management of Dairy Cows," by Mr. J. Hunter-Smith, B.Sc., N.D.A., N.D.D., Principal, Hertfordshire Institute of Agriculture.

Each paper was introduced at the meeting by a short address.

Mr. J. H. Maggs, Chairman, United Dairies, Ltd., also gave an address, entitled "That the price receivable for milk by producers should, if possible, be made to reflect due credit for higher services."

All the addresses were followed by open discussion.

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It was a striking lesson to note at the beginning of November how much the pastures had revived under the influence of the warm rains and mild temperature during the second half of October, and were—and are now, at any rate in the South—fresher than they had been since early summer. Green autumn grass may or may not have the feeding value of spring growth, but farmers beset by the abnormal price of feeding stuffs, and provided with only moderate stocks of hay and roots, are not disposed to argue the point too closely, and they will agree that fresh autumn grass is a very welcome addition indeed to their farm food supplies. Much knowledge is to be gained by examining the pastures in autumn and early winter. Not all are green. Some are brown and withered; others seem to have made their last effort for the year and are now practically stagnant. The green pastures are either those in good "heart" which have not been allowed to become coarse, or leafy aftermaths whose second growth is too late to run to seed. It is worth while noting which species of grasses are green and which are brown. It will usually be found that the outstanding green grass is perennial rye-grass, a plant that demands fertile conditions and plenty of hoof treading. Another that has rapidly filled up the bottom of the pasture and will remain green throughout the winter is rough-stalked meadow-grass. Crested dogstail is yet another. Bent-grass or *Agrostis* is, however, now brown and unpalatable. Even pastures which throughout the summer may have been quite cloverly and attractive, if they do not contain at least a moderate proportion of rye-grass, are of little value for late autumn grazing and still less so for winter grazing, for the clover will soon have dwindled to insignificance. Further, keep has been most abundant and most palatable on

pastures recently sown down. This is largely due to the fact that the seeds mixture will have been chosen with some regard to the real requirements of a good pasture.

Farmers nowadays are forced to take more interest in their grasslands. They study the habits of the different species and the parts these play in the competition plant with plant. Take the case of an ordinary seeds mixture sown out last spring and containing top grasses such as the rye-grasses and cocksfoot, and bottom grasses such as rough-stalked meadow-grass and red and white clovers. In autumn and early winter the plants most in evidence will be the rye-grasses and red clover. If, as frequently happens, these two kinds of plants are allowed to develop unchecked, the others, the slower starters such as cocksfoot, rough-stalked meadow-grass and white clover, may be smothered out. Hence the importance of a little judicious autumn grazing.

The question of the composition of seeds mixtures and of pastures is of great importance in connexion with the use of nitrogenous fertilizers—an aspect of grassland improvement that is now arousing so much interest. The degree of response to manurial dressings is very largely a question of species, and even of strains within the species. The leafy indigenous or wild strains of rye-grass, cocksfoot and so on are usually much more responsive to nitrogen than the ordinary commercial seed-producing types.

* * * * *

THE fact that 4,300 turkeys were offered by auction at the Attleborough, Norfolk, Annual Live Stock Sale, on October 18 last, is evidence both of the growing

The Attleborough popularity of this method of selling
Auction Sales poultry and of the extent of the business
of Turkeys done at this particular season. Cattle, pigs, and other classes of poultry also

figured in the proceedings, but the turkeys were the outstanding feature of the sale. Nor does the number actually offered represent the whole of the story. Birds were continually arriving in the market from an early hour up to 11 a.m., when the sale commenced, by which time the accommodation provided for them proved quite inadequate, so that late arrivals, roughly estimated at 1,200, had to be turned away. Farm carts or floats, covered with pig netting, formed the usual means of transport, but in some cases the birds were driven in in flocks.

At the mart, they were confined, in lots of 8 to 10, in pens formed of ordinary sheep hurdles covered with sheep netting, but showed no signs of discomfort or distress from being packed into a comparatively small space. The auctioning occupied several hours, and the prices realized appeared to be good. A few exceptionally well-conditioned birds fetched 21s. each, but the more usual price was 18s., and, for very small birds, 12s. to 14s. per bird.

Norfolk has long been noted for turkey rearing, and the claim of Attleborough to have the largest auction of turkeys in the country is probably well-founded. The numbers at this sale would seem to indicate either a remarkably good rearing season, or the increasing popularity of turkey production in this area. The health of the birds this year is reported to be satisfactory.

Turkeys sold at the Attleborough sales are mostly bought by farmers for fattening, during which process it appears to be the practice to let them have the run of the home paddocks, in which temporary shelter is provided by an erection of wattled hurdles. Although kept to the fields surrounding the homestead, the birds are not otherwise restricted, as they do not thrive in close confinement. The usual milling offals with pea and bean meal comprise the chief ingredients of the food given.

* * * * *

THE Annual Dairy Cattle Judging Competition, for teams drawn from Young Farmers' Clubs in England and Wales, took place at the Dairy Show on October 25. Four clubs entered teams of three members each, to compete for the silver challenge cup presented by *The Farmer and Stockbreeder and Agricultural Gazette*, and the silver and bronze medals awarded by the British Dairy Farmers' Association. Seven of the 12 young farmers taking part in the competition were girls. Shorthorn, Friesian and Jersey cattle were judged, each "ring" consisting of four animals. A maximum of 50 points was allowed for correct placing, and a further 50 points for reasons for placing.

A very interesting contest, which attracted a considerable number of spectators throughout the afternoon, resulted in the Buckingham Royal Latin School Calf Club winning the Cup by a margin of 21 points over the Bletchley Calf Club. The Horsham Calf Club were third, and the Sussex Baby Beef

Club, past holders of the Cup for three successive years, were fourth. The scores were :—

Buckingham Royal Latin School Calf Club	..	555	points
Bletchley Calf Club	.. .. .	534	„
Horsham Calf Club	.. .. .	528	„
Sussex Baby Beef Club	.. .. .	460	„

The individual championship was obtained by a newcomer to the competition, Dora Dowding, who thus secured the Silver Medal of the British Dairy Farmers' Association. The two bronze medals were won by Arthur Wm. Culley and Jack Jones. The scores were :—

(1) Dora Dowding (Horsham Calf Club)	.. ..	226	points
(2) Arthur Wm. Culley (Buckingham Royal Latin School Calf Club)	.. .. .	215	„
(3) Jack Jones (Bletchley Calf Club)	.. ..	204	„

* * * * *

ATTENTION is called to a scheme, "Railway Freight Rebates (Anticipation)" [Cmd. 3215], issued by the Ministry of Transport,

**Railway Freight
Rebates on
Selected
Agricultural
Traffics**

which provides that during the period beginning December 1, 1928, and ending September 30, 1929, Railway Companies shall allow a rebate of 10 per cent. of the carriage charges on the under-mentioned list of selected agricultural traffics.

This scheme is in anticipation of the statutory rate relief provided for in legislation introduced by H.M. Government in which, *inter alia*, from October 1, 1929, Railway Companies are to be relieved of a proportion of their local rates, and the sums thus made available are to be utilized for the reduction of certain of their carriage charges.

Save as respects milk, the rebate will not apply to any traffics conveyed at passenger train rates.

Agricultural Selected Traffics.

Manure, street, stable or farmyard, in bulk;	} Used in Great Britain
Manures, other than street, stable or farmyard, in bulk;	
Lime, limestone, chalk, basic slag, or salt for agricultural purposes;	
Any other substance for use direct as manure, or any manure substance to be mixed and used as manure, when packed and so consigned;	

Oil cake, whole, broken or ground.
 Meals or husks, for animal or poultry feeding, in cases, casks or sacks.
 Foods for live stock consisting of meals, with spice, molasses or condiment.
 Milling offals, named in the grain list in the Classification of Merchandise for conveyance by railway, for animal or poultry feeding.
 Treacle for cattle feeding, consigned direct to farmers.
 Ensilage.
 Hay.
 Hay and straw chopped, in sacks.
 Provender, consisting of chopped hay and straw, mixed with articles named in the grain list in the Classification of Merchandise for conveyance by railway.
 Beetroot pulp (residue from sugar making), in bulk, for feeding live stock.
 Carrots, mangel wurzel, or turnips, in bulk, for feeding live stock.
 Grains, brewers' or distillers' (or draff).
 Potatoes (except new potatoes as defined in the Classification of Merchandise for conveyance by railway).
 Milk (including separated milk but not condensed milk), in cans, churns, or butts, or in bottles packed in cases.
 Live stock.

Rules for the determination of carriage charges provide, *inter alia*, that :—

- (1) Where any of the selected traffics is carried at a charge which includes the services of collection or delivery or both, the carriage charge shall be determined after deduction of the amount included in the charge for each such service, and for this purpose the amount so included in any exceptional rate shall be deemed to be a sum of 1s. 6d. a ton in respect of each such service included in the charge ; and
- (2) In the case of live stock conveyed to or from Northern Ireland or the Irish Free State and carried at a throughout charge, which includes a charge for carriage by railway in Great Britain, two-fifths of that throughout charge shall be taken to be the proportion thereof attributable to carriage by railway in Great Britain and treated accordingly as the carriage charge from which the rebate is allowable.

Copies of the full scheme, Railway Freight Rebates (Anticipation) [Cmd. 3215], may be obtained through any bookseller, or directly from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 3d. net.

* * * * *

A NOVEL and interesting attempt to organize the marketing of farm produce is contained in the New South Wales Primary Products Act, 1927, as amended in July of this year, which provides, *inter alia*, for the establishment of Marketing Boards, through the agency of which producers may supervise and control the marketing of their products.

Under this Act, a Marketing Board will be set up for any primary commodity, except wool and certain kinds of dried fruit, and in any area recognized by the State, if, following a petition by a specified number of producers, at a compulsory poll, a requisite majority of the producers is in favour of its constitution. Subsequently, producers will be required to elect representatives to the Board which, in addition, will include a member or members appointed by the Governor. Once a Board has been set up, it may not be dissolved for three years, except by resolution of Parliament ; at the end of this period, a poll may again be taken and, if a majority is in favour of dissolution, it will be dissolved.

A Board, thus constituted, will be a corporate body, independent of Government control, with full powers to sell or arrange for the sale of the commodity it controls. It is also enabled under the Act to arrange for financial accommodation for the purpose of making advances to producers, and to make levies in payment of these advances or for administrative expenses.

A Board will be free to determine the manner in which its control shall be exercised. It may itself take over the sale of the commodity or it may confine itself to the regulation of distribution through existing channels by a system of licensing. Similarly, it may grant exemptions covering small producers, direct sales or sales to local retailers and consumers, provision for stock requirements, etc. It is also empowered to prescribe and enforce systems of grading.

The effects of such control, if wisely exercised, will, it is

contemplated, be beneficial and far-reaching. Organized marketing will tend to stimulate production and to remove the speculative element from distribution, to the ultimate benefit of the community as a whole. Though purely a State enactment, the Act will pave the way for inter-State understanding, and afford a foundation for inter-State reciprocity or for federal pooling of primary products such as wheat and butter.

* * * * *

THE attention of dog-owners and poultry-keepers is drawn to the Dogs (Amendment) Act of last Session. Section I of the Act extends to poultry the provisions of the Dogs Act, 1906, in respect of the liability of a dog-owner for injury done to poultry by his dog. It enables a stock-owner to take proceedings against a dog-owner for damage done to his poultry by the dog in the same way as the earlier Act enabled him to do in the case of cattle. The term "poultry" includes domestic fowls, turkeys, geese, ducks, guinea fowl and pigeons.

The main provisions of the Dogs (Amendment) Act, 1928, apply generally to Scotland, but the Act does not apply to Northern Ireland. Section I of the Dogs Act, 1906, as amended by the Dogs (Amendment) Act, 1928, therefore now reads as follows :—

- I. (1) The owner of a dog shall be liable in damages for injury done to any cattle or poultry by that dog ; and it shall not be necessary for the person seeking such damages to show a previous mischievous propensity, or to show that the injury was attributable to neglect on the part of the owner.
- (2) Where any such injury has been done by a dog, the occupier of any house or premises where the dog was kept or permitted to live or remain at the time of the injury shall be presumed to be the owner of the dog, and shall be liable for the injury unless he proves that he was not the owner of the dog at that time.

Provided that where there are more occupiers than one in any house or premises let in separate apartments or lodgings, or otherwise, the occupier of that par-

ticular part of the house or premises in which the dog has been kept or permitted to live or remain at the time of the injury shall be presumed to be the owner of the dog.

- (3) If the damages claimed under this section do not exceed five pounds they may be recovered under the Summary Jurisdiction Acts as a civil debt.
- (4) Where a dog is proved to have injured cattle or poultry or chased sheep, it may be dealt with under Section II of the Dogs Act, 1871, as a dangerous dog.

Section II of the Dogs Act, 1871, provides that where a dog is proved by a court of law to be dangerous, a summary order may be made for the dog to be destroyed, and any person failing to comply with such order shall be liable to a penalty not exceeding twenty shillings for every day during which he fails to comply with such order.

* * * * *

THE Ministry of Agriculture and Fisheries announces that the fourth World's Poultry Congress and Exhibition will be held at the Crystal Palace, London, from July 22-30, 1930.

World's Poultry Congress and Exhibition, 1930 The Congress is being organized by the Ministry, in conjunction with the Board of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland, and generally under the auspices of the International Association of Poultry Instructors and Investigators. The Ministry undertook the responsibility at the request of the National Poultry Council, and on the assurance that the full support of the poultry industry would be forthcoming.

Their Majesties the King and Queen and H.R.H. the Prince of Wales have graciously consented to become Patrons of the Congress, and the Minister of Agriculture and Fisheries, the Secretary of State for Scotland and the Minister of Agriculture for Northern Ireland will be Presidents. Mr. F. C. Elford (Canada), President of the International Association of Poultry Instructors and Investigators, is First Vice-President, and the Vice-Presidents so far appointed are Lord Dewar, Dr. Edward Brown, and the President of the National Poultry Council. The President of the National Farmers' Union has also been

invited to become a Vice-President of the Congress. The work of the Congress will be carried through with the advice of a Finance and General Purposes Committee and of various Sub-Committees, each concerned with a particular section of the work. These Committees together constitute the General Committee, of which the Chairman is Sir Charles J. Howell Thomas, K.C.B., C.M.G., Permanent Secretary to the Ministry of Agriculture and Fisheries, and the Vice-Chairman, Mr. H. E. Dale, C.B., Principal Assistant Secretary. The Director of the Congress is Mr. P. A. Francis, O.B.E., the Ministry's Poultry Commissioner. Dr. V. E. Wilkins, of the Ministry, has been appointed Secretary, and Mr. J. A. McGilvray, Assistant Secretary.

The Ministry recognizes that the success of the Congress will depend to a large extent upon the whole-hearted co-operation of all sections of the poultry industry. The Crystal Palace is an ideal venue for the purposes of the Congress, and it is probable that the whole of the lecture sessions and business meetings will be held there during the period of the Exhibition. In addition to the important paper-reading side of the Congress, at which numerous problems affecting the progress of the poultry industry will be under discussion, there will be an international exhibition, to which all participating countries will contribute. This will consist of displays of poultry, rabbits and pigeons, together with educational and research exhibits illustrating the development of the poultry industry in the various countries, and a comprehensive trade exhibit staged by commercial interests in this country and in other parts of the world.

* * * * *

A PRELIMINARY note on the general results of the 1927 beet crop and the ensuing manufacturing season was given in the JOURNAL for April of this year.

Beet Sugar Campaign, 1927-28 The final results are now available and are given below.

The 1927-28 manufacturing campaign was severely handicapped by a very bad growing season, and, in the result, the average figures compare very unfavourably with those for the previous campaign. It is, however, encouraging to observe that the general standard of efficiency of the factories has been maintained, and this notwithstanding the low purity of the beets received.

The general results, compared with those of 1926-27, were as follows:—

	1927-28	1926-27
Acreage under sugar beet	232,918	129,463
Average yield per acre (tons) .. .	6.45	8.63
Number of beet growers	33,340	22,700
Number of factories	19	14
Average number of days worked .. .	106	114
Number of workers employed in factories during the campaign	9,022	7,157
Tonnage of beets delivered to factories .. .	1,503,019	1,117,072
Average sugar content of beets (per cent.) ..	16.12	17.31
Average price paid per ton of beet .. .	55s. 4½d.	59s. 5½d.
Estimated total sum, including cost of transport, paid by the factories to the growers ..	£4,147,000	£3,322,000
Total production of sugar (cwt.)	*3,802,189	3,069,757
Average extraction of sugar expressed as a percentage of beets delivered to factories..	12.65	13.83
Average extraction of sugar expressed as a percentage of total sucrose in beets .. .	78.5	78.9
Average farm output of sugar (sucrose) per acre of beet grown (lb.)	2,330	3,346
Average factory output of commercial sugar per acre of beet grown (lb.)	1,828	2,656
Production of by-products:—		
Molasses (cwt.)	*1,144,500	753,254
†Pulp (tons) (dry)	91,436	62,801
(wet)	16,163	26,138
Subsidy paid:—		
Sugar	*3,705,000	2,990,973
Molasses	*509,100	334,420
Total	*4,214,100	3,325,393

* Subject to slight adjustment.

† The figures relating to the pulp production were reviewed in detail in this JOURNAL for July, 1928.

* * * * *

The Imperial Fruit Show.—The Ministry's fruit marketing demonstration at the Imperial Fruit Show, which was held at Manchester from October 19 to 27,

Marketing Demonstrations had this year an added interest, many of the exhibits having been packed under the National Mark. The demonstration of apple grading and packing on a commercial scale aroused great interest, and was instrumental in attracting a number of new applicants for registration as packers of National Mark apples and pears.

At a conference held at the Show on October 24, many growers and merchants took the opportunity of speaking—under a three-minute rule—on the subject of the National Mark in terms of high praise.

This year a section for potatoes was added to the Show, and the Ministry's potato marketing demonstration, given in

connexion with it, evoked considerable interest among merchants and farmers from the surrounding counties, many of whom were given an opportunity of seeing this exhibit for the first time. The suggested grades for potatoes as shown, and the proposal to put a system of potato grading into operation at an early date, met with general approval.

Northampton Cattle Market.—In conjunction with the County Branch of the National Farmers' Union and the Northampton Pedigree Pig Breeders' Association, the Ministry gave its Pig Marketing Demonstration in the Northampton Cattle Market on October 31 and November 1.

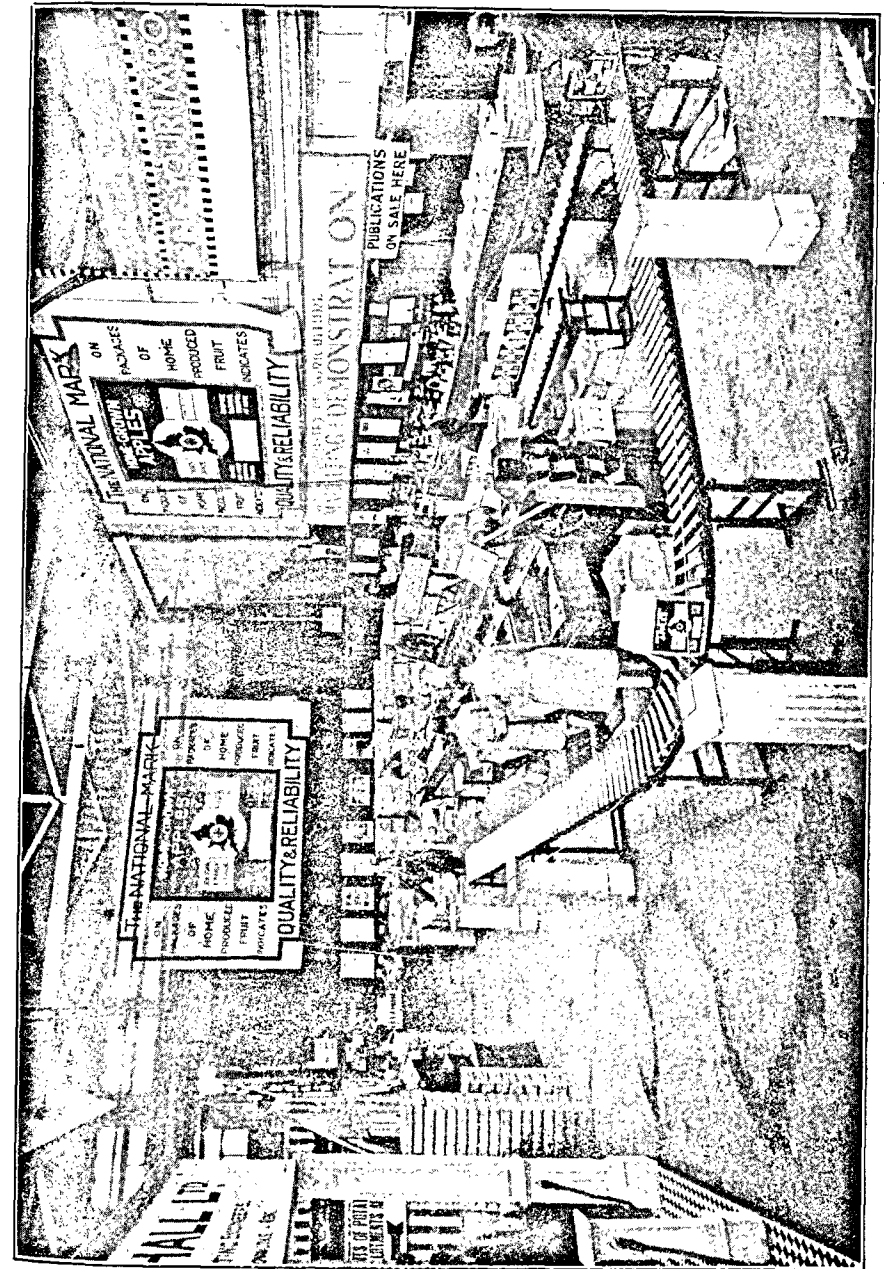
A technical demonstration of breed characteristics and market requirements was included in the programme. This feature aroused much interest, especially on the second day, when helpful discussions on Breeding in relation to Market Requirements followed the demonstrations.

The London Dairy Show.—The Ministry's Egg and Pig Marketing Demonstrations were given at the London Dairy Show of the British Dairy Farmers' Association on October 23 to 26.

As regards eggs, this was the last, during the current year, of a series of demonstrations in egg marketing which have been carried out in different parts of the country. The practical character of these demonstrations of candling, grading and packing eggs in the manner required by the scheme of egg marketing reform, has proved a great attraction, and has done much to disseminate knowledge of the objects of the scheme and of the work to be carried out thereunder by "accredited" packers.

Seventy cases of 360 eggs, *i.e.*, 210 long hundreds, as received from the producers, were graded in accordance with the national standards, and were packed and dispatched under the National Mark. This Mark, which is placed on the package, will be the future guarantee of quality, and authority to use it will be given only to packers who are registered under the scheme.

A satisfactory feature of the demonstration was the interest taken by prospective packers, many of whom, after witnessing previous demonstrations, were making a second visit to obtain additional information on the subject. Although a demonstration was given at the Dairy Show last year, the number of visitors was at least as large. Producers and distributors came from all parts of the country and from overseas. Representatives of the poultry industry from America,



The Imperial Fruit Show, Manchester. The Ministry's Marketing Demonstration, showing the grading and packing of apples under the National Mark.

Denmark and Ireland, in particular, showed keen interest in the developments that are taking place in egg marketing in this country.

The importance that is being attached to the National Mark as the future guarantee of quality is steadily increasing, and the exhibit of packages bearing the Mark drew considerable attention. Cartons, each containing 1 dozen or $\frac{1}{2}$ -dozen eggs, illustrated the direction in which the future trade in high-class eggs is expected to develop. The value of the carton in carrying eggs smoothly and speedily through the channels of trade, with a minimum amount of handling, and with the guarantee of the packer, the National Mark, on each carton, is being increasingly recognized.

The pig marketing demonstration was staged in close proximity to the bacon and hams entered for competition by producers and distributors. The demonstration was divided into three sections: (1) What the market requires; (2) What the market does not require; and (3) Bacon, hams and by-products. Feeders were thus enabled to compare their entries with the graded selections required by the distributive trades and to appreciate those defects in conformation and quality which depreciate the selling value of bacon and hams.

* * * * *

THE Report on Fruit Marketing,* published by the Ministry in 1927, dealt, in a general way, with the principles of fruit marketing as a whole, and foreshadowed further reports dealing in detail with the best commercial practice in regard to the marketing of the various fruits grown in England and Wales.

The first of these further reports is now available,† and deals with the preparation for market of apples, pears, plums and strawberries. The introductory section discusses points of general application in regard to varietal characters, thinning, picking, culling and grading, packing, packages, packing and pooling stations, and cold storage. This section also includes a chapter explaining the scope of the Agricultural Produce (Grading and Marking) Act, 1928, and its application to the marketing of apples and pears.

* *Marketing of Fruit*, Economic Series No. 15. H.M. Stationery Office, price 6d. net., post free 9½d.

† *Preparation of Fruit for Market: Part I—Apples, Pears, Plums and Strawberries*, Economic Series No. 21. H.M. Stationery Office, price 6d. net., post free 9d.

The four remaining sections deal respectively with the four fruits mentioned, on the same lines as the introductory section, but in greater detail. The Report is profusely illustrated, is a practical handbook on the whole technique of preparing fruit for market, and should be of the greatest assistance to all who grow fruit for sale, or who buy and sell fruit. The nominal price of 6d. places the Report within the reach of all concerned.

* * * * *

THE number of inquiries that reach the Ministry regarding facilities for the training of egg candlers indicates a weakness in the industry that must be remedied if the reputation of home-produced eggs packed under the National Mark is to be firmly established and maintained. The Ministry has, therefore, arranged for instruction in candling to be given under commercial conditions at three selected centres referred to below. The facilities will be open to female employees of packers who have applied for accrediting under the National Mark Scheme.

The period of training will normally be 14 days, which is considered sufficient to enable a trainee to gain a good general knowledge of the technique of candling as well as of the handling of eggs before candling and the grading and repacking of eggs after candling. During the period of training, the trainee will be regarded as an employee of the training centre for the purposes of discipline and time-keeping. Those who send her for training will be responsible for her remuneration and subsistence allowance (if any) and also for the provision of lodging accommodation during the training period.

The centres which have been selected by the Ministry for the purpose are :—

	<i>No. of Trainees that can be taken at any one time</i>
Cheltenham Egg Packing Station, Cheltenham	2
Framlingham and Eastern Counties Co-operative Society—	
Ipswich	2
Framlingham	1
Boston	1
Stamford and District Egg and Poultry Society, Stamford ..	1

Applications for such training should be addressed to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

THE WORLD AGRICULTURAL CENSUS OF 1929-30

R. J. THOMPSON, C.B., O.B.E.,

Assistant-Secretary, Ministry of Agriculture and Fisheries.

REFERENCES have already been made in this JOURNAL to the proposal of the International Institute of Agriculture that an Agricultural Census should be taken throughout the world in 1929-30. Great progress has been made in the furtherance of this idea, and it may be of interest to summarize the present position.

The need for a World Agricultural Census was particularly felt after the war, and in May, 1924, the Institute was authorized to take steps to induce the adhering Governments to carry out a general Agricultural Census in accordance with a uniform plan to be prepared by the Institute. This proposal attracted the attention of the International Education Board (Rockefeller Foundation), which made a grant of \$10,000 per annum for the five years 1925-29, to be used to defray the salaries of a Director and an Assistant Director and the travelling expenses involved in visiting the various Governments. A special Bureau charged with this particular work was created at the Institute in 1925, and Mr. Leon M. Estabrook was appointed as Director of the census project. Mr. Estabrook is an officer of the United States Department of Agriculture, and possesses an intimate and technical knowledge of methods of collecting and dealing with agricultural statistics. In addition to his experience in the United States he had, before his appointment to the Institute, been entrusted with the task of reorganizing the agricultural statistics of Argentina, and he was therefore specially qualified to fulfil the duties which the new undertaking involved.

After some preliminary investigations, a standard form for use in the collection of the Census was prepared, and this form was considered and revised in the first instance by a Committee of the International Scientific Council of the Institute in February, 1926, and subsequently by the Committee of Statisticians of the General Assembly in the following April. The standard form of schedule was circulated to all Governments, together with explanatory information as to the value of the Census, the recommendations of the Committee of Statisticians in regard to the way in which the Census should be taken, and similar matters.

Following on this Mr. Estabrook was charged by the Institute with the mission of visiting the different countries of the world

in order to interest them in the taking of the Census and to discuss details with the statistical authorities.

It would be difficult to over-estimate the importance and utility of this part of the work, which, indeed, constitutes the main contribution which the Institute has been able to make to the preliminary work of the Census. By these personal visits and interviews the proposal has been put before the competent authorities in a way which would have been quite impossible by correspondence. The reports received from Mr. Estabrook on his visits show that he has been received everywhere with the greatest courtesy, and that on every side there is a general disposition to make the Census a success. During the past two years many Conferences and Congresses have expressed their approval of the idea, and among these special reference may be made to the resolutions of the World Economic Conference organized by the League of Nations in May, 1927, and of the Imperial Agricultural Research Conference in London in October, 1927.

Recently (October, 1928) a further gathering of the Committee of Statisticians was held in Rome, and various questions relating to the World Census were discussed. This Committee, which sat for several days, was attended by representatives of over 30 countries, and made a number of recommendations which will in due course be included in a revised edition of the standard form.

The Committee had the advantage of receiving from Mr. Estabrook, the Director of the Census, an account of the results of the visits he had made during the past two years to the various countries of the world. Mr. Estabrook reported that since June, 1926, he had visited all countries of the world except Albania in Europe; Persia, Afghanistan and Mesopotamia in Asia; some of the colonial territories in Africa; Central America; and five countries of South America. He expected to visit Albania, Central America and the northern countries of South America within the next few months. In all the countries so far visited the responsible officials had expressed a desire and a willingness to co-operate as far as practicable in the World Census. In addition useful information had been obtained concerning the statistical services and the organization of Agricultural Departments, while the Colonial Departments of Great Britain, France, Belgium, Italy and Portugal had expressed a willingness to co-operate by bringing the proposed Census to the attention of their Colonies and Dependencies.

The countries visited include 76 per cent. of the land surface of the world, more than 90 per cent. of its population, and an even higher percentage of its agricultural and live stock production.

In relation to the collection of a uniform Census, the striking feature of the tour was the diversity of the agricultural conditions throughout the world. Soil and climate, crops and live stock, farm practice, transportation, marketing and distribution, all differed, and in view of this fact and of the varying degree of agricultural and statistical organization, it is considered highly necessary that the proposals in the standard form should be kept as simple as possible, each country being free to obtain as much additional information as might be desired.

The preparatory work has thus been nearly completed, and it now remains for the Governments to give effect to the scheme by completing their arrangements for the taking of the Census in 1929-30. Many practical problems are likely to arise, and the personal interviews which the Director of the Census has had with the Statistical Authorities of the different countries are likely to bear fruit in the shape of demands for advice and assistance. There are many countries where the collection of an Agricultural Census is an established practice (*e.g.*, Great Britain, United States, etc.), and with these the Institute will not be much concerned. There are, however, others where a Census has never been taken in the past, or has not been taken for many years, and much of the value of the scheme lies in the possibility of inducing these countries to take a Census and thus provide both themselves and the world at large with information which is now lacking.

Looking further ahead, the Institute has to consider what is likely to be the position when the Census has been taken. It will be the business of each country to publish a summary of the principal results as early as possible, and to follow this up with a report in more detail, providing a sound view of the agricultural conditions of the country concerned. It is hoped that each country will furnish the Institute with the preliminary results of the Census as they are obtained, and thus enable the Institute to publish, month by month, information as it becomes available. By this means all who are interested in the world's food supply, from whatever point of view, will be able to utilize at once such part of the information as is of value to them, without waiting for the publication of the full reports of each country. The Institute will incorporate the information

in the international agricultural statistics published in the Statistical Year Book, and in the tables relating to crop and live stock production published in the Monthly Bulletin.

But this is only one stage. The main and essential function of the Institute is to study the international production of food and raw materials, and to correlate the information as to supply with the demand and consumption of the different countries, so that we may have increased knowledge as to the balance of supply available from those countries which have a surplus, and the probable demand from those countries where the output is insufficient for requirements. There is here a wide field for investigation. In the case of a few important products, such as wheat and cotton, statistics of world production are closely studied and are of practical utility in regulating the direction and movement of supplies and the formation of prices. In the case of many other agricultural products, however, information is very defective, and it is particularly in regard to these that the results of the World Census are likely to be of value. Each commodity needs to be studied separately, and to be investigated not merely in regard to the past but to probable future development. It is necessary to consider whether the world's supplies of food-stuffs and raw materials are increasing proportionately to the growth and purchasing power of the population, and how far they may be limited or increased in the future by changes in methods of cultivation or in the area of land available. If the Governments of the world carry out the Census effectively they will be making a great contribution towards the provision of material on which such investigations can be based.

To enable the Institute to carry out the investigations, and to secure from the Census the results of world-wide importance which should be obtained, it will be necessary to provide funds to secure the services of a highly qualified and efficient staff.

Up to the present the main cost of the work connected with the Census has been met by a grant, already mentioned, made by the International Education Board. This grant is due to end in 1929, but at the recent meeting of the General Assembly of the International Institute the Assembly, while thanking the Board for its past assistance, expressed the hope that "the International Education Board would continue this assistance in future years so as to enable the work which has been so successfully begun to be brought to a satisfactory conclusion."

THE ECONOMIC POSSIBILITIES OF RICE GRASS (*SPARTINA TOWNSENDII*)

II.—EXPERIMENTS IN ESSEX*

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PRACTICALLY the whole of the Essex coast-line is protected from the sea by sea-walls. These walls are for the most part composed of clay. Outside them lie vast stretches of mud amounting in all to many thousands of acres. In a general sense this mud may be described as being on two distinct levels. The higher mud flats, known as "saltings," usually adjoin the sea-walls and lie between the high-water mark of spring tides and about 3 ft. below that line. They carry a fairly dense, mixed, erect type of vegetation, consisting mainly of the grasses *Glyceria maritima* and *Spartina stricta*, *Aster*, *Salicornia*, *Statice*, *Suaeda maritima* and *Armeria*, in varying proportions, according to the level and stage of development of the marsh. The outer edge of these saltings is broken at frequent intervals by creeks, which serve to drain off the water of the receding tides. Between the mouths of the creeks the saltings end generally in an abrupt cliff of, on the average, from 3 to 4 ft. in height. Stretching out from the base of the cliffs lie the lower mud flats. These also normally carry vegetation, but of a prostrate type, principally the sea-grass *Zostera* or filamentous sea-weeds. In places, the *Zostera* flats are as much as 8 ft. or more below high-water mark, but on the whole they average about 5 ft.

The saltings play the important part of giving support and protection to the sea-walls. In places they have been and are being eroded, thus leading to the exposure of the walls and adding seriously to the cost of maintenance of the latter. Since the vegetation already in possession seems unable to cope satisfactorily with the situation at the more exposed points, the possibility of introducing some new plant which, by exceptional vigour and mud-binding properties, might be expected to hold on to the endangered mud, and even to collect more mud, becomes a matter for serious consideration, especially having in mind the devastation caused at many points in 1897 by the breaking through of the sea. If, in addition, such a plant could be induced to invade the lower *Zostera* levels and there begin to arrest mud and so in a sense

* The first and introductory article, by Professor F. W. Oliver, appeared in this JOURNAL last month (November) page 709.

lay the foundation for new saltings, still further protection would be obtained. If, over and above these things, such plant could be shown to possess some agricultural or other value, the need for thorough tests and trials would become apparent. To those unfamiliar with our muddy foreshores, it may seem hardly credible that any plant could possibly satisfy all these requirements. In *Spartina Townsendii*, however, there is good reason to suppose that we have a plant almost ideally suitable for the purpose in view.

Work to the End of 1927.—Accordingly, in 1925, experimental plantations on a modest scale were begun. By April, 1927, 17 centres had been established. It is yet too soon to attempt to form any conclusions on the erosion or accretion problems. Our aim meantime has been to introduce the plant to as many and varied situations and conditions as possible, and to watch developments. In some cases it has taken more than six months before it became possible to say whether a plant was making progress or was dying or dead, so that the centres laid down in the spring of 1927 can for the present be disposed of briefly. While all seem to be progressing in greater or less degree, the most interesting indications with regard to them are (1) that those on the site of a previous failure now show some measure of success, and (2) that very promising growth has been made in a new but important situation. The actual planting of the latter, on the Suffolk side of the Stour estuary, was not carried out by the Institute but at its suggestion. There a long-neglected and exposed section of sea-wall, without protecting saltings, has recently presented considerable difficulties in an attempt to restore it to a safe condition. The suggestion was to plant up the lower part of the outer surface of the wall. The "take" has been so good in some instances that flowering has already begun. The real test, however, will be experienced during the coming winter months.

For the experimental centres made in 1925 and 1926, off-sets from Poole Harbour were used, each of them consisting of two or three shoots. None was more than a few days' old when planted.

The 1925 operations were limited to Northey Island near the head of the estuary of the Blackwater. The main objects were to establish a type of vegetation more suitable than that already in possession for the purposes of fodder, and to counteract erosion. A sea-wall encloses most of the island, but having been in disrepair for 40 years, wide breaches

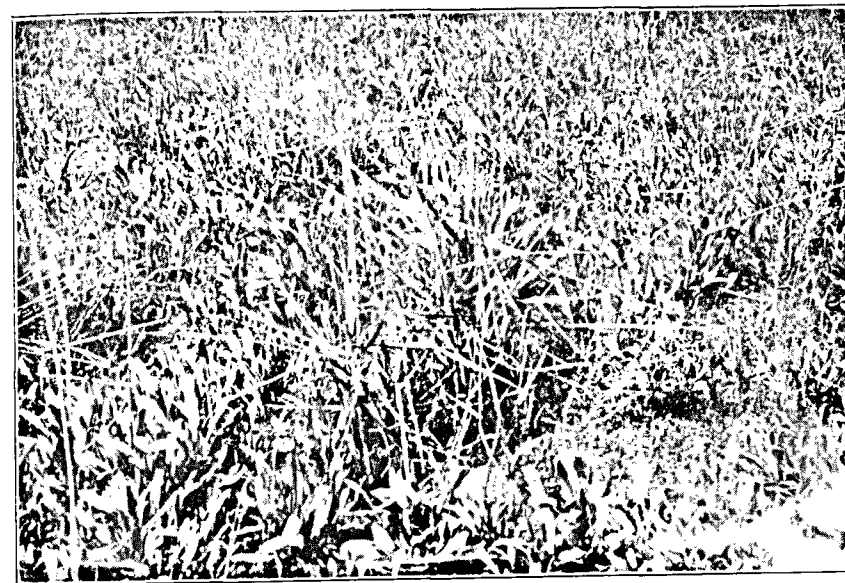


FIG. 1.—Northey Island, Essex. Inside the Walls, May 7, 1927. Plants of *Spartina Townsendii*, about two years old, spreading rapidly amongst Sea Aster.



FIG. 2.—Northey Island, Essex. Outside the Walls, May 7, 1927. Stake marks edge of saltings: cliff about two feet high. Tidal scour is fairly severe at this point. Vegetation mainly Sea Aster. Two plants of *Spartina Townsendii* are visible—about two years old. Both are sending up a circle of new shoots.

THE ECONOMIC POSSIBILITIES OF RICE GRASS (*Spartina Townsendii*).

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FIG. 4.—Saltings at Bradwell, Essex, June 22, 1927. Plant of *Spartina Townsendii* growing in a shallow "pan" bordered by the grass, *Glyceria maritima*.

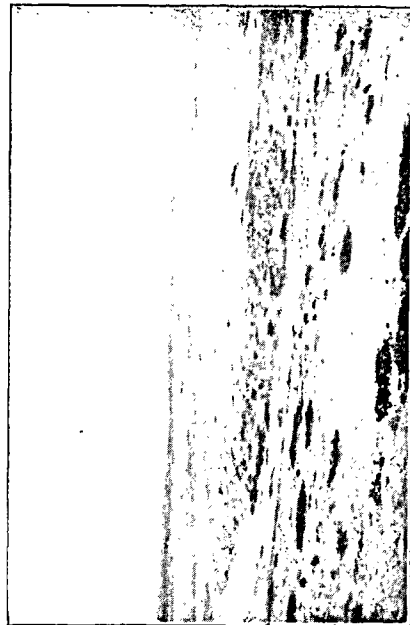


FIG. 3.—Mud Flats off Mersea Island, Essex, April 12, 1927. In foreground, mud is bare. In background, appearing as a dark line, is a dense growth of *Zostera*, amongst which *Spartina Townsendii* has been planted.

THE ECONOMIC POSSIBILITIES OF RICE GRASS (*Spartina Townsendii*).

occur through which the sea enters freely, and, at spring tides, floods an area of 200 acres to a general depth of about 2 ft. The vegetation is mainly *Aster*. Three plots were laid down, of which two have been successful. The failure occurred in a wide "pan" of soft bare mud in an angle between the sea-wall and the saltings, and on a level slightly lower than the latter. The two successes were made on typical saltings, one inside and the other outside the sea-wall. They are both on approximately the same level and are covered with some 2 to 3 ft. of water during spring tides. The outside plot, however, is subject to considerably greater wash, and there the plants have not made quite as good progress as those inside. The average greatest diameter of the clumps in October, 1927—that is, when two and a-half years old—was about 2 ft. 6 in., compared with 3 ft. within the wall. In the latter case the interval between the planted off-sets was originally 3 ft., so that the resulting plants were beginning to merge. Most of the plants have flowered freely each season, and seedlings have been found in the neighbourhood of the plots.

By the end of 1926, the owner of the island was so satisfied with the progress made that in 1927 he planted up about 15 acres. As a result he hopes before long to be able to increase substantially his head of stock.

In 1926 it was thought desirable to introduce Rice grass to some of the more exposed mud flats. Accordingly small plantations were made in the Blackwater estuary at Goldhanger, Tollesbury, Mersea and Bradwell.

The site chosen at Bradwell resembles the sites at Northey, but the saltings here are higher, being almost on the high-water mark level; there is a slightly more mixed vegetation, *Glyceria* being more in evidence and, except for extensive mud-banks, there is no protection from the North Sea. Two lines of plants were put in about 5 yd. apart, commencing near the sea-wall and running directly outwards to the limit of vegetation, where the saltings fall away sharply into a wide, deep channel. Although apparently not quite so successful as at Northey, results here are distinctly promising. On June 22, 1927, the best plant had 24 shoots, while its greatest diameter was 20 in.

The sites of the Tollesbury and Mersea plots were almost identical, and both were failures. At each, the lower *Zostera* flats were used. At high tide the depth of water is 5-6 ft. The mud is very soft, necessitating the use of mud-boards

("splachers") on the feet. Assuming the plants to have been quite sound, it is difficult to assign a reason for these failures, unless they have been due to strong currents and heavy wash. On such points further experiment and observation are needed. In 1927, Mersea flats were tried again with 35 plants. On July 20 there were 10 survivors. By October 5, these had been reduced to eight. Without doubt, many of the 27 failures found the situation unsuitable and died off, but not a few were missing altogether and were probably scoured out.

At Goldhanger, the need for a vigorous mud-binding plant has become acute. There is a considerable length of wall supported only along a short section by the usual saltings. In front of the remainder, part of which is to the east and part to the west of the strip of saltings, the mud is rapidly disappearing, thus exposing the base of the wall. On the west side the mud is bare, but on the east, commencing some 10 yd. from the wall, it carries a close sward of *Zostera*. On both sides there is almost 8 ft. of water during spring tides, and the period of immersion is just over four hours. On the west, with less scour, none of the plants set in March, 1926, succeeded, but on the east there were still six survivors out of 100 by September. In October, 1927, only three remained. On June 30, 1927, these three had 13, 10, and 9 shoots respectively, and on October 4, when 18 months old, 17, 11, and 9. It is hoped that these survivors have now adapted themselves to the very extreme conditions to which they have been subjected for a prolonged period, and that they will make the nucleus of an ever-increasing colony. None has, so far, flowered, nor is there much lateral spread. Each has a diameter of about 5 in., while the height varies from 6 to 10 in. In the meantime fresh methods are being used to induce the plant to colonize this particular area.

At other points, too, in 1927, planting was continued at Goldhanger, and good progress made. In the search for natural aids to maintain the wall other plants have been called into service, viz., *Suaeda fruticosa* and Tamarisk for a shingle bank; the maritime form of couch-grass, wild beet, and sea lyme on sand. The occupier of the adjoining land is fully alive to the need for exploiting at a minimum of cost every possible natural and artificial device for the maintenance of his sea defences. At the moment these constitute a serious item, amounting to a heavy annual charge per acre of the farm.

The Essex experiments have now advanced to such a stage that considerable interest in the possibilities of *Spartina*

Townsendii is being shown by occupiers of land along our section of the coast, and there is consequently a demand for more information on the subject. Apart from other considerations, off-sets at the moment cost about £5 per 1,000, while seed is sold at the rate of £3 per lb. But the work will have to be continued and extended before it will be possible to draw up hard and fast rules for the guidance of those desirous of utilizing *Spartina Townsendii*.

The Year 1928.—The above account of *Spartina* in Essex was written in December, 1927. It is now (November, 1928) possible to give some additional information of the progress made during the present year.

On the Stour, at Holbrook, on the Suffolk side, during the trying winter months of 1927-28, the main difficulty experienced was in maintaining the young plants in position on exposed parts of the sloping face of the wall, and it was decided to



remodel the plantation. Accordingly, in the spring of 1928, more plants were obtained, and planted out on a shelf of mud specially constructed at the foot of the wall. The plants seem to have become firmly established.

At Mundon, in Essex, the sloping lower face of a new section of wall, where the erosion problem resembles that at Holbrook, was planted up in April, 1927. No stakes were used and no special mud-shelf built. While there has been a small mortality amongst the plants, no plants have been scoured out and the remainder have grown well. This site, however, is much less exposed than that at Holbrook.

At Northey all of the plantations are extending rapidly, and in a few years the whole aspect of the island should be changed. On a recent inspection the plot within the old sea-wall looked remarkably well and could best be likened to a field of wheat at the end of May. The plants stand up in marked contrast to the brown decaying stems of the natural vegetation of the locality.

At Goldhanger also progress must be recorded at all points, but in particular with regard to the three survivors of the

100 plants set opposite the most vulnerable section of the wall and exposed to the most adverse conditions. It took these from March, 1926, to October, 1927, to become firmly established. Between October, 1927, and July, 1928, they have doubled the number of shoots, have flowered for the first time, and are at last beginning to spread.

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THE WORKING OF THE SEEDS ACT, 1920, IN THE SEASON 1927-28

THE outstanding feature as regards the administration, during the 1927-28 season, of the Ministry's powers in connexion with the supply of seeds, was the prosecution in two important cases of firms alleged to have supplied seeds not true to description. One case was against a Bromley seed merchant for selling New Zealand and Polish seed as genuine Kentish Wild White Clover, and the other against an Exeter firm in respect of the sale of parcels of "English Broad Red" and "English Singlecut" clover seed, which it was alleged were wholly or substantially foreign-grown seeds. These two cases were not, strictly speaking, Seeds Act cases, seeing that the charges were preferred, in the Bromley case, not only under the Seeds Act, 1920, but also under the Merchandise Marks Act, 1887, and the Larceny Act, 1916; and, in the Exeter case, under the Merchandise Marks Act, 1887. They were, however, so closely related to the work of administering the Seeds Act—being, in fact, first investigated in connexion with that Act—that a review of the season's work would be incomplete without some reference to them.

It is said that one of the results of the administration of the Seeds Act has been to direct too much attention to the percentage of germination and analytical purity of the seed sold, and that consequently home-grown seed, which in many cases cannot compete with foreign seed as regards germination, purity and general appearance, is becoming less popular. Too much stress, therefore, cannot be laid on the advantage of using home-grown seed, even though it may show a lower percentage of germination and purity. This is particularly true of clovers. The importance of the country of origin in the case of both grasses and clovers is recognized under the Seeds Act, which requires that in all sales this information shall be disclosed. The value of this information is beginning to be realized and, when considering the quality of a parcel of seeds,

the farmer is strongly advised to examine the figures as to germination and purity in the light of the statement as to the country of origin. Unfortunately, the checking of the accuracy of the statement as to where the seeds were grown is a much more difficult and complicated matter than that relating to the percentage of germination and purity. A technique is, however, being developed by the seed analyst which, as is demonstrated by the results of the two prosecution cases taken this year, is sufficient to prove misstatement in this connexion to the satisfaction of a Court of Law. The matter is further complicated by the fact that, as was again shown by the prosecution cases in question, even the experienced seedsman, apart from the expert seed analyst, may sometimes be misled as to the country of origin of a particular lot of seed. For this reason the seedsman's practice is to buy certain kinds of seeds largely on the strength of the reputation of the seller. It is clear that this confidence is sometimes misplaced, but it is hoped that, with the help of the analyst, such cases will be less frequent in the future.

The Prosecutions.—As regards the prosecution of the Bromley seed merchant, the Ministry had suspected for some time that spurious stocks of so-called Kentish Wild White were being marketed in this country and in Scotland; special attention was therefore directed to the securing of definite evidence of this. In October, 1927, the Ministry obtained conclusive evidence that a quantity of seed described as genuine old pasture Kentish Wild White supplied by the Bromley merchant in question was, in fact, of New Zealand origin. The seed was recognized by its similarity in appearance to seed known to have been imported from New Zealand, and also by the presence of certain weed impurities and of a clover disease characteristic of New Zealand seed. During the course of the investigations into this matter it was discovered that the defendant had been systematically purchasing both New Zealand and Polish seed and selling it at a considerable profit as genuine English seed. As the evidence disclosed a serious system of fraudulent trading, charges were preferred under the additional Acts already cited. The hearing of the various charges by the magistrates at Bromley occupied six days, the defendant pleading not guilty in each case. He was, however, committed for trial at the Kent Assizes, where he pleaded guilty, and was sentenced to twelve months imprisonment in the second division and ordered to pay the costs of the prosecution.

In the Exeter case, proceedings were first taken under the Merchandise Marks Act, 1887, in connexion with the sale of a quantity of seed described as "English Cowgrass," which it was alleged by the prosecution was wholly foreign seed. This conclusion was based on the colour, lustre and general appearance of the seed, the absence of "weathering," the high germination, and the presence of a number of weed seed impurities of foreign origin. The defendants claimed that they purchased the seed as English and sold it as such, and that they were entirely innocent in the matter. The hearing of this charge occupied two days and the Bench, which consisted of three magistrates, eventually found by a majority that the charges had not been proved. An order for costs amounting to ten guineas was subsequently made. A second charge, the hearing of which also occupied the greater part of two days, was in respect of a quantity of seed described as "English Singlecut Cowgrass" which the prosecution alleged was adulterated, to the extent of approximately 25 per cent., with foreign seed. As in the previous case, the defendants claimed that they had purchased the seed as English and, after bulking and cleaning it had sold it, in good faith, as such. The Ministry, however, called the growers and the merchants who had supplied the two lots of seed from which the consignment was claimed to have been made up, to show that the seed they delivered to the defendants was genuine English-grown seed and that there was no possibility of the foreign impurities found in the control sample being present in the bulks at the time they were delivered into the defendant's warehouse. After retiring to consider their verdict the chairman stated: "In this case the Bench are unanimous that there are foreign seeds in this clover and that it is not English in its entirety. The prosecution have proved to our satisfaction that it is mixed with foreign seed. But we find it impossible to prove guilty knowledge and the case will be dismissed. The fault is with the Act, not in the way the charge has been taken up. No application for costs will be considered."

This decision, although not as satisfactory as had been expected, will, it is believed, serve a useful purpose. It shows that the Ministry was fully justified in taking proceedings, and that it is possible to prove beyond doubt the admixture of foreign with home-grown seed. The Ministry's failure to prove to the satisfaction of the Bench that there was guilty knowledge on the part of the defendants is unfortunate, but it will serve to indicate the danger of adulterating home-grown seed, and to this extent will operate *pour encourager les autres*.

Visits to Seedsmen.—During the 1927-28 season, some 8,000 visits were paid by the Ministry's Inspectors to seedsmen's premises, a similar total to those of the two preceding seasons. These included 1,300 visits to premises which had not been visited previously, and consisted mainly of premises at which the sale of seeds is undertaken as a "side line" to the normal business. Apart from a number of minor cases the Regulations were found to be, as a general rule, carried out in a satisfactory manner.

Control Sampling.—1,950 control samples of seed were taken during the season for check testing at the Official Seed Testing Station—an increase of about 100 on the previous year's total. These samples included 429 of clovers, 204 of grasses, 10 of mixtures of clovers and grasses, 16 of field seeds, 455 of root seeds—including 64 of sugar beet—231 of vegetable seeds, 111 of cereals and 494 of packeted seeds. In the case of 94 of these samples, apart from packeted seeds, the check test showed that the seller's declaration was seriously incorrect in a material particular. These included 15 samples of grass seed, 24 of clover, 2 of field, 30 of root, 16 of garden and 7 of cereals. In 9 cases the germination was found to be over-stated to the extent of from 10 to 15 per cent., in 10 cases from 15 to 20 per cent., and in 30 cases the discrepancies were over 20 per cent. In 6 cases the purity stated was from 3 to 5 per cent. too high, and in 3 others over 10 per cent. In the other cases the principal sources of error were the omission to declare the presence of certain of the particulars required to be stated by the Regulations, such as the presence of dodder or of injurious weed seeds. Taken as a percentage of the total number of control samples drawn, the discrepancy cases represent 6.5 per cent. as compared with 4.7 per cent. in 1926-7; 6.6 per cent. in 1925-6 and 7.7 per cent. in 1924-5. Regard being had to the bad conditions under which seed was harvested in 1927 it was anticipated that there would be a greater increase in the discrepancy cases, so that the number dealt with is a satisfactory and quite unexpected feature of the season's work.

Packet Seed.—In the case of packeted seeds, however, there was a marked falling off in quality, mainly owing, perhaps, to the bad conditions at the time of harvesting. Of the 492 samples taken as controls only 86 per cent. were found to be at or above the minimum percentages of germination and purity laid down by the Regulations, as compared with 94.8 per cent. in the previous season; 8.5 per cent. were below the minimum but above two-thirds, and 2.8 per cent. were below two-thirds.

Onion Seed.—The results of the check tests on control samples of onion seed, both when drawn from bulks as well as in packets, showed, in many cases, an extraordinary falling off in germination. Of the 197 control samples taken no fewer than 27 gave germination results ranging from 50 down to 20 per cent., although it was claimed that when tested by the sellers earlier in the season they had grown at or above the prescribed minimum of 60 per cent. In one instance the growth was shown to have dropped from 81 to 30 per cent. in the course of four months. Inquiry showed that the seed giving these unsatisfactory results had originated from various sources, so that it was not a question of the distribution of a single bulk of poor seed. It is believed that the bad seasonal conditions were chiefly responsible for this state of affairs, although, in some cases, it may have been due to the bulking of old and new crop seed.

Licensed Private Seed Testing Stations.—The number of stations licensed by the Ministry to test seed for the purposes of the Seeds Act is now 86. These include 32 licensed to test all the kinds of seed covered by the Act; 2 to test all kinds of seed except grasses; 3 for field and cereal seeds; 5 for field seeds only; 33 for cereal seeds only and 11 for cereal and one or two other kinds of seed. In view of the importance of the work carried out at these licensed stations it is necessary that they shall be officially visited at short intervals, both to give advice on points of difficulty and to take samples to check the accuracy of the testing carried out. In addition to the ordinary check samples all the stations are required to test a special series of "Referee" samples. Some 1,300 check samples were drawn in this way, and in every case where the test of the Official Station showed a marked difference from that obtained at the private station the matter was carefully investigated with the object of securing more uniform results. Regard being had to the difficulties of the season, the number of these discrepancy cases was satisfactorily low as compared with previous seasons. Peas, mangolds and brassicas were the kinds of seeds with which the private stations appeared to have the most trouble. The tests on clovers and grasses were shown to be most satisfactorily uniform. In many cases the Official Station obtained substantially higher germination results for cereals than the private analysts, but this was probably because the period of storage followed on poor harvesting conditions, the proportion of dormant seeds in early season samples becoming less as the season advanced. The series of six sets of "Referee"

samples included cocksfoot, mangold, Italian rye-grass, onion, turnip and white clover. The results of these tests, which also reflected the general difficulties experienced by the seed analyst in the season 1927-28, were discussed at the annual meeting of analysts held at Cambridge. In reviewing the results the Chief Officer pointed out that each year brings its own problems for the seed analyst, and that although standardization of methods is possible up to a point there remains scope for individuality in the adaptation of methods in order to overcome these difficulties.

Training and Examination of Seed Analysts.—The seventh course of training for seed analysts was held at the Official Seed Testing Station, Cambridge, from June 26 to July 23, 1928. Twelve analysts attended and sat for the examination which, as usual, is held at the end of the course. Of these twelve, six satisfied the examiners, and of the remainder four proved satisfactory so far as their practical work was concerned but failed to reach the necessary standard in their written papers.

Seed Analysts' Conference.—On July 26, the Sixth Annual Conference of Seed Analysts was held at the Official Seed Testing Station, Mr. Wm. Hasler being in the chair. The Chief Officer of the Official Station reviewed the results obtained at the private licensed stations on the series of referee samples issued during the season 1927-28; Mr. Neale, of Messrs. Sutton & Sons, gave a paper on the effect of ether on the germination of lettuce, and Mr. C. C. Brett, of the Official Station, read two short papers, one dealing with *Coprinus lagopus* on beet and mangold seeds, and the other on experiments with celery leaf spot.

The Chief Officer then gave a survey of interesting items in the past season's work. He dealt with:—

- (1) Abnormal growths, particularly of brassicas.
- (2) The control of moisture in the germination tests of certain seeds, particularly seeds harvested under unfavourable conditions.
- (3) Delayed germination and the heating of cereals.
- (4) The desirability of examining samples for a provenance determination.

The Chief Officer laid particular stress on the point that the seed analyst is a confidential adviser to his or her firm, and consequently it is most desirable that he or she should report the presence of disease or of heating, or any suspicions he or she may have as to the genuineness of the statement as to country of origin in connexion with all samples examined.

He also gave details of the factors in the samples which enabled him to give technical evidence in the two cases in which the Ministry had prosecuted seedsmen during the season, reference to which is made earlier in this report. He emphasized the importance of being cautious, when making a provenance determination, and of not jumping to hasty conclusions on isolated factors. It was important to have two or three confirmatory factors on which to base an opinion. A knowledge of the crop and harvest conditions of the various seed-producing countries; the weed seeds common to various localities and countries; and the typical appearance each year of the seed produced in different districts, were all points with which the analyst must be familiar before undertaking a critical examination for checking the country of origin.

During the afternoon the British Association of Commercial Seed Analysts held its annual meeting, Mr. N. L. Dickson being elected President, and Mr. A. E. Birks, of Stoughton Grange, near Leicester, the Secretary-Treasurer.

"Seed Analysts' Bulletin."—Three issues of this Bulletin were made during the period under review. They contained particulars of the proceedings at the Seed Analysts' Conference and a number of papers and notes on various aspects of seed testing, the administration of the Seeds Act, foreign seed regulations, the growing of seeds, etc.

Seed Wheat Survey.—A further series of samples of seed wheat was drawn "from the drill" in the Eastern Counties during the autumn of 1927, for the purpose of collecting information as to the quality of the seed sown in this area, the source of the seed, the most popular varieties, etc. The results of this inquiry have been already published in this JOURNAL (July, 1928, p. 299).

Apart from the value of the information obtained by this survey it has been the means of getting into personal contact with a number of farmers and of discussing with them various questions relating to seed and the value of seed testing.

Sugar Beet Seed.—During the season visits have been paid to all the sugar beet factories for the purpose of drawing control samples of the seed supplied to farmer growers and generally to ascertain whether the requirements of the Seeds Act were being carried out. Some 64 control samples were drawn in this way from factories, and the check tests carried out at the Official Seed Testing Station showed that in no case were the percentage germination and purity below the minima

prescribed by the Seeds Regulations—*viz.*, 60 per cent. germination, and 97 per cent. purity.

Testing of Seeds for Export to the Colonies.—It may be recalled that in the middle of the season, 1926-27, there was put into operation a scheme which, with the assistance of a grant from the Empire Marketing Board, enabled the Ministry to arrange for free tests, to be carried out at Cambridge, of samples of seeds intended for export to the Colonies, in cases in which the colonial import regulations require consignments of seed shipped from this country to be accompanied by an official test certificate. This scheme was utilized to a satisfactory extent during the season 1927-28, during which some 1,400 samples were submitted for these free tests. These samples included 50 of grasses and clovers, 200 of mangold and beet, and over 1,000 of vegetable and pulse. Unless some unforeseen circumstances arise, this scheme, the purpose of which is to encourage the trade in home-grown seeds exported to the Colonies, will be continued during the season 1928-29.

Fifth International Seed Testing Congress.—The Fifth International Seed Testing Congress was held at Rome from May 16 to 19, 1928, under the auspices of the Italian Government. Thirty-eight countries were officially represented, the delegates from Great Britain and Northern Ireland being the Chief Officers of the Cambridge, Corstorphine and Belfast Official Seed Testing Stations. Considerable discussion took place regarding proposed International Rules for seed testing, and a number of papers dealing with various aspects of seed testing were read and debated. Amongst these may be mentioned "Sanitary Condition of the Seed and International Analysis Reports," by Dr. Doyer, of Wageningen; "Sampling of Seeds," by Professor S. P. Mercer, of Belfast; "On Broken Growths of Leguminous Plants: their Causes, Judgment and Value," by Professor Witte, of Stockholm; "Education and Training to be required of Seed Analysts of various grades, and the Possibility of conducting International Seed Testing Courses for directors and assistants in Seed Testing Stations," by Dr. Wahlen, of Ottawa; "Report of the Committee on Hard Seeds and Broken Seedlings," by Mr. T. Anderson, of Corstorphine. A full report of the proceedings at this Congress is in course of preparation.

Farmers and the Act.—Steady progress is being made in bringing home to the farmer the requirements of the Act relative to seed he may sell, and the advantages of getting the prescribed particulars when he purchases seed. There is

some increase in the number of farmers who make use of the Official Seed Testing Station, and there is evidence that the farmer is paying more attention to the test figures. This is believed to be due largely to the activities of the Ministry's staff in visiting farmers, lecturing to farmer audiences, distributing sample envelopes with instructions as to sending samples for testing, and attending agricultural shows, as well as to other forms of propaganda. Arrangements are being made for the Ministry's seeds exhibits to be taken to a number of the smaller agricultural meetings, such as ploughing matches, hedging competitions, etc., where it is believed that it will be possible to get into closer contact with the farmer than when the exhibit is displayed at the larger agricultural shows. Considerable assistance has been and is being rendered by the County educational staffs in bringing the Act to the notice of farmers.

Seed Potatoes.—Compliance with the Regulations—which require a statement as to class, variety, size and dressing to be made at or before the time of delivery, and also that these particulars shall be displayed on seed potatoes exposed for sale—has, on the whole, been fairly satisfactory. There remains the difficulty of securing the proper carrying out of the Regulations by small greengrocers, grocers, corn merchants, etc., who deal in small quantities of seed potatoes as a “side line” to their ordinary business. It is impossible for the Ministry's staff to keep all these sellers under observation, but it is believed that the efforts which are being made to cover as much of this class of trade as circumstances permit are resulting in a steady improvement, both in the quality of the seed offered and in the delivery and display of the necessary particulars.

Special inquiries were instituted in 48 cases during the past season, 33 being in connexion with alleged misstatements as to the variety, 14 as regards size and dressing, and 1 in which no particulars whatever were given. Most of the cases of wrong variety were discovered in connexion with the Ministry's scheme for the inspection and certification of growing crops. In 7 cases, where the accuracy of the variety appeared doubtful before the tubers were planted, samples were sent to the Ministry's Potato Testing Station at Ormskirk for a growing test. Some 20 control samples were drawn during the season either in connexion with the variety or the size. Of the 48 cases in which special inquiries were necessary, 30 were found to be cases in which the seed had been obtained from Scotland and 3 from Northern Ireland. Full particulars of these cases were reported

to the Scottish and Irish Departments respectively responsible for the administration of the Act in those countries. Legal proceedings were taken and convictions obtained in four cases, two in England and two in Scotland, particulars of these being given in the summary of prosecution cases which follows.

Prosecutions.—In addition to the Bromley and Exeter seed prosecution cases referred to at the beginning of this report, the following are brief particulars of the cases taken under the Seeds Act during the past season :—

(1) In November, 1927, a local farmer was prosecuted at Worcester for failing to deliver the particulars required by the Act in connexion with the sale to a merchant of a quantity of Wild White Clover. The defendant pleaded ignorance of the Regulations. The magistrates, however, described the case as an extremely serious one, and imposed a maximum penalty of £5, and ordered payment of costs amounting to £1 11s. 9d. This case has proved useful in connexion with the continuous efforts which are being made by the Ministry to bring home to the farmer, not only the advantages that the Seeds Act affords him when he is buying seed, but also that he in turn when selling seed must comply with the Regulations in the same way as a seed merchant.

(2) In January, 1928, proceedings were taken at Mansfield against a produce merchant in respect of a false statement as to the variety of a consignment of 5 tons of seed potatoes. The crop grown from this was found on inspection by the Ministry to include 9 per cent. of rogues. The defendant pleaded not guilty, his defence being that there was no intention to deceive and that he bought and sold the seed in good faith. The Bench convicted and imposed a fine of 5 guineas and £4 5s. costs.

(3) In February, 1928, a Glasgow firm of seed potato merchants was fined £2 for making a false statement as to the variety of a consignment of seed potatoes supplied to an English farmer. Inspection of the growing crop showed the presence of 16 per cent. of rogues.

(4) Proceedings were taken in March, 1928, against a firm of corn merchants at Kendal, for making a false statement as to the variety of a quantity of seed potatoes. Inspection of the crops grown from this seed showed that a considerable number of rogues were present. A novel point was taken by the defence, in that they claimed that, as the defendants had delivered only part of the statement required under the Act, the charge should have been for failure to give the necessary statement; consequently they had no case to answer as regards the false

statement. The Bench, however, agreed with the Ministry's solicitor that the defendants had no right to take advantage of their own wrong, and the maximum fine of £5 was imposed.

(5) On May 7, proceedings were taken against a firm at Eastleigh for exposing two parcels of Rye-grass seed for sale without giving the particulars required under the Act. A check test on a control sample of one of these lots showed that the germination was very low and that the seed was probably old seed. The defendants pleaded that the seed was intended for sale as bird seed and not for sowing. The case was dismissed under the Probation of Offenders Act on payment of 8s. costs.

(6) On May 10, an Edinburgh firm of seed potato merchants was fined £8 for making false statements as to the variety of seed potatoes supplied to English customers. The crops grown by four English farmers from seed supplied under a true stock number by the defendants were found on inspection to contain approximately 20 per cent. of rogues.

(7) On May 3, a chemist and seedsman of Llanelly pleaded guilty to giving a false statement as to the germination of some onion seed. A control sample, declared by the defendant to germinate not less than the minimum prescribed by the Seeds Regulations, *viz.*, 60 per cent., was found to be entirely dead seed. Fined £2 and 2 guineas costs.

General.—Copies of the Seeds Act, 1920 (price, 3d. net); the Seeds (Amendment) Act, 1925 (price, 1d. net); and the Seeds Regulations, 1922 (price, 3d. net), may be obtained through any bookseller, or direct from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2.

* * * * *

THE CHELTENHAM EGG PACKING STATION

THE Cheltenham Egg Packing Station is the property of the Gloucestershire Fruit and Vegetable Co-operative Marketing Society, Limited, which was formed in 1919, at the instance of the Food Production Department, as part of a general scheme to establish county marketing societies for handling surplus produce. From the outset, the promoters of the Society discarded the idea of dealing only with surplus produce, and decided to seize the opportunity afforded by the initiative of the Food Production Department and consequent public interest in public markets to put into operation a project for establishing a market for fruit and vegetables at Cheltenham on strictly commercial lines. The Society has made consistent

progress since that date, and its fruit and vegetable auction now ranks among the larger produce auctions of the West Midlands.

The Society began to auction eggs in quantity at the beginning of 1923. At that time, eggs were received in the producers' own baskets and counted out by the Society's employees into half-sieves. Each half-sieve counted as one lot and each lot was offered separately for auction. A reduction in the commission charged by the Society from 7½ to 5 per cent. brought increased business, and the Society's methods were revised. Cases holding 30 dozen and 12 dozen eggs, with fillers and flats, were supplied to the Society's regular senders, and arrangements for the auction were improved; ultimately, the eggs were graded into three classes.

Following the issue of the Ministry of Agriculture's Report on Egg Marketing,* the Society decided to adopt the grades suggested by the Ministry and to change over from an auction to a consignment business. To enable it to do so, and with a view to registration as an accredited packing station under the Egg Marketing Scheme, the Society acquired extensive premises close to its existing market. To facilitate the acquisition, adaptation and equipment of its new premises, the Society received a loan of £1,500, against security, under the Ministry's scheme of advances to co-operative marketing enterprises.

The new premises consist of a two-storey building with a basement and a yard attached, also stores of 500 sq. yd. floor space, and a garage, with accommodation for eight lorries, complete with petrol and oil-storage tanks. Fig. 1 shows the plan of lay-out of the building, Fig. 2 a longitudinal section, and Fig. 3 the front view. The basement forms a useful store both for the boxes used for collection and for the non-returnable cases used for dispatching eggs to buyers.

Eggs are collected from farms by the Society's motor vans, which travel over a 30-mile radius. Three vans are used in all. The containers used for the collection service are well-made, 30-dozen egg boxes of the returnable type, with "Raylite" fittings each holding three dozen eggs (Figs. 4 and 5). A form is filled in by the collector and signed by the farmer, stating the exact number of hen and duck eggs in the consignment. The

* Report on Egg Marketing in England and Wales, Economic Series No. 10, obtainable from H.M. Stationery Office, price 6d., post free 9½d., or from any newsagent. Producers and distributors who are working for the better marketing of English eggs should make a point of obtaining a copy of this Report.

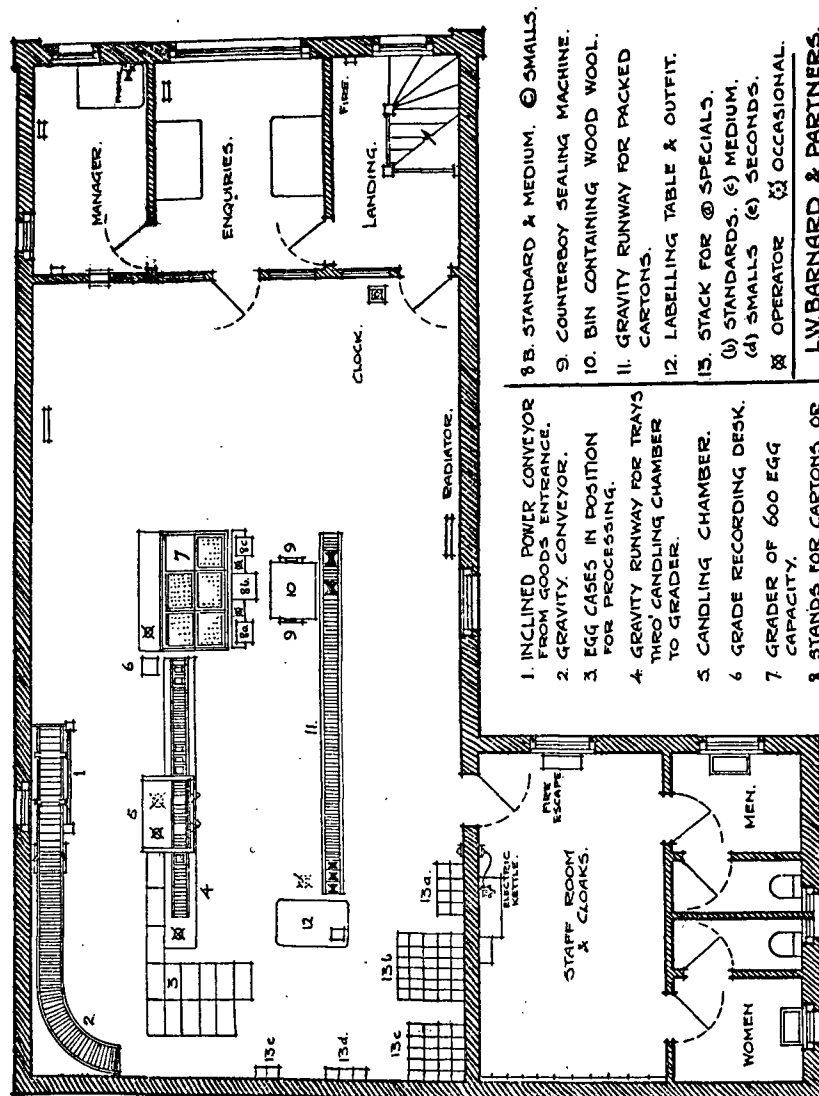
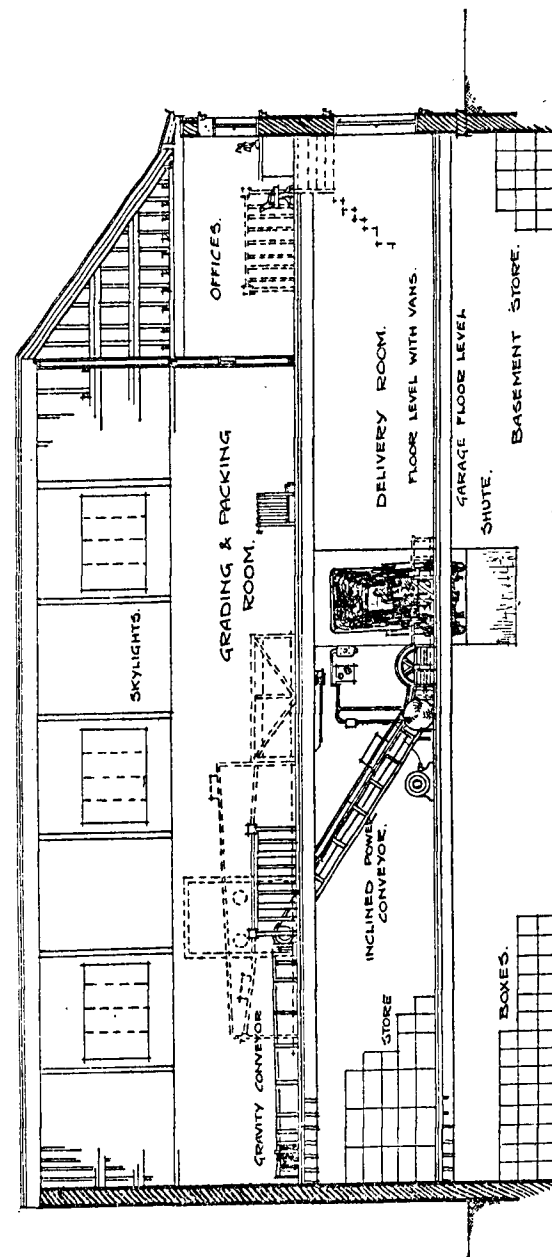


FIG. 1.—Layout plan of grading and packing room.



LONGITUDINAL SECTION.

10 5 10 20 30
SCALE OF FEET

FIG. 2.—Longitudinal Section

L.W. BARNARD & PARTNERS,
ARCHITECTS CHELTENHAM, 1928

form, when completed, is so placed in the collecting box that each sender's eggs can be identified without difficulty when the box is unpacked at the station.

On arrival at the station, the collecting boxes are off-loaded from the lorries on to a power conveyor (Fig. 4), which carries them up to the first floor, where a gravity runway conveys them to Operator A, who removes the fittings complete with eggs from the boxes (Fig. 5), and transfers the eggs, *en masse*, by a simple reversing process, to special perforated trays. These trays are carried by another runway to a testing chamber, where the eggs are examined by Operator B while passing over a strong electric light. Each egg is turned by the operator during this process, and any doubtful egg is tested singly, as indicated in Fig. 5. Fig. 6 shows the interior of the testing chamber, from which it will be observed that a second spotlight is provided, so that two operators can single-test when necessary; the chamber is fitted with an overhead exhaust fan and ventilated roof.

After passing through the testing chamber, the runway conveys the trays with the eggs that have passed the test to the graders. The grading apparatus used is a "Baker Grader," which grades by size to give the weights required. (See Fig. 7 and ref. 7 on Fig. 1.) The grader, which is of 600-egg capacity, consists of five units (or complete sets of grading trays) mounted on bearings on a framework with six divisions, so that each unit can be moved sideways or across according to requirements. Operator C, receiving a consignment of eggs from the testing chamber, fills one unit, which is then pushed across to Operator D on the opposite side of the frame, who takes out "Standards" and "Specials" and packs them in non-returnable cases. The unit is then moved sideways to Operator E, who proceeds to take out "Pullet Standards" and "Smalls" and pack them in cases. Each grade of egg is packed separately. The empty units are pushed across to Operator C to be refilled. There are always three operators working at the machine at any one time to ensure that the work is continuous. Operator C controls the grading.

In the first tray of eggs of any particular farmer's consignment sent over the slipway is placed the consignment note, and in the last tray a slip of paper declaring the number of faulty eggs that have been withdrawn by the candler from that consignment. Operator C takes the consignment note and fills in on the back the details ascertained from the graders, as to the number of "Specials," "Standards," "Pullet Standards"

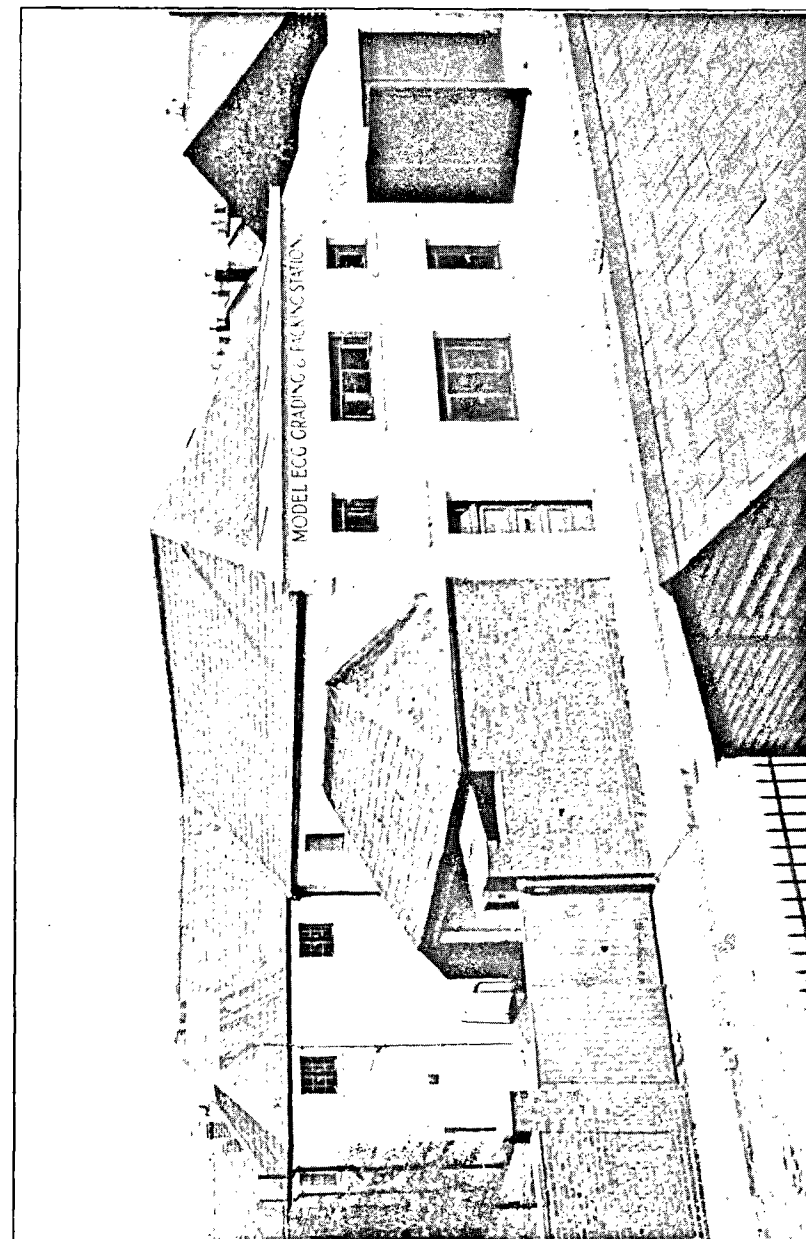


FIG. 3.—The Cheltenham Egg Packing Station: front view.

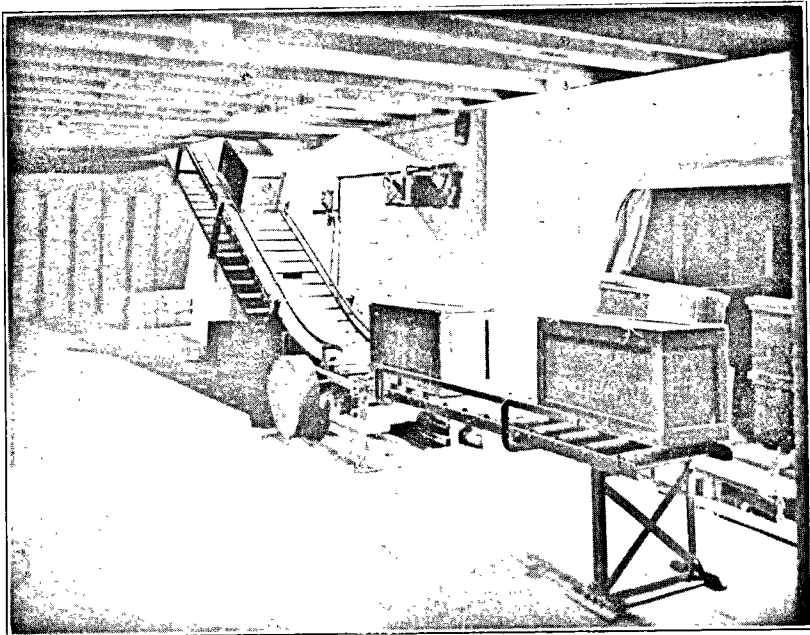


FIG. 4.—Loading-bank and power-conveyor.

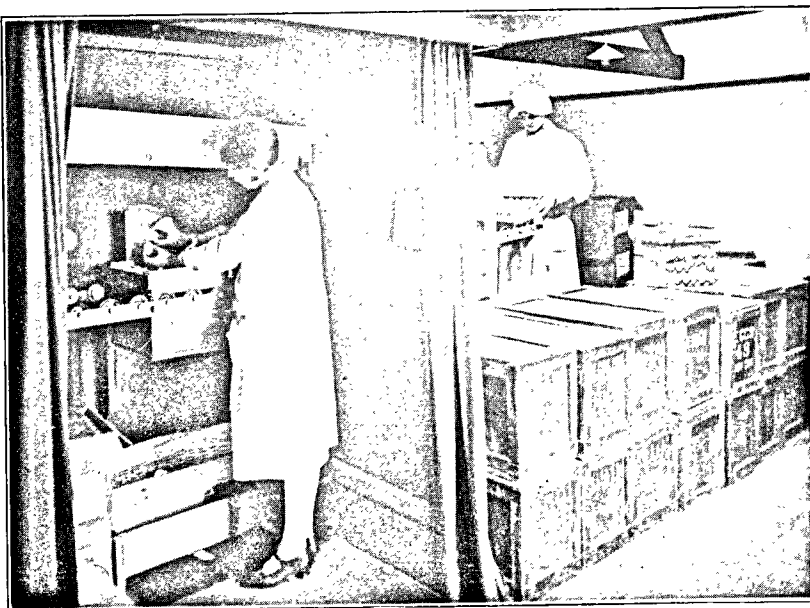


FIG. 5.—Unpacking collecting boxes (right), and candling (left).

CHEL TENHAM EGG PACKING STATION.

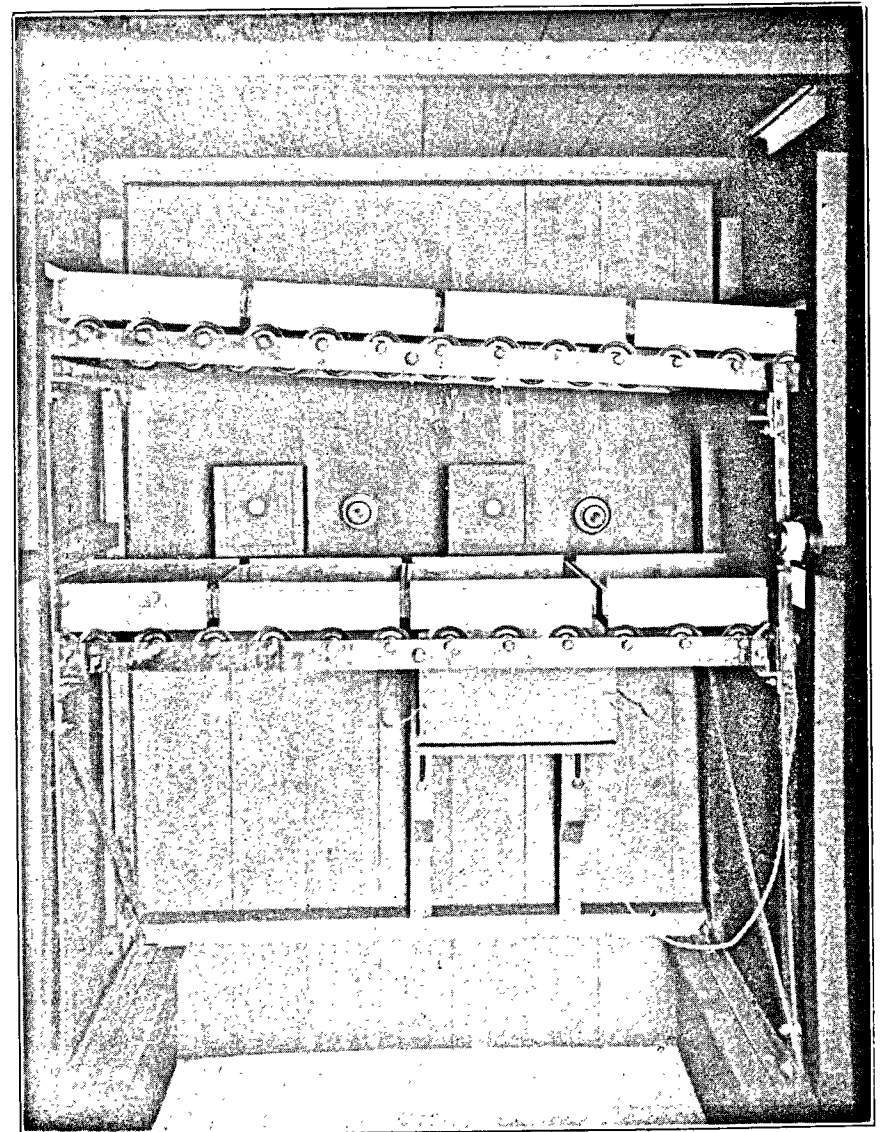


FIG. 6.—Interior of the testing chamber.

CHEL TENHAM EGG PACKING STATION.

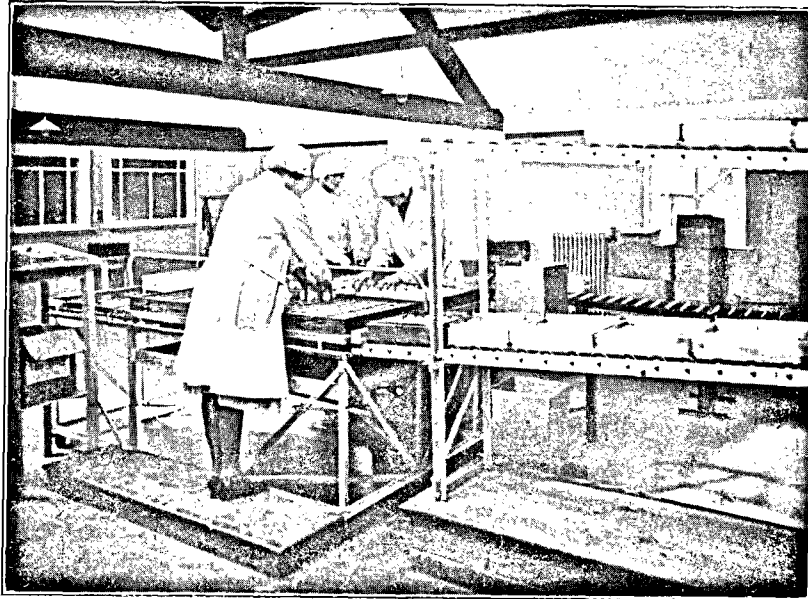


FIG. 7.—Grading.

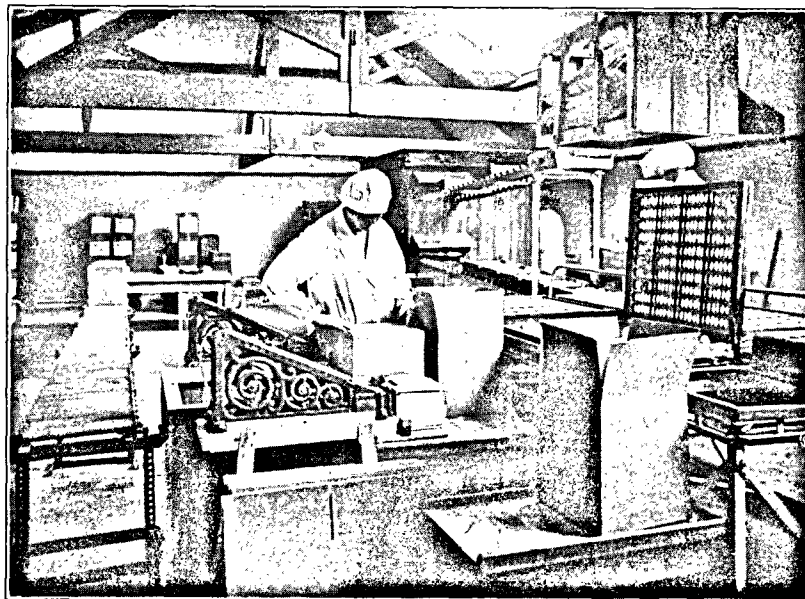


FIG. 8.—Sealing non-returnable cases.

CHELTENHAM EGG PACKING STATION.

and "Smalls," and the number rejected for such faults as blood-spots, cracks and dirt. A special desk is provided for this purpose (*see* ref. 6 on Fig. 1). The note is then returned to the office for accounting purposes. Each producer's lot is thus treated separately up to the packing stage—payment being made according to quality and weight-grading results. As Operator C empties a tray, it is placed on a runway which conveys it back to Operator A (Fig. 7).

When the non-returnable cases are filled, they are closed and sealed, as indicated in Fig. 8, and are then placed on a further runway, which carries them to a table where the appropriate label is pasted on. By reversing the motor operating the power conveyor, the runway and conveyor (Fig. 4) can be used to return the empty collecting boxes to the loading bank and also to convey to the bank the cases that have been packed and labelled for dispatch to buyers.

During 1927, over three million eggs were handled by the Society; records indicate that the total turnover in eggs in 1928 will exceed five million. The supplies of about 250 individual producers are handled at the packing station.

The Society can reasonably claim to be pioneering a valuable reform in egg-marketing in this country, and it has recently been visited by farmers and others interested in egg-marketing reform from practically every county in England and Wales. It represents, in fact, a working demonstration on a commercial scale of the improved methods of marketing which the Ministry is advocating. By way of reimbursement for the extra expenditure incurred by the Society in equipping itself, and in functioning, as a demonstration centre, and in keeping specially detailed accounts for the information of the Department, a capital grant and a small annual grant are being made to the Society out of the funds placed at the Ministry's disposal by the Empire Marketing Board. It should be understood, however, that these grants are in respect of services rendered, or expenses incurred, on the Ministry's behalf, and they do not, in any way, modify the strictly commercial basis of the Society's operations.

Visits to the Station can be arranged by appointment with the Manager.

(The above article is being issued as the Ministry's Marketing Leaflet No. 8, and copies may be obtained from the Ministry on application.)

* * * * *

FOWL POX

T. M. DOYLE, F.R.C.V.S., D.V.S.M.,
Ministry of Agriculture and Fisheries.

Introduction.—Fowl pox is the commonest contagious disease met with in the adult fowl in this country. It is also known under a number of other names, such as "bird-pox," chicken pox, contagious epithelioma, roup, diphtheritic roup, avian diphtheria, and canker. At the present time most investigators are agreed that fowl pox and avian diphtheria are merely two forms of the same disease.

To prevent any misunderstanding arising out of the nomenclature it seems necessary to explain that this was, in the first instance, formulated by laymen, without due regard being paid to the proper pathological classification of the disease. It should be understood that there is no relationship between the so-called diphtheria or chicken pox of poultry and the diseases of human beings which had priority of these names. The disease under discussion is not communicable to human beings and is observed only in birds.

Three clinical forms may be recognized :—

- (i) wart-like nodules on the comb, wattles and skin of the head ;
- (ii) adherent, yellow, cheesy membranes in the mouth ;
- (iii) a watery or muco-purulent discharge from the eyes and nose.

Only one, or any combination, of these lesions may be present in the same bird.

As these conditions are merely different manifestations of the same disease caused by the same virus, it is incorrect and misleading to refer to them as distinct diseases. It is proposed, therefore, to employ the expressions "comb lesions," "mouth lesions," and "oculo-nasal form," of fowl pox.

The use of the term *roup* in reference to fowl pox, even when applied to the condition characterized by discharge from the eyes and nose, is incorrect ; and the indiscriminate fashion in which it has been employed in the lay Press during recent years has increased the existing confusion in the nomenclature of the disease. The term *roup* should be restricted to the condition characterized by catarrhal inflammation of the eyes and nose when these are unaccompanied by lesions of fowl pox in any bird of the flock. There is no reliable information as to its pathology, and opinions are divided as to its relationship to fowl pox.

It is considered that every case of disease determined by fowl pox virus, no matter what may be the symptoms manifested or the lesions induced, should be described as fowl pox.

Species Affected.—The disease occurs principally in fowls, pigeons and turkeys, and, according to some authorities, it is also frequently seen in geese, ducks and guinea fowls. Ducks are, however, rarely affected in this country. Pheasants and various wild birds also are said to be susceptible.

Causal Agent.—This has been the subject of much research and has given rise to a considerable amount of controversy. It is now universally accepted as being a filter-passing virus.

Incubation Period.—This is the interval which elapses between actual infection taking place and the onset of symptoms. It depends to some extent on the potency of the virus and on individual susceptibility, and varies from three to twelve days.

Mouth Lesions.—The premonitory symptoms are dullness, loss of appetite, sneezing and an occasional hard cough. These are followed by the formation of false membranes in the mouth and throat. The membranes consist of tough, greyish, or yellowish exudate which adheres very firmly to the underlying tissues, considerable force being required to detach them. The removal of the membranes leaves the underlying surface raw and inflamed, but it is quickly recovered by new deposit. The membranes spread rapidly and, if the bird lives long enough, the whole of the mouth becomes involved. If at this stage the bird is watched closely, it will be noticed that owing to the extent of new growth the mouth cannot be completely closed and swallowing is difficult or impossible. Diarrhoea and emaciation occur from the absorption of toxic products, and death soon follows. In some birds, death occurs from suffocation within a few days of the onset of symptoms as the result of an accumulation of caseous exudate in the opening of the wind-pipe. In most outbreaks, the majority of birds affected in the mouth die. The duration of this form of the disease varies from two to three weeks.

Comb Lesions.—This form of the disease appears as warty-looking nodules on the featherless parts of the head, such as the comb, wattles, eyelids and adjacent skin. In severe cases, lesions may appear on the feathered parts of the head and neck, outer surface of the thighs, and points of the wings. The nodules appear as firm, rough, wart-like growths, yellowish in colour, and gradually turning darker with age ; they have a tendency to coalesce into cauliflower-like masses. They vary in size from one-eighth to one-quarter of an inch in diameter. When the lesions are confined to the skin, the health of the bird is rarely affected, and recovery generally takes

place without treatment in from 15 to 30 days. In many cases, however, the mouth becomes involved, as the result of generalization of the virus, and then death usually occurs.

Oculo-Nasal Form.—The early symptoms are similar to those described for the mouth form. They are followed by a watery nasal discharge which gradually becomes purulent and obstructs the nasal passages. The eyes are swollen, inflamed, and discharge a viscid material which tends to stick the eyelids together. In many cases the head is swollen, on one or both sides, below and in front of the eye, due to an accumulation of exudate within the infra-orbital sinus. Inflammation of the eyes and nose may be caused by agents other than the virus of fowl pox, but when it is due to this virus, birds affected with characteristic comb and mouth lesions will be found simultaneously in the same flock.

Mode of Infection.—Recent inquiry has shown that direct contact between diseased and healthy fowls is essential for infection to take place. The natural method of propagation is probably through wound infection. Wounds or abrasions of the mouth are of frequent occurrence and are produced probably to no small extent by the eating of grit, essential for the normal functioning of the gizzard. Small wounds on the head also occur as the result of the continuous pecking and fighting which occur in a flock.

As a general rule, primary lesions occur in the mouth, and lesions on the comb are secondary, following generalization of the virus. When primary lesions appear on the comb they are the result of direct infection of a wound. The more frequent occurrence of mouth lesions is mainly due to the greater liability of the mouth to injury. The disease occurs most frequently during the autumn and winter months.

Immunity.—While there is considerable variation in individual susceptibility, few birds possess a natural immunity. The immunity conferred by an attack of the disease varies in strength and duration. A severe attack produces a solid immunity, while a mild attack gives a partial protection. Birds recovered from the comb form of the disease are immune to the mouth form and *vice versa*.

In some outbreaks, only a small percentage of birds are affected and the death-rate is low; this is usually the case in recently infected flocks. In other outbreaks, as on farms where infection has been smouldering for some years, most of the flock contract the disease, and the mortality may be

as high as 90 per cent. Other factors which influence the mortality are the amount of infection present, potency of the virus, bad weather and insanitary surroundings.

Carriers.—There appears to be a general opinion amongst poultry farmers that a bird which has recovered from an attack of fowl pox becomes a "carrier," and if introduced into a clean flock may start an outbreak of the disease. By "carrier" is meant a bird which harbours and transmits the virus, but which shows no visible evidence of disease. A considerable amount of work has been carried out recently at the Ministry's Veterinary Laboratory on this phase of the disease, and no evidence could be found in favour of the existence of "carrier" birds. It would appear, therefore, that it is only birds with visible lesions of disease which are capable of transmitting infection.

Treatment.—Fowl pox is a contagious disease, and it is, therefore, inadvisable to undertake the treatment of affected birds. With or without treatment, a considerable number of birds will recover; but even on farms with the most modern equipment, it is almost impossible, if treatment is adopted, to limit the spread of infection. Recent inquiry has shown that when the disease first appears on a farm it spreads slowly, and it can at this stage be easily controlled by the destruction of affected birds, frequent examination of in-contacts, and thorough disinfection. If, however, it is allowed to establish itself, heavy losses are inevitable, eradication becomes difficult and can eventually be accomplished only by a considerable expenditure of time and money. Therefore, when due consideration is given to the contagious nature of the malady, the risk of a widespread outbreak, and the time and expense involved in the frequent dressing of affected birds, it must be concluded that the policy of treatment is both economically and scientifically unsound.

Further, in the majority of cases the effects of such a severe disease are seldom entirely eliminated. The bird remains weakened in constitution, and is likely sooner or later to fall a victim to some minor ailment which a normal bird would easily overcome. As far as is known, there is neither drug nor proprietary preparation on the market which is of the slightest value in the prevention of fowl pox.

After destruction of affected birds, the in-contacts should be divided into small lots and the mouth and throat of each frequently examined. The drinking water should be renewed daily. The grain should be fed in troughs and the use of dry

mash hoppers should be discontinued. The attendant should disinfect his hands and boots before leaving the infected premises.

Measures to be adopted against the Introduction of the Disease.—Infection may be introduced by the purchase of infected birds or by those returned from shows or laying trials. New purchases and returned birds should be isolated for one month before being allowed to join the healthy stock. During the period of isolation the comb and mouth should be examined frequently for lesions of fowl pox. An emaciated bird, even though it shows no visible lesions of disease, should never be permitted to join the healthy stock. In spite of all that has been written during recent years on the protection afforded against the introduction of contagious disease by the simple isolation of new birds, the practice is still persistently neglected by many poultry farmers in this country.

Disinfection.—Fowl pox virus is very resistant, and strong measures are required for its destruction. The first and most important part in the disinfection of an infected building is the cleaning of the interior by scraping and sweeping. The droppings, scrapings and litter should be burned or mixed with quicklime and removed from contact with fowls. The walls and roosts should be scrubbed with hot water containing caustic soda (10 per cent.) to remove all dirt and grease. This acts also as a disinfectant. The house may then be washed or sprayed with a disinfectant, such as a 5 per cent. solution of carbolic acid, a 2 per cent. solution of compound cresol, or a 2 per cent. solution of formaldehyde. The infected runs should be top-dressed with ground quicklime at the rate of two tons to the acre, and, where practicable, ploughed up and left vacant for six months. Dead birds should be burned or buried in quicklime.

Summary.—1. Every case of disease determined by the virus of fowl pox, no matter what be the symptoms manifested or the lesions induced, should be termed fowl pox.

Both comb and mouth lesions in birds affected with fowl pox are due to the same virus. The comb form confers immunity against the mouth form, and *vice versa*.

2. The use of the term "roup" should be restricted to the condition characterized by catarrhal inflammation of the eyes and nose when these are unaccompanied by lesions of fowl pox in any bird of the flock.

3. Birds showing lesions of fowl pox should be immediately destroyed. In-contact birds should be isolated and frequently

examined. This is the quickest and most economical method of eradicating the disease.

4. All newly-purchased birds, and those returned from shows and laying trials, should be isolated for one month before being allowed to join the healthy stock.

* * * * *

LICENSING OF STALLIONS UNDER THE HORSE BREEDING ACT, 1918

THE table below shows that the number of stallions licensed during the licensing year ended October 31, 1928, again shows a decrease on the previous year's figures. The number of licences issued for the 1928 service season was 1,414, a reduction of 123 as compared with 1927.

<i>Service Season</i>	1922	1923	1924	1925	1926	1927	1928
Shires	2,174	1,634	1,195	953	829	772	720
Other heavy horses . .	591	486	424	350	324	328	313
Light horses (including ponies) . .	714	641	591	546	455	437	381
Totals	3,479	2,761	2,210	1,849	1,608	1,537	1,414

Light stallions show a relatively sharper decrease than heavy stallions, although Thoroughbreds show an increase on 1927. The number of Thoroughbreds licensed for the past season was 164, an increase of 11 on the year and the largest number of the breed licensed since 1920. Hackneys, the next most numerous light breed, declined from 97 to 63. The number of Clydesdale stallions licensed was 120, a decrease of only one as compared with the previous season, but Shires declined by 52 to 720, and Suffolks, which numbered 132, showed a decrease of seven.

In 45 cases applications for licences were refused by the Ministry, but appeals against refusals were lodged under paragraph 12 of the Regulations in seven cases, five of which were successful.

The number of infringements of the Act reported to the Ministry during the season shows a slight increase on the previous year. Four unlicensed stallions were reported on the road, but in one case an application had already been made for a licence. Seven unlicensed stallions were reported as being exhibited for service, but licences had already been applied for in respect of five of these stallions. Proceedings were taken by the police in three cases, and convictions obtained. Seven stallions, though licensed, were found to be travelling unaccompanied by the licences.

Stallion owners in possession of licences for the year ended October 31, 1928, are reminded that these licences expired on that date and should have been returned to the Ministry. Applications for renewal, as well as for new licences, 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.

TABLE I.—TOTAL APPLICATIONS AND LICENCES GRANTED.

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 ..	696	682	14	38	38	—	734	720	14
Clydesdale ..	114	112	2	8	8	—	122	120	2
Suffolk ..	140	132	8	—	—	—	140	132	8
Percheron ..	41	38	3	—	—	—	41	38	3
Others ..	—	—	—	25	23	2	25	23	2
LIGHT—									
Hackney ..	61	58	3	5	5	—	66	63	3
Thoroughbred ..	167	162	5	2	2	—	169	164	5
Arab ..	9	9	—	3	3	—	12	12	—
Cleveland Bay ..	5	5	—	—	—	—	5	5	—
Welsh Roadster ..	1	1	—	—	—	—	1	1	—
Hunter ..	3	3	—	2	2	—	5	5	—
Yorkshire Coach ..	2	2	—	—	—	—	2	2	—
Others ..	—	—	—	4	4	—	4	4	—
PONY AND COB—									
Welsh ..	14	14	—	1	1	—	15	15	—
Fell ..	16	15	1	4	4	—	20	19	1
Dales ..	10	10	—	6	6	—	16	16	—
Polo and Riding ..	15	15	—	1	1	—	16	16	—
Shetland ..	9	9	—	—	—	—	9	9	—
Welsh Cob ..	44	43	1	8	7	1	52	50	2
TOTALS ..	1,347	1,310	37	107	104	3	1,454	1,414	40

TABLE II.—APPLICATIONS FOR LICENCES NOT GRANTED AND GROUNDS OF REFUSAL.

BREED	Number Examined	Number Refused	Percentage Refused	DISEASE						
				Roaring	Whistling	Sidebone	Ringbone	Cataract	Defective genital organs	Bone Spavin
PEDIGREE—										
Shire ..	696	†14	2.0	7	4	1	—	1	1	—
Clydesdale ..	114	†2	1.8	—	1	1	—	—	—	—
Suffolk ..	140	†8	5.7	1	2	§2	1	—	—	2
Percheron ..	41	3	7.3	—	1	—	2	—	—	—
Hackney ..	61	3	4.9	1	1	—	—	—	—	1
Thoroughbred ..	167	*5	3.0	2	—	—	—	1	—	1
Welsh Cob ..	44	1	2.3	—	—	—	—	1	—	—
Fell Pony ..	16	1	6.3	—	—	—	—	—	—	1
NON-PEDIGREE—										
Heavy ..	71	2	2.8	—	—	1	—	1	—	—
Pony and Cob ..	20	1	5.0	—	1	—	—	—	—	—
Total Refusals ..	—	40	—	11	10	5	3	4	1	2

* A licence was also refused in respect of a Thoroughbred stallion that had been "tubed" and could not, therefore, be examined for its "wind."

† Including one refused on previous examination.

‡ Including one refused on previous examination by the Board of Agriculture for Scotland.

§ One also affected with Bone Spavin.

* * * * *

MARKING OF PRESERVED EGGS; EGG GRADING REGULATIONS, ETC.

THE Minister of Agriculture and Fisheries has made an Order under Section 3 of the Agricultural Produce (Grading and Marking) Act, 1928, exempting from the operation of that Section eggs preserved by cold storage and chemical storage. The reason for this Order is that it is not possible to ascertain by analysis whether eggs have, in fact, been kept in cold storage or chemical storage. The effect of the Order, therefore, is to limit the operation of Section 3 to eggs preserved by methods such as immersion in lime-water, water-glass or oil; all eggs so preserved, whether home-produced or imported,

must, after February 28, 1929 (the date fixed by the Act), be marked in the prescribed manner on sale or exposure for sale.

Section 4 of the Act requires that British eggs which have been cold-stored or chemically-stored should be marked before they leave the storage premises, but this Section only becomes operative if and so long as an Order-in-Council is enforced under the Merchandise Marks Act, 1926, prohibiting the sale or exposure for sale of imported eggs unless they bear an indication of origin.

The Minister has prepared draft regulations under Sections 1, 2, 3 and 4 of the Act prescribing (a) grade designations and grade designation marks for hen and duck eggs, (b) the way in which eggs preserved by any process, including cold storage and chemical storage, shall be marked, and (c) the method by which premises used for the cold storage or chemical storage of eggs shall be registered by Local Authorities responsible for the enforcement of the Statute. Copies of these draft regulations, known as the Agricultural Produce (Grading and Marking) Draft (Egg) Regulations, 1928, can be obtained from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 1d.

General regulations regarding the appointment and empowering of the National Mark Committee have already been issued in connexion with the National Mark Scheme for apples and pears.

DRAFT STATUTORY RULES AND ORDERS, 1928.

AGRICULTURAL PRODUCE (GRADING AND MARKING).

THE AGRICULTURAL PRODUCE (GRADING AND MARKING) (EGGS) REGULATIONS, 1928, DATED 1928,
MADE BY THE MINISTER OF AGRICULTURE AND FISHERIES
AS TO GRADE DESIGNATIONS AND GRADE DESIGNATION
MARKS FOR EGGS AND AS TO THE MARKING OF EGGS WHICH
HAVE BEEN SUBJECTED TO ANY PROCESS OF PRESERVATION.

18 and 19 Geo. V.c.19. In exercise of the powers conferred on him by the Agricultural Produce (Grading and Marking) Act, 1928, the Minister of Agriculture and Fisheries hereby makes the following regulations :—

1. Grade designations to indicate the quality of hen eggs produced in England and Wales shall be as follows :—

Prescription
of Grade
Designations

SPECIAL
STANDARD
PULLET STANDARD
and
FIRST QUALITY

and the quality indicated by such grade designations shall be deemed to be as described in columns (2) and (3) of the First Schedule hereto.

2. Grade designations to indicate the quality of duck eggs produced in England and Wales shall be as follows :—

SPECIAL (DUCK)
STANDARD (DUCK)
DUCKLET STANDARD
and
FIRST QUALITY (DUCK)

and the quality indicated by such grade designations shall be deemed to be as described in columns (2) and (3) of the Second Schedule hereto.

3. A grade designation mark shall be any one of the following grade designations specified in regulations (1) and (2) :—

Grade
Designation
Marks.

SPECIAL STANDARD PULLET STANDARD SPECIAL (DUCK) STANDARD (DUCK) DUCKLET STANDARD

associated with the words "Empire Buying Begins at Home," and with the following mark, namely, a map of England and Wales in silhouette with the words "Produce of England and Wales" inscribed in a circle placed centrally in the map, within which circle is a design representing the Union Jack and which is more particularly described in the Third Schedule hereto.

4. After the twenty-eighth day of February, nineteen hundred and twenty-nine, any eggs to which Section 3 of the aforesaid Act applies shall be marked conspicuously and legibly with the word "PRESERVED" in letters of not less than $\frac{1}{8}$ in. in height, the word being enclosed in a circle of not less than $\frac{1}{2}$ in. diameter.

Method of
Marking
Preserved
Eggs.

5. If and so long as any Order-in-Council made under Section 2 of the Merchandise Marks Act, 1926, is in force prohibiting the sale or the exposure for sale in the United Kingdom of imported eggs unless they bear an indication of origin, any British eggs which have been kept in cold storage or chemical storage shall, in the former case, be marked conspicuously and legibly with the word "CHILLED" or with the words "COLD STORED" and, in the latter case, with the word "STERILIZED," the letters being in each case not less than $\frac{1}{8}$ in. in height and the word or words being enclosed in a circle of not less than $\frac{1}{2}$ in. diameter.

6. When any person applies for the registration of premises to be used by way of trade or for purposes of gain for the cold storage or chemical storage of eggs, the Council of the County or County Borough in which the premises are situated

Prescription
of
Method of
Registration

shall enter in a register the name and address of the person and the address of the premises, and shall forward a copy of each such entry to the Ministry of Agriculture and Fisheries and shall issue a certificate of registration to the person making the application.

Short Title.

7. These regulations may be cited as the Agricultural Produce (Grading and Marking) (Eggs) Regulations, 1928.

In Witness whereof the Official Seal of the Minister
L.S. of Agriculture and Fisheries is hereunto affixed
this day of 1928.

SCHEDULE I.

Hen Eggs : Grade Designations and Definitions.

Grade designation (1)	Definition	
	Minimum weight (2)	State or condition (3)
SPECIAL	Oz. 2½	Eggs which have not been preserved by any process and of which the shell is clean and sound, the yolk is translucent or faintly but not clearly visible, the white is translucent and firm and the air-space does not exceed ¼ in. in depth.
STANDARD	2	
PULLET STANDARD ..	1½	
FIRST QUALITY ..	No requirement	

SCHEDULE II.

Duck Eggs : Grade Designations and Definitions.

Grade designation (1)	Definition	
	Minimum weight (2)	State or condition (3)
SPECIAL (DUCK) ..	Oz. 2¾	Eggs which have not been preserved by any process and of which the shell is clean and sound, the yolk is visible but not dense and moves slowly and the white is translucent and firm.
STANDARD (DUCK) ..	2½	
DUCKLET STANDARD	2¼	
FIRST QUALITY (DUCK)	No requirement	

SCHEDULE III.

Grade Designation Mark.

The mark hereunder shown shall be a grade designation mark when used in association with a grade designation and with the words "Empire Buying Begins at Home."



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COUNCIL OF AGRICULTURE FOR
ENGLAND

THE twenty-eighth meeting of the Council of Agriculture for England was held at the Middlesex Guildhall, Westminster, on Thursday, October 18, 1928, Mr. R. G. Patterson, O.B.E., in the Chair.

Statement by the Minister of Agriculture.—*The Rt. Hon. Walter Guinness* referred to the scheme of rating relief to be afforded to railways on condition that the relief was passed on to certain industries in the form of reduced freight charges, and said that he took that opportunity to inform the Council of the agricultural traffics which had been selected for railway freight charge reductions. The total relief was estimated at £4,000,000, one-fifth of which was to be passed on to certain agricultural traffics. The original plan provided for the scheme coming into force on October 1 next year; but, in the unemployment debate in July, the Prime Minister had announced that, subject to certain conditions, the special help of reduced railway freights would be given to the

depressed industries at an earlier date—as from December 1 this year. The agricultural traffics which had been agreed for the rebate,* which he hoped might amount to 10 per cent. of the present agricultural freights, were as follows:—

- (1) Manures for use in Great Britain and consigned as such, i.e., any manures in bulk, including limestone and lime and chalk, basic slag, and salt for agricultural purposes; also packed manure, including any substance for use direct as manure or any manure substance to be mixed and used as manure and so consigned, packed.
- (2) Feeding stuffs, including the following: oil cake; meals and husks for animal or poultry feeding; foods for live stock consisting of meals with spice, molasses or condiment; milling offals; treacle for cattle feeding consigned direct to farmers; silage; hay; chopped hay and straw; provender consisting of chopped hay and straw mixed with grain; carrots, mangold wurzel or turnips in bulk for feeding live stock; beetroot pulp (the residue from sugar making) for feeding live stock; and brewers' and distillers' grains (or draff).
- (3) Potatoes, excluding new potatoes.
- (4) Milk (whole or separated, uncondensed) in churns, cans, butts, and in bottles packed in cases.
- (5) Live stock.

In the case of milk, the rebate would extend to milk carried by passenger train, but in other cases would be applied only to goods carried at merchandise train rates.

In reply to questions, *The Minister* said that the list had been carefully discussed with the National Farmers' Union as the body representing those chiefly concerned, and the object followed in selecting traffics was to concentrate the benefits as much as possible on the home farmer. If the list were widened, the amount available for any particular traffic would be reduced, and foreign produce would tend more and more to be included, which would injure the British farmer rather than help him. It was not possible to make a distinction between home produce and foreign produce except by selecting the traffics. The statement as to limestone and lime and chalk was intended to cover burnt ground lime and all forms of lime used as fertilizers.

Better Marketing of Fruit.—*Mr. Denton Woodhead*, Vice-Chairman of the Standing Committee, presented a Report on this subject for adoption by the Council (see Appendix A, p. 859). He said that the Committee had given much attention to this subject and was satisfied that farmers must begin at the beginning if home-grown fruit were to be placed in a sound position to compete with imported fruit. In the first

* The list in fuller and final form is set out in Cmd. 3215, see pp. 803-4.

place, suitable land must be used, and varieties must be grown which would produce the fruit wanted by the markets. Old trees that were of no use should be grubbed up. Systematic spraying should be followed in order that even-sized and healthy fruit might be produced. The manner in which imported fruit was placed upon the market gave it a great advantage from the standpoint of acceptability to the customer. The Report recommended, therefore, the system of grading and packing which had already been put forward by the Ministry in connexion with the National Mark Scheme. The National Mark gave a guarantee of quality, and the Committee had been informed that certain apples—not of the very best varieties—sold under it at Covent Garden, brought the grower as much as 6d. a lb. The members of the Council should go back to their respective areas as missionaries, recommending grading and packing under the National Mark Scheme. He would mention also the desirability of having jams made from imported fruit pulp which had been preserved by the use of sulphur dioxide marked as such. Another matter to which he would refer were the opportunities for canning home-grown fruit and vegetables, and he appealed to the womenfolk of the country to buy British canned produce. He desired to pay tribute to the various experts who had been good enough to meet the Committee and give the benefit of their experience in connexion with the inquiry. In conclusion, he would add that, although the Standing Committee had been considering, for twelve months, the subject of marketing the various commodities, they did not wish the Council to assume that they had seen the subject from every point of view. The Committee was only a small body, but the Council, as more widely representative, could help considerably with constructive criticisms of the Report.

Mr. George Hewitt said that, in Norfolk, the County Fruit Show and the Experimental Fruit Plot were having a good effect on the industry, and much help was being given by the County Horticultural Adviser. There was a great deal to be done, since, in the grading of fruit, this country was a long way behind its competitors. English fruit was better than the imported, and deserved to be better placed on the market. In his view, the future of British agriculture lay with what were regarded as sidelines rather than in the growing of cereals. In Norfolk they were very grateful for the help which the Minister had given, and realized that he was always prepared to help where they took the initial step themselves.

Colonel E. V. V. Wheeler (Worcester) welcomed the Report, which, he said, should be brought to the notice of all fruit growers. The third paragraph gave the impression, however, that Covent Garden was the only fruit market in England, whereas, from the point of view of the Midlands, the best markets were South Wales and the Midland and Northern industrial centres. The fruit grower should sort out all really inferior fruit and, rather than place it on the market as fresh fruit, use it, as they did in British Columbia, for feeding pigs, or, as in this country, for cider-making. He thought that the demonstrations of better marketing methods, recommended in the Report, should include not only the very best fruit—which could be boxed—but the large quantity of good fruit which, if sorted properly, could be sold well otherwise. Where the Ministry gave a demonstration of cider-making at agricultural shows, he thought that it should be done by the Long Ashton Research Station and not by a commercial firm.

Sir Douglas Newton, M.P. (Camb), after congratulating Mr. Woodhead on the able way in which he had submitted the Report to the Council, said that he wished to emphasize specially the importance of spraying; and would like the Ministry to consider how far it was possible to encourage local authorities to give demonstrations of power plant spraying in the winter months, or to set up some organization for ensuring that each small grower might have the advantage of power sprays. *Mr. W. Colthup* (Kent) said that, as a fruit grower, he thought no greater help had been given to the industry than that afforded by the Ministry through its encouragement of fruit canning. He found huge quantities of imported canned fruit abroad, and in every instance they were confined to the North-American product. English canned fruit would hold its own in any country in the world. At present, this country had the goods but not the organization for export. *Mr. A. Matthews* (Hereford) addressed the Council on the spraying of fruit trees; and *Sir Walter Berry* said that he hoped the members would urge in their home districts the need for eradicating useless varieties of fruit. Bad prices were, almost invariably, the result of marketing, for jam and for cider, fruit that was useless for ordinary consumption. The best varieties could, however, be grafted on the stocks of useless trees. The Gladstone apple was an instance he had in mind, but its stock was exceedingly useful for grafting other varieties. The country could not have too many Bramley Seedling trees.

The Rt. Hon. Sir Francis Acland, Bart., said he had no fewer than 106 varieties of apple trees in his garden, with not more than four or five of any one variety. That was exactly what he ought not to have. He agreed that growers should concentrate on certain good varieties which would follow on one another by maturing in sequence from October to April. Many people were interested in knowing what British fruit they were buying and eating; and if retailers would state that they were working in conjunction with growers who offered them a regular succession of first-class dessert apples throughout the season—such and such varieties in October, such and such varieties in November, and so on—many consumers would be much more interested in the native product and would insist on buying it. *Mr. William Hawke, C.B.E.* (Cornwall), said that there were two fruit demonstration plots in his county. He thought that there was a difficulty in locating suitable soils and positions for orchards. In the large area of a county, the Horticultural Inspector could not possibly indicate the many suitable situations; and he thought that the Ministry could help by sending down a capable surveyor. He had found that by cultivating between the trees, better fruit was obtained than if the orchard was simply left in grass and the grass cut. *Miss Gladys Pott, M.B.E.*, agreed that carefully graded and packed fruit would sell better. As regards tinned fruits, the average housewife, being an extremely busy person, was accustomed to save time by buying only the brands she knew to be reliable. At present, such brands were mostly Californian.

The Minister of Agriculture said that only on one point in the debate had the Ministry been specially appealed to, and that concerned the question of advice as to suitable soils. A good deal of work on the subject was being done both at the Long Ashton and East Malling Stations, but the advisory staffs of the County authorities were at the disposal of farmers and others who proposed to grow fruit, and those staffs, if they did not possess full information, could always get it from one or other of the teaching or research institutes in the area.

Mr. Woodhead, replying to the debate, said that he was grateful for the criticism that had been given. *The Chairman* said that he was a little surprised that no comment regarding small fruit had been made during the discussion, which had been confined mainly to the subject of apples and pears. The small fruit question, however, was important. He hoped

members of the Council would respond to Mr. Woodhead's appeal by interesting their districts in the matters with which the Report dealt. The motion for the adoption of the Report was put to the meeting and carried.

Better Marketing of Live Stock and Meat.—*Mr. Denton Woodhead*, in moving the adoption of the Standing Committee's Report on this subject (see Appendix B, p. 863) said that the Committee was strongly in favour of the early elimination of scrub bulls. He thought that, even in the milk-producing districts, there was a change of feeling on this matter. As regards marketing, the industry should resort to grading, both in regard to live stock and to meat. If meat were marked, as proposed in the Report, it would prevent the possibility of foreign meat being foisted upon the public as British. There seemed to be no reason why Scotch beef should be preferred to English, provided the English farmer took pains to produce the proper kind of carcass. It was better for animals to be slaughtered in the area of production than to travel long distances to slaughterhouses.

Mr. W. B. Taylor congratulated the Standing Committee on its Report. He thought the grading proposals would be welcomed in East Anglia as a step in the right direction. He was doubtful, however, if fair prices would be secured in consequence, and thought that the Standing Committee might pursue their inquiries into that aspect of the question. In his opinion, dealers' rings still operated in auction marts, which meant that the rings divided amongst themselves money which rightly belonged either to the producer or the consumer. *Sir Merrik Burrell, Bart.* (West Sussex), deprecated putting too much upon the Standing Committee. He thought that the real difficulty in selling live cattle and meat was that, at the moment, the only meat you could force the butcher to buy was the very best, and that because he was coerced by the demand. Below that, he was prepared to buy second, third or fourth grade cattle at his own price. So much of the best chilled Argentine meat was available that it was necessary for the British farmer to concentrate on producing first-class English meat. Argentine meat was competing more and more with English meat in the home market, and was getting much nearer the top price than hitherto. The English farmer had to study his market and provide what the public wanted—choice small joints. *Mr. J. S. Gibbons* (Glos.) agreed with the recommendation to eliminate the

scrub bull. In Gloucestershire, a very large number of calves were sold every week, most of them for slaughter as not worth rearing. He thought that the Minister might again approach the National Farmers' Union on the subject, and ascertain if a measure could not be carried through with general assent. A lesson in this matter could be learnt from Ireland. *Mr. Christopher Turnor* did not believe that the English farmer would never organize, or that there was anything inherent in the national character which would prevent him doing so. The organization of farmers in other countries was the result of long education. One point that he had discovered in the practical business of catering was that English beef "went much farther" than foreign. He agreed that there were too many private slaughterhouses in the country that were not well run. As to bacon factories and pig production, he thought they would have more chance of success if bacon were a subsidiary industry to milk production, as in Denmark. Not a single bacon factory had been established there until the country had been covered with a network of creameries. He thought that the Reports of the Standing Committee had carried the Council a long way, sufficiently so to enable members to go back to their respective counties and see what could be done, county by county, to improve marketing methods.

The Minister of Agriculture said that he heartily welcomed the valuable efforts of the Standing Committee. He was, naturally, in full agreement with the suggestion for the elimination of scrub bulls, but they had to be sure that they were not too far ahead of agricultural opinion on this subject. The Parliamentary Draughtsman had already been consulted as to the form and principle of a Bill for the compulsory registration of bulls. He thought that it would be a useful step to publish a Bill so as to reassure those who believed it impossible to deal with the question without entailing a great increase in bureaucracy and an undesirable interference with the freedom of the farmer. Beyond that, he did not think any immediate step was practicable at present. As to prices, he thought that the instance of Scotch beef was very enlightening, as showing that where a producer could meet the demands of the market, he would get a better price. Before very long he hoped to have in operation at Smithfield an experimental scheme of grading, which would enable the Ministry to see what could be done for English meat. It was more difficult to grade meat than many other agricultural

products, but the rewards for success were so great that difficulties had to be got over.

A question raised in the Report was the improvement of market intelligence. With the goodwill of the British Broadcasting Corporation, he hoped to have, in a few weeks time, a nightly broadcast of the prices of fat cattle ruling at one or two of the most important fat cattle markets in the country.

Mr. C. B. Fisher, C.B.E. (Northants), asked whether the weighing of cattle in fat stock markets was inspected. He was aware of one or two cases where it was not properly done. *The Minister* said that he would be grateful if *Mr. Fisher* would furnish information about such cases. It was compulsory to have the weighbridges, and it was most important that they should be efficiently used. The Report was then adopted by the Council.

Electricity Supply in Rural Areas.—*Sir Douglas Newton*, on behalf of the Standing Committee, moved the adoption of their Report on this subject. He said that the Council would recollect considering this matter and referring it to the Standing Committee in October, 1927. Shortly afterwards the Electricity Commissioners had referred the whole question to a Conference, which had set up Committees to consider certain aspects of the matter. In doing this, the Commissioners acted partly on the suggestion of the Council. The first cardinal point laid down was that the supply in rural areas must be self-supporting; it must, therefore, be possible to distribute it cheaply. The actual cost of the current was very small; the large item was the cost of distribution. It was compliance with the regulations to guard against supposed risks to life and property that made the distribution costs so very high. The Commissioners were, however, attending to this matter. The revenue required for an undertaking had to be about one-fifth of the cost of the erection of the line. It was imperative to keep these costs as low as practicable. *Mr. W. B. Taylor* asked whether it was likely that sparsely populated rural areas would be able to obtain an electricity supply. *Sir Douglas Newton* said that, where the supply was obviously not an economic proposition, it was not contemplated that the Government or any other authority should take action to make electricity available. The Report was adopted by the Council on the understanding that a copy of it would be sent to the Electricity Commissioners.

Income Tax Allowance for Liming.—*Mr. Charles Roberts* (Cumb.) moved the following resolution :—

“That this Council suggests that the Minister of Agriculture might induce the Income Tax authorities to allow expenditure by landowners on liming land, whether in lieu of abatement of rent or otherwise, to be included in their claims for maintenance, in view of the widespread need for liming to restore the lime requirements of the soil, and of the considerable duration of the benefit derived from liming.”

He said he recognized that the Minister had already done something by the relief granted to rates. As regards lime, the country was living on its capital, and farmers had been using the quicker-acting manures and fertilizers, with the result that, over the country generally, the lime supply in the soil was far too low. This fact was not apparently appreciated by the Income Tax authorities, who would not regard landowners' expenditure on lime as entitling them to an allowance or rebate for maintenance. It might well be treated in the same category as fencing and drainage. It was not an uncommon thing in these days for suggestions to be made that abatement of rent allowances should be made in the case of lime and other fertilizers, which made it an expenditure by landowners with a view to maintaining fertility and the existing rent. *Mr. Matthews* seconded the motion, and the *Minister of Agriculture*, speaking on it, said he thought the difficulty was largely one of method. The object might be attained by some different approach. Liming was looked upon by the Inland Revenue authorities as an expense not of maintenance but of cultivation. That being so, the cultivator, if he bore the cost, whether as tenant or owner-occupier, could write it off as an expense of cultivation. That would not cover the landowner who was not himself cultivating. In such a case, where a landowner wished to assist, such aid might be given by an abatement of rent rather than by payment for liming; such abatement would, presumably, be recognized as reducing liability to full income tax. A *Member* suggested that abatement of income tax could not be obtained by a voluntary reduction of rent for one year only. *The Minister* said that he would have the question closely examined and see what could be done. *Mr. Charles Roberts* thanked the Minister for his promise, and the motion was put to the Council and carried.

Constitution of the Food Council.—*Mr. C. B. Fisher, C.B.E.*, moved the following resolution :—

“That this Council instructs its Standing Committee to consider and report upon the advisability of recommending the suggestion

of the Northamptonshire Agricultural Committee that the Food Council be reconstituted, and that six representatives be appointed by the Board of Trade representing the consumers, and six by the Ministry of Agriculture representing the producers, with an independent chairman."

He drew attention to the fact that he had moved a somewhat similar resolution in October, 1927, and that the Ministry's representative, whilst not concurring with the principle of that resolution, had agreed to the Board of Trade suggestion that an Agricultural Assessor should be appointed to act as representative of producers when individual agricultural products came to be considered by the Food Council. He understood that the appointment of agricultural assessors had been discontinued. He did not complain of that, because he did not think that such appointments were of much assistance. It would be better to have the Food Council properly representative of producers and consumers. He believed that there was no member of the Food Council at the present time who understood questions of production.

Mr. Woodhead had referred to the desirability of bringing the producer and consumer together. He had also referred to the middleman and profiteer. He (Mr. Fisher) hoped that the Standing Committee would have time to go into this question. They would have seen recently the Report of the United Dairies, Ltd. A properly constituted Food Council might consider the interests of producers, retailers and consumers in the market question, and they might arbitrate upon it. The three parties would not be able to obtain fair prices and profits for each until something like that was done. *Mr. J. O. Adams* (Northants), in seconding the motion, said that any Food Council, which was to do useful work, must take into consideration the cost of production first hand, and he did not find that the Food Council considered this at all. Their only aim was to get lowest prices. *Sir Francis Acland* said that he did not think the Standing Committee could do much good by looking into this subject. *Mr. W. B. Taylor* thought that the Standing Committee should consider it, and that the rank and file farmers would lose confidence in the Council of Agriculture unless they tackled matters which affected the general welfare of the industry. *Sir Merrik Burrell*, as a member of the Standing Committee, agreed with Sir Francis Acland in thinking that the Standing Committee should not undertake the inquiry. *Sir Arthur Hazlerigg* also thought that the inquiry would be difficult. *The Minister of Agriculture* said that, if it was thought

desirable for the Standing Committee to go into this problem, it would be possible for the Ministry to give them direct information from the Board of Trade, and from its own records, as to the difficulties of the case. He was inclined to think that the Standing Committee would find that there were very strong objections to Mr. Fisher's proposals. They affected a principle which had been discussed in the constitution of a great many Committees—whether they should be representative or impartial bodies. Did Mr. Fisher really think that if the milk dispute had to go to arbitration, the two parties concerned, who had not been able to reach a decision by themselves, would be more likely to take a decision from another body, constituted, like themselves, the original parties to the dispute, of distributors and producers? He thought Mr. Fisher would find that the functions of the Food Council necessitated an impartial body. If the matter were referred to the Standing Committee, the Ministry's officials would meet it and explain the whole position in regard to agricultural assessors, etc. *The Chairman* asked Mr. Fisher whether he wished to press his resolution. *Mr. Fisher* replied that he did, as the Council was endeavouring to do the right thing in connexion with the production of food, and if the Standing Committee could not investigate, then the Council might recommend that the Food Council be done away with altogether. If the Food Council were not doing good for agriculture, they were doing harm, and that was a matter closely concerning the business of their own Council. The motion was put to the Council and lost by 15 votes to 16. The business then terminated.

APPENDIX A

REPORT FROM THE STANDING COMMITTEE ON THE SUBJECT OF BETTER MARKETING OF HOME-GROWN FRUIT.

(1) In the Interim Report on Improvement in the Marketing of Agricultural Produce generally, which was presented to the Council at its meeting in January last, Fruit Marketing was dealt with briefly with other agricultural commodities. At that meeting, we were invited to pursue our inquiries in greater detail, and inform the Council by means of separate reports on individual commodities. In this Report, we deal with the better marketing of Home-Grown Fruit.

(2) In our Interim Report, we recommended the better grading and packing of home-grown fruit, and the establishment of fruit-packing centres for this purpose. We also supported the Ministry's proposal to use National Marks on packages. Since that Report was presented, the Ministry of Agriculture, with the assistance of the National Farmers' Union, has initiated a scheme under the Agricultural Produce (Grading and Marking) Act of last Session for the better marketing of home-grown apples and pears. This scheme, which is a

voluntary one, came into force on September 1, and was made applicable in its first year to growers of over 1,000 bushels of apples of approved varieties, and 500 bushels of pears, and 250 bushels of Doyenné du Comice. These limitations were introduced so as to make the scheme simpler of administration at the start and to emphasize its wholesale nature. We understand that a substantial measure of success has met the scheme, and that the National Marks and Labels of the three grades adopted, *i.e.*, "Extra Fancy," "Fancy," and "C Grade," are now known in both wholesale and retail markets, and that the fruit packed and graded under the scheme has met good prices. A useful part of the scheme is the encouragement it gives to the use of non-returnable boxes in place of returnables belonging to the wholesaler, for the use of which the grower pays, and which usually add materially to the weight of consignments and to the overhead costs of the trade.

(3) We consider that the result of the scheme is so far encouraging, though the large bulk of the apple and pear crop of the country is as yet, of course, quite untouched by it. We suggest, therefore, in order to secure greater publicity and success for the scheme next year, that definite demonstrations be made under the Ministry's auspices showing local growers clearly the advantage of graded over ungraded sales. Similar quantities of the same kind of apples or pears might be taken in each district selected for a demonstration; one consignment, a smaller one probably because of the elimination of unpackable fruit, would be made up properly graded and packed, the other consignment being made up of all the fruit packed in the usual ungraded manner. Both might then be sent to a reliable salesman in Covent Garden, and, if possible, sold on the same day and the cash returns checked and vouched for. If thought desirable to test the market thoroughly, several graded consignments might be sent so that buyers could be given time to appraise fully the value and reliability of the particular graded produce. We do not doubt that the returns from the graded fruit would show a substantial improvement over those from the ungraded fruit. This would provide a practical demonstration of the value of the scheme which the growers of each district would understand and might be induced to follow at once. In order that growers of small quantities of fruit may be assisted, the work of grading and packing might be done for them at a co-operative packing station, set up without very great trouble or expense, for the whole district. Already co-operative packing stations exist in a few districts, notably at Cottenham in Cambridge and at Swanley in Kent, the latter having been only recently established. This season the Swanley Station between August 13 and September 30 have dealt with 8,990 bushels of apples and pears. The important thing for associated growers to remember in setting up a co-operative fruit-packing station is that the quantities to be dealt with must be sufficient in value to carry the overhead expenses of the undertaking.

(4) We are, of course, well aware of the fact that before the success of the Ministry's scheme can be assured in all districts, there must be an improvement in production. Bad trees and poor varieties must be grubbed up, and stocks planted and all trees sprayed against insect and fungus pests, sometimes as many as four or five times, in the growing season. The home grower who wishes to make money out of fruit-selling must never forget that his fruit comes into competition with that from abroad which is specially produced for our market, usually under the best possible conditions. It is often said that good home-grown apples and pears are better flavoured and more luscious than the corresponding fruit from other countries. If that is so, it should not be difficult to find larger areas of good fruit-growing soil

which would produce this best fruit in quantity at a good profit, and enable it to take its rightful place on the market at the head of our fruit supplies. While the grower should keep that ultimate object in view, and redouble his efforts to plant more fruit of the best varieties, there is no doubt that much can be done by the better presentation on the market of the fruit that is grown. The best chance for this is undoubtedly under the new grading and National Mark scheme of the Ministry of Agriculture, worked where desirable in association with local fruit-packing stations. Local Authorities might also assist the production of larger quantities of packable fruit from the present acreage by demonstrations of spraying to control insect and fungus pests, and so produce a larger quantity of even-sized unblemished fruit.

(5) It is often objected that in years favourable to fruit production gluts occur, so that it does not pay the grower to pick and market the fruit. We must say at once that under modern conditions and with existing prices, this objection cannot possibly be valid, provided, of course, that the fruit grown is in any circumstances worth growing. A little enterprise on the part of the grower in finding transport for the fruit to a suitable centre of population should certainly bridge the difficulty and should be enough without calling to aid the resources of any form of fruit preservation.

(6) Altogether, we think there is undoubtedly a large scope for the extension of fruit-growing in this country. We are convinced that, with the greater consumption of it by the public—a popularity which has no doubt been assisted by the continuously attractive displays of imported fruit—quite twice as much could profitably be grown in the country if suitable soils and positions could be indicated and suitable young trees obtained. This may seem a rough-and-ready statement, but it is estimated that somewhat less than half of the total consumption of apples in this country is normally grown here, and that the consumption per head has more than doubled in the last 20 years. It is also true that a large part of the supplies of apples from our Overseas Dominions arrive in winter and early spring, when the season of English apples and pears is waning. These supplies are of the greatest use to us in our National economy, and could no doubt be usefully augmented by quantities of home-canned and preserved stocks of our own growing, if extra supplies of fruit were grown.

(7) As regards pears, our climate does not appear to be warm enough to be ideal for all the better varieties of the crop, and we supply only about a fifth of our consumption, on an average of years. It is, however, a valuable fruit, and suitable varieties grown in the right districts find a ready market and, if marketed under the National Mark Scheme, should, on the average, secure better prices.

(8) With regard to home-grown plums, cherries, and black and red currants, these appear to furnish a varying proportion of our total needs of them from a half to three-quarters according to the season; strawberries and gooseberries usually furnish well over 90 per cent. There appears to be no reason in these cases why the home consumption should not be entirely satisfied by home production. It is purely a matter of growing in sufficient quantity the sorts which find favour with the public, and looking to their proper marketing and disposal in our home markets. These remarks apply to the requirements for jam and other forms of preservation, as well as to the requirements for consumption as fresh fruit. As regards raspberries, the home production seems to meet the requirements of home consumption, both as fresh fruit and fruit for jam and preserves.

(9) As regards importations: a good deal of foreign fruit

pulp is brought in, and some of it is preserved for the purpose of storage or transport by sulphur dioxide, which gives it the objection that jam made from it contains a small percentage of sulphurous acid. We suggest that, if this pulp is allowed to continue to come into the country, it should at least be required that jams made from it should be labelled accordingly.

(10) As to the canning of fruit, this method appears to provide means not only for dealing with the surplus of any heavy crops from the present acreage, but for dealing with fruit from an almost indefinitely extended acreage. There is reason to think that it is the best known method of preservation to keep the fruit or other suitable foodstuff in a condition as near as possible to its natural one. The practice is very common abroad, and we import large quantities of canned fruit and other foods which could be made in this country. The methods of canning are simple, and canning factories are increasing in number in this country. It is understood that about 30 exist now where none existed a few years ago. The whole question of the possibility of the extension of canning is now under practical exploration by the National Food Canning Council, and there seems to be every reason to expect that their efforts will result in the much greater use of canning as a means of extending the season of availability of many of our perishable fruit and vegetable crops. Their campaign will, no doubt, include the advocacy of tinned home-grown fruits and their preference by the consuming public to tinned fruits from abroad. If the Government could usefully assist in this important development, either by way of helping research or experiment or by stimulating the provision of large acreages of fruit or other tinnable produce, we suggest that it should do so.

(11) There remains the question of proper storage for the better varieties of dessert and cooking apples so that they may be available longer into the winter and spring. This is being carefully investigated, together with that of cold storage for other foodstuffs, by the Low Temperature Research Station at Cambridge, and no doubt reports of new discoveries in this direction will be given the earliest and widest publicity in the interests of our home-growers. In the meantime, growers or merchants will no doubt continue to avail themselves of the advantages of the municipal and other cold storage accommodation already established in producing areas.

(12) To sum up and amplify the suggestions made in this Report we would propose:—

- (a) That the Ministry's Scheme for the Grading and Packing of Apples and Pears gives promise of excellent permanent results, and should be pushed forward so that all commercial growers of fruit may be given an opportunity of coming within it.
- (b) That practical demonstrations of the value of the scheme to growers be carried out in all districts where growers are numerous, as suggested in paragraph (3) above.
- (c) That groups of growers should be urged to set up fruit-packing stations, not necessarily expensive buildings, but such as can contain the plant necessary for grading and packing. A minimum quantity of 30,000 bushels of good varieties is required in order to pay the overhead costs of a factory equipped with a Cutler Grader and having a salaried manager and a dozen or so graders and packers.
- (d) That an extension of the practice of canning fruit, as well as other foodstuffs, be widely advocated, and that the Government should assist as much as possible by way of research and experiment and in the encouragement of the production of supplies

suitable for canning. The National Mark might be used in connexion with the sale of brands of tinned fruit of standard and guaranteed quality.

- (e) That as soon as National Mark fruit is on the market in sufficient quantity, a special publicity campaign should be commenced in favour of the consumption of home-grown fruit in this country, whether fresh or tinned, or made into jam or other preserve.

October 8, 1928.

APPENDIX B

REPORT FROM THE STANDING COMMITTEE ON THE SUBJECT OF THE BETTER MARKETING OF LIVE STOCK AND MEAT.

(1) We have dealt in a general way with the marketing of cattle, sheep and meat, and pigs and pig products, in the first two sections of our Interim Report on Marketing, dated January 19 last. We have now given these subjects more detailed consideration in accordance with the Council's request, and we propose to set down certain conclusions in this Report.

(2) In the Interim Report we stated that existing methods in regard to the sale both of home-grown live stock and meat in this country were unsatisfactory. Our further inquiries lead us to emphasize this conclusion, and to add that in our view it is of the highest importance to British agriculture that improvement in this matter be made as early as possible. As a necessary correlative measure, it is essential that the standard quality of commercial live stock in England and Wales should be raised. The Live Stock Improvement Scheme of the Ministry of Agriculture is having excellent but necessarily limited results; it requires to be much strengthened and extended, and if the quick improvement which in our view the situation demands is to be made, breeders and feeders must concentrate first on the elimination of scrub bulls. We state these views at the outset, as a strong conviction of their importance underlies and inspires the practical steps we advocate in this Report.

(3) Considering marketing in the first place, we think that a system of grading fat cattle on presentation at the live stock markets is most desirable. By no means all fat cattle would be covered by such a system, since many are, of course, sold direct to the butcher. But sale through the fat stock market is usually the better method, as it means, or should mean, sale by actual live weight. At present, rough grading by the auctioneer or his deputy takes place at least at one auction mart in the country; and if that could be made a general practice, it is but a step from it to a proper grading scheme by which fat cattle would be divided into, say, three grades, first, second and third, according to written and accepted standards of live stock quality judged by appearance of the live animal.

(4) A better plan than live stock grading would be co-operative slaughter of stock and grading as to actual quality of meat before sale on behalf of the farmer. This should ensure to farmers the certainty of a full reward for proper breeding and feeding; but, as stated in our Interim Report, we do not think a country-wide scheme for co-operative action on these lines is possible unless and until the English farmer will give his whole-hearted support to co-operative methods. In isolated cases it might be possible to set up farmers' co-operative slaughterhouses, and where this can be done on sound lines it should be done. The direct selling of meat by or on behalf of the farmer would have a very beneficial effect on the quality of meat produced.

Under present conditions, wherever actual touch between farmer and butcher takes place, it is certain to be to the farmer's benefit to study how his fat stock come out in the killing in relation to the recognized standards of quality and the needs of the consuming public in regard to small joints, juicy and not over-fat meat, etc.

(5) It seems, however, inevitable that by far the larger number of sales of fat stock must continue to be to dealers, or to butchers with whom the farmer is not personally acquainted, so that a system of grading live cattle before sale in auction marts is all that is possible so far as bringing the farmer personally in contact with an improved technique in marketing by which he will certainly profit financially. If, in addition, meat were graded after killing—when the stock had passed out of his hands—he would be helped still more, as it would improve the credit, and eventually the price, of English meat on the market; we propose to deal with that subject in later paragraphs. It would be a further improvement if the whole organization of markets over the country could be overhauled and systematized so that any unnecessary smaller markets could be eliminated, and stock more evenly and proportionately distributed amongst the others, and market intelligence, including immediate broadcasting of supplies and prices, fully developed. We would recommend that all practicable steps in these directions should be taken as early as possible.

(6) With regard to the marketing of store cattle and calves, we do not doubt that farmers who breed good-class stock, under the Improvement of Live Stock Scheme or otherwise, will take care to see that their young stock are known as such when they come to be marketed. Well-bred early-maturing beef animals should always be able to command considerably better prices as calves or stores than those young scrub cattle which are unfortunately so common in our markets. The position in regard to cows and heifers in the market is in similar case. All unpedigreed stock of these classes in the market, however, might usefully be graded as part of a general live stock grading scheme.

(7) As to the marketing of sheep, lamb and mutton, the farmer's problems in buying store sheep and selling fat stock are special ones, and often peculiar to his own district. He will no doubt be careful to make himself as well acquainted with the wool value of his sheep, as he usually knows its mutton value. Co-operative wool marketing societies in the country, which clean, grade and market their farmer-members' wool in quantity, are extending, and it is suggested that their example, to which we referred in our Interim Report, might with advantage be generally followed. As regards the sale of mutton and lamb, there is no question that this, also, would benefit by a system of meat grading such as we hereafter suggest, and that any improved prices obtained on the wholesale and retail meat market for graded qualities would undoubtedly react on the price of live sheep.

(8) Another matter which we have considered is the important one of the better distribution of market supplies of fat cattle during the year. It appears to have been a feature of recent years in many districts that autumn supplies are much increased, amounting almost to a glut. This may be due to various causes, principally, perhaps, to the high cost of winter feeding, but the pressure on the market undoubtedly brings with it a decline in prices of live cattle.

This position is undesirable and has a very bad effect on the industry. It might be met to some extent by farmers growing more cattle food-stuffs on their farms. On broad lines of policy, therefore, we advocate the adoption of such measures as will help farmers to maintain more equal supplies of home-grown beef all the year round.

(9) Considering now the question of the marketing of meat, we understand that imported meat is so perfectly graded as to quality and size of joint that a retail butcher can order a side of beef by brand, number, or letter of grade, over the telephone, and be sure of getting exactly what he wants. In our Dominions and in the U.S.A. and Argentina, grading is carried out as an essential condition of the trade with this country. It cannot, therefore, be expected that home-grown meat, unless it is graded and attains a certain standard of excellence, can retain or augment its sales on the wholesale markets in face of the low-priced well-graded imported article. The fact is that the position of home-grown meat on our wholesale markets is most unsatisfactory. That position is either the result of error on the part of meat buyers, who do not recognize the true value of good-class English meat, or the result of persistent production of many inferior cattle by English farmers; or it is the result of both factors working together. If it is the first, steps must be taken to increase the reputation of English beef, and this can best be done by efficient grading and marketing. If it is the second, then the cause must immediately be removed by using better bulls for meat production. If it is partly both, as we believe it is, then the two courses advocated must be pursued concurrently.

(10) In America, the voluntary system of grading meat is, we understand, spreading widely, and it goes with a system of actual marking of the meat with an indelible vegetable-ink stamp in such a way that all the external parts of the principal joints are stamped. It should be possible to follow such a system in this country, and we understand that the Ministry of Agriculture has already publicly demonstrated the idea at a few agricultural shows this summer. The system might be voluntary, at any rate at the beginning, and should be applied through the machinery of the Agricultural Produce (Grading and Marking) Act of last Session. Under it, English meat of the best quality should fetch as high a price as the best Scotch meat, being purchasable by retail butchers in the same way as they now buy Argentine sides, *i.e.*, according to graded quality. The grades would be laid down officially by the Ministry of Agriculture in consultation with the trade, and graders employed at the chief dead-meat markets to decide as to quality of the meat coming forward and to stamp the meat accordingly. The system would serve to differentiate English graded meat from Scotch, Argentine, other imported meat, and from ungraded English meat. Such a system, we think, could not fail to be of immense advantage in the marketing of English meat. The National Mark, which the Ministry is already using in the case of fruit and will shortly use in regard to eggs, might be employed; and we think that, if such a scheme could be introduced, more and more English meat would be brought under it, and not only would the trade be rid of the discredit that on occasions imported meat is sold as best English, but the home-beef industry would be spared the commercial disadvantage of having inferior English cow beef sold as the prime product.

(11) It has been represented to us that there are some real and intrinsic advantages which Scotch meat in the London market has over English meat, quite apart from any question of quality through breeding, rearing or feeding, and that these advantages may as easily be the possession of English beef as Scotch. Other things being equal, cattle that are killed at the point of production, as the Scotch are, yield beef of superior quality to beef that comes from cattle that have been transported a long distance to the abattoir. Further, Scotch beef is generally from comparatively young cattle and requires

little hanging. These factors, we are informed on authority, ensure greater tenderness and better eating quality of meat. English meat is frequently from older animals and requires more hanging than it is given. The extended provision and use of hanging facilities should, therefore, be part of any scheme for the grading and better marketing of English meat.

(12) It would facilitate the scheme also if cattle whose meat was to be graded could be killed in central abattoirs rather than in private slaughterhouses where the methods are sometimes neither so humane nor sanitary.

PIG AND PIG PRODUCTS

In dealing with the marketing of pigs and pig products in our Interim Report, we referred to the reports issued by the Ministry on (1) the Marketing of Pigs (Economic Series No. 12) and (2) the Pork and Bacon Trades (Economic Series No. 17). These reports together contain a large amount of well-presented material which should assist in solving the problems connected with the marketing of pigs and pig products. In addition to the issue of these two reports the Ministry has set up a Pig Industry Council to consider all circumstances affecting pig production in England and Wales, with special reference to methods of marketing, and it has asked that Council to make recommendations to the industry from time to time with the object of increasing the home supply of both pork and bacon.

We do not desire to appear in any way to be anticipating the recommendations of that Council, so that we do not propose to go into any great detail in this statement. We shall content ourselves with stating a few facts which appear to us to be the cardinal ones in the position, and leave them on record more for the purpose of assisting the farmer to clear his mind on the matter pending the issue of recommendations by the Pig Industry Council.

In the first place, Great Britain and Ireland may be said to be self-supplying in regard to fresh pork. The embargo on fresh pork from Continental countries, owing to the position of foot-and-mouth disease on the Continent, still holds, and, as far as we can see, is likely to continue to do so. This accident leaves the British supplier in practically complete control of the market. It may be that advantage should be taken of this position to encourage home consumption, and bring the quality of fresh pork and fresh pork products fully into line with the public taste. We are informed that the consumer has a preference for lean meat, small joints and a high standard of quality. We are also informed that the conditions of assembling and marketing fresh pork could, taking the country throughout, be much improved. A share in a National Mark meat grading and marking scheme which we hope soon will be evolved would undoubtedly assist both producer and consumer.

On the consumer's side, there is no doubt that pork and pork products might very properly occupy a more important place in the dietary of the nation. It is more a matter of habit than of reason that the consumer gives preference to beef and mutton as a regular joint. As a matter of fact, fresh pork is never out of season, as is commonly supposed, and there is no ground for prejudice against it in any part of the year. A great deal, rather, is to be said in favour of it as a welcome alternative at all times to other forms of meat food. The producer, however, must see to it that the precise demands of the fresh pork market as to quality are adequately supplied, and so do his substantial part in encouraging an increase in the consumption of fresh pork.

As regards bacon, the English producer supplies only about one-third of the country's requirements. It is not easy to say precisely why this is so, but the fact remains that although a large part of the supply of English bacon is superior to any that is produced elsewhere, the cheapness, presentability and regularity of quality and supply of bacon from Continental sources has secured for it a dominant position in our market. There is no evidence available of the relative cost of producing bacon pigs in this and competing countries; neither is it clear whether the margin between the farmers' selling and the retailers' buying price is greater in respect of English bacon than of Continental bacon. It is true that in some countries dairy by-products are available in considerable quantities for pig-feeding, and advantages over our own pig-feeders may very well be the result. Probably this, and the lack of specialization by our own farmers in the production of bacon pigs, and the absence of any method or system by which the interests of farmers and curers are linked together for mutual benefit, cause the pig industry in this country to be economically weak. Very few English bacon factories are ever nowadays running at full capacity, and many do not reach more than half-capacity, because of the lack of sufficient suitable pigs.

In our view, an alteration in the position should first be attempted by a further measure of co-operation between the grower and the factory, and specialization in the production of pigs suitable for bacon. It seems to us that, with the excellent market at home for large quantities of bacon, it becomes a matter of national importance that impediments in the way of full production should be speedily discovered and set aside.

We submit these suggestions as worthy of consideration and possible trial pending the issue of detailed recommendations by the Pig Industry Council.

October 8, 1928.

* * * * *

DECEMBER ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),
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Seasonal Notes.—Ploughing continues during December when weather conditions permit. Land cleared of potatoes, beet, turnips, kale and cabbage, and intended for spring corn, is turned with a furrow of moderate depth—about 6 in.; and on strong soils unbroken work is preferable to digging as it facilitates percolation and allows of earlier working and sowing in spring.

Leas for spring corn are generally left unploughed until January, not only because they may be ploughed when wetness prevents work in other fields but also because the grass may be useful. Indeed, a field of old seeds adjoining a root field is valuable especially for in-lamb ewes when soil conditions on the root field become too uncomfortable. Corn stubbles intended for green crops next year should, unless already ploughed, be turned over before Christmas. The best style

and depth of work depends on conditions. Where the soil is heavy the lea breast is preferable, except on dirty land, in which case the weeds can be better covered by the more completely inverted furrow turned by the digger. This year, however, where advantage has been taken of the favourable opportunities for stubble cleaning, weed covering should be a less important consideration than usual.

The best stage in the rotation for ploughing deeply is between the corn and the green crops, *viz.*, in preparing for the latter. Where the stubble has been manured, however, very deep flat work is undesirable on heavy land, as it places the dung down in the inert layers of the soil, where, owing to lack of air and bacteria, it fails to decay normally. Under these conditions it is better to plough a depth of about 4 in. when covering the manure and a deeper furrow when cross cutting in January or February.

On grassland, the dunging of meadows continues, and applications of minerals are given to that portion—about a quarter—of the pastures entitled to receive dressings this year. The routine of top-dressing a portion of the pastures each year may advisedly be supplemented by the hand application of superphosphate and potash to any rough patches, the object being to sweeten these and thereby ensure even grazing of the entire field. As a permanent sweetener of unpalatable patches, however, lime is excellent, though more expensive and slower in action. Mowing in summer and turf slitting with the disc harrow in winter are valuable measures in the rejuvenation of pastures that have become somewhat matted; but where the chief cause of the matting is lack of lime, an application of this material should be given as part of the restorative treatment.

The Dairy Herd.—In most districts the dairy herd is now kept indoors entirely, or if allowed out of doors at all, it is only for a limited time each day. Farmers differ in opinion concerning the necessity of daily airing and exercise for cows in winter. If the cow-shed is suitably ventilated, it is possible to maintain a healthy atmosphere and a temperature between 50° and 60° F., so that daily release is not necessary on the grounds of fresh air and hardiness. The case is different where ventilation is not satisfactory; here there is obvious advantage in a daily release, while the doors, windows, etc., are thrown open to give the shed a thorough change of atmosphere. As to the need for exercise, it cannot be said that the evidence is very strong. Many herds in this country, and

most herds in Denmark and Holland, are kept in unbroken confinement from autumn until spring without visible ill-effect. On the other hand, there are many farmers who are so satisfied that daily exercise is beneficial that they give part of the daily ration out of doors and thereby keep the cows contented whilst out of the sheds. Commonly, when cows are released for water and exercise, they come back to roots or concentrates; and, knowing this, they are anxious to return to the sheds almost immediately after being turned out.

The common reason for allowing the cows to come out of the sheds is to afford them an opportunity to drink. In some cases the cattle have to drink at brooks or field ponds, which is not only inconvenient but also causes muddy gateways and poached pastures, and it adds to the labour of keeping the cows' udders clean. On the other hand, a common reason for not releasing the cows at all, where automatic water bowls have been installed, is because this reduces the labour of keeping the premises tidy, especially where the ground adjoining the cowsheds has not been concreted over, as it should be.

Experiments have shown that cows giving ordinary yields, and receiving a normal allowance of succulent fodder, will milk just as well on twice-daily watering as when given access to a continuous supply. There is no doubt, however, that deep milkers and cows on dry food do require access to water more frequently than twice a day; and in cases within the writer's experience, the installation of water bowls has eliminated stomach troubles, which had been a somewhat common occurrence in winter feeding of dairy cows on rations deficient in succulents.

Autumn and winter calvers tend to remain non-pregnant for a longer time than spring and summer calvers. During the colder season their oestrus period is comparatively brief and may easily escape notice, especially where the cows are kept entirely indoors; and even when the cows are released daily, the familiar symptoms are not observable if the heat period occurs and passes off during the night. Hammond and Sanders suggest the advisability of leading a young bull down the shed late in the evening.

Wintering Out.—Given a dry lair and sufficient long fodder, dry stock, other than calves under six months old, winter well out of doors in most parts of England; and they grow more rapidly next summer in consequence of their out-door life. In one of the best herds of British Friesians in Derbyshire,

the young stock are all wintered out; and in this case the land is not so suitable for the purpose as is generally considered necessary. Out-wintering is successfully practised even on upland farms in the Peak District, and has proved undoubtedly superior to close confinement in old-fashioned field hovels with insufficient light and ventilation. The saving of labour is a further advantage.

The case against out-wintering must be considered, however, where the land is heavy and wet, so that it poaches under the feet of the cattle; "hoof culture" is decidedly injurious under these conditions. Further, where yard manure is needed for arable crops the cattle may be necessarily housed. Again, where the acreage of grassland is limited, out-wintering is apt to cause inconvenience, by reason of the fact that the cattle crop the young growth as it appears in spring and thus impair its summer productivity.

A certain amount of roughness in the pastures is useful as fodder for cattle wintering out of doors. When this has been cleared off, long forage is needed, typically about a stone per head per day for two-year-olds. Good clean straw may form part of the fodder supplied; and for the purpose in view—namely, heat forming—straw has a feeding value higher than it has for the production of fat or milk.

Milking Machines.—During the past two years there has been another wave of interest in mechanical milking in this country, and at the present moment the subject is being widely discussed. It may be recalled that just before the war dairy farmers were seriously considering the possibilities of milking by machinery; and in 1913 the Royal Agricultural Society carried out competitive trials with 10 makes of machines that were then being advertised in Britain. There was a comparatively rapid sale for mechanical milkers during 1913-17, several new makes becoming widely distributed during that period.

When the writer conducted his inquiry into the use of milking machines in the Midlands in 1916, nine patterns were under notice. Of these only three are now exhibited at English agricultural shows; the remainder have now ceased to be manufactured or are not now commercially represented in this country. In a wider investigation conducted during 1917 and 1918 by the Astor Milk Committee of the Board of Agriculture, it was found that some 1,400 to 1,500 herds in England and Wales were then being milked by machine; and it is noteworthy that over 500 of these installations belonged to patterns which have since gone off the British market.

In view of the above experience—of which we are frequently reminded by the rusty vacuum pipes of the abandoned outfits—older farmers are sceptical about the merits of milking machines in general; and, while it would be absurd to ignore recent introductions because they have not passed through the test of survival since 1918, farmers are naturally critical of the claims of the newer patterns, and require to know wherein these excel types which have survived the test of years under British conditions.

The recent revival of interest in mechanical milkers may in part be due to advertisement, supported by successful demonstration, of both older and newer patterns; but it is also attributable to the increased cost of milking by hand. Farm labour now costs 100 per cent. more than in 1914, while the price of milk is only 65 per cent. above pre-war figures. In fact, when account is taken of the hours of work, which are necessarily long in dairying, the cost of hand milking has increased by more than 100 per cent.

There is now abundant evidence that good yields and clean milk can be obtained by machine milking. As regards the saving of labour effected by the machine, instances of success frequently come to one's notice. Early in November a farmer informed the writer that his 70 cows were now being milked by two men, he himself carrying-in. Installing the machine had, he said, enabled him to increase his herd by 20 cows and to dispense with one man.

While granting that improvements have been effected in the construction of milking installations since 1913, it cannot be said that any fundamental change in design has been introduced which will assure success where it was impossible 15 years ago. The success of the mechanical milker still depends largely on the intelligence of the operator and especially on the foresight of the farmer himself. Omission to observe a faulty condition of the power unit; failure to detect early symptoms of wear in the vacuum pump or other moving parts; omission to keep a stock of spares—all these may involve the farmer in the disappointment of missing the train or even the difficulty of having to hand-milk the herd with a depleted staff. Efficient cleansing and sterilization of all parts that come in contact with the milk are also essential to secure satisfactory bacterial counts. Milking machines, like tractors, have their limitations as well as their virtues. Neither can be recommended to farmers who are not prepared to undertake thorough supervision of mechanical equipment.

NOTES ON MANURES

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When Phosphates Fail.—It is a matter of frequent observation that in certain cases the use of phosphate alone on grassland does not give satisfactory results. The cause may lie in the mechanical condition of the surface of the pasture, for the mat of benty herbage may be so thick that the clover plants cannot find root-hold in the soil below; or occasionally there may be no minute clover plants present to form the starting point of improvement. The first of these conditions can be dealt with by hard grazing followed by heavy harrowing; the second by the sowing of a little wild white clover seed. A commoner cause of the failure of phosphate, however, is the lack of a sufficient supply of potash. Clovers respond markedly to potash fertilizers, and it is probably because our grasslands on the whole occur on the heavier types of soil, which provide a good natural supply of potash, that this fact is not more widely appreciated by farmers. On the lighter soils, on the chalk, and on peaty land, potash fertilizers are frequently necessary to supplement the action of phosphate. In fact, phosphate and potash together on the above soil types have a similar effect to that shown by phosphate alone on "slag" land. The need for potash is increased when little dung can be spared for the grassland and on land which is frequently mown. A simple trial may be made by the farmer by carrying a strip of potash salts across those fields which are not doing well with phosphate alone. Such an observation strip costs little and gives a direct answer on which future treatment may be based. When it turns out that potash is required the lower grades of potash salts, *i.e.*, 14, 20 or 30 per cent., are very suitable for grassland, as the common salt which these forms contain is beneficial. Four hundredweight of 14 per cent. kainit, or its equivalent of 20 or 30 per cent. salts, would constitute a dressing for two or three seasons.

A further cause of failure of phosphatic manures is lack of lime, and this condition may be determined with some certainty by the appearance of the herbage and the presence of certain weeds. As advice based on chemical examination of the soil is readily available in most districts through the County Agricultural Organizers, it is best to proceed by obtaining such advice where possible.

The indiscriminate use of lime on grassland is not to be recommended. Even where lime is certainly required the result

takes a season or two to appear, and the first cost is greater than that of ordinary manurial dressings. Grassland can stand a slight amount of acidity without harmful results, and in many cases the small amount of lime applied in periodical dressings of basic slag appears to meet the need of the herbage. This has been observed also in cases where the land was decidedly acid, as in the series of trials carried out in the years 1924-27, with phosphates and lime in the West Country.* Here phosphates produced marked benefit, which was not appreciably improved by lime in the early years, although after three or four seasons a slight effect was noticed. There are districts, however, in which this certainly does not occur, and these have been described in detail by Hanley and other workers in Yorkshire.† Thus on soils derived from the Millstone Grit and the Coal Measures the presence of a mat of undecayed residues of vegetation, together with the predominance of bent-grass, fine-leaved fescue and Yorkshire fog, with abundance of weeds such as sorrel, woodrush and carnation-grass, indicates a serious lack of lime in the soil. Further symptoms are the scarcity of perennial rye-grass and wild white clover, and the occurrence of bare patches. In such circumstances an application of some form of lime or chalk will constitute the first means of improvement, the result being the gradual disappearance of the mat and a marked increase in the growth of clover and in freshness of the grass. This change is promoted by the tighter grazing following the application of lime.

Thus the need of lime is not so readily decided by trial as is the need of potash, for the effect takes longer to appear, and technical advice is desirable whenever it can be obtained.

Losses from Farmyard Manure.—Much has been written about the loss of nitrogen which takes place during the storage and handling of farmyard manure, but it is not so widely recognized that the potash in dung is also highly susceptible to loss by careless treatment. A considerable amount of the fertilizing value of dung is to be attributed to its potash content, which is about 0.7 per cent., or 16 lb. per ton, in a sample of bullock manure which has been stored under good conditions. This potash is readily available to plants and is the equivalent of about 1 cwt. of kainit. The potash in dung is derived from two sources: part is supplied in the straw and the remainder comes mainly from the urine of the farm stock.

* Ling and Wallace: *Jour. Bath and West Agric. Soc.*, 1927.

† Leeds Bulls. Nos. 107 and 150.

Assuming that 1 ton of straw makes 6 tons of fresh manure, straw supplies about one-fifth of the total potash.

It is well known that the potash of the urine is water-soluble and liable to loss through leaching, but it might be thought that the potash in the straw would occur in a much more firmly held condition and not easily be washed out. This, however, is not the case. It has been found at Rothamsted that the potash in straw is readily water-soluble. Thus 97 per cent. of the total potash in barley straw was extracted by percolation with warm water, while during the wetting of barley straw in a pit in the preparation of some artificial farmyard manure 44 per cent. of the initial potash was dissolved out. Analysis showed that a considerable proportion of this potash certainly came from the straw.

The loss of potash from farmyard manure by leaching is well brought out by the following experiments in the storage of dung :—

		<i>Loss of potash per cent.</i>	
		<i>Rothamsted</i>	<i>Woking</i>
Stored in the open	.. ..	35.5	30.0
Stored under cover	.. ..	7.3	5.4

By exposure to the weather about one-third of the total potash in the manure was washed away, while cover almost completely prevented this wastage.

In caring for farmyard manure it is generally necessary to make a compromise between what is scientifically desirable and what is practicable in the circumstances of the individual farm. Nevertheless it is clear that undue exposure of manure to rain is to be avoided. Yards should be guttered, and heaps should be made small in area and deep, rather than extensive and shallow. The soaking away of urine or the well-known black liquid should be as far as possible guarded against by rendering the bottoms of boxes and dungsteads water-tight.

Sugar Beet Tops.—Although sugar beet tops are a valuable food for live stock, cases occur in which it is not practicable to utilize the whole of the tops in this way, and some will consequently be ploughed in for green manure. The analysis of beet tops as determined at Cambridge was as follows : Nitrogen, 0.40 per cent. ; phosphoric acid, 0.13 per cent. ; potash, 0.70 per cent. ; lime, 0.30 per cent.

If we assume that only 5 tons of tops are produced per acre they would contain on the above basis : 44.8 lb. nitrogen, 14.6 lb. phosphoric acid, 78.5 lb. potash, 33.5 lb. lime.

Certain German figures referring to large crops of leaves per acre give considerably higher amounts of nutrients in one

acre of tops. As an average of four seasons at Lauchstädt the following amounts of manurial constituents were found in the leaves : 103 lb. nitrogen, 30 lb. phosphoric acid, 123 lb. potash.

Taking the English figures, however, and reckoning nitrogen, phosphoric acid and potash at 5d., 1½d. and 2d. per lb. respectively, the manurial value of one acre of beet tops would be £1 13s. 7d., or 6s. 9d. per ton, neglecting the value of the lime and the organic matter. If the tops are fed the value of the manurial residue would be about £1 0s. 6d. per acre, or 4s. 1d. per ton.

Lime from Beet Factories.—Farmers in the neighbourhood of sugar beet factories have two types of lime products available. These are :—

(1) *Scrap Lime.*—This is the finely divided burnt lime from the factory kilns, which must be disposed of, since only the lumps are used in the sugar manufacturing process. Scrap lime may be used on the farm in the same way as ordinary quick lime. If an analysis can be obtained this will assist in comparing its price with that of lime from other sources.

(2) *Waste Lime or Factory Lime.*—Strictly speaking, this is not lime at all, but consists chiefly of carbonate of lime together with a varying amount of water. It is a by-product arising out of the purification of the juice, and is pumped from the factory into settling ponds where as much as possible of the water is removed by drainage and evaporation. As sold it contains about 47 per cent. of chalk and 50 per cent. of water, with varying quantities of organic matter and a trace of nitrogen and phosphoric acid. It is, therefore, a low-grade article, and finds its best outlet within a radius of a few miles from the factory. Unless specially dried the price does not exceed 5s. per ton, and is frequently less.

Large dressings would generally be used—up to 4 tons per acre or more. Distribution is made easier by allowing the material to weather in heaps, and when spread over the land the action of frost helps to reduce it further.

Nitro-Chalk.—The relative merits of nitric and ammonia nitrogen have repeatedly been examined and discussed by agricultural investigators since the early 'forties of last century, when Lawes began his famous experiments at Rothamsted in which Chile nitrate was compared with ammonium salts. Thousands of field experiments have since been conducted, both in England and on the Continent, to determine the

relative effectiveness of these two forms of nitrogen. Although their actual performance will depend on soil, season, and the type of crop, Chile nitrate has on the whole been slightly more effective than sulphate of ammonia when compared on a basis of equal nitrogen. As a result nitric nitrogen commands a somewhat higher price per unit than ammonia nitrogen. Apart from this, each form has a number of agricultural relationships which are now well understood. Nitric nitrogen is quick to act, and makes no special demand on the supply of soil lime, but it is liable to be washed out of the surface layers in wet periods when no active growth is in progress. Its special place is for late top-dressings in dry districts. Ammonium nitrogen is firmly held in the soil and is rather more gradual in its action, while a certain amount of lime is used up in its transformation into nitrate. It is suitable for use before sowing or as an early top-dressing.

A fertilizer containing nitrogen in each of these forms should have a wide range of uses, for it would provide some very active nitrogen for immediate needs with the safeguard that some of the nitrogen would be in a condition to stand through wet periods. Such a fertilizer is nitro-chalk, the recent product of the Billingham factory. Nitro-chalk consists of a mixture of ammonia nitrate and finely divided chalk, in which half of the nitrogen is in the nitric condition and the remainder is present as ammonia. There is also enough chalk in the mixture to take part in the transformation of the ammonia nitrogen without drawing on the soil supply. As first introduced, nitro-chalk contained 10 per cent. of nitrogen, but from January next the grade will be raised to 15½ per cent. Nitro-chalk is suitable for top dressing cereals and root crops, or for use in spring and summer on grass-land. It should prove a valuable source of nitrogen for such crops as barley, swedes and sugar beet on soils having a poor reserve of lime. It might also be used in dry districts, or when top-dressing has been delayed till late in the season. As it will have the same content of nitrogen as nitrate of soda, applications would be at the rate of about 1 cwt. per acre for cereal crops and from 1—2 cwt. per acre for roots. The price will be £10 per ton at the farmer's station, providing nitrogen at 12s. 11d. per unit.

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PRICES OF ARTIFICIAL MANURES

Description	Average price per ton during week ended November 7					Cost per unit at London
	Bristol	Hull	L'pool	London		
	£ s.	£ s.	£ s.	£ s.	s. d.	
Nitrate of soda (N. 15½%)	10 4f	10 4f	10 4f	10 4f	13 2	
Nitro-chalk (N. 10%)	7 0	7 0	7 0	7 0	14 0	
Sulphate of ammonia :—						
Neutral (N. 20·6%)	10 5d	10 5d	10 5d	10 5d	9 11	
Calcium cyanamide (N. 20·6%)	9 6e	9 6e	9 6e	9 6e	9 0	
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%)	11 19g	11 3h	..	..	..	
Kainit (Pot. 14%)	3 5	2 19	2 18	3 0	4 3	
Potash salts (Pot. 30%)	5 1	..	4 15	4 18	3 3	
" (Pot. 20%)	3 13	3 9	3 6	3 10	3 6	
Muriate of potash (Pot. 50%)	9 12	9 3	8 17	8 17	3 6	
Sulphate, " (Pot. 48%)	11 13	11 6	10 19	11 0	4 6	
Basic Slag (P.A. 15½%)	2 3c	1 17c	..	2 4c	2 9	
" (P.A. 14%)	1 19c	1 17c	1 12c	2 0c	2 10	
" (P.A. 11%)	..	1 2c	1 7c	..	..	
Ground rock phosphate (P.A. 26·27½%)	\$ 2 10||	2 7||	..	2 5a	1 8	
Superphosphate (S.P.A. 16%)	3 0	..	3 1	3 0	3 9	
" (S.P.A. 13½%)	2 15	2 8	2 15	2 15	4 0	
Bone meal (N. 3½%, P.A. 20½%)	8 15	8 10	8 12	8 7	..	
Steamed bone flour (N. 3%, P.A. 27½-29½%)	5 17b	..	6 15	5 15	..	
Burnt Lump Lime	1 7k	1 10l	1 13n	2 2m	..	
Ground Lime	1 14k	..	..	1 17m	..	
Ground Limestone	1 1k	..	1 9n	2 6m	..	
Ground Chalk	..	1 6	..	1 11m	..	
Slaked Lime	..	..	2 16n	3 2m	..	

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. 85% through standard sieve.

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

g F.o.r. Gloucester.

h F.o.r. Goole.

k 4 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.

NOTES ON FEEDING STUFFS

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The Nutritive Value of Sugar Beet Pulp.—In the Notes for last month, it was shown that sugar beet pulp is a highly digestible feeding stuff when consumed by ruminant animals. In respect of the digestibility of its total organic matter and its carbohydrate constituent, it compares very satisfactorily with maize meal. The process of drying the wet beet pulp in the factory does not in any way depress its digestibility. Further, from the standpoint of digestibility, it is immaterial whether dried sugar beet pulp is included in the rations of ruminants in the dry or soaked condition. It was also shown that although dried sugar beet pulp contains as much as 18 per cent. of crude fibre, this constituent is very little inferior in respect of digestibility to the carbohydrate ingredient, a fact which justifies the conclusion that the fibre in this feeding stuff is present almost wholly in the form of simple cellulose, unmixed with any significant amount of the indigestible lignocellulose.

The questions next arise as to (1) the mechanism whereby the carbohydrate and fibre, which together form about 85 per cent. of the dry substance in sugar beet pulp, are digested in the ruminant organism, and (2) the nature and nutritive value of the products which arise in the course of their digestion.

The Carbohydrate.—It has already been shown that the carbohydrate of sugar beet pulp contains only a very small proportion of sugar, amounting to 2·6 per cent. of the dry matter of the beet pulp. The main carbohydrate present is pectose, and although the existence of at least three ferments (pectosinase, pectase and pectinase) capable of acting on pectic substances has been definitely proved in plant tissues, it is doubtful whether the secretions of the digestive tracts of animals contain any ferment capable of bringing about the digestion of pectose. This possibility, however, is being investigated by the writer at the present time. In the absence of an enzyme mechanism for this purpose, it must be assumed that the pectose in the beet pulp is rendered available for absorption into the blood stream by the digestive action of bacteria.

The existence of bacteria and fungi which have the power of breaking down pectose has long been recognized. In the process of flax retting, the pectic cell cement is decomposed by a specific organism, *Granulobacter pectinovorum*. Flax retting may also be brought about artificially by the common hay and potato

organisms, *B. subtilis* and *B. mesentericus*, the insoluble pectose being first transformed into pectin and finally into sugars. Under certain conditions, the reaction may proceed a stage further, giving rise to marsh gas and organic acids. It is proposed to submit to further investigation the question of the breakdown of pectose by bacteria, especially by the micro-organisms which are found in the rumen of animals. It will be necessary to assume for the present, however, that the rumen is the seat of such bacterial activity, and that by this means the pectose is digested mainly to sugars like arabinose and galactose, together with, as in the case of the bacterial digestion of cellulose, minor quantities of marsh gas and organic acids. As with many other feeding stuffs (for example, green fodders and oil cakes) in which the true chemical nature of the carbohydrate is obscure, it is fair to assume that the digestible carbohydrate in sugar beet pulp has a value to the animal equal to that of the same weight of starch, an assumption which is in keeping with the results of Kellner's respiration studies of this feeding stuff, and, further, with the satisfactory results obtained with sugar beet pulp in practical feeding tests carried out in America, Germany, Sweden and elsewhere.

The Fibre.—The mechanism whereby the fibre of the beet pulp is rendered available for the nutrition of the animal has been explained recently by the writer. The cellulose component is transformed mainly into glucose sugar by the controlled activity of cellulose-splitting bacteria in the rumen. The striking fact is brought to light, therefore, that more than four-fifths of the dry matter of sugar beet pulp is digested, not by the normal enzymic processes, but by the agency of bacteria. In view of this circumstance, it is of importance to emphasize the statement that the results of the Cambridge trials in respect of the digestibility and nutritive value of sugar beet pulp are *only applicable to ruminant animals*. The extent to which *swine* are able to digest and utilize sugar beet pulp is now being submitted to investigation.

In Table I are recorded the percentages of digestible nutrients (on the basis of the Cambridge trials) in sugar beet pulp. The data are compared with corresponding figures for maize meal.

TABLE I.—DIGESTIBLE NUTRIENTS IN SUGAR BEET PULP AND IN MAIZE MEAL (DRY MATTER BASIS).

	Sugar Beet Pulp (per cent.)		Maize Meal (per cent.)	
Digestible protein	5·89		8·16	
Digestible oil	—		4·48	
Digestible carbohydrate ..	60·04	} 78·11	75·52	} 77·02
Digestible fibre	18·07		1·50	
Total digestible organic matter	84·00		89·66	

How to Use Sugar Beet Pulp.—An interesting parallel has already been shown to exist between dried sugar beet pulp and maize meal in respect of the digestion coefficients of the total organic matter and of the carbohydrate of these carbohydrate-rich foods. This parallelism receives further emphasis from the results shown in Table I, from which it appears justifiable to conclude that *dried sugar beet pulp must be included with feeding stuffs like maize meal in the class known as carbohydrate concentrates*. 100 parts of the dry matter of maize contain 89·6 parts of digestible organic matter including 77 parts of digestible total carbohydrate (*i.e.*, digestible carbohydrate and digestible fibre); the corresponding values for sugar beet pulp are 84 and 78. With both feeding stuffs, a very large proportion of the digestible organic matter consists of digestible carbohydrate. It would thus be necessary in practice to supplement both sugar beet pulp and maize with feeding stuffs which are richer in protein. Further, both these carbohydrate foods have the characteristic of being deficient in respect of minerals.

Kellner has proved that 94 per cent. of the energy in the digestible matter of sugar beet pulp is utilized for maintenance or production purposes in the body of the animal when the feeding stuff is consumed in the fresh, wet condition. Technical readers will recognize this as being equivalent to stating that V, the percentage availability, for *wet* sugar beet pulp is 94 per cent. When *large* allowances of dried sugar beet pulp are fed in the *dry* condition, however, the energy in the digestible nutrients is utilized only to the extent of 78 per cent. Kellner attributed this difference in the productive values of the two kinds of beet pulp to the greater difficulty experienced by the animal in masticating the dried product. If, however, the dried sugar beet pulp is soaked thoroughly in water before feeding, the availability of the digestible nutrients is increased to 87 per cent., a figure which also holds when *moderate* allowances of dried beet pulp are fed in the dry condition in intimate admixture with other concentrates, so as to ensure softening by salivation.

From the foregoing statements, it is evident that the best form in which sugar beet pulp can be utilized is the fresh wet condition. Unfortunately, considerations of transport and the difficulty of storing *wet* sugar beet pulp without spoiling preclude its use on farms except those in the immediate vicinity of beet sugar factories. When liberal allowances of the *dried* beet pulp are being fed to animals, it is desirable that

the food should be well softened in water before feeding. This procedure will ensure a higher availability of the digestible nutrients for productive purposes in the animal, and will also obviate the risk of choking trouble which sometimes arises during consumption of the dried product. This trouble is encountered now and then with sheep, the latter, on account of their liking for dried beet pulp, being liable to devour it too greedily.

TABLE II.—STARCH EQUIVALENTS AND NUTRITIVE RATIOS OF SUGAR BEET PULP (CAMBRIDGE TRIAL), MAIZE MEAL AND BARLEY MEAL.

	<i>Sugar Beet Pulp</i>		<i>Barley Meal</i> 14·9 per cent. moisture V=98	<i>Maize Meal</i> 13 per cent. moisture V=100
	<i>Wet</i> 85 per cent. moisture V=94	<i>Dried</i> 10 per cent. moisture V=87		
Starch equivalent per 100 lb. . . .	11·8 lb.	65·5 lb.	71·0 lb.	81·4 lb.
Starch equivalent per 100 lb. of dry matter of food . . .	78·6 lb.	72·8 lb.	83·4 lb.	93·6 lb.
Nutritive ratio . .	13·3	13·3	10	11

The data in Table II further confirm the concentrate character of dried sugar beet pulp; they show that 100 lb. of dry matter of this feeding stuff is equal, for purposes of fattening, to 72·8 lb. of starch. It will be noted that although sugar beet pulp and maize are very similar in respect of content of digestible organic matter, yet the starch equivalent of the latter is appreciably higher than that of the former feeding stuff. This is mainly due to the higher availability of the digestible nutrients in maize, V for this feeding stuff having the full value of 100 per cent.

It may be concluded from the data that, for purposes of fattening in the ruminant animal, 1 lb. of dried sugar beet pulp (moisture content=10 per cent.) may replace 0·8 lb. of maize (moisture content=13 per cent.). In the Scandinavian system of food values, one food unit is contained in 1·2 kg. of dried sugar beet pulp and in 0·95 kg. of maize, and this means that 1 kg. of dried beet pulp is regarded as being interchangeable with 0·8 kg. of maize—a striking confirmation of the result arrived at in the Cambridge investigation, especially as the Scandinavian result represents the conclusion drawn from an essentially different line of inquiry, namely, large-scale practical feeding tests on the farm instead of digestion trials conducted under laboratory conditions.

In this country it has become customary to regard sugar beet pulp solely as a substitute for roots in the ration and to advise against using it for the replacement of concentrates. In the light of the Cambridge work, however, this view is too narrow. Dried sugar beet pulp must be regarded as a carbohydrate concentrate, 1 lb. of which is capable of replacing 0.8 lb. of maize or 0.9 lb. of barley in the productive part of the rations of ruminant animals. This comparison is based on the assumption that the beet pulp, maize meal and barley meal contain 10, 13 and 14.9 per cent. of moisture respectively. It would be safer to state that 1 lb. of the *dry matter* in dried sugar beet pulp is equivalent to 0.78 lb. of the *dry matter* in maize meal and 0.87 lb. of the *dry matter* in barley meal.

The data compiled in Table III indicate that dried sugar beet pulp is also a relatively cheap source of digestible carbohydrate.

TABLE III.—RELATIVE FOOD VALUES OF DRIED SUGAR BEET PULP, MAIZE MEAL AND BARLEY MEAL.

	Dried Sugar Beet Pulp			Maize Meal*			Barley Meal*		
	£	s.	d.	£	s.	d.	£	s.	d.
Price per ton..	5	10	0	10	12	0	12	5	0
Manurial value per ton	0	9	0	0	11	0	0	10	0
Food value per ton	5	1	0	10	1	0	11	15	0
Price per unit of starch equivalent	0	1	6	0	2	6	0	3	4
Price per lb. of starch equivalent	0.80			1.34			1.78		

* Quoted from this JOURNAL, April, 1928.

In the Notes for next month, the writer will conclude this series of articles on sugar beet pulp by recounting the experiences of a number of English farmers in the use of this new feeding stuff.

* * * * *

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro- tein equiv
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British..	—	—	10 2	0 13	9 9	72	2 7	1.38	9.6
Barley, British feeding	—	—	9 10	0 10	9 0	71	2 6	1.34	8.2
" Canadian No. 4 Western	34 9	400	9 15*	0 10	9 5	71	2 7	1.38	6.2
" " feed ..	32 0	"	9 0	0 10	8 10	71	2 5	1.29	6.2
" American ..	32 0	"	9 0	0 10	8 10	71	2 5	1.29	6.2
" Persian ..	35 0	"	9 17	0 10	9 7	71	2 8	1.43	6.2
" Tunisian ..	33 6	"	9 8*	0 10	8 18	71	2 6	1.34	6.2
Oats, English, white ..	—	—	9 10	0 10	9 0	60	3 0	1.61	7.6
" " black and grey ..	—	—	9 7	0 10	8 17	60	2 11	1.56	7.6
" Scotch, white ..	—	—	10 7	0 10	9 17	60	3 3	1.74	7.6
" Irish, black ..	—	—	9 18	0 10	9 8	60	3 2	1.70	7.6
" Canadian No. 2 Western	32 3	320	11 5	0 10	10 15	60	3 7	1.92	7.6
" " 3 ..	30 3	"	10 12	0 10	10 2	60	3 4	1.78	7.6
" Argentine ..	28 9	"	10 2	0 10	9 12	60	3 2	1.70	7.6
" Chilean ..	28 9	"	10 2	0 10	9 12	60	3 2	1.70	7.6
" German ..	28 9	"	10 2	0 10	9 12	60	3 2	1.70	7.6
Maize, American ..	43 0	480	10 0	0 10	9 10	81	2 4	1.25	6.8
" Argentine ..	44 0	"	10 5	0 10	9 15	81	2 5	1.29	6.8
Beans, English, winter ..	—	—	10 13†	1 4	9 9	66	2 10	1.52	20
" Chinese ..	—	—	11 0	1 4	9 16	66	3 0	1.61	20
Peas, English, blue ..	—	—	15 0†	1 1	13 19	69	4 1	2.19	18
Millers' offals—									
Bran, British ..	—	—	8 0	1 2	6 18	42	3 3	1.74	10
" broad ..	—	—	9 0	1 2	7 18	42	3 9	2.01	10
Middlings, fine, imported	—	—	9 15	0 15	9 0	69	2 7	1.38	12
" coarse, British ..	—	—	8 17	0 15	8 2	58	2 10	1.52	11
Pollards, imported ..	—	—	8 5	1 2	7 3	60	2 5	1.29	11
Meal, barley ..	—	—	11 0	0 10	10 10	71	2 11	1.56	6.2
" maize ..	—	—	10 10	0 10	10 0	81	2 6	1.34	6.8
" " germ ..	—	—	11 0	0 16	10 4	85	2 5	1.29	19
" locust bean ..	—	—	10 0	0 7	9 13	71	2 9	1.47	3.6
" bean ..	—	—	12 15	1 4	11 11	66	3 6	1.87	20
" fish ..	—	—	19 10	3 7	16 3	53	6 1	3.26	48
Maize, gluten feed ..	—	—	10 7	0 19	9 8	76	2 6	1.34	19
" cooked flaked ..	—	—	12 10	0 10	12 0	85	2 10	1.52	8.6
Linseed—									
" cake, English, 12% oil	—	—	14 0	1 9	12 11	74	3 5	1.83	25
" " " 9% "	—	—	13 5	1 9	11 16	74	3 2	1.70	25
" " " 8% "	—	—	13 0	1 9	11 11	74	3 1	1.65	25
Soya bean " 5% "	—	—	11 15	1 17	9 18	69	2 10	1.52	36
Cottonseed cake, English—									
" Egyptian, 4½% "	—	—	8 2	1 7	6 15	42	3 3	1.74	17
" " Egyptian, 4½% "	—	—	7 17	1 7	6 10	42	3 1	1.65	17
Coconut cake, 6% oil ..	—	—	11 5	1 4	10 1	79	2 7	1.38	16
Ground-nut cake, 7% oil ..	—	—	10 17*	1 7	9 10	57	3 4	1.78	27
Decorticated ground-nut cake, 7% oil	—	—	13 5*	2 0	11 5	73	3 1	1.65	41
Palm kernel cake, 4½-5½% "	—	—	10 0†	0 17	9 3	75	2 5	1.29	17
" " " meal, 4½% "	—	—	10 10†	0 17	9 13	75	2 7	1.38	17
" " " meal 1% "	—	—	9 7†	0 18	8 9	71	2 5	1.29	17
Feeding treacle ..	—	—	6 0	0 8	5 12	51	2 2	1.16	2.7
Brewers' grains, dried ale ..	—	—	8 15	0 18	7 17	49	3 2	1.70	13
" " " porter ..	—	—	8 5	0 18	7 7	49	3 0	1.61	13
Malt culms ..	—	—	7 15*	1 7	6 8	43	3 0	1.61	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 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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton, its manurial value is 17s. per ton. The food value per ton is therefore £9 3s. per ton. Dividing this figure by 76, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 5d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.29d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 8s. 10d.; P₂O₅, 3s. 10d.; K₂O, 8s. 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 follows :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	9 8
Maize	81	6.8	10 2
Decorticated ground nut cake	73	41.0	13 5
„ cotton cake	71	34.0	12 0

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

The cost per unit starch equivalent works out at 2.51 shillings, and per unit protein equivalent, 2.18 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, 1928, 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	10 2
Oats	60	7.6	8 7
Barley	71	6.2	9 12
Potatoes	18	0.6	2 6
Swedes	7	0.7	0 19
Mangolds	7	0.4	0 18
Sugar Beet Pulp, dried	65	5.2	8 14
Beans	66	20.0	10 9
Good meadow hay	31	4.6	4 8
Good oat straw	17	0.9	2 5
Good clover hay	32	7.0	4 16
Vetch and Oat silage	13	1.6	1 16
Barley straw	19	0.7	2 9
Wheat straw	11	0.1	1 8
Bean straw	19	1.7	2 11

* * * * *

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1928

PRODUCE OF HOPS

PRELIMINARY STATEMENT showing the ESTIMATED TOTAL PRODUCTION of HOPS in the years 1928 and 1927, with the ACREAGE and ESTIMATED AVERAGE YIELD per STATUTE ACRE in each COUNTY of ENGLAND in which Hops were grown; and the AVERAGE YIELD per ACRE of the TEN YEARS 1918-27.

Counties, etc.	Estimated Total Produce		Acreage returned on June 4		Estimated Average yield per acre		
	1928	1927	1928	1927	1928	1927	Average of the 10 yrs. 1918-27.
	Cwt.	Cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Kent { East	41,000	41,000	3,280	3,173	12.6	12.9	13.1
Mid	58,000	55,000	4,944	4,790	11.6	11.5	13.5
Weald	63,000	68,000	6,583	6,329	9.6	10.7	11.9
Total, Kent	162,000	164,000	14,807	14,292	10.9	11.5	12.7
Hants	12,500	8,900	987	948	12.7	9.4	10.7
Surrey	1,800	1,600	158	150	11.5	10.8	10.6
Sussex	22,000	22,000	2,146	2,149	10.1	10.3	11.2
Hereford	30,000	41,000	3,739	3,593	8.2	11.3	9.4
Worcester	12,800	17,000	1,794	1,773	7.1	9.8	9.8
Other counties*	1,000	1,000	131	99	7.6	10.1	8.3
Total	242,100	255,500	23,762	23,004	10.2	11.1	11.7

* Salop, Gloucester, and Berkshire.

Note.—Although the acreage returned as under hops on June 4 was slightly larger than the acreage returned in 1927, a decrease in the average yield per acre has resulted in a continuation of the decline in the total production which has occurred each year since the record year of 1924. The total production in England is estimated at 242,100 cwt., or 13,400 cwt. less than in 1927, and about 32,000 cwt. below the average for the 10 years 1918-27. The average yield per acre over the whole of the hop-growing areas is estimated to be 10.2 cwt., compared with an average of 11.7 cwt. for the previous 10 years and with 11.1 cwt. in 1927. Against this decrease must be recorded the fact that this year's crop was picked under exceptionally favourable conditions, and is reported almost without exception to be of unusually good quality.

In Kent, where 162,000 cwt., or nearly 67 per cent. of the total crop, was grown, the yield is estimated to be 10.9 cwt. per acre, compared with 11.5 cwt. in 1927, and 12.7 cwt. for the 10 years 1918-27. It will be seen that the decrease over the whole county for the year is chiefly

due to the drop of over 1 cwt. per acre in the average for the Weald. In East Kent there was little variation from the average yield for 1927, while in Mid Kent the average yield per acre was very slightly higher. Hampshire shows a much improved yield, the average per acre being 12·7 cwt., or nearly 3½ cwt. more than in 1927, and 2 cwt. more than the 10 years' average for this county. Surrey also shows an increase on its average per acre for 1927 and for the 10 years, while Sussex, although only slightly less than its average for last year, shows a yield of over 1 cwt. per acre below the average for the previous 10 years. The yield was relatively much lighter in the West Midland counties, where Hereford with 8·2 cwt. per acre shows over 3 cwt. below the figure for last year and over 1 cwt. less than its 10 years' average, and Worcester about 2½ cwt. below the average both for 1917 and for the years 1918-27.

* * * * *

MISCELLANEOUS NOTES

THE fourth annual award of scholarships from the United Dairies Scholarship Fund has recently been made. The scholarships, which are open to the sons and daughters of farmers and small-holders in Somerset, Cornwall, Devon, and Dorset, are tenable at Reading University, the Somerset Farm Institute, Cannington, Bridgewater, and the Seale-Hayne Agricultural College, Newton Abbot, Devon. Eight scholarships were awarded, the successful candidates being as follows:—

Two Years' Course at Reading University—

R. H. Weeks ; Miss Ida Tiley ; Miss M. Osborne.

Three Years' Course at Reading University—

S. L. Huthnance ; H. H. Mitchell.

One Year's Course at Somerset Farm Institute, Cannington—

C. G. Green ; Miss K. Maddever.

The United Dairies, Ltd., created this Fund, which amounts to £30,000, in 1924 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 terms and conditions of both ordinary and research scholarships for next year will be issued in the spring.

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended September, 1928, compared with the corresponding period in 1927. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	July to Sept., 1928		July to Sept., 1927	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	35	5,204	28	7,233
Belgium	0	0	30	670
Brazil	15	2,765	14	2,785
Colombia	10	241	14	1,229
Uruguay	11	1,400	13	1,210
Canada	128	5,975	134	10,300
Irish Free State ..	362	7,490	702	10,221
Rhodesia	1	450	22	875
Union of South Africa ..	19	1,712	45	3,839
Other countries ..	11	799	42	1,954
Total	592	26,036	1,044	40,316
SHEEP AND LAMBS				
Argentina	96	2,211	185	4,717
Belgium	67	675	0	0
Brazil	19	1,488	9	436
Chile	47	1,234	17	755
Peru	0	0	50	625
Russia	502	5,171	0	0
Uruguay	68	1,529	40	1,340
United States of America	0	0	59	1,052
Canada	231	2,006	326	5,190
Irish Free State ..	179	1,734	1,195	3,279
Union of South Africa ..	10	108	40	428
Other countries ..	7	148	64	976
Total	1,226	16,304	1,985	18,798
SWINE				
Argentina	6	130	9	245
France	3	70	31	232
Latvia	0	0	15	238
Poland	4	198	4	250
Portugal	11	170	0	0
Russia	44	1,065	0	0
Falkland Islands ..	0	0	22	77
Irish Free State ..	52	1,026	421	787
Union of South Africa ..	3	150	10	259
Other countries ..	12	348	19	515
Total	135	3,157	531	2,603

THE Alfa-Laval Company is offering a Scholarship in dairy engineering of the value of £100 a year for four years. The course for the first three years will be in mechanical engineering (with as far as possible a dairy bias). The fourth year will be spent in specialized training in Sweden. Candidates are required to be men of British parentage, and either to be graduates in agriculture with dairy qualifications or to have passed the N.D.D. Examination. The Ministry of Agriculture and Fisheries has agreed to undertake the administration of the scholarship. It will receive and consider applications for the scholarship, make the award, arrange the course, and pay the amounts due under the scholarship.

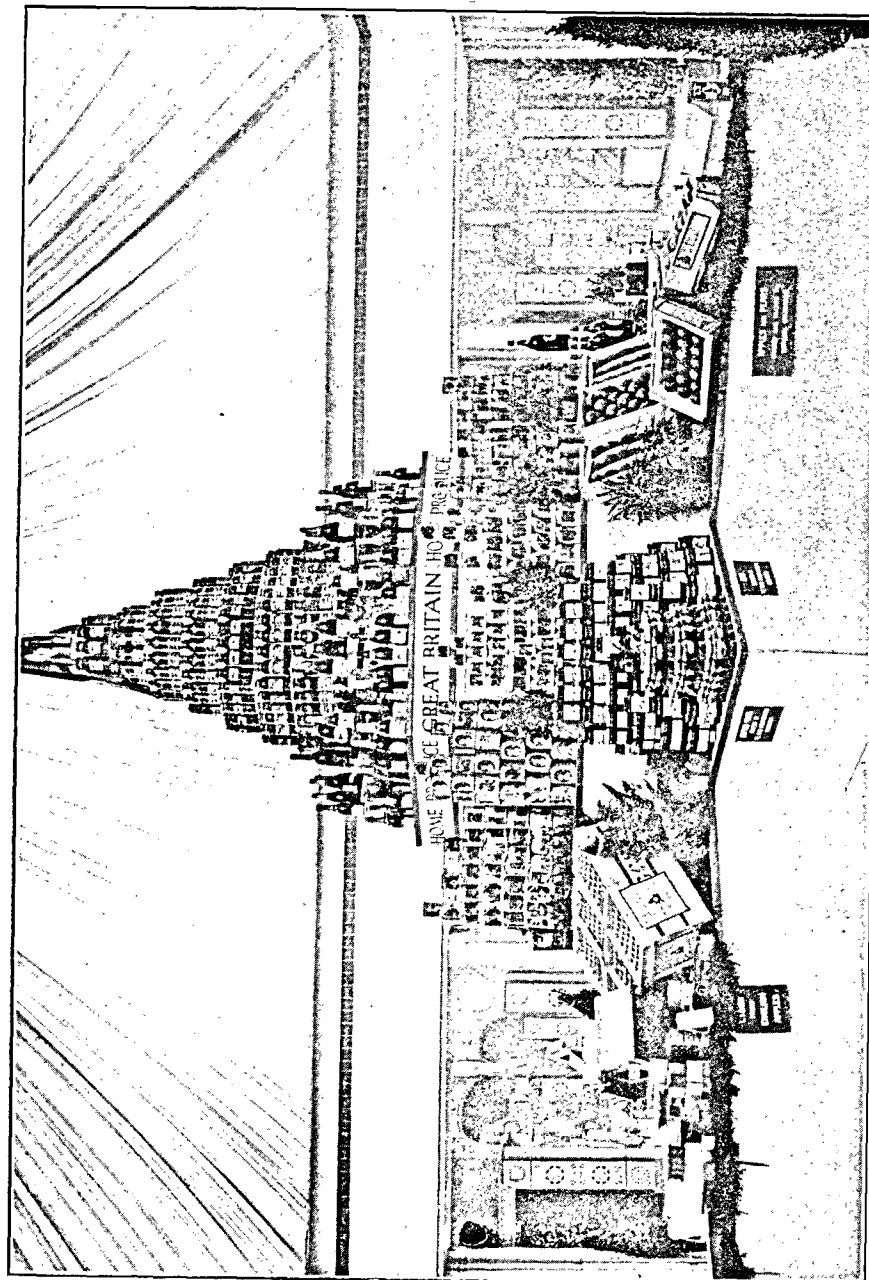
The first scholarship under this scheme will date from October 1, 1929, and applications should be addressed to the Ministry before June 15, 1929. Forms of application will be available in due course.

* * * * *

At the Imperial Fruit Show, which was held at Manchester from October 19-27, the Empire Marketing Board was responsible for the staging of an excellent display of Empire fruit. The home produce section was organized by the Ministry of Agriculture in collaboration with the National Farmers' Union, the Food Manufacturers' Federation, the National Food Canning Council, the British Glasshouse Produce Marketing Association, and the National Association of Cider Makers. The principal feature was a comprehensive display of apples and pears drawn from the main fruit-growing districts of England. A large proportion of this fruit was graded and packed in accordance with the regulations prescribed under the Agricultural Produce (Grading and Marking) Act, 1928, and bore the National Mark. Canned and bottled fruit, jams and cider, glasshouse produce and potatoes, were also well represented.

A grant from the Empire Marketing Board enabled the Imperial Fruit Show Committee to present a gift of Empire fruit to every visitor to the Show; 45 per cent. of the money was allocated to Great Britain, and the distribution of the 22,000 samples involved was made from the Great Britain Stand.

The Civic Authorities of Cardiff organized an "Empire Fortnight," which commenced on October 29, and an



Cardiff Empire Exhibition: Home Produce Stand.

impressive Empire Exhibition was staged simultaneously in the Drill Hall. Great Britain was given the place of honour in the centre of the hall, and arrangements similar to those mentioned above were made for the display of home produce. In addition to fruit and vegetables, bacon, hams, preserved meats, cheese, condensed and dried milk, cereals, and eggs were also shown. The Exhibition was a very great success and attracted 70,000 visitors.

Both at Manchester and Cardiff a feature of the Empire Marketing Board's Section was a kitchen in which demonstrations of cookery were given during the whole period of the Exhibitions. In particular, demonstrations of the more unusual methods of cooking potatoes were given each day. The Ministry's leaflet on this subject was distributed, and an increase in the consumption of potatoes should result. Arrangements were also made for home products to be featured in the various menus.

* * * * *

THE October general index number of prices of agricultural produce was 39 per cent. above the level of 1911-13, or 5 points

lower than in September, but only one

The Agricultural point below the figure recorded a year ago.

Index Number The fall is attributable mainly to the decline in prices for fat cattle, fat sheep

and bacon pigs, and the lower average values for barley, potatoes and hay. The customary autumn rise in milk prices, also, was not so large proportionally as in 1911-13, and the resulting lower index number for this commodity further depressed the general index figure.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13					
	1923	1924	1925	1926	1927	1928
January ..	67	60	71	58	49	45
February ..	63	61	69	53	45	43
March ..	59	57	66	49	43	45
April ..	54	53	59	52	43	51
May ..	54	57	57	50	42	54
June ..	49	56	53	48	41	53
July ..	50	53	49	48	42	45
August ..	52	57	54	49	42	44
September ..	52	61	55	55	43	44
October ..	50	66	53	48	40	39
November ..	51	66	54	48	37	—
December ..	55	65	54	46	38	—

Grain.—Wheat, at an average of 9s. 6d. per cwt., was 4d. dearer than in September, and the index number advanced 6 points to 28 per cent. above pre-war, as against 42 and 53 per cent., respectively, in the corresponding periods of 1927 and 1926. The average for barley declined from 12s. 6d. per cwt. in September to 10s. 9d. in October, and the relative index number fell from 50 to 26 per cent. above the base years 1911-13. Oats also showed a decline, the average being 3d. lower at 8s. 9d. per cwt. and 27 per cent. above pre-war, whereas a year ago oats sold at 33 per cent. above the level of the base years and barley at 62 per cent.

Live Stock.—The decline in fat cattle prices which had been noticeable in previous months persisted during October, and the index number at 31 per cent. above 1911-13 was very similar to that recorded in February of this year. Fat sheep values fell during October, and at 52 per cent. more than pre-war are the same as in October, 1926. Bacon pigs were cheaper than in September by about 6d. per 14 lb. stone dead weight, while pork pigs were a little dearer, the index for the former falling 7 points to 26 per cent. above pre-war, and for the latter rising 1 point to 33 per cent. Dairy cows were appreciably dearer in October, the customary rise in prices at this season being considerably larger than in the three previous years, although the level of prices this October at 39 per cent. above the base years 1911-13 was only 1 point higher than two years ago. The index number for store pigs was 3 points higher on the month, but store cattle and sheep declined to 20 and 54 per cent. respectively above pre-war.

Dairy and Poultry Produce.—The index number for milk declined by 8 points to 57 per cent. above 1911-13, owing to the fact that the increase from summer to winter prices in October was not so large as in the corresponding period of the base years. Butter and cheese advanced in price, the former standing 1 point higher at 55 per cent. above pre-war, and the latter remaining unaltered at 78 per cent., the rise in October being proportional to that in the base years. The index number for eggs advanced to 66 per cent. above pre-war, or the same as in October, 1927, and poultry averaged 51 per cent. as against 43 per cent. a year ago.

Other Commodities.—Potatoes in October sold at about 10s. per ton less than in the preceding month, and the index number declined by 9 points to 51 per cent. above pre-war, and hay at an average reduction of 4s. per ton was 8 points lower at 6 per cent. Apples and pears sold at about the same

prices as in September, but vegetables were a little dearer. Wool prices fell to an average of 70 per cent. above the base years as compared with 76 per cent. in the previous month.

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

Commodity	1926	1927	1928			
	Oct.	Oct.	July	Aug.	Sept.	Oct.
Wheat	53	42	34	30	22	28
Barley	42	62	37	58	50	26
Oats	17	33	58	49	33	27
Fat cattle	35	23	44	40	36	31
Fat sheep	52	41	66	59	59	52
Bacon pigs	74	22	41	36	33	26
Pork pigs	81	35	34	33	32	33
Dairy cows	38	27	34	33	34	39
Store cattle	25	19	31	29	27	20
Store sheep	47	40	67	55	66	54
Store pigs	142	56	25	26	28	31
Eggs	68	66	36	55	52	66
Poultry	48	43	54	45	42	51
Milk	60	57	55	55	65	57
Butter	52	41	50	54	54	55
Cheese	30	56	66	84	78	78
Potatoes	81	72	37	35	60	51
Hay	6	18	11	13	14	6
Wool	32	43	78	76	76	70

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THE Seventh Annual Conference of County and College Poultry Instructors was held on October 23 at the offices of the Board of Education, the Ministry's Poultry Instructors' Poultry Commissioner, Mr. P. A. Francis, Conference, 1928. O.B.E., occupying the chair. Seventy-seven Instructors, Agricultural Organizers, Principals of Colleges, and others, were present.

The Conference was opened by the Minister of Agriculture and Fisheries, who said that since the War the poultry industry had made a very great advance. The number of hens in England and Wales was now 30 per cent. more than in 1913 and the egg production had increased by 70 per cent. He pointed out that the educational and research work, in which the poultry instructors are engaged, was a powerful factor making for the further improvement and efficiency of the poultry industry to-day.

Mr. W. H. Hogg contributed a paper on "What is the most suitable unit for poultry educational and demonstrational

purposes at Agricultural Institutions," after which Mr. P. A. Francis described the progress made in the arrangements for the World's Poultry Congress, 1930. Mr. H. T. Atkinson gave an interesting address on the results of five years' laying trials in Leicestershire; and Major C. H. Eden put forward proposals for the further development of County Egg-Laying Trials. Captain Doyle spoke on "Poultry Diseases," and Mr. A. F. Tomey submitted a scheme for the establishment of Rabbit Breeding Stations. In the afternoon, Mr. A. W. Street dealt with the progress of schemes for the better marketing of poultry produce; Mr. E. T. Halnan raised the question of the standardization of rations at County Egg-Laying Trials; and Mr. H. M. Jelley spoke on a new Egg and Chick Distribution Scheme. All the addresses were followed by open discussion.

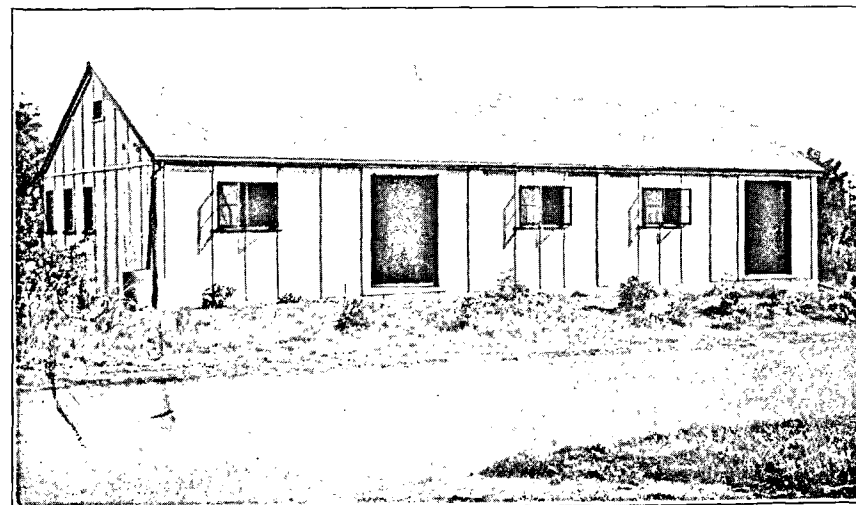
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FURTHER progress has been made with the organization of the egg marketing scheme since that recorded in the November issue of the JOURNAL. By November 7, 1928, applications for accrediting had been received by the Ministry in respect of 65 stations, as follows:—

County	No. of applications received
Bedfordshire	1
Berkshire	4
Cambridgeshire	3
Carmarthenshire	3
Cornwall	9
Devon	3
Essex	2
Gloucestershire	1
Hampshire	3
Hertfordshire	2
Kent	1
Lancashire	2
Lincs (Holland)	1
Lincs (Kesteven)	1
Norfolk	7
Northants	2
Oxfordshire	3
Salop	1
Somerset	8
Sussex	1
Warwickshire	2
Wilts	4
Yorks	1



[By courtesy of "The Norwich Mercury."
Depot of the Norfolk Egg Producers, Ltd., Norwich. The loading bank.



Depot of the Hampshire Egg Producers, Ltd., Four Marks, near Alton.

EGG PACKING STATIONS.

In this connexion the illustrations opposite will be of interest. The Norfolk Egg Producers, Limited, which commenced operations at the beginning of October, is a Co-operative Society registered under the Industrial and Provident Societies Acts; it was formed under the auspices of the National Farmers' Union for the purpose of putting into practice in Norfolk the egg marketing scheme. The depot is at Norwich, where eggs are received, candled, graded and dispatched in non-returnable cases to the centres of demand.

The Hampshire Egg Producers, Limited, of Four Marks, Alton, is an example of how commercial egg farmers who, as individuals, might have difficulty in qualifying for the use of the National Mark as regards turnover, can combine to do so effectively. The station is modelled on the lines of the Cheltenham Egg Packing Station which is described on page 832.

* * * * *

In last month's (November) issue of the JOURNAL, some account was given of the progress of the National Mark Scheme for apples and pears. Since the

National Mark beginning of October, further applications
Scheme for for permission to use the Mark have been
Apples and Pears received, and the number of registered users now stands at 44 for apples and 8

for pears, these latter being registered also for apples.

Fair supplies of National Mark fruit have been reaching the market, although they have been quite inadequate to meet the demand; as a result, every consignment has been quickly sold. A remarkable feature has been the way in which National Mark apples maintained a fair price level on the collapse of the market for imported apples at the end of October and early in November. In this period, National Mark Bismarcks and Bramleys sold fairly freely in Manchester at 12s. per box, while American case apples were down to as low as 7s. 6d.

Further confirmation of the value placed by the trade upon the National Mark Scheme was provided at the Imperial Fruit Show which was held at Manchester from October 19 to 27. The Mark was very much in evidence at the Show, and it was noticeable that authorized users figured prominently as prize winners in the open competitions for various classes of apples and pears.

* * * * *

National Diploma in Poultry Husbandry, 1928.—The Sixth Annual Examination for the National Poultry Diploma was held on September 17 to 21, under the auspices of the National Poultry Council, at the Harper Adams Agricultural College, Newport, Salop. It is satisfactory to note that 30 candidates presented themselves this year, as compared with 17 in 1927, 16 in 1926, and 12 in 1925. The Examination Board announces that the following diplomas have been awarded:—

Passed with Honours.—Miss Helen Mary Molyneux (Harper Adams Agricultural College).

Passed.—Miss Marjorie L. Mann (Instructress, Studley College, Warwickshire); Miss Kathleen Elliott (Midland Agricultural and Dairy College); Miss Myra E. Crossman (Lancashire County Council Farm School); Miss Kate Boyes (Instructress, Oxford County Council); Miss Sarah M. Howe (Harper Adams Agricultural College); Miss Phyllis Irene Price (Lancashire County Council Farm School); Miss Betty Lang (Lancashire County Council Farm School); Miss Winifred C. Davies (Harper Adams Agricultural College); Miss Margaret Leach (Midland Agricultural and Dairy College); Miss Cicely Edith Day (Horticultural College, Swanley).

* * * * *

Tanganyika Territory Agricultural and Industrial Exhibition.—The Board of Trade has been informed by H.M. Eastern African Dependencies Trade and Information Office, 31 Cockspur Street, London, S.W. 1, that an Agricultural and Industrial Exhibition is to be held in the autumn of 1929 at Dar-es-Salaam, Tanganyika Territory. The Exhibition should prove a good opportunity for British manufacturers to bring their products to the notice of buyers in the Territory, and special facilities for exhibits have been promised. Among a number of competitive classes, with awards, which it is hoped to arrange will be *Agriculture*: all products grown in the Territory by natives and non-natives; *Veterinary*: all live stock, including poultry and dairy produce; *Forestry*: all classes of timber and local manufactures therefrom; *Machinery*: industrial, mining and agricultural, including ploughing demonstrations; *Horticulture*; and a *Natural History Section*. The Chairman of the Exhibition Committee is Mr. A. H. Kirby, Director of Agriculture in the Territory; Mr. Ernest Adams, O.B.E., Controller of Customs at Dar-es-Salaam, is Chairman of the Finance Committee, and The Tanganyika Estate Offices, Post Box 220, Dar-es-Salaam (represented on the Committee by Mr. A. L. B. Bennett, D.F.C.), are acting as Secretaries to the Exhibition.

* * * * *

Importation of Animals into Ireland.—As from November 1 the Foot-and-Mouth Disease (Importation of Animals and Poultry) Orders of the Irish Free State and Northern Ireland, which have been in operation since 1924, have been withdrawn. The effect of this is that horses, asses, mules, dogs, foxes, hares, rabbits, live domestic fowls, turkeys, geese, ducks, guinea fowls and pigeons may be imported into Ireland from any part of Great Britain without a certificate as to the freedom of the district of origin from Foot-and-Mouth Disease. Permits, however, must still be obtained from the Department of Agriculture, Dublin, or the Ministry of Agriculture, Belfast, as the case may be, for the importation into Ireland of horses, asses and mules.

There is a general prohibition on the importation into Ireland from Great Britain of hay, straw and peat moss, and their use in connexion with the transport of animals or poultry should accordingly be avoided, unless a special permit has been obtained from the Irish Department of Agriculture concerned.

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on October 23 and November 12, at 7 Whitehall Place, 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:—

Cambridgeshire and Isle of Ely.—An Order to come into force on November 1 (when the existing rates are due to expire) and to continue in operation until October 31, 1929, fixing minimum and overtime rates of wages for male and female workers. The minimum rates in the case of male workers of 21 years of age and over are, for horsemen, cowmen and shepherds (other than stockmen or yardmen), 37s. per week for the hours necessary for the performance of the customary duties of workers so employed, and for other male workers 30s. per week of 48 hours in winter and 50 hours in summer, except during the weeks in which Christmas Day and Good Friday fall, when the number of hours in respect of which the minimum weekly wage is payable are 40 and 42 respectively. The overtime rates for male workers of 21 years of age and over (other than workers of the special classes) are 9d. per hour on weekdays 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 to come into force on November 1 continuing the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until October 31, 1929. 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. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour for all time worked, provided that, in the case of milkers the wages shall be not less than 6d. per "meal," that is, each occasion on which the worker visits her place of employment for the purpose of milking.

Shropshire.—An Order to come into force on November 19 continuing the existing minimum and overtime rates of wages for male and female workers, with an amendment in respect of overtime employment on Sunday. The minimum rate in the case of male workers of 21 years of age and over is 32s. 6d. per week of 54 hours, with overtime at 9d. per hour, except in respect of employment on Sunday other than employment in connexion with the care of and attention to live stock, when the overtime 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. This Order will continue in operation until further notice.

Warwickshire.—An Order to come into force on October 28 continuing the operation of the existing minimum and overtime rates of wages for male and female workers until October 27, 1929. 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.

Wiltshire.—An Order to come into operation on December 23, 1928, and to continue in force until December 21, 1929, fixing

minimum and overtime rates of wages for male workers and minimum rates of wages for female workers in substitution for the existing rates, which are cancelled as from December 22, 1928. The minimum rates in the case of male workers of 21 years of age and over are 30s. per week of 50 hours, except during the weeks in which Christmas Day and Good Friday fall, when the number of hours in respect of which the minimum weekly wage is payable is 41. The overtime rate in the case of male workers of 21 years of age and over is 8d. 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.—(1) An Order to come into operation on November 24 (when the existing rates are due to expire), and to continue in force until November 23, 1929, fixing minimum and overtime rates of wages for male and female workers. 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; 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 Sunday 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 are: Foremen, 32s.; beastmen and shepherds, 29s.; waggoners, 28s. per week, 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 of age and over who are not boarded and lodged by their employer is 35s. 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 16 years of age and over the minimum rate is 6d. per hour, with overtime at 9d. per hour.

(2) An Order fixing special differential rates of wages for overtime employment on the corn harvest in 1929, the rates in the case of male workers boarded and lodged by their employer 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.

West Riding of Yorkshire.—An Order to come into force on November 24, continuing with certain amendments the operation of the existing minimum and overtime rates of wages for male and female workers until November 23, 1929. The minimum rates of wages for 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 0s. 0d. 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 3 hours on Sunday for work in connexion with the care of and attention to stock. In the case of waggoners and other horsemen of 21 years of age and over who are not boarded and lodged by their employers, the minimum rate is 42s. for the same number of hours as in the case of workers living in. The minimum rate for other classes of 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 of wages 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.

Carmarthen.—An Order to come into force on November 15 continuing the operation of the existing minimum and overtime rates of wages for male and female workers until November 14, 1929. The minimum rate in the case of male workers of 21 years of age and over is 31s. for a 7-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.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending November 15 legal proceedings were instituted against 16 employers for failure to pay minimum and overtime rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fine		Costs		Arrears of wages		No. of workers concerned
		£	s. d.	£	s. d.	£	s. d.	
Derby	.. Dronfield ..	2	0 0	4	3 0	45	0 0	2
Gloucester	.. Newent ..	6	0 0	—	—	76	5 4	3
Hants	.. Whitchurch ..	—	—	2	0 6	14	11 1	3
Hereford	.. Hay ..	2	0 0	—	—	27	7 0	1
Lancs	.. Chorley ..	*	—	—	—	37	15 0	3
"	.. Bolton ..	12	0 0	—	—	41	10 0	3
Notts	.. Retford ..	—	—	—	—	—	—	3
Salop	.. Clun ..	*	—	0	18 0	25	0 0	1
"	.. " ..	—	—	0	13 0	5	7 3	1
Somerset	.. Bridgwater ..	4	0 0	—	—	68	8 0	3
Wilts	.. Pewsey ..	8	0 0	—	—	35	0 0	2
Yorks N.R.	.. Thirsk ..	5	0 0	0	17 6	3	5 0	1
"	.. " ..	1	10 0	0	10 0	15	0 0	1
"	.. Bedale ..	8	0 0	1	0 0	30	14 4	4
"	.. W.R. .. Sheffield ..	2	0 0	—	—	35	17 7	2
Carmarthen	.. Whitland ..	—	—	—	—	—	—	1
		£50	10 0	£10	2 0	£461	0 7	34

* Dismissed under Probation of Offenders Act.

* * * * *

Wages for Public Holidays in Essex: Appeal Result.—In the JOURNAL for June, 1928, it was reported that an Appeal was pending against the decision of the Chelmsford magistrates in regard to the effect of the Order of the Essex Agricultural Wages Committee defining employment on certain Public Holidays as overtime. The magistrates

accepted the Ministry's view that in weeks in which Public Holidays fell, workers were entitled under the terms of that Order to the weekly minimum wage, and in addition overtime payment for any work actually performed on the holiday. The Ministry also contended that in the event of the worker not being required to work on the Public Holiday he was nevertheless entitled to the full weekly minimum wage. The defendant in the Chelmsford case appealed against the magistrates' decision, but the High Court on November 20 dismissed the Appeal.

Farmers in Essex and other areas where similar Orders operate are requested to make a particular note of the general effect of this High Court decision, in view of the imminence of Christmastide. Orders of a somewhat similar character are in force in Bedfordshire and Huntingdonshire, Buckinghamshire, Cambridge, Dorset, Middlesex, Northumberland, Oxford, Salop, Suffolk, Wiltshire, East Riding of Yorkshire, Pembroke and Cardigan, and proposals to make similar Orders have been issued by the Berkshire and Hampshire Agricultural Wages Committees. Copies of the Orders and Proposals may be obtained free of charge on application to the Ministry.

A full note of the Appeal will appear in next month's JOURNAL.

Foot-and-Mouth Disease.—Outbreaks have been confirmed at five fresh centres as follows: At Hextable, Sutton-at-Hone, Kent, on October 20; at Crewe, Cheshire, and at Tamerton Foliot, Plymouth, Devon, on October 26; at Eype, Bridport, Dorset, on November 3; and at Tarrant Monkton, Blandford, Dorset, on November 4. The usual restrictions were applied to areas of approximately 15 miles round the infected premises, but the area in the case of the Kent outbreak did not include any country to the north of the River Thames. One further outbreak occurred in that area, and 10 further outbreaks have been confirmed in the Devon area; there has been no spread of disease from any of the other three centres.

Restrictions were withdrawn in the Yorks, East Riding and Gloucestershire Infected Areas—referred to in the November issue of this JOURNAL—on October 28 and November 7 respectively, and in the Kent Infected Area on November 19.

One hundred and thirty-one outbreaks in all have been confirmed since January 1 last, involving 19 counties, and the slaughter of 3,959 cattle, 4,887 sheep, 2,075 pigs and 17 goats.

APPOINTMENTS: CHANGES AND CORRECTIONS

COUNTY AGRICULTURAL EDUCATION TEACHING STAFFS:

ENGLAND

Cornwall: Miss E. Walters, N.D.D., B.D.F.D., has been appointed Assistant Instructress in Dairying, *vice* Miss G. Lyne.

Cumberland: Mr. M. B. Smithson has been appointed Chief Instructor in Poultry-keeping.

Dorset: The temporary appointment of Instructress in Dairying, held by Miss E. Bucknell, N.D.D., has been made an established post.

Hampshire: Mr. O. Anderson, M.Sc., has been appointed Warden of Hostel and Lecturer in Agriculture at the Sparsholt Farm Institute, *vice* Dr. T. H. Rose.

Staffordshire: Mr. R. A. Jeffery, N.D.A., N.D.D., has been appointed Warden and Instructor in Dairying at the Staffordshire Farm Institute, *vice* Mr. E. Knowles.

WALES

Monmouthshire: Mr. L. T. Lowe, B.Sc., has been appointed as an Assistant Lecturer in Agriculture. (Additional appointment to those already notified in this JOURNAL.)

TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., ENGLAND

Royal Agricultural College, Cirencester.

The staff list, published in this JOURNAL for September, 1928, should read as under:—

<i>Principal</i>	J. A. HANLEY, A.R.C.Sc., Ph.D.
<i>Vice-Principal</i>	J. F. H. THOMAS, B.Sc., N.D.A.
<i>College Warden and Bursar</i> ..	P. S. BROWN, N.D.A.

Agriculture:—

<i>Crop Husbandry</i>	The Principal: P. S. BROWN, N.D.A.
<i>Animal Husbandry</i>	J. F. H. THOMAS, B.Sc., N.D.A.
<i>Dairy Husbandry</i>	J. F. H. THOMAS; H. E. WELLS, N.D.A., N.D.D.

Estate Management, Bookkeeping .. S. W. EDWARDS, P.A.S.I., A.A.I.

Agricultural Economics C. V. DAWE, M.Com.

Veterinary Science A. C. DUNCAN, F.R.C.V.S.

Forestry A. D. C. LE SUEUR, F.S.I., Dip. For.

Agricultural Science The Principal: J. F. H. THOMAS, B.Sc., N.D.A.

Agricultural Implements and

<i>Engineering</i>	G. W. CHANNON, N.D.A., B.D.F.D.
<i>Poultry Management</i>	H. E. WELLS, N.D.A., N.D.D.

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ADDITIONS TO THE LIBRARY

Carlos, A. S.—Feeding Stuffs (152 pp.) London: Chapman & Hall, 1928, 5s. [63.6043; 63.60432.]

Kansas Agricultural Experiment Station.—Technical Bulletin No. 23. The Importance of Vitamin A and Vitamin C in the Ration of Swine; concerning Especially their Effect on Growth and Reproduction. (47 pp.) Manhattan, 1928. [612.394; 63.64 : 043.]

Dairying

Larsen, C. W., and Putney, F. S.—Dairy Cattle Feeding and Management. Second Edition. (450 pp.) New York: John Wiley; London: Chapman & Hall, 1928, 20s. [63.711; 63.711 : 043.]

East Anglian Institute of Agriculture.—Bulletin No. 2, 1928. Modern Methods of Milk Production. (8 pp.) Chelmsford, 1928. [63.71; 63.718.]

Miyawaki, A.—Condensed Milk: A Study of Condensed, Evaporated and Powdered Milk. (380 pp.) New York: J. Wiley; London: Chapman & Hall, 1928, 22s. 6d. [63.715.]

Comité de Défense des Agriculteurs.—Le Lait: Production—Prix-Consommation. (34 pp.) Confédération Nationale des Associations Agricoles, Paris, 1928. 2 fr. [63.71; 63.714.]

Walker-Tisdale, C. W., and Woodnutt, W. E.—Practical Cheese-making. A General Guide to the Manufacture of Cheese. (204 pp.) 3rd Edition, London: Allen & Unwin, 1928, 4s. 6d. [63.73.]

U.S. Department of Agriculture.—Bulletin No. 608. Varieties of Cheese: Descriptions and Analyses. (68 pp.) Washington, 1928. [63.73.]

Irish Free State.—Report of the Inter-Departmental Committee to advise as to the Cleanliness and Wholesomeness of the Milk Supply. (49 pp.) Dublin: Stationery Office, 1928, 9d. [63.71; 614.32.]

Poultry and Small Live Stock

Third World's Poultry Congress, Ottawa, Canada.—Report of the Proceedings, July 27 to August 4, 1927. (538 pp.) (Obtainable from Harper Adams Agricultural College, 12s. 6d.) [63.65.]

Hertfordshire Institute of Agriculture.—No. 212. The Herts County Egg-Laying Trials Point the Way to Successful Poultry-keeping, by D. W. Ferguson, (21 pp.) Oaklands, St. Albans, 1928. [63.651.]

Harper Adams Agricultural College.—The National Institute of Poultry Husbandry. (48 pp.) Newport, Salop, 1928. [37.6265: 63.65.]

Carter, Capt. H. F.—A Manual of Management for Duck Keepers. (76 pp.) Utility Duck Club, Eastleigh, Hants, 1928, 3s. 6d. [63.657.]

U.S. Department of Agriculture.—Farmers' Bulletin, No. 767. Goose Raising (14 pp.) Washington, 1928. [63.658.]

Winter, Elsie L.—How to Make £5 a Week from Angora Rabbits in your Spare Time. (60 pp.) London: Austin Rogers, 1928, 9d. [63.69.]

Veterinary Science

University College of South Wales and Monmouthshire.—Advisory Leaflet; Liver Fluke in Sheep. (3 pp.) Cardiff, 1928. [619.3.]

Australian Council for Scientific and Industrial Research.—Pamphlet No. 5: Liver Fluke Disease in Australia—Its Treatment and Prevention. (23 pp.) Melbourne, 1928. [619.3.]

League of Nations (Health Organization).—Reports to the International Rabies Conference, held at the Pasteur Institute, Paris, April 25 to 29, 1927. (164 pp.) Geneva, 1927. [619.7.]

United States Department of Agriculture.—Technical Bulletin, No. 76:—Report of the Foot-and-Mouth Disease Commission of the United States Department of Agriculture. (172 pp.) Washington, 1928. [619.2.]

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Wool

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THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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NOTES FOR THE MONTH

The Ministry has lately had to consider what steps it could usefully take to secure the permanent consolidation and development of the Young Farmers' Clubs movement. There are now nearly one hundred active clubs in England and Wales, with a total membership of about 2,000 boys and girls. These young people, under the guidance of a committee, and with the help of a Club leader, engage in the business of rearing calves, pigs, and small live stock, including poultry and the production of eggs, and some of them grow vegetables and fruit.

For some time the Ministry has supervised the formation of these clubs, but it was never intended that the headquarters of the movement should remain permanently at the Ministry. If it has the funds, a Government Department can provide, or arrange for, the technical advice required by the clubs; but it cannot easily organize guidance and assistance to the club members in conducting club business, emphasize the social and educational side of the movement, or, above all, develop the club spirit. For these purposes, there is required the free action of a voluntary and self-governing organization independent of State control. If any proof is needed on this point, it is supplied by the history and success of such bodies as the Boy Scouts and the Women's Institutes.

It is felt, therefore, that the time has come when the first steps should be taken towards the formation of an association which will link together Young Farmers' Clubs and help to spread the movement all over the country. To this end, the Ministry invoked the aid of the various organizations interested in the problems of country life, many of which are working together as members of the National Council of Social Service. Believing that the clubs will welcome this step, the Ministry has invited the National Council to help in building up such an association of clubs, and the Council has agreed to do so. With this object in view, the Council will from now

onwards be responsible for the propaganda and organizing work formerly undertaken by the Ministry, and all further correspondence on club matters should be addressed to the National Council of Social Service, 26 Bedford Square, London, W.C. 1.

The Ministry wishes to make it clear that it regards the development of the movement as an integral part of agricultural education as well as of the broader purpose of creating a full and varied rural life. The Ministry will continue to be closely associated with the movement, and to take the most active interest in it; in particular, it will, in co-operation with local education authorities and agricultural colleges, do its utmost to ensure that, as far as available funds permit, the Clubs shall obtain the technical advice and help which is so valuable, and indeed indispensable, to them.

In making this preliminary announcement of the change, it may be added that the Ministry will discuss the detailed plans for the future at the annual conference of Young Farmers' Clubs which will be held early in this year.

* * * *

For some five years past *The Field* newspaper has conducted a careful inquiry into the subject of distemper in dogs, a trouble which has been the bugbear of all dog lovers. With the aid of a fund raised through its efforts *The Field* enabled serious researches to be carried out by Dr. Laidlaw and Mr. G. W. Dunkin, D.V.H., M.R.C.V.S., at the Mill Hill laboratories of the Medical Research Council. As a result of this work *The Field* announced, in its issue of November 29 last, that a complete preventive of distemper had been discovered. The report of the investigators was submitted on their behalf to the Field Distemper Council at a meeting over which the Duke of Portland presided, and to the Medical Research Council, of which Earl Balfour is President. The report in full was published in *The Field*, with an introduction by Sir Charles Martin, F.R.S.

Many difficulties were encountered in finding the true nature of the virus or poison which produces distemper in dogs, but it is stated to have been identified beyond doubt. This having been accomplished, the task of employing it so as to render dogs immune from attacks of distemper presented further difficulties, but it is now established that dogs can be completely immunized.

The most convincing demonstration of this is afforded by the fact that no fewer than 1,300 dogs and hounds of many breeds have been inoculated with success. All these dogs after treatment at the Distemper Research Station proved to be completely resistant to the disease afterwards, whether they were exposed to infection by close contact with other dogs suffering from acute distemper, or whether an attempt was made to inoculate them with the actual poison of distemper.

The method of preventing distemper in any given dog consists of a double inoculation. Distemper occurs in dogs, not as was once supposed by a visible germ or micro-organism, but by an invisible one which is recognizable only by the virus or poison which is the sign of the organism's presence. The virus is the concomitant of the organism causing distemper in dogs and is present in all cases of distemper. The first inoculation of the dog which is selected for treatment is made with a vaccine which is in fact the virus of distemper made inactive by laboratory treatment. The second inoculation is made after an interval of about ten days with a weak or attenuated strain of the living virus. This dose of living virus is a hundred times as much as that which would suffice to infect any dog with distemper which had not been previously vaccinated with the first vaccine, or had not suffered from distemper already. With a dog so vaccinated, however, the dose of living poison produces only slight symptoms, sometimes none at all, because it is rendered partially immune by the first vaccination. The second vaccination makes it completely and permanently immune.

The preparations of the vaccine and of the virus requisite for the inoculations are not yet available for distribution among the general public, or even among veterinary practitioners, who are the proper people to employ them; but arrangements will be made for their production by responsible biological chemists on a scale such as will make them generally available.

* * * *

THE distribution of awards to the winners of the Inter-County Clean Milk Competition for England and Wales, 1927-28, held under the auspices of the British Dairy Farmers' Association, took place at the Dairy Show on Tuesday, October 23, 1928, the prizes being presented by the Minister of Agriculture and

Fisheries. The competition was instituted in 1926-27, when it was won by Cornwall; thus this is the second year of the competition. Eight counties competed as against 11 last year, and over 250 dairy herds with nearly 9,000 cows were included. All the counties also held clean milk demonstrations and/or milkers' competitions.

Mr. Whitley (British Dairy Farmers' Association), in opening the proceedings, said that there was a great difference in the milk supply of to-day and that of 20 years ago. The improvement in cleanliness was so great that it could hardly be expressed, and this happy state of affairs was largely due to the work which was being carried out throughout the country by the staffs of local education authorities and other bodies co-operating with them. He hoped that the public would note the clean milk supply now available, and he felt sure that if more milk were consumed, the nation would be more efficient as a whole.

The Minister, in presenting the prizes, expressed his appreciation to Mr. Stapleton for having given the Cup, and to the British Dairy Farmers' Association for having instituted this admirable competition. He complimented Essex on their splendid example of what could be done by co-operation on the part of all those concerned, and said he was glad to see that they had won this year, particularly as they were the first county to hold a county Clean Milk Competition in this country, *viz.*, in 1920. After making favourable references to Cornwall, Berkshire, Suffolk, and Wiltshire, who occupied second, third, fourth, and fifth places respectively, the Minister said that he hoped more entries would be forthcoming in future years, and, in particular, he would like to see counties from the North of England and Wales in the Competition, none of which had, so far, entered.

Commenting generally on clean milk production, the Minister said that if the producer is to get a satisfactory return for his milk, the consumer must be satisfied with the supply. He was glad to observe in the Ministry of Health report just published, that the figures given by the Public Analyst in regard to the testing of milk, showed better results than in previous years. The awards were as follows:—

Winning County (Essex), Stapleton Cup.

Leading Competitor in Essex Clean Milk Competition, Lord Rayleigh, £50. (Mr. G. M. Strutt attended to receive this cheque.)

Leading Competitor in Cornwall Clean Milk Competition, Mr. R. J. Dunstan, £25.

Leading Competitor in Berkshire Clean Milk Competition, Mr. E. G. W. Wilson, £10.

Head Cowmen of the above three Competitors, Mr. G. Cloughton, Mr. Wm. Ashwin, and Mr. F. C. Futcher, £10, £8, and £6 respectively.

The system of marking is indicated in the following statement of marks awarded to the leading counties.

COUNTY CLEAN MILK COMPETITIONS	Essex	Cornwall	Berkshire
For each herd in excess of 30	70	—	—
For each herd competing for first time 5 ..	65	70	35
In a competition embracing not less than 20 herds, for each 1 per cent. of herds gaining not less than 75 per cent. of possible marks for Inspection 5 ..	455	318	437
Ditto for Bacteriological Count 5 ..	432	500	458
Ditto for absence of <i>B. Coli</i> 5 ..	409	477	458
Ditto for Keeping Quality 5 ..	364	477	125
Ditto for Fat 1 point	59	91	71
Ditto for absence of Sediment 1 ..	95	100	100
CLEAN MILK DEMONSTRATIONS			
On the relationship of the total number of attendances of bona-fide farmers at clean milk demonstrations held on farms to the total number of dairy farmers in the administrative area			
For each 1 per cent. .. 10 points	980	359	109
MILKERS' COMPETITIONS			
For each competitor gaining not less than 75 per cent. possible marks 2 ..	342	576	110
For each 1 per cent. of competitors gaining not less than 75 per cent. possible marks 3 ..	285	287	289
LICENSED PRODUCERS			
For each licensed producer of Certified Milk 5 ..	25	—	30
For each licensed producer of Grade "A" (T.T.) milk .. 5 ..	60	10	140
For each licensed producer of Grade "A" milk .. 3 ..	120	57	—
For each producer taking out a licence for Graded Milk for the first time, during the year of competition .. 5 ..	65	25	10
	3,826	3,347	2,372

THE Report of proceedings under the Diseases of Animals Acts for the year 1927 gives particulars of an important amendment of the legislation governing procedure in dealing with contagious diseases of animals, passed through Parliament during the year under the title of the Diseases of Animals Act, 1927. The effect of this new legislation is set out in detail.

The Report contains a detailed narrative of the outbreaks of foot-and-mouth disease during the year and up to March, 1928, when the serious outbreak in the Midlands which commenced in December, 1927, was finally stamped out. It also describes the steps which have been taken by the Ministry of Agriculture to prevent as far as practicable the introduction of the disease from South America.

During the year an Order was issued entitled the Transit of Animals Order of 1927, which consolidated and strengthened the provisions of the existing orders for preventing avoidable suffering to animals in transit by land in Great Britain and by sea between the ports in Great Britain, Ireland, the Channel Islands and the Isle of Man, and also coastwise in Great Britain. The Report explains the new provisions.

The results of the administration of the Tuberculosis Order of 1925 are fully recorded. Statistics are given showing the numbers and classes of animals slaughtered under that Order, the results of the post-mortem examinations and the compensation paid.

The Report also includes records and statistical tables showing the incidence of the other scheduled diseases, namely, Sheep Scab, Swine Fever, Anthrax, Glanders and Parasitic Mange, and as to the numbers and classes of animals imported and exported.

The Report may be obtained from the Sale Offices of His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2, or through any bookseller, price 2s., post free 2s. 2d.

* * * * *

THE following summarized statement indicates the progress that has been made during the past two years in connexion with county clean milk competitions organized by Local Authorities for Agricultural Education. The competitions have all been organized on the lines of the scheme set out in the Ministry's "Guide to the Conduct of Clean Milk Competitions."*

Instruction in Clean Milk Production

organized by Local Authorities for Agricultural Education. The competitions have all been organized on the lines of the scheme set out in the Ministry's "Guide to the Conduct of Clean Milk Competitions."*

* Miscellaneous Publications, No. 43 (Price 4d., post free, direct from the Ministry).

It will be observed from the summary that the number of competitors in each of the two years under review exceeded 1,000. In view of the limited staff at present available for advisory work, this appears to represent the maximum number of competitors who can be efficiently instructed in any one year, and arrangements have been made, therefore, whereby first consideration of entry is given to producers who have not previously competed, or who have not already gained a certificate. In this connexion it may be pointed out that there were 596 new entrants in last season's competitions, and that a total of 2,550 individual producers have taken part in the movement since its inception. Perhaps the most important statement from the consumers' point of view is that the competitions have demonstrated that milk which is produced under hygienic conditions will keep sweet and untainted at a temperature of 60° F. for two and a half to four days.

Although the scheme for clean milk competitions is probably the most effective of special education schemes connected with the production of clean milk, there are other schemes which play an important part in the general campaign towards improvement. Thus, clean milk lectures, exhibits and demonstrations are given at local centres and agricultural shows in most counties by the staff of the Local Education Authority, the total attendance each year being about 18,000 to 20,000. In addition, milkers' competitions are held either at agricultural shows or on the farms of competitors in the county clean milk competitions, and in most cases instruction is provided before the competition is held. Marks are awarded on a definite scale (see the Ministry's form A. 241/T.D.), which takes into account both efficiency and cleanliness. During the year 1927-28, 92 milkers' competitions were held, with 1,376 competitors, compared with 43 competitions and 828 competitors in the previous year.

General advisory work in clean milk production is carried out both in connexion with, and apart from, the special schemes. In most counties the staff of the Local Authority for Agricultural Education are available to help those who seek advice; in addition there is available in each Agricultural Province an advisory service for the bacteriological testing of milk samples for a moderate fee. Producers wishing to avail themselves of such advice and service should communicate with the Agricultural Organizer for their county.

CLEAN MILK COMPETITIONS.
April, 1926, to March, 1927, and April, 1927, to March, 1928.

County	Competitions commenced 1926-27					Competitions commenced 1927-28					Individual producers who have competed at least once	
	Com- petitors	Cows	Samples ex- amined	Samples reaching Grade "A" standard	Total advisory visits	Com- petitors	No. of producers com- peting for first time	Cows	Samples ex- amined	Samples reaching Grade "A" standard		Total ad- visory visits
Berks ..	22	901	264	229	25	24	7	824	288	271	30	47
Bucks ..	28	576	164	121	112	31	13	692	204	153	193	65
Cambridge ..	—	—	—	—	—	21	21	596	158	107	64	21
Cheshire ..	17	506	131	98	25	26	21	1,227	222	178	56	67
Cornwall ..	22	342	279	263	286	23	15	453	207	202	115	58
Cumberland & Westmorland ..	25	859	175	103	50	19	10	660	57*	28*	38	41
Devon ..	29	413	208	164	174	—	—	—	—	—	—	62
Dorset ..	33	1,232	384	181	429	7	1	206	42	22	12	53
Durham ..	—	—	—	—	—	15	11	305	116	78	65	22
Essex ..	61	2,198	854	678	130	44	13	1,989	396	373	120	108
Gloucester ..	22	537	129	101	66	31	13	883	186	156	118	42
Hants ..	72	2,594	424	98	288	116†	48	4,215†	335†	126†	244†	120
Hertford ..	33	1,280	264	173	80	35	10	1,285	315	266	85	52
Kent ..	32	883	779	501	108	33	10	696	245*	206*	79*	113
Leicester ..	8	167	56	42	12	56	54	642	342	88	89	79
Lincs, Kesteven ..	27	410	162	45	180	18	14	226	110	61	142	65
" Lindsey ..	21	242	262	162	128	15	10	221	118	96	90	37
Middlesex ..	15	570	180	92	80	11	2	522	99	77	60	25
Northants ..	30	571	174	70	120	26	9	550	136	116	138	39
Northumberland ..	24	504	192	133	84	26	19	625	182	139	78	61

Notts ..	17	345	204	130	51	34	30	454	299	199	85	83
Oxford ..	15	473	179	113	110	14	10	473	94*	83*	73	36
Rutland ..	13	237	94	45	117	—	—	—	—	—	—	13
Salop ..	17	493	102	76	17	17	9	468	85	65	17	29
Somerset ..	85	2,109	960	653	255	73	2	2,832	60*	48*	219	218
Stafford ..	20	616	120	113	20	—	—	—	—	—	—	20
Suffolk East and West ..	29	700	348	232	78	31	11	775	279	249	124	53
Surrey ..	39	1,132	470	357	100	45	11	1,250	407	291	170	109
Sussex East ..	68	1,900	322	89	272	63	18	1,800	114*	64*	156*	140
Sussex West ..	40	1,047	475	316	95	22	15	612	187	92	80	114
Warwick ..	26	645	312	162	130	29	19	719	261	129	145	45
Wilts. .	50	2,016	639	450	200	41	22	2,009	367	263	160	153
Worcester ..	14	346	168	136	56	12	7	290	108	96	60	34
Yorks ..	28	442	252	220	42	39	23	784	472	420	58	76
Anglesey ..	9	238	81	51	36	10	6	148	90	68	48	16
Brecon and Radnor ..	—	—	—	—	—	8	5	144	64	53	40	21
Cardigan ..	24	269	198	150	96	26	12	310	156	94	30	26
Carmarthen ..	9	204	72	49	18	11	10	263	99	66	15	33
Denbigh ..	—	—	—	—	—	65	63	1,085	372	285	70	80
Flint ..	12	200	86	37	24	16	15	318	128	86	40	34
Montgomery ..	13	193	98	67	65	—	—	—	—	—	—	18
Pembroke ..	13	226	104	82	91	11	7	176	99	67	121	23
Total ..	1,062	28,616	10,355	6,782	4,248	1,144	596	31,727	7,499	5,461	3,527	2,550

* These figures are incomplete, as the competitions were still in progress at the time of making the return.

† Two competitions were commenced in Hampshire, one of which was still in progress at the time of making the return. Derbyshire is omitted from the statement, as the scheme in that county was organized on modified lines.

At the Imperial Fruit Show, held at Manchester last October, Mr. R. G. Hatton, Director of the East Malling Horticultural Research Station, gave an address to fruit growers, and his advice may usefully be summarized here. Mr. Hatton dealt principally with the results of experiments and observations at East Malling with regard to winter pruning, spraying, manuring, and thinning, and to some extent the selection of root stocks.

Improved Fruit-Growing

Winter Pruning.—In the experiments at East Malling, there is no doubt that pruning has increased the size of the fruit. Trees that were lightly pruned in winter have borne larger fruit than unpruned trees, and those whose leaders had been tipped and spur-pruned annually have borne larger fruit than those unpruned or lightly thinned. How these results come out in the year's accounts will be seen when it is stated that the return per acre from unpruned trees of the variety Lord Derby was £32, and from the tipped and spur-pruned trees of the same variety, £40. In the case of Lane's Prince Albert, unpruned trees gave a return of £44 an acre against £56 from tipped and spur-pruned trees. In the case of Rival, the figures were £56 an acre from unpruned trees, and nearly £79 from tipped and spur-pruned trees. It seems that severe spur-pruning becomes more and more justified with the advancing maturity of the tree. From 10 years old and onwards such pruning has had a marked effect on the size of the fruit.

General pruning also helps very much in the control of Apple Scab, as spraying is more effective where the trees have well-spaced branches, and there is less wood and consequently fewer centres of infection to spray. Figures provided by Mr. Grubb, of the East Malling Research Station, show that, in 1921, scabbed fruit was as much as 40 per cent. on unpruned and open-centred trees, and only 5 per cent. or even less on tipped trees. The past season's figures are 62 per cent. scabbed from unpruned unsprayed trees, and 40 per cent. scabbed from tipped and spurred trees, which were also unsprayed. Furthermore, pruning reduces the number and extent of blemishes caused by wind injury.

Spraying.—As regards spraying, the figures given for the East Malling operations in 1919 show that, in the case of the variety James Grieve, the percentage of clean fruit on tipped trees which had been sprayed was 77, as against 40 per cent. of clean fruit on the unsprayed trees. In 1920 the figures were 77 and 19 respectively. In the past season, the sprayed

trees gave 91 per cent. of fruit unblemished by scab, unsprayed trees gave only 38 per cent.

It will be seen, therefore, how very effective good spraying can be under conditions which are no doubt quite normal, but Mr. Hatton pointed out that many a crop full of promise has been ruined by injudicious spraying, and he emphasized the importance of having demonstrations of proper spraying on a commercial scale carried out by experts to show how spraying should be done. There is a likelihood of such demonstrations being arranged, and carried out in fruit-growing districts this season. The Ministry is, in fact, discussing the matter with the National Farmers' Union, and in due course will announce the dates and places of the demonstrations for the information of growers.

A typical spraying schedule for a plantation 10 years old is as follows: (1) In mid-January a 10 per cent. tar-distillate was carefully sprayed to cover the whole tree, costing about 8d. a tree, or £7 6s. an acre. (2) Then, towards the end of April, a spray of lime-sulphur and arsenate of lead, with a little gelatine—average cost about 4½d. a tree, or £4 3s. an acre. (3) Then, towards the end of May, the first post-blossom spray, lime sulphur, arsenate of lead and gelatine as before with a little nicotine, 5 oz. to 100 gallons, average cost 5½d. a tree, or £5 an acre. (4) Finally, in the middle of June a second post-blossom spray, colloidal sulphur, soft soap and nicotine, average cost 2½d. a tree, or £2 11s. per acre. Thus the total cost of one year's spraying programme of four sprays is reckoned at a little under £20 an acre. Mr. Hatton considers that on scab-susceptible varieties a cost approaching this figure must be faced by commercial growers who aim at producing first quality fruit. On varieties resistant to scab the cost should be considerably less. There is, besides, as might be expected, a cumulative effect through spraying for two or more years. Moreover, the whole programme must be carried out each year if done at all. In Mr. Hatton's opinion the random omission of any item in a logical spraying schedule may have very serious consequences. In the case of Worcester Pearmain and James Grieve, for instance, the omission of the first post-blossom spray this year on certain trees reduced the crop by as much as one-quarter to one-half, quite apart from the less effective control of scab.

Manuring.—The next point is manuring to obtain high quality fruit. This is a big question, and fruit growers must consult Mr. Wallace's reports from Long Ashton and Mr.

Grubb's recently published analysis of the effects of potash fertilizers on apple trees at East Malling, if they wish to have the full idea of right manuring. It must suffice here to quote one or two figures. Where potash was used, the value of the produce from a plantation of Lord Derby apple trees over three years was £51 an acre. Where potash was not used, the value was £27 10s. only. Lane's Prince Albert potash plots in the same years yielded an average of £57, as against £41 with no potash. The variety Rival gave a return of £93 per acre from potash plots, and £47 from the no-potash plots.

These are very striking figures. The improvements were brought about by four annual dressings of sulphate of potash, 4 cwt. to the acre, costing only £2 9s. per acre per annum. There is another point about manuring. It affects both the colour and maturity of the fruit, though the exact degree of either cannot be foretold in individual cases, and hasty conclusions must not be drawn from experiments. In the past season the improvement in colour of the fruit of certain varieties, such as Newton Wonder, Allington Pippin, and Cox's Orange Pippin, was very obvious in the East Malling plantations when the fruit was still on the trees.

Fruit Thinning.—The last item in Mr. Hatton's schedule of important operations is fruit thinning, which enables individual fruits to grow larger and finer. The most progressive growers in the country have practised thinning for some years past. By doing it they secure a larger number of uniformly sized, high-grade fruits, which, of course, must increase their returns very much where they change over their method of sale to graded fruit packed under the National Mark. With judicious thinning there seem to be both more apples of the larger sizes, and an actual increase in the weight of saleable fruit. That is a most important item. Colour is also improved. As to actual figures, a case is mentioned of 10-year-old Lane's Prince Albert trees in full crop, half of which were lightly thinned and half left unthinned; the advantage of the lightly thinned trees over the unthinned was as much as £26 an acre from an operation which cost only about £3 an acre. Here, again, however, one must be careful, for thinning young trees beyond a certain point of severity may definitely reduce the crop without giving a sufficient compensation through increased size of fruit, though the same severity in older trees will give good returns. Further, trees upon certain root stocks show a more definite response to thinning than do the same varieties on other root stocks.

Though not expressing any definite opinion, Mr. Hatton puts forward the theory (held by many growers) that high quality fruit can only be grown to the best advantage over a comparatively short period of a tree's early maturity, and that in order to maintain this high standard of fruit successional plantings must be made. In this connexion he emphasized the importance of a proper selection of root stocks, specially mentioning Jaune de Metz for this particular purpose.

* * * * *

THE Minister has appointed a National Mark Egg Trade Committee to consider applications for permission to use grade designation marks in connexion with home-produced eggs, to make recommendation thereon to the National Mark Committee and to advise this Committee generally in regard to the application of such marks to home-produced eggs.

The Committee consists of: Dr. Thos. Milburn, of the Midland Agricultural and Dairy College (Chairman); Mr. H. German and Mr. S. Street-Porter (producers); Mr. F. Wilkinson and Mr. Stanley G. Shaw (distributors). With the exception of the Chairman, all are members of the Poultry Advisory Committee. The Secretary of the Committee is Mr. S. A. Smith, of the Ministry of Agriculture and Fisheries.

The number of applications for registration as "accredited country packers" under the scheme of egg marketing reform had on December 1 reached the total of 79, made up as follows:—

Bedford	1	Lines (Holland) ..	1
Berkshire	4	„ (Kesteven) ..	1
Cambridgeshire ..	3	Norfolk	7
Carmarthen	3	Northants	2
Cheshire	1	Northumberland ..	1
Cornwall	11	Oxfordshire	3
Cumberland	3	Salop	1
Devon	4	Somerset	8
Essex	2	Sussex	2
Gloucestershire ..	1	Warwickshire	2
Hampshire	3	Westmorland	1
Hertfordshire ...	3	Wiltshire	4
Huntingdonshire ..	1	Worcestershire ..	2
Kent	1	Yorkshire	1
Lancashire	2		

As provided for in the egg marketing scheme, town packers who desire to be accredited should now make application direct to the Secretary of the Egg Trade Committee.

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A NEW volume, *The Cultivation of Vegetables*, has been added to the Ministry's series of Sectional Volumes of Collected Leaflets.* This is a booklet of

The Cultivation of Vegetables commercial vegetable production written specially for market growers. The methods of production described are those which have proved successful for market growers, and the varieties suggested are known to be suitable for most markets. At the same time, the volume contains very sound advice for the private grower or allotment holder. The information contained in the leaflets has been condensed as far as possible, and simple language has been used.

Several of the leaflets have been specially written for the volume, e.g., those on shallots, leeks, seakale, rhubarb and salad vegetables. Other vegetables dealt with include cabbages and savoys, Brussels sprouts, peas and beans, the vegetable marrow, parsnips, onions, mushrooms, asparagus, tomatoes, cucumbers and watercress. In addition, there are leaflets on the general cropping, manuring and cultivation of allotments (with chart), the manuring of vegetable crops, and practical soil sterilization by heat for glasshouse crops. Diseases and pests of tomatoes and cucumbers are touched upon, and methods of marketing are also dealt with. It is hoped that the volume will prove of value both to the commercial vegetable grower and the amateur gardener.

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THE Institute has recently published the International Year Book of Agricultural Statistics for 1927-28, thereby bringing up to date the information given in the corresponding volume for 1926-27. This latest issue contains nearly 600 pages, largely tabular matter, and is divided into nine main sections.

The first section deals with the total area and population of each country of the world, while the second gives the latest available information as to the apportionment of the total area, the agricultural production and the numbers of live stock in many of the more important countries. Sections three and

* Sectional Volume No. 12, price 1s. 3d. net, post free, obtainable from the Ministry, 10 Whitehall Place, London, S.W. 1.

four relate to the production of the principal crops (to the number of 35) and to the numbers of live stock practically throughout the world, while the international trade in as many as 45 agricultural products is set out by countries in section five, the figures in all three sections covering recent years and the pre-war average. The remaining sections deal with prices, ocean rates of freight, fertilizers (production, trade, consumption and prices) and rates of exchange.

Copies of the Year Book, which contains a most extensive range of agricultural statistics, can be purchased from the Ministry (price 20s., in paper covers).

* * * * *

ACCORDING to returns made to the Ministry by the beet sugar factories operating in Great Britain, the quantity of home-grown beet sugar manufactured during October and November, 1928, compared with the quantity produced during the corresponding months in 1927, was:—

	cwt.
October, 1928	825,966
November, 1928	1,579,631
October, 1927	714,628
November, 1927	1,423,825

The total quantities of sugar produced during the two manufacturing campaigns to the end of November were:—

	cwt.
1928-29	2,413,393
1927-28	2,138,925

* * * * *

Potato Acreages in Scotland, 1928

THE following table, which has been prepared from a statement issued by the Board of Agriculture for Scotland, shows the acreages of potatoes grown in Scotland in 1928, with corresponding acreages in 1927.

	1928 Acres	1927 Acres
Total Acreage Grown	145,000	147,184
Total First Earlies	15,059	15,984
Total Second Earlies	19,413	21,377
Total Maincrops	92,423	92,603
Total Unclassified	18,105	17,220

Acreage figures for the more important varieties only are as under:—

FIRST EARLIES—		
Duke of York, etc.	1,850	1,703
Eclipse, etc.	2,878	3,285

Epicure	8,128	8,605
Sharpe's Express	1,341	1,412
May Queen	234	199
Ninetyfold	153	216
SECOND EARLIES—		
Great Scot	12,287	12,732
British Queen.. ..	3,568	4,939
Ally	1,542	1,540
Royal Kidney, etc.	445	462
MAINCROPS—		
Immune—		
Arran Consul	2,430	693
Kerr's Pink	44,539	35,359
Majestic	8,024	8,938
Golden Wonder	7,429	8,342
Non-Immune—		
Arran Chief	8,343	9,718
King Edward	13,310	20,130
Up-to-Date	1,544	1,653
Field-Marshal	912	1,426

The maincrops show an increase of 8,642 in the acreage of immune varieties and a practically corresponding decrease of 8,822 acres in non-immunes. This increase in immune varieties is more than accounted for by the additional acreage of Kerr's Pink, but it will be observed that the area under Arran Consul is growing rapidly.

English buyers of Scotch seed potatoes will be chiefly interested in the fact that among non-immune maincrops the loss has fallen most heavily on the area under King Edwards, which has diminished by 6,820 acres, or more than one-third of the area planted last year. To some extent this decrease may be offset by an increased yield per acre, but the Scottish estimates for this year are not yet available, and the quantity of King Edward potatoes produced cannot, therefore, be estimated. For comparative purposes it may be stated that the preliminary estimates already issued for England and Wales indicate a yield of 7·2 tons per acre in 1928 as compared with 5·9 tons in 1927.

* * * * *

THE Ministry's Potato Marketing Demonstration was given at the Great Yorkshire Show on November 6, and also at a

Potato Conference held at Penrith under the auspices of the Newton Rigg Farm Institute on November 29. A demonstration covering pigs and pig products was given at the Birmingham Fat Stock Show from December 1 to 6. Both of these demonstrations—potatoes and pigs—were staged at the Smithfield Show in the Agricultural Hall, Islington, from December 10 to 14. This show concluded the Ministry's autumn programme.

TAR-DISTILLATE WINTER WASHES AND THE APPLE CAPSID BUG

S. G. JARY, B.A.,

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As a result of trials carried out in various parts of the country during the past few years, the egg-killing properties of the tar-distillate winter washes for fruit trees are now well known.

These washes are employed in many orchards and provide a ready means of destroying such fruit pests as Aphides and Apple Sucker. To a lesser extent, the damage caused by caterpillars of the various winter moths is also prevented, so that, in many districts, these insects are not now regarded by the fruit grower as difficult to control and, where regular spraying is carried out, there is seldom a serious attack. On the other hand, the Apple Capsid Bug, *Plesiocoris rugicollis*, has become very common in many apple orchards and, where it occurs, is rightly regarded as the most serious pest on apples. Foliage, young wood and fruit are all attacked by this bug, and its control in an orchard is both difficult and expensive, usually necessitating a series of spring sprayings.

It was hoped that the Apple Capsid Bug might be controlled by the destruction of the eggs, in the same way as Apple Sucker and Aphides, when high strengths of tar-distillate washes were used, but up to the present results have been inconsistent. Particularly in the south-western counties, certain proprietary brands of winter washes have at times given very good results, but in the midland, eastern and south-eastern counties little or no good seems, as a rule, to have been done in this way. A certain amount of control is usually obtained when high strengths of wash are used, but the "kill" obtained is not sufficient to prevent material damage from being done. Most fruit growers who are troubled with Capsid Bug still have to resort to spring sprayings with a nicotine or similar wash.

It has been claimed that two winter sprayings with a tar-distillate wash, applied with an interval of a few days between, give a more effective control than a single spraying, and this matter has been further tested out in the experiments dealt with below.

Observations on the attack by Capsid Bug have led to the conclusion that this insect is often very unevenly distributed throughout an orchard. Apart from the difference in intensity of attack on different varieties, there is also a con-

siderable variation on adjacent trees of the same variety, worked on the same type of stock. It is apparent that any variation of this nature may introduce a serious error into the estimation of the results, and in laying out an experiment such differences have to be considered.

Washes Employed.—A well-known brand of tar-distillate winter wash was employed as a basis in these experiments and various modifications in its use were introduced. For convenience in tabulating the results, each wash is given a key number. Table I shows these numbers and the corresponding washes.

TABLE I.

Key	Wash
0	Unsprayed.
1	A 10 per cent. tar-distillate wash as commonly employed—applied February 20.
2	A 7½ per cent. tar-distillate wash (applied February 20) followed by a 10 per cent. tar-distillate wash (applied February 22).
3	A 2 per cent. solution of caustic soda (applied February 20) followed by a 10 per cent. tar-distillate wash (applied February 22).
4	A composite caustic soda and tar-distillate wash made up in the following way, and applied on February 22:—

The tar-distillate wash was first made up at a 15 per cent. strength in a known volume. To it was added half that volume of 5 per cent. caustic soda solution and the mixture thoroughly stirred. The resulting liquid rapidly became covered with a black tarry scum, which when removed, left a coffee-coloured liquid, alkaline in reaction. This liquid only was employed in spraying and the tarry material discarded.

In this wash, assuming that the volume of the resulting mixture is the sum of the volumes mixed, the concentration of tar-distillate wash is 10 per cent. and of caustic soda 1½ per cent.

Application of Washes.—The period, February 20-26, was dry and rather cold. There was no measurable precipitation, and little wind, so that the washes were applied under almost ideal conditions. A pneumatic knapsack sprayer was used and the trees were thoroughly covered. All the trees were of the same age (12-15 years), of bush type, and were therefore easily sprayed.

Arrangement of the Trees.—The arrangements for the spraying provided 10 trees under each kind of treatment, and 11 trees left untreated.

In June, 1927, this block of trees was examined and marked for Capsid Bug attack. It was found that the attack varied considerably from tree to tree between the limits of 5 per cent. and 80 per cent. of leaf trusses showing the characteristic markings. Such a variation had obviously to be taken into

account if trustworthy results were to be obtained from different kinds of treatments on this block of trees; and the trees were accordingly marked down for treatment as shown in Table II.

TABLE II.

0	3	0	4	2	1
1	4	2	0	3	2
2	0	3	1	4	3
3	1	4	2	0	4
4	2	0	3	1	0
0	3	1	4	2	1
1	4	2	0	3	2
2	0	3	1	4	3
Bramleys	Lanes	Bramleys	Newton		

Thus, commencing with the left-hand row of Bramleys the top tree, 0, is unsprayed, 1 received 10 per cent. tar-distillate, 2 a 7½ per cent. tar-distillate followed by a 10 per cent. a few days later, and so on. With this arrangement of trees the average attack in 1927 was made approximately the same for each treatment, thus overcoming the differences between individual trees. Table III indicates the average intensity of attack, arrived at from the counts made in 1927, and this percentage may be regarded as the "expectation of attack" for 1928, on the assumption that the differences between individual trees are the same in two succeeding years.

TABLE III.

Key	
0	= 45 per cent. (average of 11 trees 1927)
1	= 50 "
2	= 53 "
3	= 52 "
4	= 45 "

Estimation of Results.—The extent of attack was estimated as before and the numbers given represent the percentage of leaf trusses showing the characteristic markings. Two different sets of figures have been obtained by examining the trees on two different dates. Every tree was carefully examined and given a mark, so that the number given for any particular treatment represents the average obtained from the 10 trees under that treatment.

Key No.	Leaf trusses attacked	
	May 11	July 13
	per cent.	per cent.
0	8.4	29.0
1	2.1	9.4
2	1.6	10.0
3	1.8	11.0
4	2.6	9.5

It was hoped that, in addition to the figures obtained by examining the leaf trusses, a series showing the percentage of marked fruit might have been added. Unfortunately, owing

to the failure of some varieties to crop in consequence of late frosts, this was not possible.

Discussion of Results.—The attack by the Apple Capsid Bug during the past summer in the orchard concerned has been generally less than in the previous year. The unsprayed trees never reached the same figure as shown in the "expectation of attack" arrived at in 1927. By May 11, when the first examination was made, the attack had not reached its maximum, although the figures are in almost the same proportion as those obtained on July 13.

No one treatment is outstanding as being either distinctly superior or inferior to the others. One spraying with a 10 per cent. wash has given just as effective a control as a $7\frac{1}{2}$ per cent. followed by a 10 per cent. spray after an interval of two days, and the inclusion of caustic soda in the wash appears to have had no beneficial effect when applied either by itself or in combination. Had the double spraying with a tar-distillate proved effective, it would have been at any rate an expensive method. It might have been supposed that the first application of the wash would soften the gummy secretion which covers the ends of the eggs, and that a second application would be able to produce a "kill" through having a better chance of penetration. Had this been the case, caustic soda would probably have been an equally good softening agent, and if the combination such as was used in Wash 4 could have been effective, the one spraying might have been sufficient. The key to the way in which the eggs of the Capsid Bug may be destroyed, however, evidently does not lie in that direction. It is worth noting, however, that Wash 4 was extremely satisfactory from some other points of view. It gave a control of Aphides and Winter Moth Caterpillars as good as that obtained by other washes; it was economical in use, and a tree could be covered well with two-thirds the quantity required when an untreated tar-distillate wash at 10 per cent. was used. The black tarry substances which are produced float to the top and if the spraying pump is fed by a suction hose, the liquid below can be drawn off and the tarry residues discarded at the end. It is clear that they are not essential to the killing power of a tar-distillate wash.

Conclusions.—(1) The tar-distillate washes and the various combinations used in these experiments gave only a partial control of the Apple Capsid Bug, although spraying was done

more thoroughly than would be possible under commercial conditions. In order to prevent serious fruit marking a spring spraying would still have been necessary.

(2) Two sprayings at an interval of two days gave no better control than one spraying.

(3) The inclusion of caustic soda, either as a preliminary wash or in combination with a commercial tar-distillate wash, did not increase the killing power.

(4) When used in combination with a tar-distillate wash, caustic soda has certain advantages. Tarry material which clogs the spraying machinery is thrown out and floats on the surface of the wash.

(5) Such a combination as that used in Wash 4 was much more economical in use than an ordinary tar-distillate wash, and on Aphides and Winter Moth Caterpillars gave an equally good result.

* * * * *

REPORT OF THE OFFICIAL SEED TESTING STATION

THE tenth annual report of the Official Seed Testing Station for England and Wales, covering the period from August, 1926, to July, 1927, appears in No. 1, Vol. 11 of the *Journal of the National Institute of Agricultural Botany*.*

During the period under review, the total number of samples received for test amounted to 22,837, a decrease of 47 samples on the total of the previous season, and 181 greater than the average for the eight previous complete annual periods. The sources of the samples, together with comparative figures for the previous season, are as follows:—

		1926-27	1925-26
<i>Seed Firms</i>			
Number sending samples ..	..	1,610	1,732
" of samples received ..	..	17,673	18,375
<i>Farmers, etc.</i>			
Number sending samples ..	..	701	676
" of samples received ..	..	1,374	1,404
<i>Public Departments</i>			
Number of samples received ..	..	3,790	3,105
Total number of Samples ..	..	22,837	22,884

It will be seen that in 1926-27 there was a decrease of 7 per cent. in the number of seed firms sending samples, and an increase of 4 per cent. in the number of farmers. The number of samples received from seed firms showed a decrease of 4 per cent. and from farmers of 2 per cent. An analysis of

* Copies may be obtained from the Institute, Huntingdon Road, Cambridge, price 2s. 6d. or post free 2s. 8d.

the samples shows the following distribution, according to related species, compared with similar data for previous seasons:

	1926-27	1925-26	1924-25
Cereals	8,228	8,402	9,066
Pulses	1,975	2,601	1,891
Roots and vegetables ..	5,182	4,954	4,148
Clovers	4,727	4,280	4,283
Grasses	2,508	2,418	2,334

The number of cereal samples shows a decrease of 2 per cent. on the previous season's figures. Pulse samples decreased by 24 per cent., but the total was only slightly less than the average number for the previous eight seasons. Root and vegetable samples show an increase of 4.6 per cent., and thus maintain the steady annual increase which has been operating since 1923-24. The number of clover samples, which includes 2,583 of red clovers, is 10 per cent. greater than in 1925-26, and is the largest number received at the Station in one season since 1921-22. Grass samples also show an increase of nearly 4 per cent.

The numbers of samples received each month follow generally the growth of the average for the eight previous seasons, and were as follows:—

1926-27.					
August	423	February ..	4,199		
September ..	1,648	March	4,698		
October	2,640	April	1,984		
November ..	1,966	May	602		
December ..	1,627	June	203		
January	2,676	July	171		

Cereals.—The average percentage germination of wheat, barley, and oats was, in each case, slightly higher than for the period 1917-25, being 96.9 per cent., 96.5 per cent., and 94.6 per cent. respectively. Rye, with an average of 89.9 per cent., was slightly below the average. The percentage of barley samples falling below the authorized minimum percentage of 90 per cent. was only 4.6 per cent., compared with 20.9 per cent. in 1925-26.

A naked eye examination showed that 5.6 per cent. of the wheat samples were infected with bunt (as compared with 11.9 per cent. in the previous season) and 3.9 per cent. with earcockles. 7.2 per cent. of the barley samples showed smut, and ergot was present in 1.1 per cent. of the wheat and 13.4 per cent. of the rye samples. The percentage of wheat samples containing bunted grain is the smallest, and the percentage of rye samples infected with ergot is the highest on record at the Station.

A table is included in the Report showing the distribution of cereal samples received for test, arranged according to variety. Red Standard heads the list of the wheats, 16 per cent. of the samples being of that variety. Plumage Archer heads the barley with 12.6 per cent., and Victory is at the top of the oat list with 10.7 per cent.

Pulse and Root and Vegetable Crops.—The average germination of the pea samples (85 per cent.) was below the average for 1917-26 (86 per cent.), as were also the percentage germination of turnips, swedes, carrots, and onions. In the case of all the other garden seeds, the average germination was slightly higher than the average for 1917-26.

Grasses.—The average purity of Italian Rye-grass, Cocksfoot, Timothy, and Meadow Fescue shows an improvement on the 1922-26 figures, but in the case of Perennial Rye-grass and Dogstail there is a falling off in this respect, the average percentage of impurities found in Dogstail (5.6 per cent.) being greater than in any of the five preceding seasons. All these grasses, with the exception of Meadow Fescue and Dogstail, showed an improvement in the average percentage of germination.

Clovers.—The purity of the Red Clovers (all samples) is below the average, the figure recorded being lower than in any season since 1919-20. The percentage of samples containing 1 per cent. or more of injurious weed seeds is higher than in the immediately preceding season, and is the highest figure recorded since 1920-21. The average germination shows a slight improvement over the previous season, but is still below the average. Wild White Clover gave an average germination of 76.2 per cent. as compared with the 1917-26 average of 74 per cent.; an average of 11.2 per cent. of hard seeds as compared with 13.5 per cent.; and an average of impurities of 8.1 per cent. as compared with 9.72 per cent.

The percentage of samples of English Red Clover containing dodder (3.6 per cent.) is slightly greater than in the previous season (3.2 per cent.). 89.6 per cent. of the samples of Chilian Red Clover were found to contain this weed.

Investigations, etc.—In addition to the normal tests, particulars of which are given at the beginning of this note, nearly 4,000 tests of an investigational nature were carried out at the Station during the season. The work upon the problems referred to in the previous Report of the Station have been continued and extended, and a considerable amount of investigational work has been carried out with Wild White

Clover, both in the laboratory and in the field. A similar investigation with respect to Red Clover has also been commenced.

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, 1927.

* * * * *

FOUR FEEDING EXPERIMENTS WITH SILAGE—I.

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THERE are three methods by which the value of any food may be assessed. The first is by making a chemical analysis. This is essentially the method of the chemist and is comparatively simple. The results are valuable, but have a limited application in practice. The second is by carrying out a digestibility experiment. Such experiments* have recently been carried out with silage by Wood and Woodman. This is the method of the animal physiologist. It requires special equipment and great care, but gives most valuable information. The animal or animals concerned in the experiment must be kept under careful control with special harness for collection of faeces and urine and therefore in some measure under artificial conditions, so that the deductions may not be completely convincing to the farmer.

The third method is by conducting feeding experiments. On the face of it this sounds simple and straightforward. If accurate results are required, however, it is found in practice that many difficulties have to be surmounted, not only as regards selection of uniform animals, provision of comparable accommodation, and careful feeding, but, of much greater consequence, the organizing of the details of the ration itself.

In planning and conducting a feeding experiment with silage, the following difficulties must be considered and as far as possible overcome:—

- (i) Silage, as commonly made in this country, is composed of a mixture of crops containing oats and tares, and sometimes other plants. With what food shall it be compared? In the farmer's mind, it is grown and fed in substitution for roots; but it is impossible to compare oat and tare silage with roots directly in a feeding experiment with the hope of obtaining a useful result, because the food constituents are so different—see Table I, which gives typical analyses of the dry matter of oat and tare silage, oat and tare hay, and mangolds.

* Wood & Woodman: "The Digestibility of Oat and Tare Silage." *Jour. of Agric. Sci.*, July, 1921.

TABLE I.—COMPOSITION OF DRY MATTER.

	Oat and tare hay	Oat and tare silage	Mangolds
Crude protein	14.1	16.4	8.7
Carbohydrate	43.3	37.1	78.0
Crude oil (ether extract) ..	2.4	5.2	0.8
Crude fibre	31.5	32.0	6.0
Ash	7.4	8.8	6.5

As regards moisture, carbohydrates, fibre, and albuminoids, the two classes of food are essentially different. It is, of course, possible to adjust the remainder of the ration to compensate for these, but this destroys the first essential to accurate experiment, the testing of one variable only. In the first three experiments to be described, the advice of Dr. (now Sir John) Russell* was taken, and the difficulty largely overcome by comparing oat and tare hay with the same crop made into silage. In the fourth experiment, maize silage was compared with roots, but in this case the composition of the two foods is more comparable.

- (ii) The second great danger in working with silage is due to the fact that the composition of silage varies greatly in the amount of dry matter which it contains. Sometimes it contains no more than 20 per cent. of dry matter, at other times it may contain 40 per cent. Table II shows the variation in dry matter of the silage fed during the course of the first experiment.

TABLE II.—PERCENTAGE OF DRY MATTER IN SAMPLES OF SILAGE TAKEN FROM THE SAME SILAGE DURING FIRST EXPERIMENT.

	Percentage of dry matter
November 18	28.6
„ 24	30.4
„ 30	32.8
December 11	30.3
„ 17	30.0
January 4	31.1
„ 10	29.6
„ 24	30.3
February 4	32.1
„ 10	34.2
„ 23	37.2
March 6	27.5
„ 17	25.6

The maximum variation in the table is from 37.2 per cent. on February 23 to 25.6 per cent. on March 17. From these figures, it is clear that, if the same weight of fresh silage were fed on the two dates, the ration on February 23 would contain about 50 per cent. more food than on March 17. It is obvious, therefore, that no feeding experiment with silage is reliable unless precautions are taken to check frequently the percentage of dry matter in the silage and to recalculate the weight of the ration. During the experiments about to be described, the dry matter of the silage was determined once a fortnight at least, and of the hay at less frequent intervals.

- (iii) Lastly, for any feeding experiment it is always difficult to obtain two lots of animals that are really comparable. To

* Journal of The Farmers' Club, March, 1920.

illustrate this difficulty, feeding experiments are often carried out with dairy cows to test the value of any two rations. In this case inevitable variables occur in addition to those under experiment, e.g., dates of calving, total milk yields, rate of fall of milk yield, development of foetus, body weight, etc.

An experiment designed to test the value of a food when fed to dairy cows can therefore yield but uncertain results.

In the experiments to be described, calves, approximately a year old, were selected. Animals of this age have grown beyond the ills of infancy and may be fed continuously for a period of four to six months, gaining weight steadily so as to be near baby beef at the end of the experiment if desired. This allows a long period of experimentation, so that, half way through the period, the rations may be transposed. Such a precaution provides an automatic check on any chance errors in dividing the animals into two lots at the beginning of the experiment. This precaution was always adopted in the experiments to be described below.

Experiment I, 1920-21.—This experiment, as well as Experiments II and III, was designed to compare the food values of equal quantities of dry matter contained in hay and in silage made from the same crop of oats and tares. The cattle under experiment numbered 24, and were selected from a bunch of 30 reared upon Howe Farm, the farm then occupied by the Plant Breeding Institute at Cambridge, where the experiment was conducted. These cattle had been well reared and were all healthy. The following method was adopted for dividing the cattle into two equal lots, as in all the other experiments. Pairs of animals were selected as equally matched as possible in sex, age, growth, weight and quality. From each pair one animal was then put into each experimental pen. If one of a pair was superior to the other, then care was taken when the next pair were divided to place the inferior animal of this pair in the same pen as the superior animal of the previous pair. When the selection was complete each pen of 12 animals was placed in a large yard under a space-boarded roof, provided with ample trough room so that all animals could feed comfortably. Careful observation was maintained throughout the experiment to watch this point, and it was observed that all the animals fed most amicably, except in one case. In this case bullock No. 2 was found to be "under-bullock" and was immediately separated and placed in an adjoining small pen, where it obtained its proper share of the ration and fed contentedly.

The cattle were watered once each day by being turned into a paddock where both pond and well water were available. It is recognized that this is a possible criticism of the experiment, since the silage ration contained about 15 lb. more moisture than the hay, but the basal ration always contained some roots, varying from 14 lb. per day to 21 lb. at the end of the experiment, and it was a matter of observation that the cattle, whilst always drinking a little, at no time drank ravenously when given access to water. It was not possible to obviate this condition until the beginning of the third experiment, when water was laid on to the experimental yards, and thereafter water was always in front of the animals. The animals were bedded on straw, of which they ate small quantities. Care was always taken to supply bedding equally to each pen and, as far as observation could decide, each pen consumed equal quantities.

The Rations.—At the beginning of the experiment the basal ration for all animals in both pens was :—

Straw chaff	..	..	..	..	..	2 lb.
Roots—kohl rabi	..	..	..	..	..	14 „
Palm kernel cake	..	..	..	..	..	2 „
Crushed linseed	..	..	..	..	..	$\frac{1}{2}$ „
Bean meal	..	..	..	..	..	$\frac{1}{2}$ „

In addition, the bullocks receiving oat and tare hay had $8\frac{3}{4}$ lb. each and those receiving oat and tare silage $25\frac{3}{4}$ lb. The percentage of dry material in the hay was 84, that of the silage at the beginning of the trial 28.5. The weight of silage required to supply the 12 bullocks with an equal quantity of dry matter to that in $8\frac{3}{4}$ lb. of hay was calculated as follows :—

$$\begin{array}{l}
 12 \text{ hay bullocks received } 12 \times 8.75 = 105 \text{ lb. hay per day.} \\
 105 \text{ lb. hay containing 84 per cent. dry matter contains} \\
 \quad 84 \\
 105 \times \frac{\quad}{100} \text{ lb. dry matter.} \\
 \quad 84 \\
 105 \times \frac{\quad}{100} \text{ lb. dry matter are contained in } 105 \times \frac{84}{100} \times \frac{100}{28.5} \text{ lb. of} \\
 \quad 100 \quad 28.5 \\
 \text{silage containing 28.5 per cent. dry matter.} \\
 \text{This equals 309 lb.}
 \end{array}$$

The 12 "silage" bullocks therefore received 309 lb. of silage (=25.75 lb. each) per day during the period November 18 until the second sample of silage was analysed on November 24. After each analysis, the silage ration was recalculated so as to maintain equality of dry matter on both sides of the experiment.

TABLE III.

Ration	Dry matter	Dig: crude protein	Starch equivalent
2 lb. straw chaff	1.7	.02	
14 lb. kohl rabi	1.8	.10	
2 lb. palm kernel cake ..	1.8	.34	
$\frac{1}{2}$ lb. bean meal	.4	.10	?
$\frac{1}{2}$ lb. linseed meal	.45	.12	
8 $\frac{1}{2}$ lb. oat and tare hay ..	7.35	.57	
Total in ration	13.5	1.25	
Requirements 5 $\frac{1}{2}$ cwt. bullock (Wood and Halnan)	15.5	1.35	

The rations were designed, see Table III, to supply rather less than the food requirements in respect of total dry matter and digestible crude protein, given by Wood and Halnan*, so as to ensure the fullest possible consumption of the ration, since nothing is so disconcerting in the interpretation of a feeding experiment as the effect of unconsumed food, and nothing so detrimental to the thriving of the animals in practice as remnants of one meal remaining in the manger until the time of the next meal. As a result of this precaution, with the exception of one occasion during the first experiment, the whole of the ration offered to the animals was consumed in each of the four experiments. The exception occurred on March 15 and was due to a sudden deterioration in the quality of the silage, the bottom of the silo being found to contain sour (butyric) silage. In consequence of this the animals were weighed on March 16, and the experiment brought to a close.

Apart from the sour silage mentioned, the silage was of good quality throughout and possessed the character of typical acid (acetic) silage. The quality of the oat and tare hay was good without being pronouncedly so. It was cut at the same time as the silage when maturity was ideal for silage but perhaps rather too old for ideal oat and tare hay. The oats were well forward in milk and some of the tare seeds half formed in the pod. It is important to record that occasionally, during the first experiments, but not in subsequent ones, half formed but undigested tare seeds could be found in the dung. The oat and tare silage was chaffed when put into the silo and fed as taken from it. The oat and tare hay was fed unchaffed. It was placed in circular cribs and covered either with a light wheel from a disused milkcart or a light cart tyre strung loosely with galvanized stranded wire, so that the cattle had to pull the hay either between the spokes of the

* Composition and Nutritive Value of Feeding Stuffs, Wood and Halnan.

wheel or the meshes of the wire. This method was completely satisfactory, the cattle eating the whole of the hay without waste from littering the hay on the floor, as so often happens when long hay is fed. It is, in fact, a simple and economical refinement in feeding long hay, which might be more generally adopted in ordinary farm practice.

As the experiment progressed, and the size and appetites of the animals increased, certain changes and augmentations were made in the ration to satisfy the appetites of the animals. In each case the increase in ration was made simultaneously to both hay-fed and silage-fed cattle. These increases are stated below :—

December 10. Kohl rabi increased from 14 lb. to 17 $\frac{1}{2}$ lb. per head.
 December 13. Kohl rabi increased from 17 $\frac{1}{2}$ lb. to 21 lb. per head.
 December 23 } Kohl rabi gradually substituted by mangolds, when
 to } kohl rabi were exhausted.
 January 1. }
 February 3. (Beginning of second period.) Straw chaff increased from 2 lb. to 3 lb. per head and mangolds from 21 lb. to 25 lb. per head.

In each of the first three experiments, the animals had to be weighed on a weighbridge located 1 $\frac{1}{2}$ miles away. It was, therefore, only possible to weigh them once at the beginning and end of each period. This had its compensations, for the animals were induced to empty their bowels by the walk to the weighbridge. On each occasion they were weighed at 10.30 a.m., having had no food or water on the morning of the weighing.

The cattle were divided into two lots on November 18 and gradually accustomed to the experimental rations. Fourteen days later, on December 2, when properly settled to their rations, they were weighed and the experiment commenced. They were weighed again after a period of seven weeks on January 20, when the first part of the experiment was concluded. Between January 20 and February 3, a period of 14 days, the rations were gradually changed over, so that the lot fed silage during the first part were fed the hay ration during the second part and *vice versa*, and were weighed on February 3. The cattle were weighed for the last time on March 16, after a period of 41 days, when, as previously stated, the quality of the silage changed from acid to sour.

A careful record was kept of the health of the animals during the experiment. No important disorder was noticed except in the case of heifer No. 3. This heifer on February 13, during the second period, was found to be "blown." She was consequently drenched, but lost appetite for three days. On

February 16 she was apparently feeding normally but the final weighing showed that this illness had affected her gain in weight.

Table IV gives the results of the experiment in terms of increased live weight of the animals. During the first part of the experiment, it shows that the 12 bullocks fed on the silage ration gave, on average, an increased live weight of 79 lb. in 49 days, equivalent to 1.61 lb. per day as compared with an average increase of only 49 lb., equivalent to 1 lb. per day by the bullocks fed on the hay ration. In the second half of the experiment, the average increase in live weight of the silage-fed cattle is not so pronouncedly superior to the hay-fed cattle, being 48 lb. in 41 days, equivalent to 1.16 lb. per day compared with 45 lb., equivalent to 1.10 lb. per day, but the silage-fed cattle were handicapped in two respects, firstly, because No. 3 was sick during the experiment and gained only 6 lb. in the period, and, secondly, because the quality of silage suddenly changed from "acid" to "sour," in consequence of which the animals refused to clear up the ration before the experiment was abruptly concluded. This failure to clear up the ration meant that at the final weighing the stomach and intestines of the silage-fed cattle had lesser contents than normal, and hence depreciated the weight of the bullocks by this amount.

Experiment II, 1921-22.—The second experiment was designed on similar lines to that of the first with a few minor alterations, as follows:—

The cattle on this occasion numbered only 16, eight on either side of the experiment. The basal ration at the beginning of the experiment, on December 8, was as follows:—

Straw chaff	..	..	..	..	3 lb.
Roots—kohl rabi	..	..	..	..	14 "
Palm kernel cake	..	..	..	..	1½ "
Bean meal	..	..	..	..	1½ "

In addition, the bullocks receiving oat and tare hay had 8 lb. per day each and those on silage an equal dry weight of food in this form, calculations for correction due to alteration of per cent. of dry matter being carried out frequently as before. The quality of the oat and tare hay was in this case exceptionally good, the crop both for hay and silage having been cut at an earlier stage of maturity and harvested in good order, and the whole was digested perfectly.

The quality of the oat and tare silage was also exceptionally good, being of the green fruity type, but, during the period December 26 to January 12, some amount of secondary

TABLE IV.

Number	Sex	FIRST PERIOD Hay Feeding				SECOND PERIOD Silage Feeding			
		Weight, December 2	Weight, January 20	Gain in weight, 49 days	Weight, February 3	Weight, March 16	Gain in weight, 41 days	Weight, April 16	Gain in weight, 41 days
		C. Q. lb.	C. Q. lb.	lb.	C. Q. lb.	C. Q. lb.	lb.	C. Q. lb.	lb.
1	Heifer	4 3 0	5 0 0	28	5 0 0	5 2 2	58	5 2 2	58
2	"	4 2 0	5 0 14	70	5 1 4	5 3 0	52	5 3 0	52
3	"	5 1 25	5 3 11	42	6 0 13	6 0 19	6	6 0 19	6
4	"	5 3 14	6 1 7	49	6 1 12	6 2 21	37	6 2 21	37
5	"	6 0 21	6 3 0	63	7 0 3	7 1 21	46	7 1 21	46
11	Steer	4 2 21	5 1 8	71	5 2 7	5 3 21	42	5 3 21	42
12	"	5 1 7	5 3 21	70	6 0 22	6 3 0	62	6 3 0	62
13	"	5 1 21	5 3 10	45	6 0 25	6 1 16	19	6 1 16	19
14	"	5 2 18	5 3 13	23	5 3 12	6 1 0	44	6 1 0	44
15	"	5 3 14	6 1 7	49	6 2 0	7 0 2	58	7 0 2	58
16	"	5 3 14	6 1 1	43	6 2 7	7 0 25	74	7 0 25	74
17	"	6 2 14	6 3 17	31	7 1 10	8 0 1	75	8 0 1	75
Total, 12 Bullocks	..	66 1 1	71 1 25	584	74 0 3	79 0 16	573	79 0 16	573
Average ..	..	5 2 2	5 3 23	49	6 0 19	6 2 11	48(51½*)	6 2 11	..
Number	Sex	FIRST PERIOD Hay Feeding				SECOND PERIOD Silage Feeding			
		Weight, December 2	Weight, January 20	Gain in weight, 49 days	Weight, February 3	Weight, March 16	Gain in weight, 41 days	Weight, April 16	Gain in weight, 41 days
		C. Q. lb.	C. Q. lb.	lb.	C. Q. lb.	C. Q. lb.	lb.	C. Q. lb.	lb.
6	Heifer	4 3 7	5 1 22	71	5 1 12	5 2 10	26	5 2 10	26
7	"	4 3 21	5 2 21	84	5 2 9	5 3 21	40	5 3 21	40
8	"	5 1 14	5 3 0	42	5 3 0	6 1 1	57	6 1 1	57
9	"	5 0 10	5 3 25	99	5 3 18	6 0 14	24	6 0 14	24
10	"	6 1 14	7 0 14	84	7 0 14	7 1 14	28	7 1 14	28
18	Steer	4 3 19	5 2 4	69	5 2 7	6 0 0	49	6 0 0	49
19	"	5 2 0	6 0 6	62	6 0 18	6 2 21	59	6 2 21	59
20	"	5 1 14	6 0 18	88	6 1 0	6 2 21	49	6 2 21	49
21	"	5 2 21	6 1 12	75	6 1 7	6 3 7	56	6 3 7	56
22	"	5 2 21	6 1 1	64	6 1 0	6 2 25	53	6 2 25	53
23	"	6 0 0	6 3 16	100	7 0 14	7 1 8	22	7 1 8	22
24	"	6 2 0	7 2 3	115	7 2 12	8 1 2	74	8 1 2	74
Total, 12 Bullocks	..	66 1 1	74 3 2	953	74 3 27	79 3 4	537	79 3 4	537
Average ..	..	5 2 2	6 0 26	79	6 1 0	6 2 17	45	6 2 17	45

* Excluding No. 3, which was ill.

fermentation occurred on the exposed surface of the silage owing to careless digging of the silage—the workman dug deeply in one place instead of taking off the silage in shallow layers. As far as possible this altered silage was thrown aside, but some of it was mixed with the good silage and rendered it less palatable. With this exception the quality of the silage was excellent throughout.

The cattle were sorted into two lots on November 24 and put on to their respective rations. By December 8 they had settled down, were feeding well and the experiment started, the animals being weighed on this day. The first part of the experiment continued until February 9, a period of 63 days. The rations were then transposed and a fortnight allowed for the cattle to settle down to the changed food. They were weighed again on February 23 when the second period started and this period lasted until April 13—49 days.

The record of the health of the animals during the experimental period shows only one important disorder; No. 12, on December 26 and 27, was constipated and twice drenched with castor oil and linseed oil. This was during silage feeding, but the incident appeared to have little adverse effect upon the growth of this animal.

Table V gives the results of the second experiment, set out exactly as those for the first. During the first period of 63 days the eight bullocks given silage made an average live weight increase of 105 lb. (=1.67 lb. per day). Compared with this the eight hay-fed bullocks made an average live weight increase of 89 lb. (=1.41 lb. per day). During the second period of 49 days the silage-fed bullocks made an average live weight increase of 79 lb. (=1.61 lb. per day), while those fed hay made 58 lb. (=1.18 lb. per day). In both parts of this experiment the silage-fed animals made a substantially larger gain than the hay-fed animals.

An interesting corroboration of the value of silage occurred during this experiment. For the purpose of assessing the costs of the experiments the cattle were valued before and after each experiment. It happened, however, that the professional valuer was unable to make the first valuation until December 16—after the cattle had been on the experimental rations, including the preliminary period, for 23 days. Without being instructed to do so the valuer made a separate valuation of each lot. Those on the hay ration were valued at £11 15s. 0d. per head, and those on the silage at £13, a difference of 25s. per head. The valuer also expressed the opinion that the

TABLE V.
FIRST PERIOD
Hay Feeding

Number	Sex	Weight, December 8			Weight, February 9			Gain in weight, 63 days			Weight, February 23			Weight, April 13			Gain in weight, 49 days		
		C.	Q.	lb.	C.	Q.	lb.	C.	Q.	lb.	C.	Q.	lb.	C.	Q.	lb.	C.	Q.	lb.
1	Heifer	..	..	4 2 24	..	..	5 1 3	..	..	63	..	..	5 2 5	..	..	6 1 4	..	..	83
2	Steer	..	..	4 3 7	..	..	5 1 11	..	..	60	..	..	5 2 1	..	..	6 1 8	..	..	91
3	"	..	..	5 0 3	..	..	5 3 8	..	..	89	..	..	6 0 8	..	..	6 1 19	..	..	39
4	"	..	..	5 1 10	..	..	6 0 7	..	..	81	..	..	6 1 23	..	..	7 0 20	..	..	81
5	"	..	..	5 2 16	..	..	6 1 14	..	..	82	..	..	6 2 23	..	..	7 0 23	..	..	56
6	"	..	..	6 0 0	..	..	6 1 18	..	..	46	..	..	6 3 6	..	..	7 2 23	..	..	101
7	"	..	..	6 0 0	..	..	7 1 8	..	..	148	..	..	8 0 0	..	..	8 3 0	..	..	84
8	"	..	..	7 0 9	..	..	8 1 11	..	..	142	..	..	8 2 20	..	..	9 2 8	..	..	100
Total, 8 Bullocks		..	..	44 2 13	..	..	50 3 24	..	..	711	..	..	53 3 2	..	..	59 1 21	..	..	635
Average	..	..	..	5 2 9	..	..	6 1 14	..	..	89	..	..	6 2 25	..	..	7 1 20	..	..	79

Number	Sex	Weight, December 8			Weight, February 9			Gain in weight, 63 days			Weight, February 23			Weight, April 13			Gain in weight, 49 days		
		C.	Q.	lb.	C.	Q.	lb.	C.	Q.	lb.	C.	Q.	lb.	C.	Q.	lb.	C.	Q.	lb.
9	Heifer	..	..	5 0 0	..	..	5 3 2	..	..	86	..	..	5 3 26	..	..	6 1 3	..	..	33
10	Steer	..	..	4 2 0	..	..	5 1 14	..	..	98	..	..	5 2 9	..	..	5 3 14	..	..	33
11	"	..	..	4 3 0	..	..	5 2 14	..	..	98	..	..	5 3 5	..	..	6 1 13	..	..	64
12	"	..	..	5 0 7	..	..	5 3 21	..	..	98	..	..	6 0 22	..	..	6 2 20	..	..	54
13	"	..	..	5 3 21	..	..	6 3 17	..	..	108	..	..	7 0 10	..	..	7 3 8	..	..	82
14	"	..	..	6 1 16	..	..	7 1 21	..	..	117	..	..	7 2 25	..	..	8 1 23	..	..	82
15	"	..	..	6 1 23	..	..	7 2 7	..	..	124	..	..	7 3 19	..	..	8 2 0	..	..	65
16	"	..	..	6 3 0	..	..	7 2 24	..	..	108	..	..	8 0 15	..	..	8 2 7	..	..	48
Total, 8 Bullocks		..	..	44 3 11	..	..	52 1 8	..	..	837	..	..	54 1 9	..	..	58 2 4	..	..	461
Average	..	..	..	5 2 12	..	..	6 2 5	..	..	105	..	..	6 3 5	..	..	7 1 7	..	..	58

cattle had not been well divided. At the end of the experiment, when the cattle came to be revalued, the valuer was asked to value each lot separately once more and was not told which lot were now receiving silage. Again he made a wide difference, but transposed his figures. The lot feeding on silage at the time of the first valuation, and estimated at 25s. per head above the other lot feeding on hay, was now valued when feeding on hay at 22s. 6d. less than the other lot now feeding on silage. It is a matter of common observation that animals, when feeding on silage, always look well in their coats, and probably this condition misled the valuer, but as far as it goes it confirms the value of silage.

(To be concluded next month.)

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THE ECONOMIC POSSIBILITIES OF RICE GRASS (*SPARTINA TOWNSENDII*)

III.—COMPOSITION AND NUTRITIVE VALUE

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As Essex is a county likely to be affected by the growth of this grass, it was decided to carry out feeding experiments with it. The reason for doing so was that the only known recorded information on this point is that given by Oliver in the *Journal of Ecology*, Vol. XIII, No. 1, 1925. Oliver here states: "As a fodder, *Spartina* is eagerly devoured by beasts of all kinds. I have seen cows, horses, ponies, donkeys, pigs and sheep grazing on it in Poole Harbour. They go down to the meadows almost before the tide has run off and gorge themselves on it. Farmers find *Spartina* to be a useful reserve feed, and it is cut and stacked for winter use. Opinions differ as to whether it taints the milk or not, but on the whole the weight of opinion seems against making use of it for dairy cows. So far as I know, proper feeding tests have never been made."

As a preliminary to the feeding trials it was thought desirable to ascertain the possible nutritive value of *Spartina* by chemical analysis. The results of such analysis are set out below and compared with figures for average meadow hays.

Analyses of *Spartina Townsendii*.—(a) A sample of the grass was obtained on July 4, 1927. The following figures are given for the wet and moisture-free material, and the dry matter figures are compared with those calculated for very good, good and poor meadow hay from the figures given in the Ministry's Publication, *Rations for Live Stock*.

	Freshly cut <i>Spartina</i> <i>Townsendii</i>	Dry matter of <i>Spartina</i> <i>Townsendii</i>	Dry matter of very good meadow hay	Dry matter of good meadow hay	Dry matter of poor meadow hay
Moisture ..	77.9	—	—	—	—
Ether extract ..	0.61	2.76	3.57	2.92	1.75
*Crude protein..	2.88	13.04	16.06	11.32	8.77
Crude fibre ..	5.00	22.95	23.00	30.69	39.08
Nitrogen-free extractives ..	11.18	50.27	48.21	47.84	44.57
Ash ..	2.43	10.98	9.16	7.23	5.83
*Containing true protein ..	2.06	9.34	—	—	—

The true protein nitrogen of this sample was therefore 71.4 of the total nitrogen.

The mineral components of this sample, expressed as percentages of the dry material, are compared below with those of pasture grass on the same basis. The latter figures are given by Godden in the *Journal of Agricultural Science*, Vol. XVI, 1926 (page 18).

	<i>Spartina</i> <i>Townsendii</i>	English and Welsh Pastures Eaten	Not eaten
Silica ..	2.29	1.521	0.70
Silica-free ash ..	8.69	4.663	2.733
Chlorine ..	2.72	0.561	0.291
Phosphoric acid ..	0.782	0.516	0.325
Potash ..	1.82	2.394	1.533
Magnesia ..	0.967	—	—
Calcium oxide ..	0.45	0.464	0.264
Soda ..	not determined	0.151	0.16
Total ash ..	10.98	6.184	3.433

This sample when dried, therefore, was of somewhat similar chemical composition to good or very good meadow hay. The mineral composition of the plant is, however, somewhat unusual, as might be expected from its habit of growth.

(b) For the purpose of the feeding trials, detailed below, two samples of *Spartina*, each amounting to about 10 cwt., of the dried plant were obtained from Poole Harbour. The first sample was cut on July 18, and spread out on a drier piece of land within about 40 yards of the sea where it was roughly dried for a period of a week of rainless but dull weather, put into bags and dispatched on an eight-day railway journey. On arrival it was spread out in bright sunshine for three days to "make" thoroughly. The dry material was then chaffed and the chaff spread out on the clean floor of an airy room for about a month, with frequent turning and mixing to ensure an even moisture content throughout.

It is noteworthy that, even after this length of time and in the chaffed condition, the sample retained about 18½ per cent. of moisture. In the green condition, and during the haymaking process, there was a decided smell of the sea and to a lesser degree also of seaweed. This smell persisted in the dried hay.

At the outset it should be observed that this sample can hardly be taken as representing the best possible *Spartina* hay.

In the first place, if *Spartina* were grown as a crop it is unlikely that the conditions for haymaking would be as bad as those obtaining on the mud of Poole Harbour; and, in the second, under proper conditions the hay would not have its nutritive value lowered by admixture with dead woody material of a previous growth as was the case with the sample obtained for this experiment. How much the nutritive value of this sample was lowered by these factors can be seen by comparing its analysis with that of a second cut, taken exactly seven weeks afterwards, from the identical spot where the first sample had grown. Perhaps the most astonishing thing about this second cut or aftermath was the extreme vigour of growth in so short a period, the young shoots being from 18 to 20 inches in length, and the yield apparently as heavy as had been obtained at the previous cutting. It should also be borne in mind that this growth was made during the latter part of July and in August, during which months the growth of ordinary pasture grass is normally small.

The following figures give an analysis of the dry matter of the *Spartina* hay used in the first experiment, compared with that of aftermath from the same spot and with good and poor meadow hay.

	Good meadow hay	<i>Spartina</i> aftermath, 7 weeks' growth	<i>Spartina</i> hay, with old growth used in the experiment (1st sample)	Poor meadow hay
Ether extract ..	2.92	2.54	1.63	1.75
Crude protein ..	11.32	13.04	7.90	8.77
Crude fibre ..	30.69	29.65	30.61	39.08
Nitrogen-free extrac- tives ..	47.84	43.00	49.85	44.57
Ash ..	7.23	11.77	10.01	5.83
Containing silica ..	—	1.77	3.75	—
Silica-free ash ..	—	10.00	6.26	—
Containing true protein ..	—	10.17	6.47	—
True protein percentage of crude protein ..	—	78.3	81.9	—

The figures indicate that considerable loss had occurred in the silica-free ash constituents and in protein content of the *Spartina* hay fed to the animals, when compared with the *Spartina* aftermath. It would appear, therefore, desirable, where the best hay is to be obtained, to have better conditions for the making process than those obtaining near the water side. This is shown by the fact that much better quality hay was made at the Institute when the green plants were obtained and the hay made more quickly; also by the fact that the first sample of hay from Poole, which experienced only dull days during its drying there, gave indications by its smell that some slight fermentation of an unusual character had proceeded. This smell was absent from the second sample, which had better weather conditions for the making, and was less time on the railway journey before being spread out here for the final stages of making.

The sample of hay, for the second experiment, was cut on August 28, and, roughly made at Poole during eight days of rainless weather, reached Chelmsford three days later in a semi-green condition. The weather now experienced was so bad that the haymaking could not proceed and the partly dried grass was kept under cover for about a month when it was chaffed and spread out on the floor of an out-building for about a week, and then on the floor of a warm and airy room for a further fortnight.

Feeding Trials.—The feeding trials were directed towards a determination of digestibility of the animal nutrients present when made into hay. Three factors beyond control have doubtless affected the results to some extent. They are :—

- (1) Absence of local supplies of *Spartina*;
- (2) The lack of previous attention to the *Spartina* beds from which our samples were derived.
- (3) The extremely bad weather for haymaking in 1927.

The Digestibility Trials were carried out with two 12 months' old Border-Leicester-Suffolk wether sheep. The sheep were confined in the usual stalls designed for this kind of work and wore a light harness to which was attached a suitable rubber-lined bag and rubber funnel for collection of the whole of the faeces and urine respectively. It was found that the sheep readily ate green *Spartina* on first acquaintance with it, and that no difficulty was experienced in getting them to eat moderate quality *Spartina* hay three days after their arrival from the farm.

(1) In the first trial, the actual experimental period was nine days; but the animals underwent a preliminary period of nine days on the diet to clear them of food previously consumed.

(2) At the conclusion of the first experiment the sheep were allowed liberty for a period of six weeks before the commencement of the second trial. During the last month of this period, they received nothing but *Spartina* hay, which they were allowed to consume *ad lib*. The sheep were fed in their stalls on the fixed ration for four days before records were taken of the quantities of faeces and urine voided. The experimental period was then commenced and was of 11 days' duration.

The mean digestibility coefficients, *i.e.*, percentage digested of the nutrients of the two samples of *Spartina* hay harvested at an interval of six weeks, are compared below:—

				First sample in poor condition	Second sample in better condition
Ether extract	..	..	..	40.5	39
Crude protein	..	..	..	39.3	45.7
Crude fibre	..	..	..	62.6	66
Nitrogen-free extractives	..	..	..	48.5	46

Conclusions.—Poor *Spartina* hay is similar in composition, apart from mineral matter, to poor meadow hay and is fully as digestible.

It is evident that *Spartina* hay contains no poisonous properties, since the sheep were fed on it and maintained in perfect health throughout a period of two months. No signs of constipation were noticed, even when the sheep were in close confinement and fed solely on the hay. At the end of the second trial, the sheep were examined by a sheep farmer of experience who pronounced them to be in good condition.

A great diminution in the volume of urine voided and of water consumed was noticed when the sheep were fed with clover hay at the end of the trials.

If very indifferently made *Spartina* hay has a nutritive value equal to that of poor meadow hay, it does not seem unreasonable to suppose that *Spartina* could be equal to good meadow hay if favourable haymaking conditions could be obtained. This observation is borne out by the results of the analysis of the *Spartina* aftermath.

Alternatively, it might be worth while to consider making *Spartina* silage, particularly as it would probably be some years before the land newly colonized by the plant would be

sufficiently consolidated to allow of grazing by heavy stock. *Spartina* silage might conceivably be better suited for stock than either the green plant or the hay, as a good deal of the salt would probably be expelled during ensiling.

* * * * *

A STUDENT'S IMPRESSIONS OF A DANISH FARM

JOHN P. MAULE, B.A.

THE following notes give some account of the working of a large Danish farm near Copenhagen. As is well known, Denmark is mainly a land of small farms; consequently, the methods and practices on the farm under review vary, in many respects, from those of the average holding. This may be better appreciated, perhaps, by a brief mention of some of the general practices on the smaller farms, contributing features to the countryside which appear strange to British eyes—the absence, for instance, of hay and corn ricks; the tethering of cattle and horses on the leys; the large amount of rye grown; and, above all, the absence of hedges and hedgerow trees, and the utilization of nearly every corner of land capable of producing a crop.

Practically all hay and corn is stored under cover, the utmost use being made of loft space in the roofs over stables and cowsheds. One aim of the small farmers is to grow sufficient fodder on their holdings to keep their stock all the year round, and avoid buying anything except essential meals and cake. Occasionally, on these small farms, one may see cows folded on young oats or barley in the early summer; either this corn crop is grazed again later, or, if oats, is allowed to grow and yield a grain crop in the late summer for home consumption. Lucerne is grown on many farms for forage, and is usually left down for a number of years. Rye replaces wheat for bread-making, being better adapted to the light soils. Temporary leys are an important item in every rotation, the farmers aiming at getting a sufficient crop to provide keep for their stock throughout the summer. Frequent and close grazing seems to be the best way to get as much out of the ley as possible, and to ensure this, it is customary to tether the cattle and horses on leys during the summer. This practice has the advantage of close grazing all over the field, and an equal distribution of manure.

On the other hand, the animals get little choice and frequently leave small patches where they have dunged; also, it necessitates frequent changing of position, up to six or seven

times a day being quite usual. On the small farms this is not a great drawback, but on some of the bigger farms, recently, the practice has been given up in favour of the free grazing which is normal in Great Britain.

The farm on which the writer stayed consists of 560 acres, of which only 65 are permanent grass. It is divided into two parts, each having a set of farm buildings, kept very clean, and in excellent repair. Being situated near Copenhagen, it is favourably placed for a market, so that it is advantageous to grow high-grade crops for sale. Wheat, for instance, is grown instead of rye; also barley, chiefly for malting purposes. In addition, milk from a herd of 80 cows, of the Red Danish breed, is taken daily by lorry to a dairy in the city.

Twenty men (increased to 30 in the summer) are usually employed on the farm, six of them on the dairy side and the remainder on the arable. Some of the 24 working horses on the farm are of Jutland breed, others imported Belgian, one man being responsible for each pair.

The soil is principally a light sandy loam. In parts, however, it is heavier and contains a high percentage of chalk (94 per cent. of CaCO_3), while a considerable area is very light indeed, with pure sand only a few feet below the surface. The farm is worked on two 8-course rotations, as given later.

The 8-year (sometimes 9-year) rotation is usual throughout Denmark, it having been found that an interval of six or seven years between the temporary leys decreases the liability of clovers to disease. To lessen the chances of clover disease also, clover and rye-grass are never used alone, more varied mixtures being employed than is usual in this country. A mixture frequently adopted is as follows:—

	<i>Lb. per acre.</i>			
Early red clover	..	..	..	7
Lucerne	..	..	..	3½
Bird's-foot trefoil	..	..	..	3½
Perennial rye-grass	..	..	..	3½
Italian rye-grass	..	..	..	1½
Cocksfoot	..	..	..	1½
Timothy	..	..	..	1½
Tall oat-grass	..	..	..	2½

In the first year the seeds are often grazed once in the autumn after the barley has been harvested, and, if there is sufficient growth, again in the spring. It depends on the weather how much growth is made and how many grazings are possible in the summer. In the second year, the ley is kept for hay and the aftermath is grazed.

The preparation of the soil for corn crops is very simple,

and usually consists in once ploughing and then harrowing down two or three times before drilling. For roots, the land is harrowed as often as is necessary to get a fine tilth, and is then usually rolled once or twice, the seed drilled on the flat in rows 20 in. to 22 in. apart and then consolidated by means of a disc or ring roller, which presses the earth together on each side of the seed.

The manuring of the 8-course rotation aims at improving the soil and also getting crops of good quality. It should be noted that all farmyard and liquid manure is carefully conserved and used.

The following table shows the rotation employed and the manures applied to each crop in the rotation:—

<i>Year</i>			<i>Per acre</i>
1st	Mangolds	.. ..	about 20 tons F.Y.M. (applied in winter).
			1½ cwt. Potash salts (37 per cent.)
			2½ cwt. Nitrate of Soda
2nd	Barley	.. ..	1½ cwt. Superphosphate
			¾ cwt. Nitrate of Lime
3rd	Potatoes	.. ..	about 20 tons F.Y.M. (applied in winter)
			1½ cwt. Sulphate of Ammonia
			Liquid Manure after planting
4th	Barley	.. ..	¾ cwt. Nitrate of Lime
5th	Seeds	.. ..	No manure
6th	Seeds	.. ..	1½ cwt. Superphosphate
			¾ cwt. Nitrate of Lime
			¾ cwt. Nitrate of Lime
7th	Oats	.. ..	1½ cwt. Superphosphate
8th	Wheat	.. ..	¾ cwt. Potash Salts (37 per cent.)
			2 cwt. Nitrate of Lime (applied in spring)

The permanent grass is manured with

1½ cwt. Superphosphate
¾ cwt. Nitrate of Lime
¾ cwt. Potash salts (37 per cent.)

This manuring of the rotation may be open to criticism, but the results are certainly satisfactory and the yield of crops high, being approximately as follows:—

Mangolds	..	..	30—40 tons per acre
Barley	..	..	21—23 cwt. „ „
Oats	..	..	} 26—27 cwt. „ „
Wheats	..	..	
Potatoes about 7 tons of Ware.			

The production of milk and, also, to a lesser degree, bacon, is important and must be considered in some detail. On this

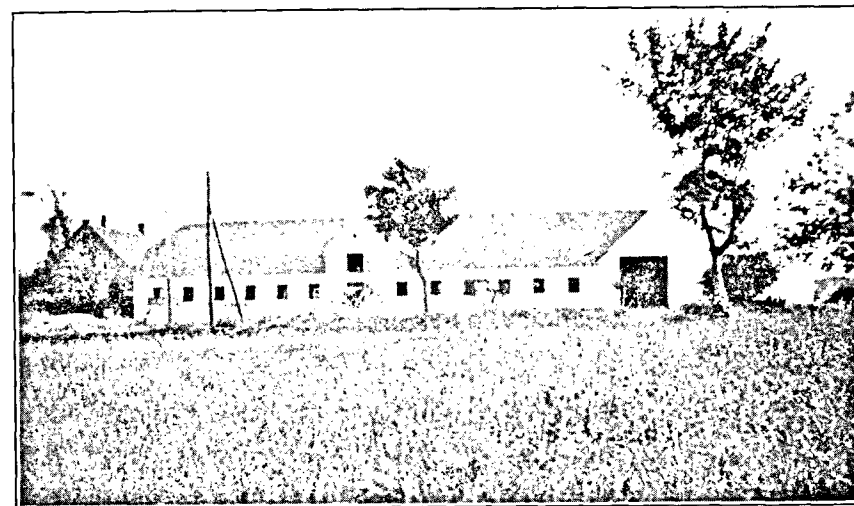
farm the production of bacon is subsidiary to that of milk, as all the whole milk is sold for direct consumption, so that the pigs are not fed on skim milk, as is the practice on the smaller farms where the milk is used for butter making and the skim milk is returned and fed to the pigs. During the time the writer was on the farm the pigs were in temporary quarters during the construction of a new building, and bacon production was not at its maximum. Bacon pigs, however, are generally reared and are sold to a co-operative factory about 10 miles away.

The treatment of a heifer calf which would eventually join the milking herd can be given in detail, though it must be confessed that no explanation was given of the practices involved. When the calf is born in autumn (which is usual) it remains at least three days with the cow, after which it is taken away and fed on one or one and a half litres (about one-third of a gallon) of whole milk three times a day, the quantity being increased to two litres three times a day when the animal is able to digest it. When it is about a fortnight old, and is able to nibble solid food, it gets a little hay and linseed cake and oats, mixed together, every day. At about a month old it is given a mangold or two per day. Until the calf is three months old the milk is continued, being then diluted with water and decreased in quantity until, at five months, it is discontinued altogether.

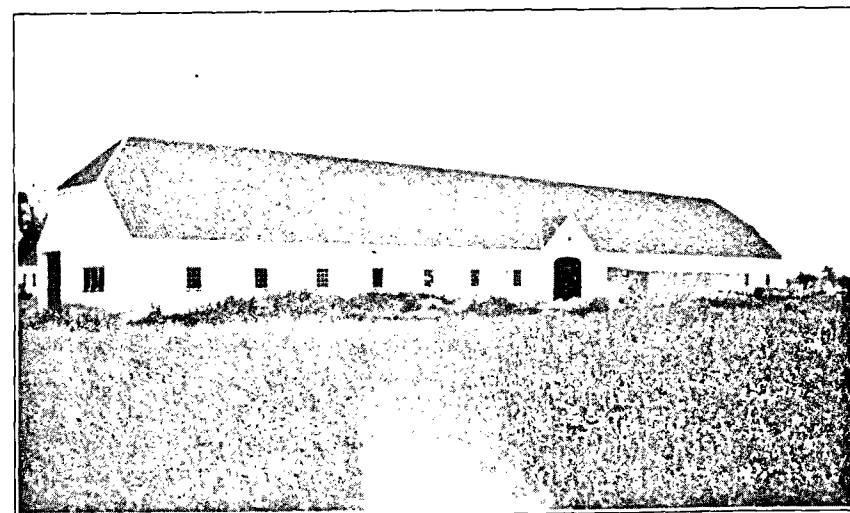
At this age the calf's ration consists of—

Hay	<i>ad lib.</i>	Linseed cake ..	1 lb.
Oats	1 lb.	Mangolds ..	about 15 lb.

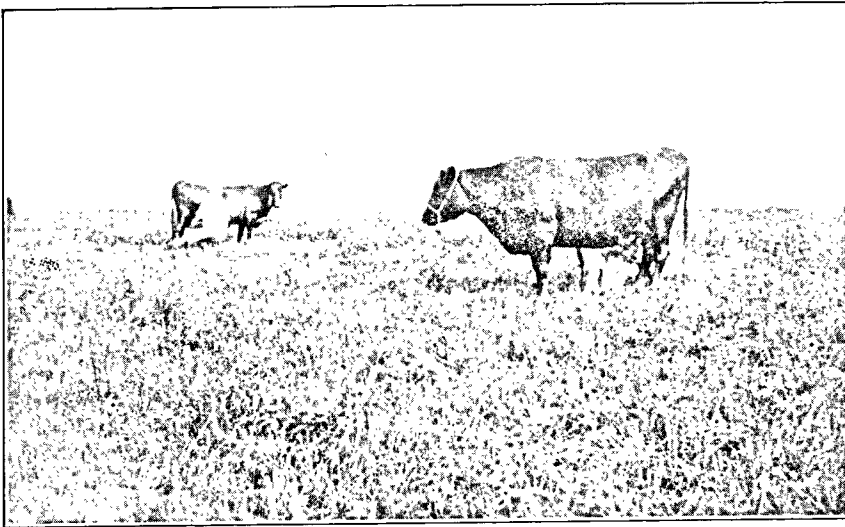
In the spring, when about six months old, the calf is put out to grass. (Spring-born calves receive 1 lb. of cake and oats together per day at this stage.) At a year old, the calf is taken in again and given hay, straw and mangolds—*ad lib.*—and 1-2 lb. of cake and oats per day. When one and half years old the heifer is injected with contagious abortion bacilli, and after a fortnight a second injection is given. It is then kept in about two months or so, depending on its size and health, before going to the bull, so that it should calve at nearly two and a half years old. During the period of gestation (summer) the heifer is on grass alone, and is only taken in one month before calving, being fed up a little before it is due to calve, although neither before nor directly afterwards is it fed too liberally. During this month it also receives one ounce a day of di-calcium phosphate. When the calf is removed from the cow, three days after birth, the ration of the mother is fixed



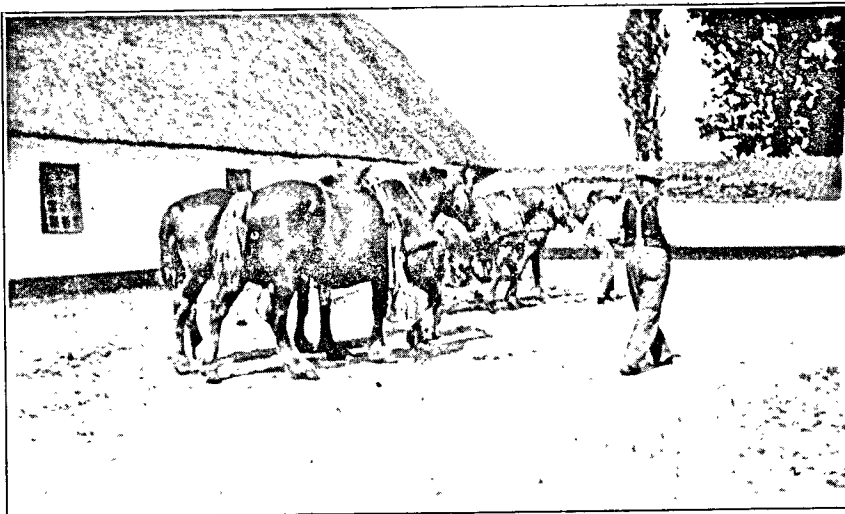
A Danish Farm. New cowshed with loft for hay above.



A Danish Farm. New farm building, comprising (on left side) covered piggery and (on right side) granary for storing corn.



A Danish Farm. Cows being milked while tethered on a temporary ley.



A Danish Farm. Jutland horses (in foreground) used on the farm.

according to the milk yield, allowing a slight excess to force her to yield more if possible.

The winter rations of the cows, the best of which yield from five to six gallons per day, are made up somewhat as follows :—

Not more than 66 lb. of mangolds to all cows, about 10 lb. of hay to the best cows, and about 2 lb. of hay and 12 lb. of straw to the worst.

The amount of concentrates, according to yield, were as follows :—

Cows yielding	11 lb.	Received	4½—5½ lb.
"	22 "	"	5½—6½ "
"	33 "	"	8½—9 "
"	44 "	"	12—13 "
"	55 "	"	15½—17½ "
"	66 "	"	20 lb.

The concentrated ration consisted (1926) of equal weights of linseed cake, coconut cake, sunflower cake, and bran.

In summer the cows are kept out of doors entirely for four months, tethered on the leys; only the best cows (*i.e.* those giving about four gallons or over) get a ration of cake to supplement the grass. They are milked three times a day, out of doors, all the milking being done by hand. In winter they do not go out of the cowshed at all, since it is usually too cold, and they are milked three or four times a day—at 4 a.m., 11 a.m., 5.30 p.m., and again at 9 p.m., when only cows giving 40 lb. are milked again.

The cowsheds are roomy and well ventilated, with a low ceiling and loft above, and they are always kept whitewashed. The standings are entirely of concrete, with chain ties, and a concrete trough which serves for both food and water. These troughs run the length of the standings and are filled by one tap at the end.

The method of feeding the cows during the winter, when they are in the cowshed, is roughly as follows :—

The ordinary cows are fed twice and the best cows three times a day. The two main times of feeding are after the early morning and mid-day milkings; but after their last milking at 9 p.m. the best cows (about 30) receive a part of their cake ration. The usual method is to give first of all one-half or one-third of the cake ration, this being fed in the troughs. When this has been consumed, the troughs are filled with water for the cows to drink, after which the whole mangolds are put in the water so that as the cows push them about in eating them some of the mud is washed off. Lastly, the troughs are emptied, and the hay and straw is fed so that they can fill up as they require.

They are also given about 1-1½ oz. of chalk per day, according to size, and about 1 oz. of salt per day. The hay is also salted (this helps to preserve it in the lofts) so that the cows should not suffer from lack of minerals.

In 1925-26 the very best cows gave 1,500-1,700 gal. of

milk in the year (equivalent to 550–700 lb. of butter), and the majority of cows averaged 1,000 gal. in the year (450 lb. of butter), containing 4·02 per cent. of butter fat. In this year the herd suffered to some extent from foot-and-mouth disease.

Six men are responsible for looking after the herd and the calves and pigs. Five of them milk the cows by hand, and carry out their jobs as follows:—

One man cools the milk and is responsible for the dairy;
Two men look after and feed the calves and pigs after milking;
Two men feed all the cows;
One man cleans the stalls; the sixth man spends his time cleaning the cows and giving them fresh bedding before every milking.

When these men are not employed between milking hours they are allowed to have the time off, thus avoiding too long hours occasioned by extra milking.

All the milk is sold in Copenhagen as “Children’s Milk” (Børnemaalk), and for this purpose has to be up to a certain standard. The cows are inspected by veterinary officers twice yearly, and are tested for tuberculosis. The milk is weighed and recorded, and samples are taken for analysis once every fortnight. The rations for all cows supplying “Children’s Milk” are under supervision, and, in this connexion, turnips and silage are not allowed to be fed to the cows, nor are large quantities of roots of any sort—hence the limit of 66 lb. mentioned before.

The price paid for this milk is higher than for ordinary milk and, in 1925–26, the receipts for milk sold off the farm were about £3,000.

It should be noted in passing that the bulls used were highly bred, particular attention being paid to the milk records of their dams. They were purchased from the famous Kolle-Kolle Farm, noted for its breeding of high-class stock.

In dealing with the financial aspect of this farm, the writer was, unfortunately, not in a position to ascertain definite figures relating to costs of production and so forth. It appeared that most of the profits were put back into the farm in improvements, such, for instance, as the draining of a lake for permanent grass—which has proved decidedly beneficial.

The milk production was undoubtedly a very remunerative side of the farming. It may seem to the reader, in view of the heavy labour bill and liberal treatment of the young stock, that this is doubtful, but the writer is convinced that any extra expenditure was amply repaid by the efficiency of both the animals and the dairy staff.

As regards wages, the system was for the majority of the men to be boarded and fed on the farm in a cottage adjoining the farmhouse. In addition to this, they were paid approximately £2 15s. per month.

In conclusion, let it be said that the farm as a whole is undoubtedly a financial success, and this should be a sufficient argument in support of the methods involved. No criticism of these methods, some of which are not common in England, has been suggested, and it is left for the reader to judge for himself and form his own opinion of the practices that have undoubtedly been found successful on this farm.

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THE FEEDING OF BEES

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THE natural food of bees is honey and pollen. Honey is composed of carbohydrates and is the typical food of adult bees, supplying the energy for the work of the hive and for maintaining the temperature of the bees, both summer and winter. It is derived by the concentration and inversion of the nectar of flowers. Pollen is a nitrogenous food, and is necessary for the production of brood. It is present in sufficient quantity at most seasons of the year. According to Parker the feeding of artificial substitutes for pollen is not to be recommended.

It has long been the custom to feed sugar in some form or other to bees. The ancients used to supply them with figs, dates, raisins and sweet wine. Apart from the special needs of queen breeders, and others, sugar feeding may be divided under two headings:—

- (1) To supply a deficiency of stores. Here a relatively concentrated solution of sugar is given as a substitute for honey and is fed rapidly to the bees. This is the usual practice in autumn feeding.
- (2) To stimulate the rearing of brood. For this purpose a more dilute solution of sugar is fed slowly to imitate a constant supply of nectar. This is practised (a) in autumn, to provide young bees for wintering; (b) in spring, to build up a foraging force for the honeyflow.

Under certain conditions, and at certain seasons of the year, granulated sugar may be fed dry, provided water is at the same time available to the bees (Simmins). Candy made from white sugar is used for emergency winter feed, because

it is not so liable to cause excitement as syrup. For spring stimulation, honey may be used, provided it is from an unimpeachable source. It is said to give better results for this purpose than sugar syrup, probably owing to the protein and mineral salts, and possibly also to enzymes and accessory food factors, which it contains.

Cane versus Beet Sugar.—The commonest mode of feeding is by means of sugar syrup. It is generally agreed that this should be prepared from refined white sugar. Sugars which contain considerable quantities of impurities may be satisfactory when used for immediate consumption at times when the bees can take frequent cleansing flights. On the other hand, when used for winter consumption, even small quantities of indigestible non-sugars accumulate during the rest period and cause serious symptoms of dysentery in spring. For this reason commercial glucose syrup (which is prepared from starch and contains dextrans), brown sugar, and molasses are unsuitable food for bees.

Much has been said as to the unsuitability of beet sugar for feeding bees, and many bee-keepers go to considerable trouble to obtain sugar known to have been prepared from sugar cane. Apparently this is partly due to a misapprehension as to the meaning of the term cane sugar. "Cane sugar," "sucrose" or "saccharose," is the name of a definite chemical compound. It is obtained commercially from both the sugar cane and the beet, besides being present in numerous other plants.

Both the product of the refineries, and the so-called "plantation white" and "factory white," which are now prepared direct at the cane mills and beet sugar factories, are of a very high degree of purity, and it is not easy to see what deleterious substance there could be which could have harmful effects when present in such minute quantities as the analyses permit. An attempt has been made at the Bee Research Institute at Rothamsted to trace the blame to raffinose-trisaccharide which is present in beets but not in sugar cane. It was thought that, since analyses of sugar are usually based on polarimetric estimations and since raffinose has a specific rotation higher than that of cane sugar, not only might raffinose itself be present, but that if it were present it might allow some optically inactive substance to pass undetected. It was found on inquiry, however, that there had been a "raffinose scare" at one time, when wholesale buyers were

afraid that they were paying too highly for their sugar on a polarimetric estimation, and it was clear that not only were analysts fully alive to this possibility, but that raffinose very seldom found its way into even crude sugar, but remained in the molasses.

Dr. Phillips in America has made feeding tests with bees on a number of sugars and non-sugars. Raffinose was found to be entirely non-assimilable by the bee. Assuming that any quantity of raffinose were present in winter stores, it would accumulate in the large intestines of the overwintering bees, just as dextrin and other indigestible substances are known to do, and dysentery would ensue.

In a preliminary experiment, covering the winter 1927-28, four colonies of bees were fed on cane sugar of West Indian origin, and four others of similar antecedents on beet sugar from Czecho-Slovakia.* Owing to the poor season of 1927, the amount of natural stores in the hives was not great. The feeding was done with syrup at the concentration of two parts sugar, one part water by weight. The usual type of rapid feeder was used. No attempt was made to invert the sugar. The feeding was done later in the season than would normally be advisable. All colonies were fed at the same times, save towards the end, when the syrup was not taken down by all. No difference was noted between the readiness with which the sugar was accepted. All the hives showed rather over 20 lb. increase of weight between September 27 and December 2. Each colony was given a 2 lb. cake of candy, made from cane or beet sugar, respectively, during the latter part of December. These were not all consumed by spring. There was no great difference between the way the bees took the candy, though, if anything, the colonies getting beet sugar accepted it more readily. This is attributable to the fact that, inadvertently, the cane sugar candy turned out somewhat harder than that from beet. No signs of dysentery or distress were noted, and in spring the "beet sugar" and "cane sugar" colonies built up at about the same rate. About 20 lb. of stores were consumed between December 2, 1927, and April 24, 1928. Feeding for spring stimulation was continued, using the two kinds of sugar, but since the bees were now flying freely, it was not to be expected that any difference would now be seen.

* The strain of bee used in all cases was Italian hybrid and every effort was made, prior to the experiment, to render each colony as uniform as possible with its fellows.

Inversion.—Honey consists mainly of invert sugar, that is a mixture of approximately equal parts of dextrose and lævulose. The nectar of plants, from which it is derived, is largely sucrose. Invertase has been found to be present in the alimentary canal of the bee,* and the process of "ripening" honey comprises both the inversion of the sucrose of the nectar and the removal by evaporation of excess moisture. The inversion, begun in the honey stomach of the bees, is continued at hive temperature in the cells. Honey is handled several times before being sealed over (Park) and it is fair to assume that additions of the inverting ferment are made each time it is taken up by a bee. When weak syrup is fed slowly to bees for stimulative purposes the conditions are those of a mild honey flow, and the bees have plenty of time to invert the dilute solution. Usually such syrup is used at once for brood production and is not stored, or at any rate not sealed over. The difficulty with such syrup is that when given to the bees in large feeders it is liable to ferment in the vessel before it is taken down by the bees. To avoid this, many bee-keepers feed little and often, which much increases the labour involved where there are many stocks of bees to tend. It would be worth while to test the effect of various antiseptics on the inversion rate.

In the case of rapid feeding the conditions are different. The more concentrated solution of sugar does not invite fermentation, but trouble is sometimes caused by crystallization in the feeder. In order to prevent this, and with the idea of helping the bees, the guide books advocate the addition of a weak acid, such as vinegar or tartaric acid. This is intended to be added and the syrup boiled for some time to bring about hydrolysis of the cane sugar. An experiment at Rothamsted, using acetic acid, showed that the time and amount of acid usually recommended is not nearly enough to bring about a reasonable amount of inversion. After boiling for 30 minutes, only about 15 per cent. of the sugar had been inverted. Identical results were independently obtained by Elser in Switzerland at about the same time.

In the brewing trade, large quantities of invert sugar are manufactured from cane sugar by hydrolysis with hydrochloric acid. Using a strong mineral acid, the inversion is very rapidly accomplished, but it would be unsafe in the hands of the average bee-keeper, who uses tinplate vessels, and is ignorant of the properties of the chemicals which he handles.

* Paulovsky.

Stocks of bees in the experimental apiary at Rothamsted were fed in autumn with syrup which had been boiled with acetic acid for 5, 10, 15 and 30 minutes respectively. A control stock was fed with plain sugar syrup without the addition of acid. The feed was given at a moderate rate. Samples of the resultant "honey" from sealed combs were tested with the polarimeter. The analyses showed that inversion had proceeded further in the case of the plain syrup than where acid had been used. At the spring examination, no more granulation was found in the combs of the colony which had received plain sugar syrup than in those which had had the syrup boiled with acid. In each case granulation was negligible. Sarin states that citric acid tends to inhibit the inversion of sugar by bees. The above results would seem to corroborate Sarin's findings.

FEEDING EXPERIMENT WITH CANE AND BEET SUGAR.

Hive Number	Sugar B=Beet C=Cane	Weight on Sept. 27, 1927.	Weight on Dec. 2, 1927	Weight on Apr. 24, 1928
		lb.	lb.	lb.
B3	B	80	101	83½
B2	C	68½	89½	77
B1	B	69½	113½	95
A7	C	79½	99½	82½
A5	B	77½	96½	78½
A3	C	76½	95½	76½
A2	B	69½	100	82½
A1	C	—	93½	71-0

Feeding took place during this interval.

A 2lb. cake of Candy was given in this interval.

Summary.—In conclusion it would appear:—

- (1) That the prejudice that has existed among bee-keepers against beet sugar has little or no foundation at the present day.
- (2) That the indiscriminate addition of drugs and disinfectants to bee-syrup is unwise, as we do not know what effect they have on the inversion of the sugar.
- (3) That the methods usually employed by beekeepers for inverting the syrup with weak organic acids are ineffective and in the end defeat their intended result.
- (4) It would be better to start autumn feeding earlier than is frequently done, and, by feeding less concentrated syrup at a slower rate, to let the bees do their own inverting. It is sometimes objected that this leads to breeding rather than storing. It is preferable to have more young bees for spring and less old bees for winter at the expense of a few pounds of syrup.

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THE ALL-MASH METHOD OF FEEDING CHICKENS

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THE present-day systems of feeding employed in chicken rearing in this country may be divided into three groups:—

(a) Chicken Grain and Wet Mash.

(b) Chicken Grain and Dry Mash.

(c) Chicken Grain, Wet Mash and Dry Mash.

Of these three systems, until comparatively recently, the first was given the preference, and even to-day large numbers of chicken rearers adhere to it. The dry mash system has taken a considerable time to establish itself as an efficient method because, it was argued, the danger of digestive troubles was increased. It has become apparent, however, that the reasons for this argument were more often due to the rations fed than to the method of feeding. A combination of the first two systems named has proved very satisfactory and is likewise commonly used throughout the country.

With the growth of large-scale egg production in England, the question of the labour attached to the rearing of a large

number of pullets for replacements became a real problem. To meet this labour problem in some degree the dry-mash system of feeding chicks was introduced, and where proper management existed entirely satisfactory results justified the choice of the system. It is of interest to note here that during the spring of 1927 between 1,100 and 1,200 vigorous pullets of both light and heavy breeds were raised at the National Institute of Poultry Husbandry on dry mash and chicken grains only. The mortality among this young stock was appreciably less than 10 per cent., which figure must be considered good when large numbers of chickens are raised.

Again, if one studies the compositions of grain and mash mixtures used for chickens during even the last 10 years, it will be readily seen that very complicated and expensive rations have been advised. Coupled with this, it has in many cases been recommended that changes of rations shall be made with the varying age of the chicken. This to the novice, and to many with greater experience, is not only confusing but often impracticable where large numbers of chicks are being reared during the spring months.

To-day, if satisfactory profits are to be made, the poultry farmer is faced with the problem of cutting his costs of production, whether of eggs or of pullets, to the minimum. Thus it would seem that any advance towards simplifying the rearing of chickens, and lowering labour costs, must be of great advantage in the future. With this idea in view a preliminary test of the all-mash method of feeding chickens was carried out last spring at the National Institute of Poultry Husbandry. The method is fairly well-known in America and Canada, and is not unknown in this country, although but few have given the method a trial in England. The test carried out at the Institute was outlined very largely upon the work of Kennard and Bethke in America (1926), and the results obtained have quite justified its inclusion in an experimental programme. Before passing on to a discussion of these results it will be necessary to give an account of the feeding system itself, as it differs in some respects from systems in common use.

The All-Mash System of Feeding Chickens.—In the first place, it should be clearly understood that no "chick feed" or chicken grain is fed at any period in the life of the growing pullet. This obviates the necessity of using expensive seeds or grains, and saves the rearer the necessity of changing the size of the chick feeds according to the age of his birds.

After removal from the incubator the chickens receive

water and grit, no mash being supplied until the last hatched chickens are 48 hours old. As a first feed, a small quantity of the mash is spread out on a board or any flat tray-like object which can easily be reached by the young chicks. The object at this early stage is to feed little and often in order to promote an appetite in the chicks, and to prevent the mash becoming fouled by prolonged trampling of their feet. Care must be exercised at this stage, as well as at a later date, that a sufficient area of mash is exposed, as this ensures even the more weakly chickens being able to get food. It must be continually borne in mind that this mash is the principal food to which chickens have access.

When the chickens have been thoroughly accustomed to eating dry mash on the flat board or tray mentioned above, suitable dry mash hoppers for young stock are introduced. When the hoppers are brought into the pen it is wise not to remove the trays immediately, but rather to leave them in use until the chickens readily feed from the hoppers. The retention of the trays for, say, a further five days will give an excellent opportunity to the weaker chickens to reach an ample supply of mash without competing with more vigorous chicks.

From the stage when the chickens readily use the dry mash hoppers, the system becomes simplicity itself, as it is only necessary to see that the mash hoppers are frequently replenished. As the chickens increase in size the hopper accommodation must be increased; and this progressive increase goes on until the pullets, in the colony houses at, say, three months old, are feeding from an ordinary standard dry mash hopper for adult birds. Any lack of hopper space is immediately accompanied by a lower mash consumption and a resultant check in growth, which is highly undesirable at any stage in pullet rearing. It is also of considerable advantage to place fresh mash before the chickens as often as is practicable, as this invariably stimulates the appetite and results in increased mash consumption.

To obtain the greatest advantage from this simple system of rearing it is desirable to give a mash which varies little or not at all throughout the rearing period. This is quite possible, although the rearer will be easily able to increase or decrease the protein content in the mash to suit the growth of the birds at any time during the summer. Such a change is simply a matter of altering the amount of fish meal, meat meal, or whatever protein food is used, without interfering with the other ingredients of the mash. In this way there is

no fear of in any way affecting the health or growth of the chicks by too sudden a change in the character of the rations.

The 1927 Experiment.—In this preliminary experiment, outlined with the object of testing the efficiency of the all-mash system of rearing chickens, some 486 White Leghorn chickens were used. These were all hatched at the same time in a mammoth incubator, while the eggs from which they were hatched were all taken from the same breeding stock. In this way two flocks of chickens were secured which were as alike as possible under ordinary practical conditions.

Each flock of 243 chicks was placed in a 10 ft. × 12 ft. pen in the brooder house and had, as a source of heat, an anthracite stove capable of brooding at least 350 chicks. The management of the two pens, except for the system of feeding, was identical from a day old onwards, right up to the time of placing the pullets in the laying house in September. The chicks were hatched on April 13, 1927, when, as indicated above, they were divided into two pens, each of 243 chicks. From each pen were selected 40 chicks, which were wing banded and weighed at a day old. These acted throughout the experiment as a representative sample from each pen and were accordingly weighed individually at weekly intervals during the first eight weeks and then once a fortnight until they were 20 weeks of age. Thus the data collected during this experiment cover a period of 20 weeks, at the end of which time the pullets were transferred to a laying house for further experimental work. The two pens under discussion will be referred to as Lot 1 and Lot 2.

Feeding Rations: Lot 1.—Lot 1 constituted the flock of chickens reared under the all-dry mash system, and received the following dry mash when 48 hours old:—

- 50 lb. Maize grits.
- 20 „ Sussex ground oats.
- 20 „ Thirds.
- 8 „ Meat and bone meal.
- 2 „ Mineral mixture.
- 2 per cent. Cod-liver oil.

The mineral mixture consisted of:—

- 60 per cent. Sterilized steam bone flour.
- 20 „ Common salt.
- 20 „ Carbonate of lime.

The reason for including maize grits and meat and bone meal was to make the mash as granular as possible, a condition likely to be more attractive to very young chicks.

The above mash was fed for a period of one month, after which maize meal was substituted for the maize grits and

10 per cent. meat meal (60 per cent. protein) in place of the meat and bone meal. After this change at the end of a month no further alteration, with one exception, was made in the mash during the whole of the 20 weeks, so that the rationing of these chickens was extremely simple. The exception referred to is that of discontinuing the cod-liver oil at the ninth week when the pullets went out on free range.

Lot 2.—Lot 2 constituted a control flock and was fed under the usual dry mash and chick grain system. At the age of 48 hours these chickens received a feed of a No. 1 chick feed and during the first week were fed entirely on this grain mixture. The chick feed used was as follows:—

2 parts Pinhead oatmeal.
2 parts Crushed wheat.
1 part Maize grits.

On the seventh day, the chickens received dry mash of a similar composition to that fed to Lot 1 in the first month, while at the end of the month they were given the 10 per cent. meat meal as has been described for Lot 1.

At the beginning of the ninth week, when they were placed in colony houses on free range, the grain ration became two parts whole wheat and one part cracked maize. From this time onwards, no further alteration was made in their diet, except the omission of cod-liver oil as described for Lot 1.

Both Lot 1 and Lot 2 received water to drink during the first week, after which they received diluted skimmed milk for the period up to and including the eighth week, when they were again given water. The skim-milk referred to was given in the proportions of half skim-milk and half water. Grit and shell of a suitable grade were placed before the chickens throughout the rearing period.

General Management.—Apart from feeding, the general management of the two lots was similar and typical of average methods employed in chicken rearing. The young chicks were kept in close proximity to the stove for the first two days, after which they received full use of their pen. About the fourth day they were allowed out into the grass run, and from that stage onwards were only confined to the house during weather totally unsuitable to young chickens.

At six weeks old, the cockerels were removed and the pullets left in the brooder house for a further two weeks, during which period the heat was gradually cut off until the stove was finally allowed to go out altogether. In the ninth week, the pullets of the two groups were placed in separate colony

houses when they had access to a large run of good fresh grass. At 10 weeks old they were allowed to perch; and were at the same time given ordinary adult dry mash hoppers, thus bringing their management into line with that of mature pullets. No further change in management occurred after this until the pullets were transferred to the laying houses.

Results.—The two groups, composed of 243 chicks in each case, were under close observation from a day old onwards, and data upon food consumption, cost of food consumed, growth, mortality and health were accurately kept during a period of 20 weeks. These data will be discussed under their respective headings as given above.

(a) *Growth.*—To obtain information concerning the comparative growth of the chickens under the two systems, 40 chicks were chosen from each group. These chicks were wing banded and weighed individually at a day old and then once every week until eight weeks of age. Between the ninth and the twentieth week, fortnightly weighings only were made.

Table 1 shows the average weights of the birds in ounces and drams. The figures for the first six weeks give the average weights for both sexes, while the remainder refer only to pullets.

TABLE I.—WEIGHTS OF WHITE LEGHORN CHICKENS.

Age	Lot 2 Dry Mash and Grain		Lot 1 All Dry-Mash	
	Average weight	Gain	Average weight	Gain
Day-old	oz. drms. 1 6	—	oz. drms. 1 7	—
1st week	1 13	0 7	1 13	0 6
2nd week	2 14	1 1	2 4	0 7
3rd week	4 4	1 6	2 13	0 9
4th week	5 8	1 4	3 12	0 15
5th week	7 1	1 9	4 14	1 2
6th week	10 2	3 1	8 0	3 2
7th week	12 8	—	10 8	—
8th week	15 5	2 13	14 8	4 0
10th week	21 0	5 11	21 0	6 8
12th week	28 0	7 0	28 0	7 0
14th week	33 0	5 0	33 0	5 0
16th week	38 0	5 0	39 0	6 0
18th week	42 0	4 0	43 0	4 0
20th week	47 0	5 0	47 0	4 0
	2 lb. 15 oz.		2 lb. 15 oz.	

TABLE II.—FOOD CONSUMPTION AND COST OF FEEDING PER CHICKEN.

Age	Lot 2 Dry Mash and Grain				Lot 1 All-Dry Mash	
	Grain	Mash	Total	Cost	Mash	Cost
Week	oz.	oz.	oz.	d.	oz.	d.
1st ..	1.13	—	1.13		1.24	
2nd ..	1.61	1.82	3.43		2.60	
3rd ..	1.61	2.41	4.02		3.30	
4th ..	1.76	2.91	4.67	1.3	2.81	1.0
5th ..	2.09	3.64	5.73		3.14	
6th ..	1.93	5.00	6.93		7.72	
Total ..	10.13	15.78	25.91		20.81	
7th ..	4.4	6.9	11.3		12.1	
8th ..	3.0	6.0	9.0	4.2	11.0	3.5
9th ..	4.1	8.8	12.9		12.5	
10th ..	5.4	7.5	12.9		12.0	
11th ..	5.7	10.1	15.8		13.6	
12th ..	5.8	10.7	16.5	4.8	16.0	4.6
13th ..	6.6	7.6	14.2		12.8	
14th ..	6.6	10.6	17.2		16.0	
15th ..	7.6	12.3	19.9		16.3	
16th ..	6.7	11.4	18.1	5.5	16.7	5.0
17th ..	6.6	11.4	18.0		17.6	
18th ..	6.5	11.5	18.0		17.6	
19th ..	5.7	12.3	18.0		17.6	
20th ..	5.2	13.7	18.9	6.0	17.6	5.8
Grand Total ..	90.0	156.5	246.5	21.8	230.2	19.9
Average per pullet	5½ lb.	9¾ lb.	15¼ lb.	1s. 10d.	14¼ lb.	1s. 8d.

A study of Table I brings out two interesting points—the appreciably slower growth of Lot 1 at the beginning, and the similarity of the average weights of the birds in both lots at the age of 20 weeks. It is possibly fair to assume that the feeding system will have played some part in the slower growth of the all-mash chicks during the first six weeks, but it is practically certain that insufficient hopper space was allowed, with a consequent shortage of mash. This is confirmed by the very rapid growth made by the pullets after the cockerels were removed, even before the former were placed on free range when a response to the good growing conditions might be expected. The lower mash consumption for Lot 1 also goes to confirm the statement that they received insufficient hopper accommodation.

The growth of the pullets in Lot 1 from the eighth week onwards was entirely satisfactory and their condition was equal to that of the control pen receiving a grain ration. Owing to the lack of hopper space in the earlier period, there was some unevenness among the chicks in respect of size. This almost entirely disappeared when the birds had ample mash while on range.

Closely connected with growth is the factor of feathering. This was satisfactory in both groups, while the pullets from the all-mash pen showed, when half grown, a tightness of feather indicative of good health and constitution.

(b) *Food Consumption and Cost of Feeding.*—It should be noticed that the same mash was fed to both Lots and that meat and bone were included during the first month in order to make the mash as granular as possible and not too rich in animal protein. Table 2 sets out the amounts of the mash and grain consumed per chick per week, together with the cost. The cost includes the value of the milk and cod-liver oil used during the first eight weeks of feeding these chickens. Three pence per gallon is allowed for the skim-milk and 4s. 6d. per gallon for the cod-liver oil.

The figures given in the Table were obtained from all the chickens in the experiment, allowance being made where deaths occurred. The total consumption figures for the two groups show that the all-mash chickens consumed a slightly smaller total quantity of food over the whole period—1 lb. less per bird in 20 weeks. The grain feed in Lot 1 was given, in respect to quantity, as found necessary under ordinary practical conditions, while the mash was fed *ad lib.* in constantly open mash hoppers for both lots. It is of some interest to note that

when the pullets reach an age of about 16 weeks the total consumption of food becomes similar during the succeeding weeks. At this age the pullets apparently required for the ration given between 2¼ and 2½ oz. of food daily.

When a comparison of the cost of feeding the pullets under the two feeding systems is made the all-mash lot work out at a slightly, but probably not significantly, lower cost. A further testing of this system of rearing will have to be carried out before anything approaching conclusive figures can be given on this point. The cost of feeding the pullets in this experiment is slightly lower than that quoted by Roberts and Shaw* in their

* C. W. Roberts and R. B. Shaw: *Report on the Cost Accounts of the College Poultry Farm, 1924-25*, Bulletin No. 10, Midland Agric. and Dairy College.

report. They put the cost of feeding a White Leghorn pullet to the age of 21 weeks at 2s. 1d. and give higher total food consumption. The latter must depend somewhat upon the type of mash used and the rearing season in question.

Mortality.—This is a most important factor, but one that does not readily enable an accurate conclusion to be reached. The factors involved in the brooding itself may easily influence the mortality as much as, or more than, the feeding system itself.

In the experiment under discussion, the mortality in the control pen was very low, as shown by the fact that only 15 chickens were lost out of 243 during the whole of the period. This is slightly over 6 per cent. mortality. In the all-mash fed chicken group there was a loss of 20 chickens, or approximately 9 per cent. mortality. From this it will be seen that there is no apparent reason to suspect a higher mortality under the newer system being tested.

General Discussion.—The general impression gained by one season's trial of the all dry-mash system of rearing chickens was favourable. The trial clearly indicates the simplicity of the system, and the possibility of producing strong, well-grown pullets. It also suggested that the system might be a cheap one, both with regard to the cost of food and of labour.

As against these advantages, it was noted that some care must be given in the early stages to ensure that the chickens receive sufficient mash and, more particularly, get every opportunity to reach the mash without difficulty. The weaker chicks should not have to undergo severe competition with the stronger ones to obtain their food.

The Experiment Repeated, 1928.—As a result of the satisfactory data obtained in the spring of 1927, it was decided to make the all dry-mash system of rearing chickens the object of a further experiment. This was carried out in the spring of 1928, and was a duplicate in every respect of the previous experiment. To avoid reiteration of the details in connexion with the two experiments, only the important differences between the two years' work will be described.

On April 11, 1928, two groups of chickens, each consisting of 237 day-old White Leghorns, were placed under coal-burning brooders and were given the same housing and management as in the experiment of 1927. Lot 1 were reared under the all dry-mash system, while Lot 2 got both chicken grain and mash.

The mash and grain used were of the same formulae as in 1927, except that a slight alteration was made in the added mineral mixture :—

1927		1928	
60 per cent.	Sterilized steam bone flour.	55 per cent.	Sterilized steam bone flour.
20	„ Common salt.	20	„ Common salt.
20	„ Carbonate of lime.	20	„ Carbonate of lime.
		5	„ Flowers of sulphur.

Milk again formed a part of the rations for both Lots, but was supplied in the form of semi-solid buttermilk instead of as skimmed milk. The semi-solid buttermilk was prepared in the proportions of 1 part of the buttermilk to 15 parts of water. This liquid was placed before the two Lots of chickens at all times from the second to the eighth week, inclusive, after which date the birds all received water.

From a purely experimental point of view only one change was made : 50 chicks in each Lot were wing banded and weighed as against 40 chicks in 1927.

All other details in housing, feeding and management throughout the 20 weeks were similar to those described above for the 1927 experiment.

Experimental Results Obtained in 1928.—Data relating to food consumption, cost of food consumed, growth, mortality and general health were again carefully observed and recorded for the period of 20 weeks. These data are discussed below.

(a) *Growth.*—The comparative growth of the chickens in the two Lots was obtained by weighing the 50 wing banded chicks in each Lot at a day old and thereafter every week until eight weeks of age, after which they were weighed fortnightly only. Table I shows the average weights of the pullets thus weighed.

There is little or no difference between the weights of the pullets fed under the two systems. It is interesting to note that the final weights of the birds at 20 weeks are almost identical with those obtained in the 1927 experiment. Further, it is equally interesting to note that the slow gain in weight exhibited by the chickens under the all dry-mash system in 1927 has not recurred in 1928. This would seem to indicate that an increased amount of hopper space brought about the desired results, a point that was particularly emphasized in the report on the first year's work. It is, unfortunately, impossible to account for the uneven gains in weight of the all dry-mash pullets between the twelfth and the sixteenth weeks. It will

be noted, however, that there is a decrease in mash eaten during the twelfth week.

As in the previous experiment, the feathering of the pullets in both Lots was satisfactory. The pullets reared under the newer system again exhibited signs of good health and of satisfactory stamina.

TABLE I.—WEIGHTS OF WHITE LEGHORN PULLETS.

Age	Lot 2 Dry Mash and Grain		Lot 1 All Dry Mash	
	Average weight	Gain	Average weight	Gain
	oz. drms.	oz. drms.	oz. drms.	oz. drms.
Day-old	1 7	—	1 8	—
1st week	1 13	0 6	1 14	0 6
2nd week	2 3	0 6	2 2	0 4
3rd week	2 13	0 10	3 4	1 2
4th week	3 15	1 2	4 6	1 2
5th week	5 6	1 7	5 12	1 6
6th week	7 3	1 13	8 1	2 5
7th week	9 7	2 4	10 1	2 0
8th week	12 15	3 8	13 0	2 15
10th week	17 9	4 10	19 10	6 10
12th week	24 5	6 12	23 5	3 11
14th week	30 0	5 11	32 12	9 7
16th week	35 8	5 8	36 6	3 10
18th week	41 0	5 8	41 5	4 15
20th week	45 15	4 15	45 3	3 14
	2 lb. 14 oz.		2 lb. 13 oz.	

(b) *Food Consumption and Cost of Feeding per Chick.*—Great care was taken to ensure that the figures for food consumption should be accurate, and in order to make the cost of feeding a figure of interest, it includes in every case the total cost of the complete rations fed. The semi-solid buttermilk was charged at 23s. 6d. per cwt. and the cod-liver oil at 4s. 6d. per gallon. The cost of the mash, including the added cod-liver oil, averaged 14s. 7d. per cwt., while the chick feeds Nos. 1 and 2 averaged 17s. 4d. and 12s. 9d. per cwt. respectively.

Table 2 gives the full details of the food eaten by both Lots of chickens during the experiment; and also shows the cost of this food for each of the five months of the experiment. There was no pronounced difference in the cost of feeding a pullet under the two systems, but it is of interest that the small difference of 1d. is the same figure as was obtained in the 1927 experiment. This probably has no real significance, as if Lot 2 had consumed as much food as Lot 1, as was the case in the

previous year, then the all-mash fed pullets would have had a definite advantage in relation to cost of feeding.

TABLE II.—FOOD CONSUMPTION AND COST OF FEEDING PER CHICKEN.

Age	Lot 2 Dry Mash and Grain				Lot 1 All Dry Mash	
	Grain oz.	Mash oz.	Total oz.	Cost d.	Mash oz.	Cost d.
Week						
1st ..	1.3	—	1.3		2.0	
2nd ..	1.1	1.8	1.9		2.9	
3rd ..	0.8	2.9	3.7		3.9	
4th ..	1.0	3.4	4.4	1.21	3.6	1.46
5th ..	1.1	2.7	3.8		4.0	
6th ..	2.1	3.0	5.1		5.3	
7th ..	1.5	3.8	5.3		7.7	
8th ..	2.1	8.4	10.5	3.15	9.9	2.56
9th ..	3.7	7.0	10.7		12.0	
10th ..	4.9	7.6	12.5		13.3	
11th ..	4.2	8.5	12.7		14.4	
12th ..	5.0	9.0	14.0	4.20	13.5	4.61
13th ..	7.8	9.0	16.8		15.5	
14th ..	8.4	8.4	16.8		14.9	
15th ..	7.2	10.2	17.4		16.0	
16th ..	7.2	9.8	17.0	6.15	16.6	6.43
17th ..	8.5	7.7	16.2		18.0	
18th ..	8.5	7.1	15.6		16.7	
19th ..	8.7	5.0	13.7		16.6	
20th ..	9.3	4.6	13.9	6.98	18.3	5.56
Grand Total ..	94.4	119.9	214.3	21.69	225.1	20.62
Average per pullet	6 lb.	7½ lb.	13¼ lb.	1s. 9½d.	14 lb.	1s. 8½d.

(c) *Mortality.*—The mortality in both groups of chickens was not excessive. At the end of the 20 weeks Lot 1 had lost 34 chicks out of the original 237, 8 having died as the result of an accident at one of the weekly weighings. Lot 2 lost 31 chicks, of which two deaths were due to accident. Thus, excluding the accidental deaths, the Control Pen shows a mortality of 12 per cent. and the all dry-mash pen approximately 11 per cent. These figures agree very closely with those obtained for the whole season with all breeds at the National Institute of Poultry Husbandry. The mortality of chicks up to the time that the pullets went out into the colony houses for the past season was 11½ per cent.

General Discussion.—Generally speaking, satisfactory results were obtained with the all dry-mash system. While not giving better results than the Control Pen the all-mash pullets were

as good as those of the Control. In cost of feeding, the all dry-mash system had a very slight advantage, while, although costs of labour could not be kept, it is safe to say that the more simple system would have an advantage where a large number of pullets are being reared. Experiments are now being conducted at the National Institute of Poultry Husbandry to compare the laying ability of pullets raised by the all-mash and the mash and grain systems of feeding. Each of these groups of pullets will be fed during their first laying year under the same system as that on which they were originally reared. This will test the stamina of the pullets in each group and show whether the all-mash method is a suitable system for producing pullets likely to stand up to the strain of heavy egg-production.

General Discussion of the Two Experiments.—The experiment of 1928 has confirmed the satisfactory results of 1927. The figures obtained in the two years compare in most cases very favourably. The weights of the pullets under the all-mash system for 1927 and 1928 are almost identical and there is a similar food consumption in the two years. The mortality of the chicks was increased in 1928, but since both groups show an equal increase, this point has no significance.

Although, under experimental conditions, the newer system has been satisfactory, it has yet to be tested on a larger commercial basis before it can be advocated generally. The system has only been given a limited trial in this country, despite the fact that it has probably received more attention during the last two years than before the first experiment was started. It is to be hoped that those who have given the system a thorough trial commercially will make public the results they have obtained. It is only by close co-operation between the commercial poultry farmer and those responsible for research work that progress can be made and fresh knowledge accumulated.

In conclusion, the author would like to tender his thanks to Prof. Parkhurst, B.Sc., Director of the National Institute of Poultry Husbandry, for the help given with this work during the last year, and also to Miss M. Law, N.D.P., for the continuous help that she has given during both experiments.

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AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1928

Produce of Crops.—The crops of 1928 were favoured by the weather during their ripening period, and the harvest was gathered under exceptionally favourable conditions. The yields of the principal crops in most instances show a marked improvement on those of 1927, and are above the average for the previous 10 years. In the case of corn, the only crop which fell short of last year's figure was beans, although even in this instance the crop was slightly above average. Potatoes and root crops are in each case also above average and even more above the yield for last year. The yields of both seeds and meadow hay are slightly below average, but in regard to these crops it may be said that as compared with 1927 the reduction in quantity is more than counterbalanced by the quality of the crops.

PRELIMINARY STATEMENT SHOWING THE ESTIMATED TOTAL PRODUCE AND YIELD PER ACRE OF THE CORN, HAY AND ROOT CROPS IN ENGLAND AND WALES IN 1928, WITH COMPARISONS FOR 1927, AND THE AVERAGE YIELD PER ACRE OF THE TEN YEARS, 1918-27.

Crops	Estimated Total Produce		Acreage		Estimated Yield per Acre		
	1928	1927	1928	1927	1928	1927	Average of the ten years, 1918-27
	Thou- sands of cwt.	Thou- sands of cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Wheat ..	25,320	28,456	1,395,541	1,635,929	18.1	17.4	17.4
Barley ..	20,378	17,246	1,184,958	1,048,886	17.2	16.4	15.0
Oats ..	28,883	26,874	1,762,364	1,750,637	16.4	15.4	13.9
Mixed Corn	1,906	1,633	118,243	108,328	16.1	15.1	14.4
Beans ..	2,611	3,263	157,502	189,864	16.6	17.2	16.2
Peas ..	1,101	1,011	69,288	76,815	15.9	13.2	14.0
	Thou- sands of tons	Thou- sands of tons					
Seeds Hay*	2,143	2,108	1,567,973	1,586,173	27.3	26.6	28.0
Meadow Hay† ..	4,277	4,157	4,500,274	4,317,347	19.0 Tons	19.3 Tons	20.6 Tons
Potatoes ..	3,513	3,055	489,019	513,947	7.2	5.9	6.0
Turnips & Swedes	9,954	8,630	720,209	714,581	13.8	12.1	12.4
Mangolds	5,756	5,448	297,630	304,580	19.3	17.9	18.9

* Hay from Clover, Sainfoin, and Grasses under rotation.

† Hay from Permanent Grass.

Corn Crops.—WHEAT.—The total yield of wheat is estimated at 25,320,000 cwt. This figure is 3,136,000 cwt. below that of last year, and the reduction is wholly attributable to the marked decrease in the wheat acreage. The yield per acre is estimated to be 18.1 cwt. (32.9 bushels), which is slightly more than $\frac{2}{3}$ cwt. above the average per acre for 1927 and for the previous 10 years. This improvement in the yield per acre of wheat sown was noticeable over the whole country, only a few counties showing a yield lower than average, and in some of the important wheat-growing areas the improvement was quite substantial. In the Isle of Ely the yield per acre was 3.4 cwt. above average, while Lincs (Holland), Gloucester and Dorset showed over 2 cwt. above their averages.

BARLEY.—There was an appreciable increase in the acreage under barley, and with an improved yield per acre the total production of this crop is estimated at 20,378,000 cwt., which is an increase of 3,132,000 cwt. as compared with 1927. The estimated yield per acre is 17.2 cwt. (35.8 bushels) or $\frac{4}{5}$ cwt. more than in 1927, and $2\frac{1}{2}$ cwt. above the average for the previous 10 years. The improvement in the yield per acre of barley was even more general than in the case of wheat. Only three counties showed a falling off in their average yield, and these instances were quite negligible. Increases of over 3 cwt. per acre above their 10 years' average were obtained in the Isle of Ely, Hertford, Lincs (Kesteven), Kent, Dorset and Stafford, while over the Eastern and North Eastern divisions, which contain the chief barley-growing areas in the country, the yields were 1.8 cwt. and 2.5 cwt. respectively above their averages.

OATS.—Oats were grown on a slightly increased acreage, and both the yield per acre and the total production of this crop were higher than in 1927. The total production is estimated at 28,883,000 cwt., which is an increase of 2,009,000 cwt. The estimated yield per acre is 16.4 cwt. (46.6 bushels), an increase of 1 cwt. on that of 1927 and of $2\frac{1}{2}$ cwt. on the 10 years' average. Every county except one had improved yields, the increases being relatively heaviest in the Northern and North Western divisions and in North Wales.

MIXED CORN.—The total production of mixed corn on a slightly larger acreage is estimated at 1,906,000 cwt., which is 273,000 cwt. more than in 1927. The estimated yield per acre is 16.1 cwt. (39.3 bushels), an increase of 1 cwt. per acre on that of the previous year and of 1.7 cwt. on the 10 years' average. An increased yield per acre was obtained in every county except one in England and two in South Wales.

BEANS.—The acreage under beans was appreciably lower than in 1927, and although the yield per acre is slightly above average, it was lower than in the previous year. The total yield, which is estimated at 2,611,000 cwt., is consequently substantially lower than in 1927, the decrease being 652,000 cwt. The average yield per acre, which was estimated at 16.6 cwt. (28.9 bushels), compares with 17.2 cwt. in 1927 and 16.2 cwt. for the previous 10 years.

PEAS.—Notwithstanding a decrease in acreage, the total yield of peas is appreciably larger than in the previous year. The total production is estimated at 1,101,000 cwt., an increase of 90,000 cwt. The yield per acre is 15.9 cwt. (28.5 bushels), or 2.7 cwt. more than in 1927, and 1.9 cwt. above the 10 years' average.

Hay.—SEEDS HAY.—The yield of seeds hay obtained from a slightly reduced acreage is estimated at 2,143,000 tons, or 35,000 tons more than in 1927. The estimated yield per acre at 27.3 cwt. is slightly below the 10 years' average of 28 cwt., but is an improvement on last year's average yield per acre of 26.6 cwt. The only divisions which improved on their average yields were the South-Eastern and South-Western divisions.

MEADOW HAY.—The estimated total yield of meadow hay is 4,277,000 tons, or 120,000 tons more than in 1927. This yield, however, was obtained from an increased acreage, and the yield per acre at 19 cwt. is consequently below that of last year by $\frac{1}{2}$ cwt. and under the 10 years' average by 1.6 cwt. Most counties obtained under average yields, but a number of counties, chiefly in the North-Eastern, Eastern and South-Eastern divisions, returned yields per acre above their averages.

Potatoes.—The potato crop was eminently good. The yield on a decreased acreage is estimated to be 3,513,000 tons, or nearly half a million tons more than in 1927. The yield per acre is estimated to have been 7.2 tons, compared with 5.9 tons last year, and an average per acre of 6 tons for the previous 10 years. Only five counties in the country showed reductions from their average yield per acre, and these were quite insignificant. The highest increases were obtained in Norfolk, with an average yield of 10 tons per acre, or 3 tons per acre above the average for the county, and in Lincs (Holland), where an average yield of 9 tons was 2.5 tons above the county average.

Roots.—TURNIPS AND SWEDES.—As compared with 1927, there was a slight increase in the acreage under turnips and swedes. The yield per acre was also higher, and the total pro-

duction, which is estimated at 9,954,000 tons, is very substantially higher than in the previous year, the increase being 1,324,000 tons. The yield per acre is estimated at 13·8 tons, compared with 12·1 tons in 1927 and 12·4 tons over the previous ten years. The crop was good throughout the country, and under-average yields were returned by only a few counties with relatively unimportant acreages under this crop.

MANGOLDS.—Although the acreage under mangolds was smaller, this crop was appreciably heavier in total than that of last year, and the yield per acre was above both that of 1927 and the 10 years' average. The total production is estimated at 5,756,000 tons, an increase of 308,000 tons, while the yield per acre at 19·3 tons compares very favourably with 17·9 tons in 1927 and 18·9 tons for the previous 10 years. The increase in the yield of mangolds was by no means as general as in the case of most other principal crops, for while only two divisions returned under-average results, no less than 25 counties in England and Wales fell short of their average.

SUGAR BEET.—The acreage under sugar beet showed a somewhat sharp reduction, the area returned on June 4 in England and Wales being 175,681 acres compared with 222,600 acres in 1927. So far as can be estimated at present, the total yield is likely to be about 1,430,000 tons. The yield per acre, which is likely to be a little above 8 tons, is an improvement upon that of last year, and indications suggest that the crop will also be more satisfactory in regard to general quality and sugar content.

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CEREAL CROPS IN ESSEX, 1926-27

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IN the autumn of 1926 three members of the Council of the National Institute of Agricultural Botany met a representative body of Essex agriculturists, including the Chairman and Secretary of the Essex County Farmers' Union and Mr. Johnston-Wallace, Principal of the East Anglian Institute of Agriculture. As the result of this meeting, Mr. J. B. Gill, the Secretary of the Farmers' Union, arranged to collect from members of that Union records of the crops of cereals which they would be growing in 1926-27 in the ordinary course of farming. Records of nearly 900 fields, scattered over the whole of Essex, and representing about 5 per cent. of the cereal area in the county, were successfully obtained by Mr. Gill. They show the present distribution of cereal varieties in Essex, and their yields and money returns per acre, and therefore

supplement and check the field trials carried out by the National Institute of Agricultural Botany. The results for each crop are considered in turn in the following paragraphs. As the figures refer to one season only, and the reliability is proportionate to the number of returns, conclusions should not be drawn from the tables without reference to the notes that accompany them. Only those varieties for which there is a substantial number of returns have been included in the tables.

WINTER WHEAT.

Variety	No. of fields	Total area	Average yield per acre			Average of actual selling prices per qr. headcorn	Cash return per acre	
			Head-corn	Sec-onds	Total			
		Acres	Qr.	Qr.	Qr.	s. d.	£	s. d.
Victor	77	859·85	4·73	·36	5·06	47 3	11	18 10
Yeoman & Yeoman II	126	1403·50	4·61	·37	4·95	47 2	11	13 2
Squarehead's Master	46	487·50	4·26	·22	4·45	47 6	10	11 8
Standard Red ..	29	265	4·04	·35	4·32	47 4	10	6 1
Little Joss ..	49	525	4·07	·25	4·29	47 8	10	4 7

Yeoman and Yeoman II together cover a very much larger area than any other variety. Victor, which, if not identical with, yet behaves in much the same way as Wilhelmina, comes next in area. That these are the most profitable varieties to grow in Essex is confirmed by the behaviour of Yeoman II and Wilhelmina in the N.I.A.B. trials at Good Easter, near Chelmsford, on heavy clay. The prices per quarter show that the miller declines to pay the higher price which the proved quality of Yeoman II deserves, and it is therefore worth noting that Rivett, of which there were 166 acres, gave a higher average yield and cash return than any of the above varieties.

There were very few returns of spring wheat, and the financial return in every case was pitifully low.

WINTER BARLEY.

Variety	No. of fields	Total area	Average yield per acre			Average of actual selling prices per qr. headcorn	Cash return per acre	
			Head-corn	Sec-onds	Total			
		Acres	Qr.	Qr.	Qr.	s. d.	£	s. d.
Plumage-Archer and Plumage - Archer 1924	57	612	4·87	·32	5·07	53 4	13	10 11

The two Plumage-Archers occupied two-thirds of the winter barley area. The figures for other varieties were too few to warrant detailed quotation, but Spratt-Archer on 81 acres gave a return of £12 14s. 9d. per acre, and Archer on 88 acres £10 15s. 3d. Very little six-row barley was grown and its return was only £10 13s. 7d.

SPRING BARLEY.

Variety	No. of fields	Total area	Average yield per acre			Average of actual selling prices per qr. headcorn		Cash return per acre	
			Head-corn	Sec-onds	Total	s.	d.	£	s. d.
Archer	19	186.50	4.77	.44	5.12	49	9	12	12 9
Spratt-Archer ..	29	343.75	4.59	.38	4.93	48	1	11	14 0
Plumage-Archer and Plumage - Archer 1924	92	1255.50	4.42	.40	4.73	47	8	11	4 8
Plumage	7	98	3.9	.37	4.27	49	2	10	1 10

The differences in yield and values of the two Plumage-Archers and Spratt-Archer are insignificant. Further light on their relative merits may be forthcoming when the results of the 1925-28 trials of the N.I.A.B. have been analyzed. Too much attention should not be paid to the position of Archer at the head of the list, as there are comparatively few returns. It is impossible to form conclusions on the malting value of these barleys from the above figures, but it is known from very extensive trials that Spratt-Archer and the Plumage-Archers are the best malting barleys nowadays grown on any scale.

It is noteworthy that the Plumage-Archers return £2 6s. 3d. per acre more as winter than as spring barleys. Spratt-Archer also did better when autumn sown. It will be interesting to see later whether the same is true of the 1927-28 season, when the winter was so much more severe.

WINTER OATS.

No money returns could be calculated for the winter and spring oats, as almost the whole of the crops of all varieties were fed on the farms.

Variety	No. of fields	Total area	Average yield per acre		
			Headcorn	Seconds	Total
		Acres	Qr.	Qr.	Qr.
Marvellous ..	15	176.75	8.08	.34	8.20
Grey Winter ..	53	582.84	6.84	.35	6.92
Black Winter ..	21	242.50	5.88	.23	5.93

There is no doubt that, in mild seasons on sheltered and well-drained soils, Marvellous is the heaviest-yielding oat for autumn sowing, but it is not capable of resisting severe frost. Farmers who wish to be certain of getting a crop of winter oats should choose Grey Winter; if they must have an oat that stands, Bountiful is the happiest compromise.

SPRING OATS.

Variety	No. of fields	Total area	Average yield per acre		
			Headcorn	Seconds	Total
		Acres	Qr.	Qr.	Qr.
Victory	14	191	7.08	.44	7.37
Abundance ..	21	233	6.75	.30	6.87

The area under spring oats was only two-thirds of that under winter oats, but more varieties were represented in the returns than in the case of any other crop but winter wheat. Victory and Abundance alone were grown widely enough to justify the publication of figures; the N.I.A.B. trials confirm that the former is the better yielder.

Conclusion.—The present returns come in the main from land that is in a good state of cultivation; it is probable that if the average yields could be ascertained on the same basis for the whole county they would be rather lower than those given in the foregoing tables. It is satisfactory to find that these Essex figures agree very well with the results of the N.I.A.B. trials, and that with few exceptions the best varieties prove also to be those that are the most widely grown. Many inferior varieties, however, are still in use, and it is significant that some of the poorest returns were those for varieties to which the grower was unable to put a name.

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MOLE DRAINING

THE recent demonstration of modern mole draining, given in the grounds of Studley College for Women, Warwickshire, organized by the Ministry in conjunction with the Warwickshire Agricultural Education Authorities, was the last of the year. The demonstration provided an opportunity for local farmers to see the different types of mole-ploughs and become acquainted with the latest agricultural tractors and other machines used in these operations. They were able to inspect the work done by each before deciding to buy or hire mole draining equipment, and had also an opportunity of studying the various methods for carrying out the necessary operations in connexion with the making of both mole and main drains.

There can be no question that expenditure on mole draining on heavy land farms in need of drainage is money well spent. It is very little use applying good fertilizer to badly drained soils, or cultivating such soils intensively. The water must first be got rid of, after which money may usefully be expended in increasing the fertility of the land, either by the application of fertilizers or by more intensive cultivation.

Drainage of water-logged pastures should improve the herbage and lengthen the period during which the land will carry stock; and on arable land, increased crops should quickly repay the cost of the mole draining. Further information on the subject will be found in Leaflet No. 356—"Mole Draining"—obtainable direct from the Ministry, 10 Whitehall Place, London, S.W. 1.

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JANUARY ON THE FARM

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Review of 1928.—The past year will be remembered both as a good and as a bad farming season. The arable farmer had on the whole good weather for sowing, growing and harvesting his crops and his barns have been well filled; but by the time he could thrash and market his grain, the price of cereals had fallen to a level below that of any period since 1923. On holdings where the financial results are largely determined by the returns from the sale of corn, the past year has been far from a good one.

The grass farmer has not had such abundant herbage as usual; indeed, at times pastures have been definitely insufficient, and the meadows yielded somewhat light crops; excellent weather for haymaking enabled the produce of the meadows to be secured in good condition, however, and an open autumn has so far allowed of economy in the use of the winter fodder. In the matter of prices, the grass farmer has been appreciably more fortunate than the arable cultivator during the past season. Sheep have undoubtedly paid; fat lambs especially have sold well, but all classes of sheep have realized satisfactory prices. Fat cattle also met a good trade during about half of the year and throughout the season realized higher values than those of the previous year. Cheese prices have been higher, compared with the pre-war basis, than any other form of agricultural produce; and, as is well

known, milk producers secured an appreciable advance on last year's prices for the contract period which commenced on October 1.

The year 1928 was undoubtedly one in which prices favoured the grassland farmer rather than the occupier of an arable holding. If the results of the past season could be regarded as a reliable guide to future farming policy, the solution of one of the main problems in British agriculture would be obvious: temporary and permanent grass might be extended at the expense of cereals; the numbers of sheep and grass-fattening cattle might be increased; and dairy farming might be still further developed—especially the production of milk on summer grass, with cheese-making as a means of utilizing surplus. Unfortunately it cannot be said that sufficient data are available to enable one to weigh up prospects satisfactorily, although certain indications would seem to favour the policy outlined.

Since 1923, when all kinds of home-grown corn met a bad trade, wheat had been realizing prices which, on the evidence of costings reports, enabled the producer to make a profit on the crop. The average price in 1927 was 11s. 6d. per cwt., and according to the Cambridge Farm Economics Report No. 11, the net cost of production on the five farms recorded was 8s. 1d. per cwt. on an average yield of 17·8 cwt. per acre, a cash deduction from costs being made in respect of straw. In the Wye Report No. 6, for the three years 1924–26, the cost per cwt. on 922 acres in the South-Eastern counties was 11s. 1d., the cost per acre being higher than in the Cambridge area. Thus, while a small profit could be made on wheat production in previous years, it is obvious that there is little or no margin now, with wheat at less than 10s. per cwt., especially in districts where wages are higher and climatic conditions are less favourable to wheat growing than they are in the areas mentioned.

The collapse in prices of cereals of the 1928 harvest was mainly due to the yields in all the chief exporting countries of the world, increased acreage and good crops resulting in a total output which exceeded the post-war requirements of the grain trade. Record areas of corn in Australia and Argentina are now approaching their harvest, the produce of which may reasonably be expected to prevent any appreciable rise in values for some time. Indeed, there appear to be no indications of any reduction in supplies of any of the cereals which might cause a rise in prices within the next six months.

As regards the prospects of grass farming, it must be remembered that the main products of this type of agriculture supply a demand of rather limited dimensions. The comparatively favourable prices realized for mutton, beef and milk discussed above were attributable partly if not wholly to temporarily reduced supplies.

The Dairy Herd.—It always sounds like a confession of failure when a farmer admits that he can purchase better milkers than he can breed; and it is a fact that these purchased heifers often come from districts and farms where the bulls in particular would not score high marks on inspection for conformation. It may be that the cause of such a large proportion of poor milkers in the home-bred cattle on many farms is the use of sires that have been bred for points that may not be compatible with milk production. The farmer himself often attaches more importance to conformation than to pedigree of performance; and not uncommonly he purchases his bull without adequate inquiry as to the milking performance of the bull's relatives. Sometimes also even milk records are misleading, because of the practice of stating only the maximum yield in a year instead of the average of three or more years.

As is well known, the after-effects of abortion, especially sterility, are responsible for many otherwise good cows having to be disposed of. Attention may therefore be called to what appear to be remarkable results in the veterinary treatment of barren cows in herds affected with contagious abortion. Nielson (*Jour. Min. Agric. N. Ireland*, p. 124) treated 1,083 barren cows, of which 79 per cent. subsequently proved in calf. The chief method adopted was that of injecting a disinfectant solution into the uterus by means of special apparatus. Nielsen holds that one of the most important causes of sterility in cows is chronic inflammation of the womb, and that the infection occurs at calving or aborting, especially when the cow is handled in an unskilful and uncleanly manner, when the afterbirth is retained or when contagious abortion is present. Preventive measures include the cleaning of the cow before calving, clean quarters for parturition, and early professional assistance in the event of retention of the afterbirth.

January Operations.—During this month, the land is commonly either too wet or too hard-frozen to permit of important tillage operations, although opportunity may be found for ploughing grass leys and sometimes for ploughing-

back or cross-ploughing other land. Many farmers believe that ploughing at this season helps to eradicate wireworm, which is perhaps its main benefit on light land; on heavy land, however, a timely ploughing or splitting of ridges may appreciably improve the prospects of obtaining a good tilth. Manure carting is a standard form of employment for men and teams during frosty weather.

In accordance with the rule, "Sow when you can and wait when you must," any suitable opportunities for corn sowing will doubtless be utilized, as any of the cereals may do well when sown after the first fortnight in January. The writer's experience in this matter, however, emphasizes the value of shallow covering of the seed at this time of the year and of giving an application of quick-acting artificial manures at the time of sowing.

In January, most of the pasture land is free of stock and such parts as are intended to be top-dressed may be conveniently treated now. Towards the end of the month the first application of nitrogenous manure may be given to the fields intended to provide the desirable early bite. The disc harrowing of hide-bound fields—cutting up the turf in two directions—followed by harrowing and heavy rolling may be profitable employment in this month.

Besides thrashing, boxing seed potatoes, attention to live stock and such land operations as those mentioned above, the good manager utilizes any available time in January in performing some of the many odd jobs that should not be left to the busy season but which are necessary for smooth working of the farm and to its general tidy appearance. Hedging, ditching, road mending, attention to drains, mending gates and gateways, hurdle-making, and overhauling and repainting implements and machinery, are some of the odd jobs that come under this heading.

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NOTES ON MANURES

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Liquid Manure.—The utilization of liquid manure is one of the unsolved problems of British agriculture. With the growth of dairy farming, increasing numbers of cattle are being housed during the winter under conditions in which the bulk of the urine is almost certain to run to waste. This

urine contains about three-quarters of the total original manurial value of the concentrates and roots fed, and this plant food is in a highly available condition and of much the same value, unit for unit, as that contained in the soluble commercial fertilizers. Even when farmers appreciate these facts they rarely do anything to prevent loss, the wastage being regarded as a more or less necessary evil. In laying emphasis on the great value of liquid manure a few notes on its nature and some methods of handling it may be of interest.

Liquid manure as usually collected consists of the urine from cow stalls and stables, diluted with a certain amount of wash water used in these buildings and also possibly with the drainings from manure heaps in open yards. It is very variable in composition, being affected by the nature of the feeding and to a greater extent by the degree of dilution and the manner of its storage and collection. It is never as rich as the urine of the live stock, which in the case of cows contains about 1.05 per cent. of nitrogen and 1.36 per cent. of potash. Thus Prof. Hendrick found that typical Scotch samples of liquid manure contained 20 lb. nitrogen and 46 lb. potash per 1,000 gal. Corresponding values for a very large number of Swiss samples were 17 lb. and 44 lb. Cow urine undiluted, however, would contain about 105 lb. nitrogen and 136 lb. potash per 1,000 gal.

The nitrogen compounds contained in liquid manure, chiefly urea and related substances, rapidly undergo decomposition through the agency of bacteria, and the final result is the evolution and loss of ammonia. The condition which favours this loss of valuable nitrogen is free exposure to the air, so that the essential point in the economical collection, storage, and application of liquid manure is to keep it as far as possible from contact with air.

In the more elaborate systems of liquid manure conservation practised on the Continent, the urine of cattle tied up in stalls is separated as quickly as possible by the aid of specially constructed floors and gutters and conveyed to tanks by means of covered channels. The tanks are provided with air-tight covers or the liquid itself may be covered by boards which float on the surface or by a thin layer of oil which lies on the top of the liquid and forms an effective air seal. When used on arable land the high grade manure thus obtained is applied by means of a special drill whose coulters cut a track in the soil and deposit the liquid below the surface. Here again the aim is to hinder the volatilization of ammonia.

There is no doubt that these measures are sound in principle, and when new cowsheds are being built or old ones altered the opportunity occurs to incorporate an effective liquid manure system. Plans and specifications for simple and effective arrangements, which can be constructed almost entirely by the labour on the farm, are given in the Ministry's Leaflet No. 382 on Liquid Manure Tanks.

Use of Liquid Manure.—The most suitable crop to take the liquid manure accumulated during the winter is grass for hay, either permanent or temporary. Not only does the grass offer a better chance of carting out heavy loads relatively easily without injury to the land, but the composition of the manure containing readily available nitrogen and potash is favourable for hay production. Where the liquid is repeatedly used, however, it should be supplemented by phosphate, and on slightly acid soils with lime also. It has been shown in Swiss experiments that if grass is repeatedly forced with liquid manure on soils poor in lime, the fodder obtained does not contain sufficient calcium to provide a satisfactory diet for dairy stock. The application of liquid manure to grassland is convenient, but not without its drawbacks. The chief of these arises out of the loss of ammonia which occurs when the liquid is exposed to evaporation on the leaves of the grasses. In dry windy weather this loss may be very considerable, and it is further increased by the use of concentrated liquid manure and the application of light dressings per acre. Under such conditions the effect is virtually a manuring with potash salts, and it is rarely that such a treatment is productive of good results.

The best thing that can be done is to choose still dull weather for emptying the tank, and if rain is likely to follow so much the better. The liquid should be dilute, which will usually be the case where wash water and drainings get into the tank, and as heavy a dressing as possible should be applied—5–10 tons per acre would not be too much. It is best to cart out the liquid manure when the grass is short. On small farms in regions of intensive cultivation in many parts of the Continent repeated doses of liquid manure are used as the basis of a highly productive system of grassland husbandry, the manurial principle being the same as in the intensive treatment of pasture with nitrogenous fertilizers which is now under trial in this country.

On arable land the use of liquid manure presents some difficulties. It has been shown that unless steps are taken to

get the liquid covered by soil great loss of nitrogen takes place. Harrowing or cultivation can do something to obviate this, but tests have shown that shallow ploughing is more effective. Moreover, if liquid manure is applied to free draining land in the winter—and it is often necessary to empty manure tanks at that time—the loss of nitrate by leaching can be considerable. On the whole, the most hopeful course is to use the liquid as an early spring dressing for fodder crops which it is desirable to force on for early keep, such as rye, winter vetches, or young seeds. It may sometimes be possible to give some to the root land and work it into the soil.

It is sometimes suggested that liquid manure should be pumped over manure heaps and carted out with the dung. This is better than letting the liquid go to waste, but even so a certain amount of loss is likely to take place, particularly if the dung is already in a well rotted condition. When this practice is adopted it is helpful to spread and plough in the dung as quickly as possible.

Manuring and Quality.—In an interesting report on the investigation of factors determining quality in potatoes* a section is devoted to the effect of manuring. The main conclusions bear out the results of similar work elsewhere. It is shown that artificials in themselves are not damaging to the cooking qualities of potatoes; in fact potatoes grown with 9 cwt. of a complete fertilizer mixture, showing a normal balance of nutrients, boiled better than those grown without manures. As to the effect of the individual constituents, it was noted that excessive amounts of nitrogenous fertilizers produced wet soapy potatoes, but $1\frac{1}{2}$ cwt. of sulphate of ammonia in the mixture did no harm. Varieties of high natural quality could stand heavier dressings of nitrogen than those of inferior quality.

From the standpoint of quality, sulphate of ammonia was to be preferred to nitrate of soda or nitrate of lime, unless small applications were given. Phosphates were beneficial in mixtures, since the quality was lowered by omitting them; and, of the phosphates tried, superphosphate was the most effective. The absence of potash was also reflected in poor quality tubers which turned black on cooking. Of the potash salts the low-grade compounds were distinctly harmful to quality, especially in wet seasons; while the higher-grade salts, sulphate and muriate, were about equal in dry seasons, but there was a preference for sulphate in wet years. The potatoes were better without lime than with it.

* W. M. Findlay: *Scot. Jour. Agric.*, XI, 1928.

PRICES OF ARTIFICIAL MANURES

Description	Average price per ton during week ended December 5th				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda	10 6f	10 6f	10 6f	10 6f	13 3
Nitro-chalk o	—	—	—	—	—
Sulphate of ammonia:—					
Neutral (N. 20.6%)	10 8d	10 8d	10 8d	10 8d	10 1
Calcium cyanamide (N. 20.6%)	9 9e	9 9e	9 9e	9 9e	9 2
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%)	11 19g	11 3h	..	..	..
Kainit (Pot. 14%)	3 5	2 19	2 18	3 1	4 4
Potash salts (Pot. 30%)	5 2	..	4 16	4 19	3 4
" (Pot. 20%)	3 14	3 9	3 7	3 11	3 7
Muriate of potash (Pot. 50%)	9 14	9 3	8 19	8 18	3 6
Sulphate, " (Pot. 48%)	11 15	11 6	11 1	11 2	4 7
Basic Slag (P.A. 15½%)||	2 3c	1 17c	..	2 4c	2 9
" (P.A. 14%)||	1 19c	1 12c	1 12c	2 0c	2 10
" (P.A. 11%)||	..	1 7c	1 7c	..	..
Ground rock phosphate (P.A. 26-27½%)	\$ 2 10||	2 7||	..	2 5a	1 8
Superphosphate (S.P.A. 16%)	3 0	..	3 1	3 6	4 2
" (S.P.A. 13½%)	2 15	2 12	2 15	3 0	4 4
Bone meal (N. 3½%, P.A. 20½%)	8 15	8 10	8 12	8 7	..
Steamed bone flour (N. ½%, P.A. 27½-29½%)	5 17b	..	6 15	5 15	..
Burnt Lump Lime..	1 7k	1 10l	1 12n	2 2m	..
Ground Lime ..	1 14k	..	..	1 17m	..
Ground Limestone..	1 1k	..	1 8n	2 6m	..
Ground Chalk ..	..	1 6	..	1 11m	..
Slaked Lime ..	..	..	2 14n	3 2m	..

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. 85% through standard sieve.

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

g F.o.r. Gloucester.

A F.o.r. Goole.

k 4 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.

o The prices in this table are the average prices ruling on December 5 1928, but, as stated in a note on page 876 of the December issue of the JOURNAL, as from January the grade of Nitro-chalk will be raised to 15½ per cent. nitrogen, and the price will be £10 per ton, giving a cost per unit of 12/11.

Nitrate of Soda.—There is no doubt of the good reputation which nitrate of soda has enjoyed among farmers, both here and abroad. Before the Great War it was extensively used as a top-dressing for cereals and roots and had been found suitable for a wide range of soils, on which it gave both rapid and certain action. Owing to war conditions and the steady development of cheap supplies of by-product and synthetic ammonia compounds, ammonia nitrogen became so much cheaper per unit than the nitrogen of nitrate of soda that Chile nitrate lost ground in this country. It is gratifying to find that steps are being taken to bring this valuable fertilizer once more within the reach of farmers. A flat rate of delivered prices has recently been fixed for the coming season which will apply to the whole country. Nitrate of soda is to be sold at from £10 to £10 13s. according to the month of delivery, giving a price of from 12s. 11d. to 13s. 9d. per unit of nitrogen. This will still be dearer than the price of ammonia nitrogen, but the reduction is such as to make nitrate once again a fertilizer which can be used economically for the purposes for which it is known to have special value. Like other nitrogenous fertilizers, nitrate of soda is now cheaper than it was in 1914. For late top-dressings and in dry districts nitric nitrogen has no rival. Nitrate of soda also seems to be specially suitable for sugar beet and mangolds, while in market garden practice it is much used for forcing on leafy vegetables.

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NOTES ON FEEDING STUFFS

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The Feeding of Sugar Beet Pulp.—In the Notes for last month it was demonstrated that dried sugar beet pulp must be included in the group of feeding stuffs known as carbohydrate concentrates, and that 1 lb. of this product is able to replace 0.8 lb. of maize meal or 0.9 lb. of barley meal in the rations of *ruminant* animals. Before the commencement of the Cambridge investigations, the writer thought that it would be of great assistance to collect the opinions of a number of practical men on the uses and feeding value of sugar beet pulp. It was believed that such collected experience would not only be extremely valuable in helping to decide the merits and demerits of this by-product, but might throw some light on the apparent disinclination, manifested by

stock-owners in the early days of the beet sugar industry, to purchase it freely. To this end, a circular, embodying the following series of questions, was sent to a number of well-known farmers:—

- (1) For what purposes do you use sugar beet pulp? What amounts do you feed to different classes of stock? Are you satisfied with the results it gives?
- (2) Do you regard sugar beet pulp merely as a substitute for roots in the ration?
- (3) Do you always soak the pulp prior to feeding? If not, what amounts do you find can safely be fed in the dry condition to different classes of stock?
- (4) Do you use sugar beet pulp for pig-feeding? If so, what amounts do you recommend? Are the results satisfactory?
- (5) Do you use sugar beet molasses? If so, how do you feed it, and what amounts do you recommend for different classes of stock? Are the results good? Do you note any undesirable effects (*e.g.*, scouring)?
- (6) Do you regard sugar beet pulp as worth £5 10s. 0d. per ton? If not, what price would you suggest?

Not many replies were received. This, perhaps, was not altogether surprising, since the questionnaire may have borne a suspicious resemblance to an examination paper for an agricultural diploma. Moreover, it appeared that many farmers had no experience of this feeding stuff. Nevertheless, a number of extremely useful answers to the questions were sent to the writer, who takes this opportunity of thanking all those farmers who went to such trouble to supply him with the desired information.

A well-known Lincolnshire farmer replied as follows: "I only feed the molasses pulp, as it is much less bulky than the ordinary, and this is an important consideration in the feeding of dairy cows. My production ration for cows in milk is one part by weight of decorticated ground nut cake, two parts of molasses pulp and one part of palm kernel cake. If the hay is good, I feed 3½ lb. of this mixture per gallon of milk; if of poor quality, I increase the allowance to 4 lb. This is for every gallon up to four for cows and three for heifers; above that, I feed linseed cake. I use no roots, but feed 20 lb. of hay for maintenance. My full-time cows last year averaged 1,005 gallons. For my store beasts, I mix one part of decorticated ground nut cake and two parts of molasses pulp. I have replaced all my root crops with sugar beet and find my cattle look just as well as when they had roots. Further, beet pulp is much less costly and is easier to handle. For my sheep (ewes with lambs) I use a mixture of equal parts of Egyptian cotton cake and molasses pulp, ½ lb. per head. Formerly, I used the same mixture as for my store beasts, but found that this was too laxative, as the rear wool and bags became soiled and the lambs did badly. There also was an undue proportion of trimmings at clipping time. I have not used beet pulp for pigs, but from what I have heard, it is not a very satisfactory food for this purpose."

An agricultural official, also in the Lincolnshire area, states

in his reply: "I have found that farmers who commenced to take sugar beet pulp a few years ago, now buy up all they can get at £5 per ton and consider it cheap. Nearly all of them use it as part of the concentrate ration."

A Cambridgeshire farmer writes: "I feed sugar beet pulp to stock in the following amounts: Dairy cows, 6-8 lb. soaked pulp per day. Weaning calves (two to three months), $\frac{1}{2}$ -1 lb. dry. Fattening cattle, 6-8 lb. dry. Store cattle, 6-8 lb. dry. Ewes, $\frac{1}{2}$ -1 lb. dry. Less labour is required to feed the pulp in the dry condition, though possibly the succulence of the soaked condition may be useful to milking cows. I consider sugar beet pulp worth buying at £5 per ton to grower's station."

A Cambridgeshire agricultural official reports as follows: "Sugar beet pulp is being used in this county for dairy cows, sheep, horses and fattening bullocks. For dairy cows, it is being fed up to 4 lb. per cow per day, and in most cases it is soaked prior to feeding. For sheep, it is being used at the rate of $\frac{1}{2}$ lb. per ewe per day, fed dry. For horses, a little is being mixed with the corn, dry. For bullocks, it is being fed at the same rate and in the same manner as for cows. As a substitute for roots, the price is high. If it may be used as a substitute for cereal food, the price would appear to be reasonable."

The following reply was sent by the managing director of a well-known sugar factory: "A large proportion of the pulp is fed to cows and sheep, cows receiving 10-12 lb. per animal per day, and sheep, $\frac{1}{2}$ -1 lb. We believe most farmers have had fairly satisfactory results, and many of them are realizing the feeding properties of molasses pulp to be those of a carbohydrate concentrate. The best feeders appear to be feeding molasses pulp to dairy cows in the dry condition, or only slightly moistened. Farmers get better results from feeding sheep dry. We have been unable to find anyone who has carried out experiments in feeding pulp to pigs, but in all probability it would be a small part of the ration and would be soaked before feeding. During last summer, we fed 30 bullocks on our grass round the factory, and as a concentrate we used molasses pulp slightly moistened with molasses solution. After a short time, we got the bullocks on to 12-15 lb. of pulp per day, together with 7-8 lb. of beet molasses (mixed with the pulp as described above). We also had a tub of molasses in the field where the bullocks could help themselves at any time and the cattle did very well on the ration, no undue scouring occurring. During the winter, we have sold a great quantity of molasses to farmers, who appear to use it with chaff or hay. Apparently farmers are satisfied with the results, as they come back for repeat orders, and at the moment our supply is all sold."

Through the kindness of Mr. F. H. Garner, who has returned recently from a year's visit to America, the writer is able to add a few notes on the use of sugar beet pulp in the United States. Mr. Garner writes: "Sugar beet pulp is very largely used in the rations of dairy cows which are being fed for records of milk or butter-fat production in the United States. It is in such big demand by the dairymen of the States, who are endeavouring to establish world's records with their respective charges, that it has reached a fictitious price, far above the actual food units it contains. I think I am correct in stating that at the present time sugar beet pulp is being imported into the States from England (season, 1927-28). The special value of feeding sugar beet pulp to dairy cows on official test is attributed to several points:

(1) It is slightly laxative and is said to be 'cooling.' (2) It 'lightens' the heavy concentrate mixtures fed to good milkers, this resulting in the digestive juices mixing more thoroughly with the constituents of the ration and leading to more efficient digestion. Dr. Eckles, an eminent American authority on the management of dairy cows, recommends the use of dried sugar beet pulp in the rations of high-producing cows. He suggests feeding the dried pulp in the following way: moisten one part of dried pulp with three parts of warm water. Allow to stand for several hours, place in the manger and cover with the concentrate ration."

Space forbids any further citations from the replies which were received to the questionnaire. Enough has been written, however, to show that dried sugar beet pulp bids fair to become a popular feeding stuff in the near future. The replies are given without comment, though the reader, when considering the substance of these statements, should keep in mind what has already been printed in these columns concerning the nutritive value of sugar beet pulp.

It will be recalled that in the Notes for February, 1928, the writer summarized an article by Professor T. B. Wood, in which the latter demonstrated very clearly that an all-round standard of high productivity in the various branches of animal husbandry in this country would not be attainable until means had been found for bringing about a material increase in the supply of concentrated foods for feeding to farm animals. Recent work at Cambridge has shown that the available supply of protein concentrates may be augmented considerably, (1) by adopting a system of close-grazing or rotational grazing of pastures, since the dry matter of young pasture herbage is a protein-rich food of high digestibility, and (2) by conserving young pasture herbage, either by artificial drying or by ensilage, for use in winter as a source of protein in the rations of farm animals. The results of the present work on dried sugar beet pulp have demonstrated further that in this feeding stuff the farmer possesses what is, for this country, a new and relatively cheap carbohydrate concentrate. By the fuller utilization of these sources of digestible protein (young pasture grass) and digestible carbohydrate (sugar beet pulp), the farmer will be able to solve many of the problems associated with intensive production in farm animals.

A feeding trial of great interest was carried out on the University Farm at Cambridge during the winter of 1927-28. A number of steers of the Shorthorn type, with an average weight of about 8½ cwt. at the commencement of the trial, were fed in a covered yard on a ration containing 10 lb. of

dried beet pulp, 5 lb. of artificially dried pasture grass, 5 lb. of hay and 14 lb. of silage. Towards the end of the feeding period, the dried pasture grass was increased to 7 lb. and the hay reduced to 3 lb. It will be noted that in this ration, the young dried grass formed the source of digestible protein, and the sugar beet pulp the source of digestible carbohydrate. The cattle did particularly well. They averaged a steady 2 lb. per day live-weight increase during the first two months of fattening and about $1\frac{3}{4}$ lb. for the last month. They displayed a noticeable "bloom" at the end of the experiment, and, after slaughter, the quality of the beef proved excellent.

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	9 8
Maize	81	6.8	10 8
Decorticated ground nut cake	73	41.0	13 5
" cotton cake	71	34.0	11 10
(Add 10s. per ton, in each case, for carriage.)			

The cost per unit starch equivalent works out at 2.57 shillings, and per unit protein equivalent, 1.93 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, 1928, 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	10 5
Oats	60	7.6	8 9
Barley	71	6.2	9 14
Potatoes	18	0.6	2 7
Swedes	7	0.7	0 19
Mangolds	7	0.4	0 19
Sugar Beet Pulp, dried	65	5.2	8 17
Beans	66	20.0	10 8
Good meadow hay	31	4.6	4 9
Good oat straw	17	0.9	2 5
Good clover hay	32	7.0	4 16
Vetch and Oat silage	13	1.6	1 16
Barley straw	19	0.7	2 10
Wheat straw	11	0.1	1 8
Bean straw	19	1.7	2 12

DESCRIPTION	Price per qr.		Price per ton		Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.				s. d.	d.	
Wheat, British.. ..	—	—	10 0	0 13	9 7	72	2 7	1.38	9.6	
Barley, British feeding	—	—	9 5	0 10	8 15	71	2 6	1.34	6.2	
" Canadian No. 4 Western	35 0	400	9 17	0 10	9 7	71	2 8	1.43	6.2	
" " feed	31 9	"	8 18	0 10	8 8	71	2 4	1.25	6.2	
" American	32 0	"	9 0	0 10	8 10	71	2 5	1.29	6.2	
" Persian	35 3	"	9 17	0 10	9 7	71	2 8	1.43	6.2	
" Tunisian	33 3	"	9 7*	0 10	8 17	71	2 6	1.34	6.2	
Oats, English, white	—	—	10 0	0 10	9 10	60	3 2	1.70	7.6	
" " black and grey	—	—	9 13	0 10	9 3	60	3 1	1.65	7.6	
" Scotch, white	—	—	10 7	0 10	9 17	60	3 3	1.74	7.6	
" Irish, black	—	—	9 18	0 10	9 8	60	3 2	1.70	7.6	
" Canadian No. 2 Western	32 9	320	11 10	0 10	11 0	60	3 8	1.96	7.6	
" " 3 "	30 9	"	10 15	0 10	10 5	60	3 5	1.83	7.6	
" " Feed	29 3	"	10 5	0 10	9 15	60	3 3	1.74	7.6	
" Argentine	29 9	"	10 8	0 10	9 8	60	3 2	1.70	7.6	
" Chilean	30 0	"	10 10	0 10	10 0	60	3 4	1.78	7.6	
" German	29 6	"	10 7	0 10	9 17	60	3 3	1.74	7.6	
Maize, Argentine	44 6	480	10 8	0 10	9 18	81	2 5	1.29	6.8	
Beans, English, winter	—	—	10 10†	1 4	9 6	66	2 10	1.52	20	
Peas, English, blue	—	—	14 10†	1 1	13 9	69	3 11	2.10	18	
" Japanese	—	—	19 15‡	1 1	18 14	69	5 5	2.90	18	
Millers' offals—										
Bran, British	—	—	7 17	1 2	6 15	42	3 3	1.74	10	
" broad	—	—	8 17	1 2	7 15	42	3 8	1.96	10	
Middlings, fine, imported	—	—	9 15	0 15	9 0	69	2 7	1.38	12	
" coarse, British	—	—	8 5	0 15	7 10	58	2 7	1.38	11	
Pollards, imported	—	—	8 0	1 2	6 18	60	2 4	1.25	11	
Meal, barley	—	—	10 10	0 10	10 0	71	2 10	1.52	6.2	
" maize	—	—	10 10	0 10	10 0	81	2 6	1.34	6.8	
" " germ	—	—	11 0	0 16	10 4	85	2 5	1.29	10	
" locust bean	—	—	10 0	0 7	9 13	71	2 9	1.47	3.6	
" bean	—	—	12 15	1 4	11 11	66	3 6	1.87	20	
" fish	—	—	19 10	3 7	16 3	53	6 1	3.26	48	
Maize, gluten feed	—	—	10 7	0 19	9 8	76	2 6	1.34	19	
" cooked flaked	—	—	12 5	0 10	11 15	85	2 9	1.47	8.6	
Linseed—										
" cake, English, 12% oil	—	—	14 5	1 9	12 16	74	3 6	1.87	25	
" " " 9% "	—	—	13 12	1 9	12 3	74	3 3	1.74	25	
" " " 8% "	—	—	13 5	1 9	11 16	74	3 2	1.70	25	
Soya bean " " 5% "	—	—	11 15	1 17	9 18	69	2 10	1.52	36	
Cottonseed cake, English—										
" Egyptian, 4½% "	—	—	8 5	1 7	6 18	42	3 3	1.74	17	
" " Egyptian, 4½% "	—	—	8 5	1 7	6 18	42	3 3	1.74	17	
Coconut cake, 6% oil	—	—	11 5	1 4	10 1	79	2 7	1.38	16	
Ground-nut cake, 6.7% oil	—	—	10 17*	1 7	9 10	57	3 4	1.78	27	
Decorticated ground-nut cake, 6.7% oil	—	—	13 5*	2 0	11 5	73	3 1	1.65	41	
Palm kernel cake, 4½-5½% "	—	—	10 2†	0 17	9 5	75	2 6	1.34	17	
" " " meal, 4½% "	—	—	10 12†	0 17	9 15	75	2 7	1.38	17	
" " " meal 1% "	—	—	9 7†	0 18	8 9	71	2 5	1.29	17	
Feeding treacle	—	—	6 0	0 8	5 12	51	2 2	1.16	2.7	
Brewers' grains, dried ale	—	—	8 15	0 18	7 17	49	3 2	1.70	13	
" " " porter	—	—	8 5	0 18	7 7	49	3 0	1.61	13	
Malt culms	—	—	7 15*	1 7	6 8	43	3 0	1.61	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 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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 17s. per ton. The food value per ton is therefore £10 3s. per ton. 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. 8d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch is 1.43d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 8s. 10d.; P₂O₅ 3s. 10d.; K₂O, 8s. 3d.

MISCELLANEOUS NOTES

A GRASSLAND Conference, over which Lord Bledisloe will preside, will be held on Tuesday, January 8, at the Midland Agricultural and Dairy College, Sutton Bonington, Loughborough. All persons interested are cordially invited to attend, and copies of the Conference programme, tickets for luncheon, particulars of overnight accommodation at the College for visitors, etc., can be obtained on application to Dr. Milburn, Principal of the College. The Conference lasts the day, commencing at 10.45 a.m. with the Chairman's opening remarks. At the morning session, papers will be read by Mr. J. R. Bond on "Improvement of Grassland by Mechanical Treatment," and by Mr. G. A. Cowie on "Present-day Tendencies in the Manuring of Grassland." In the afternoon, Mr. H. T. Cranfield will deal with "The Feeding Value of Grass for Milk Production," and Dr. A. C. Ruston with "The Economics of Grassland Manuring," after which the Chairman will give his concluding remarks. Ample time will be allowed after each paper for discussion. The College is within 10 minutes' walk of Kegworth Station, L.M.S. Railway.

* * * * *

AN eelworm disease of potatoes has been mentioned a good deal recently in the Press in some parts of the country.

It is probable that some potato growers have an exaggerated idea of the damage caused by the disease to the potato crop.

The pest is usually prevalent only in areas where potatoes are grown repeatedly on the same soil, and it is still a matter of doubt in such cases whether the eelworm is really responsible for all the damage to the potato crop that arises under such conditions. Research work is going on to discover the exact part played by the pest and the measures that should be taken to deal with the trouble with which it is at present associated.

What is known is that the eelworm attacks the fine roots of the plant, which, when lifted, show the female eelworms in the form of small round white or brown bodies adhering to the root. The disease must not be confused with another kind of eelworm trouble due to the Stem Eelworm, which may do much damage to potatoes, especially when stored in clamps for any length of time. At present, the point for

farmers and others to remember is that it is important for several reasons that they should not use the same land too frequently for potatoes; it is probably unsafe to take this crop more frequently than once every three years.

* * * * *

At the Cookery and Food Exhibition, which was held at the Olympia from November 23 to December 1, the Ministry, in collaboration with the National Farmers' Union and other organizations, staged a display of Home Produce in the Empire Marketing Board's Pavilion. The display included the usual commodities; in particular, apples packed under the National Mark, and eggs graded in accordance with the new regulations, proved of general interest.

At the request of the Ministry the Empire Marketing Board offered three prizes for the best loaves made from all-English flour and liquid milk. The competition attracted a number of entries and served to draw attention to the possibilities of the all-English Milk Loaf.

* * * * *

AGRICULTURAL produce in November was 41 per cent. dearer than in 1911-13, as compared with 39 per cent. in the preceding month and 37 per cent. in

The Agricultural Index Number November last year. The majority of commodities were little altered in price or index number during the month, and the increase of 2 points in the general index number was due principally to the rise in the contract price of milk.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :-

		Percentage increase compared with the average of the corresponding month in 1911-13					
Month		1923	1924	1925	1926	1927	1928
January	..	67	60	71	58	49	45
February	..	63	61	69	53	45	43
March ..	..	59	57	66	49	43	45
April ..	..	54	53	59	52	43	51
May ..	..	54	57	57	50	42	54
June ..	..	49	56	53	48	41	53
July ..	..	50	53	49	48	42	45
August ..	..	52	57	54	49	42	44
September	..	52	61	55	55	43	44
October	..	50	66	53	48	40	39
November	..	51	66	54	48	37	41
December	..	55	65	54	46	38	—

Grain.—The average price of wheat in November was 9s. 10d. per cwt., or 4d. more than in October, and the index number moved 3 points upward to 31 per cent. above pre-war. Barley averaged 10s. 8d. per cwt., or 1d. less than in the preceding month, but oats were 2d. dearer at 8s. 11d. per cwt., the index number for the latter remaining unaltered at 27 per cent. above 1911–13, while for the former it fell 1 point to 25 per cent. A year ago wheat stood at 34 per cent., barley at 45 per cent., and oats at 30 per cent. above their pre-war levels.

Live Stock.—Fat cattle prices were maintained at practically the same figures as in October, and the index number was unaltered at 31 per cent. above the base years, but a rise of about $\frac{1}{2}$ d. per lb. occurred in the average for fat sheep, and the index number rose 1 point to 53 per cent. Bacon pigs showed a decline in price and index number, but prices for porkers remained at about the same level as in October, and the index number was unchanged at 33 per cent. above pre-war. Increases in the prices of dairy cows and store sheep were recorded, but as these were not so large relatively as in the corresponding period of the base years, the index number in each case declined by 1 point. Store cattle were a little dearer and store pigs a little cheaper, but there was no alteration in the index numbers.

Dairy and Poultry Produce.—The November contract price for milk was generally 1d. per gallon higher than in October, and at 71 per cent. above pre-war the index number showed a considerable rise of 14 points. Butter advanced about $\frac{1}{4}$ d. per lb. and eggs about $4\frac{1}{4}$ d. per dozen, but in both cases the advance was relatively less pronounced than in the corresponding period of the base years, and the index numbers were lower by 3 and 15 points respectively at 52 and 51 per cent. above 1911–13. Cheese continued at 78 per cent. dearer than pre-war. Fowls and geese were a little cheaper than in October, and a decline of 4 points was recorded in the index number for poultry.

Other Commodities.—A further reduction in wool prices was recorded, and the index number fell 4 points to 66 per cent. above pre-war. Hay prices declined slightly to an average of 4 per cent. above the base years, while potatoes, owing to a reduction in price in the corresponding months of 1911–13, were relatively dearer on the month at 53 per cent. above pre-war; the prices of vegetables remained at about one-third

above those ruling in the base years. Apples were 60 per cent. dearer than pre-war.

Index numbers of different commodities during recent months and in November, 1926 and 1927, are shown below.

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

Commodity	1926	1927	1928			
	Nov.	Nov.	Aug.	Sept.	Oct.	Nov.
Wheat	66	34	30	22	28	31
Barley	35	45	58	50	26	25
Oats	20	30	49	33	27	27
Fat cattle ..	31	19	40	36	31	31
Fat sheep ..	43	40	59	59	52	53
Bacon pigs ..	71	18	36	33	26	24
Pork pigs ..	76	29	33	32	33	33
Dairy cows ..	34	28	33	34	39	38
Store cattle ..	22	13	29	27	20	20
Store sheep ..	42	35	55	66	54	53
Store pigs ..	135	44	26	28	31	31
Eggs	60	47	55	52	66	51
Poultry	49	46	45	42	51	47
Milk	64	59	55	65	57	71
Butter	47	47	54	54	55	52
Cheese	28	55	84	78	78	78
Potatoes	113	76	35	60	51	53
Hay	4	19	13	14	6	4
Wool	31	46	76	76	70	66

* * * * *

DURING recent years, there has been a growing tendency for exporting countries to engage in various forms of publicity on behalf of their produce. One form of propaganda has been the entertainment of deputations of distributors from this country for the purpose of demonstrating the methods of production and processing of goods destined for export. Such organized tours secure much publicity in trade journals, and the effect is considerable. It is also enduring, at any rate so far as the actual personnel of the tour is concerned.

As an experiment, and with a view to emphasizing to an important section of the distributive trade the superlative quality of home produce and, where applicable, bringing retailers in touch with new schemes of grading, packing, etc., the Ministry of Agriculture and Fisheries has approached the

**Travelling
Scholarships
for Grocer
Students**

Institute of Certificated Grocers and offered to arrange a tour in England and Wales for (a) 15 students, ordinarily resident in England and Wales, who take the highest places in the Institute's final examination, 1929, and who are desirous of making the tour; (b) five accredited teachers of classes to be nominated by the Institute, provided that such teachers are practical grocers, and (c) one official of the Institute.

The tour will start and finish in London, and will last for 11 days during the second and third weeks in July next. Details of the tour have not yet been settled, but visits will probably be made to egg, fruit and poultry packing stations, fruit and vegetable canneries, cheese-making farms and factories, bacon and ham factories, a beet sugar factory and a cider factory, as well as poultry farms, pig farm, orchards and the Royal Show.

The Ministry will defray the cost of the tour from the marketing grant placed at its disposal by the Empire Marketing Board.

* * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on December 10, at 7 Whitehall Place, S.W. 1, the Chairman, 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 into effect the Committees' decisions:—

Berkshire.—An Order cancelling, as from December 22, the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers, and fixing rates in substitution therefor to operate from December 23, 1928, to December 21, 1929. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours, except during the weeks in which Christmas Day and Good Friday fall, when the number of hours in respect of which the minimum weekly wage is payable is 41. The overtime rate in the case of male workers of 21 years of age and over is 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.

Derbyshire.—An Order to come into force on December 26 continuing the operation of the existing minimum and overtime rates of wages for male and female workers until December 25, 1929. The minimum rate in the case of male workers of 21 years of age and over is 8d. per hour, with overtime at 10d. per hour for employment on Sunday. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour, with overtime at 8d. per hour for employment on Sunday.

Hampshire and Isle of Wight.—An Order cancelling the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers as from December 22, and fixing rates in substitution therefor to operate from December 23, 1928, to December 21, 1929. The minimum rate in the case of male workers of 21 years of age and over is 30s. 6d. per week of

48 hours in winter and 51 hours in summer, except during the weeks in which Christmas Day and Good Friday fall, when the number of hours in respect of which the minimum weekly wage is payable is 40½ or 41½ respectively. 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 connexion with the immediate care of animals, when the overtime rate is 7½d. per hour. The minimum rate in the case of female workers of 18 years of age and over is 5d. per hour for all time worked.

Anglesey and Caernarvon.—An Order to come into force on December 24, and to continue in operation until further notice, varying the 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 are for horsemen, cowmen, shepherds or hwsmyrn (bailiffs), 35s. per week of 58 hours (instead of 60 hours as at present), and for other male workers 31s. per week of 50 hours as at present. Overtime is payable in the case of all male workers of 21 years of age and over at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate remains unchanged at 6d. per hour for all time worked.

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 December 15, legal proceedings were instituted against seven employers for failure to pay minimum and overtime 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 concerned
		£	s.	d.	£	s.	d.	£	s.	d.
Cheshire	.. Broxton	..	2	0	0	—	—	30	0	0
Devon	.. Lifton	..	—	—	—	1	5	0	8	10
Kent	.. Maidstone	..	0	10	0	0	2	0	6	16
Lancashire	.. Bury	..	—	—	—	0	8	0	2	11
Lincolnshire	.. Gainsborough	..	3	0	0	0	19	6	21	8
Lincolnshire	.. Grantham	..	0	17	6	2	12	6	15	0
Northumberland	.. Bellingham	..	5	0	0	—	—	14	12	0
		£11 7 6			£5 7 0			£98 18 4		16

With regard to the case heard at Maidstone on December 10, the worker concerned, on becoming entitled to the contributory old age pension, had his wages reduced by 6s. 6d. a week, and no Permit of Exemption had been granted to him. The Bench, in fining the employer for an offence under the Agricultural Wages (Regulation) Act, warned employers in the area that the old age pension was granted to the worker, and employers had no right to appropriate it or any part of it in this manner. The Act contained machinery

whereby, if a worker is incapable by reason of physical injury or mental deficiency, or any infirmity due to age or to any other cause, of earning the minimum rate, a Permit of Exemption may be granted by the local Agricultural Wages Committee exempting, subject to certain conditions, his employer from paying him the minimum rate, but the fact that the worker was in receipt of an old age pension was not in itself a valid reason for obtaining a permit.

* * * * *

Wages for Public Holidays in Essex : Appeal Case.—In last month's JOURNAL, it was stated that the High Court upheld the Ministry's view as to the effect of the Order of the Essex Agricultural Wages Committee defining certain public holidays as overtime. The Appellants in normal weeks paid their workers at not less than the minimum and overtime rates applicable. In regard, however, to the week in which Good Friday fell, they instructed certain of their employees not to present themselves for work on Good Friday and for that week made a *pro rata* deduction in wages. The Appellants contended that in the particular circumstances of the case, they were only required to pay for the 41 hours' actual work performed during the remainder of the week, 41/50 of the weekly minimum wage of 30s., and that if they had, in fact, required the worker to work on Good Friday they should have paid the appropriate overtime rates for the hours worked on that day plus 41/50 of the weekly minimum wage. The Ministry's view was that for the purpose of the computation of the weekly minimum wage the effect of the Orders made in respect of Essex was that employment on public holidays having been defined as overtime, any employment on such days must be paid for at overtime rates quite outside the ordinary weekly minimum wage which, under the provisions of the Orders, is payable, notwithstanding that the hours of work in any week, excluding hours of overtime employment, agreed with the employer may be less than 50 in "summer" (or 48 hours in "winter"). Thus if, excluding all employment on the public holidays, Sunday, or Saturday afternoon, a worker works less than 50 hours in the remainder of the week in "summer" (or 48 hours in "winter") with the agreement of his employer, the worker is entitled to the full weekly minimum wage for those hours in addition to payment at overtime rates in respect of any employment on a public holiday, Sunday, or Saturday afternoon.

The Appeal was heard by a Divisional Court consisting of the Lord Chief Justice of England, Mr. Justice Avory and Mr. Justice Acton, and Judgment was delivered as follows :—

The Lord Chief Justice : This is a Case stated by Justices which raises an interesting point under the Agricultural Wages (Regulation) Act, 1924. The Justices had to consider whether a certain Order made by the Wages Board on the initiative of the Agricultural Committee was *ultra vires* in whole or in part of it. They came to the conclusion that no clause or part of it was *ultra vires* but that the whole of it was *intra vires*, and accordingly they came to the conclusion that the agricultural worker referred to was entitled to receive the full minimum wage of 30s., less National Health Insurance, in respect of the Good Friday week, whether he worked for the whole 50 hours or for a shorter period. Holding those views, and others which are consequential upon them and are set out in the Case, the Justices fined the present Appellants; and the question for this Court is whether, in so holding, the Justices came to a correct determination in point of law.

In our opinion the key to the matter is to be found in the Definition Section in the Statute. Throughout the ingenious argument of

Mr. Comyns Carr, one could not fail to observe that the term "employment" was used from time to time in two quite different senses, as if those different senses were the same. It is quite clear that in ordinary speech the term "employment" may mean a contract of employment, or, on the other hand, may mean actual work; and it makes all the difference in construing different parts of this Statute, and different parts of the Orders made under it, whether one realizes the sense in which the term "employment" is used. By Section 16 sub-section 1 of the Statute, it is clearly provided that the expression "employment" means employment under a contract of service or apprenticeship. It does not mean actual working at the very moment. It was with that definition in view that these bodies, which, as the learned Attorney-General has reminded the Court, are representative bodies very carefully chosen from all parties interested, had before them the task of fixing the minimum rates of wages, under Section 2, a Section which includes sub-section 4: "In fixing minimum rates a Committee shall, so far as practicable, secure for able-bodied men such wages as in the opinion of the Committee are adequate," etc. There is nothing in the Statute to say that the Committee may fix the rate per hour, but not the rate per week; on the contrary, it provides expressly that such minimum rates may be fixed by the Committee so as to apply universally to all workers or to any special class of worker or any special area or to any special class in a special area, subject to any exceptions which may be made, and so as to vary, according as the employment is for a day, week, month or other period, or so as to provide a differential rate in the case of overtime. The particular part of the Order with which this case has to do, is an Order relating to a whole-time male worker employed by the week. Addressing themselves to the task of fixing a minimum rate for him, the Committee came to the conclusion that if such a worker is 21 years old or older, he ought to have at least 30s. a week, that week being normally 50 hours a week. Then it immediately occurred to their minds that although in practice that was the week, there might be an agreement for what was nominally a week but which included less than 50 hours of employment or actual work, and so they provided that, even so, the worker should have his wages at the minimum rate per week secured to him, because in his case the rate of wages applicable to him should be made such as to secure to him the wages which would have been payable if the agreed hours had been 50. In my opinion there is nothing *ultra vires* in that part of the Order. Neither do I think that that part of the Order needs to be invoked in order to justify what was contended here. What was contended here was that here was a male worker of full age employed by the week, and as such he was entitled to the minimum wage per week. It matters not that in the particular week there came Good Friday. In my opinion the Justices were right for the reasons which they gave, and the contentions of the Respondents prevail in the case. I think, therefore, this appeal ought to fail.

Mr. Justice Avory : I am of the same opinion. Once it is admitted that the Committee had power to make or fix the rate of wages of 30s. per week for male workers of 21 years and over, I think it cannot be said that they were acting *ultra vires* in providing that although normally 30s. a week was to be paid for 50 hours work in summer and 48 hours in winter, if in any particular case the employers chose to agree that the worker need not work the whole of the 50 hours or 48 hours, as the case might be, that then, in that case, the man should still be entitled to his 30s. for the week. Having come to that conclusion, I can see nothing *ultra vires* in these regulations taken as a whole; and, therefore, I agree that the appeal fails.

Mr. Justice Acton : I agree.

Foot-and-Mouth Disease.—Outbreaks have been confirmed at three fresh centres as follows :—at Hollington Rural, Hastings, East Sussex, on November 25; at Halebank, Widnes, Lancs, on December 15; and at Wrockwardine, Wellington, Salop, on December 16. The usual restrictions were applied to an area of approximately 15 miles round the infected premises. A further outbreak in the Devon Infected Area occurred on November 22, making a total of 12 outbreaks in all in that area, and a second case was confirmed in the Salop Area on December 17.

No further outbreaks having occurred in the following Infected Areas referred to in the December issue of this JOURNAL, the restrictions were withdrawn on the dates mentioned: Crewe, Cheshire (November 24), Eype, Bridport, Dorset, and Tarrant Monkton, Blandford, Dorset (December 3).

One hundred and thirty-six outbreaks in all have been confirmed since January 1 last, involving 21 counties, and the slaughter of 4,048 cattle, 4,975 sheep, 2,223 pigs, and 16 goats.

* * * * *

New Quarantine Regulations for Imported Cats.—The following notice was issued to the Press on November 21 :—

By an Order made by the Minister of Agriculture on the 19th instant, which will come into operation on January 1 next, no cat or other feline animal brought to Great Britain from any other country except Ireland, the Channel Islands, and the Isle of Man, may be landed in Great Britain unless its landing has been authorized by a licence from the Ministry of Agriculture previously obtained. The most important condition attached to a licence will be the detention and isolation of the animal at the expense of its owner upon the premises of a veterinary surgeon approved by the Ministry for a period of six calendar months. Imported cats will thus for the first time be brought under the same quarantine requirements as already apply to imported dogs.

The reason for this Order is the increasing prevalence of rabies amongst cats as well as dogs on the Continent of Europe and elsewhere. A report of some recent cases of rabies in cats has been received from a place near Marseilles, France. One cat went mad and severely scratched and bit its owner and four other people, including three children. Another ferociously attacked three other people. Both animals, on post-mortem examination, proved to be infected with rabies.

Visitors to the Continent for their holidays sometimes take their cats abroad with them, others occasionally pick up a stray kitten whilst travelling abroad and bring it back to this country on their return. All such cats will in future have to undergo six months' quarantine immediately on landing as a safeguard against the risk of their being the means of introducing rabies from abroad.

Applications for importation licences must be made to the Secretary, Ministry of Agriculture, Whitehall Place, London, S.W. 1.

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APPOINTMENTS: CHANGES AND CORRECTIONS.

COUNTY AGRICULTURAL EDUCATION STAFFS

ENGLAND

Durham: Mr. H. Wignall, N.D.A., N.D.D., has been appointed Instructor in Poultry-keeping, *vice* Mr. G. M. Robertson.

Norfolk: Mr. E. G. Davison has been appointed Assistant Instructor in Horticulture, *vice* Mr. C. Savidge.

Yorkshire: (University of Leeds Agricultural Department). Mr. C. W. Goode, N.D.A., N.D.D., Assistant Lecturer in Poultry-keeping, has been appointed Lecturer in Poultry-keeping,

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., ENGLAND

The Horticultural College, Swanley, Kent

The notification in the November, 1928, issue of the JOURNAL that Miss S. Fillmer had left the staff of the College is incorrect. The List of Lecturers in Horticulture should, therefore, read as follows:—Miss A. M. Dickens, B.Sc. Hort., Mr. W. H. Barker, M.C., N.D.H., Miss S. Fillmer.

School of Agriculture, University of Cambridge

Mr. A. Walton, Ph.D., and Mr. H. Dean, F.S.I., have been appointed to the staff as University Demonstrators in Agricultural Biology and Estate Management respectively.

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APPOINTMENTS

LISTS of provincial officers connected with the work of agricultural education in England and Wales have been published in the issues of this JOURNAL for April, May, August, September, and October, 1928. These lists covered the teaching staffs employed by County Education Authorities (April and May); the teaching staffs at University Departments of Agriculture, Agricultural Colleges, etc. (August and September); and the Specialist Advisory Staffs of the various agricultural provinces (October). The series is completed with the list of the staffs of Agricultural Research Institutes. Part of the list of these staffs is given in this issue and the remainder will appear next month. For a general description of the work undertaken by these Institutes, readers should consult Dr. V. E. Wilkins' book, "Research and the Land," obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. Price 2s. 6d. net, paper covers, and 3s. 6d. net, cloth covers.*

STAFFS OF AGRICULTURAL RESEARCH INSTITUTES

Imperial College of Science and Technology

RESEARCH INSTITUTE IN PLANT PHYSIOLOGY

<i>Director</i>	..	..	..	..	Prof. V. H. BLACKMAN, Sc.D., F.R.S.
<i>Staff</i>	..	..	..	..	R. C. KNIGHT, D.Sc., F. G. GREGORY, D.Sc., B. D. BOLAS, M.Sc., F. J. RICHARDS

Royal Veterinary College, London

RESEARCH INSTITUTE IN ANIMAL PATHOLOGY

<i>Director of Research</i>	..	..	..	..	F. C. MINETT, D.Sc., M.R.C.V.S.
<i>Senior Assistants</i>	..	..	..	..	A. D. McEWEN, B.Sc., M.R.C.V.S., A. W. STABLEFORTH, B.Sc., M.R.C.V.S., D.V.S.M.
<i>Assistant</i>	..	..	..	..	S. J. EDWARDS, B.Sc., M.R.C.V.S.

* See also "Abstracts of Papers on Agricultural Research," obtainable from the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1. Price 1s. net, post free.

London School of Hygiene and Tropical Medicine
INSTITUTE OF AGRICULTURAL PARASITOLOGY

<i>Director</i>	R. T. LEIPER, M.D., D.Sc., F.R.S., Professor of Helminthology in the University of London, and Director of the Division of Medical Zoology.
<i>Assistant Director and Veterinary Adviser</i>	T. W. M. CAMERON, M.A., D.Sc., Ph.D., M.R.C.S.
<i>Principal Research Assistant</i>	T. GOODEY, D.Sc.
<i>Research Assistant</i>	D. O. MORGAN, M.Sc., Ph.D.

John Innes Horticultural Institution, Merton

<i>Director</i>	Sir DANIEL HALL, K.C.B., LL.D., F.R.S.
<i>Breeding and Genetics</i>	J. B. S. HALDANE, M.A., E. J. COLLINS, D.Sc., The Misses C. PELLEW, D. DE WINTON and I. ANDERSSON, and Mrs. L. NEWTON, D.Sc.
<i>Cytology</i>	C. D. DARLINGTON, Ph.D., C. L. HUSKINS, Ph.D., and Miss A. E. GAIRDNER
<i>Mycology</i>	Miss D. M. CAYLEY
<i>Fruit Problems</i>	M. B. CRANE, W. J. C. LAWRENCE
<i>Physiology</i>	The DIRECTOR and Mr. PHILLIS

University of Cambridge

(a) ANIMAL NUTRITION RESEARCH INSTITUTE

<i>Directors</i>	T. B. WOOD, C.B.E., M.A., LL.D., F.I.C., F.R.S., Drapers Professor of Agriculture in the University, and F. H. A. MARSHALL, Sc.D., F.R.S., Reader in Agricultural Physiology in the University.
<i>Consultants</i>	Sir F. G. HOPKINS, M.A., LL.D., F.R.C.P., F.R.S., Professor of Bio-Chemistry in the University; J. W. CAPSTICK, O.B.E., M.A., D.Sc., Fellow of Trinity College; and G. UDN YULE, M.A., F.R.S., University Lecturer in Statistics.
<i>Principal Assistants</i>	F. W. FOREMAN, M.A., F.I.C. (Chemist); J. HAMMOND, M.A. (Physiologist); E. T. HALNAN, M.A. (Physiologist)
<i>Senior Assistants</i>	H. E. WOODMAN, Ph.D., D.Sc. (Chemist); T. DEIGHTON, Ph.D., B.Sc. (Physicist).
<i>Assistants</i>	S. A. ASDELL, Ph.D. (Physiologist); H. G. SANDERS, Ph.D. (Statistician); I. S. MORGAN, M.A. (Agriculturist)

(b) INSTITUTE OF ANIMAL PATHOLOGY

<i>Director</i>	J. B. BUXTON, M.A., F.R.C.V.S., D.V.H., Professor of Animal Pathology in the University.
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<i>Assistant Director and Pathologist</i>	T. J. BOSWORTH, B.Sc., M.R.C.V.S., D.V.S.M.
<i>Pathologists</i>	R. E. GLOVER, B.Sc., M.R.C.V.S., W. J. LEYSHON, M.R.C.V.S., and J. R. M. INNES, M.R.C.V.S.
<i>Chemist</i>	J. STEWART, M.A., B.Sc.

(c) PLANT BREEDING INSTITUTE

<i>Director</i>	Prof. Sir R. H. BIFFEN, M.A., F.R.S.
<i>Assistant Director</i>	F. L. ENGLEDDOW, M.A.
<i>Assistants</i>	H. HUNTER, D.Sc., A. E. WATKINS, M.A.
<i>Special Staff for Virus Diseases of Potatoes</i>	R. N. SALAMAN, M.D. (Assistant Director), K. M. SMITH, D.Sc. (Entomologist)

(d) HORTICULTURAL RESEARCH STATION

<i>Director</i>	Prof. Sir R. H. BIFFEN, M.A., F.R.S.
<i>Deputy Director</i>	D. BOYES, M.A.
<i>Physical Chemist</i>	R. M. WOODMAN, Ph.D.

(e) SMALL ANIMAL BREEDING RESEARCH INSTITUTE

<i>Director</i>	Prof. R. C. PUNNETT, M.A., F.R.S.
<i>Assistant</i>	M. S. PEASE, M.A.

National Institute of Agricultural Botany, Cambridge

<i>Director</i>	W. H. PARKER, M.C.,) M.A.) (Administrative and Crop
<i>Assistant Director and Secretary</i>	F. C. HAWKES, M.A.) Work)
<i>Manager of Field Plots</i>	S. F. ARMSTRONG, M.A. (Crop Improvement Work)
<i>Chief Officer, Official Seed Testing Station</i>	A. EASTHAM, D.S.O., M.C., B.Sc. (Seed Testing)
<i>Assistants to Chief Officer, Official Seed Testing Station</i>	C. C. BRETT, M.A., and R. A. FINLAYSON (Seed Testing)
<i>Superintendent of Potato Trials</i>	H. BRYAN, B.Sc. (Potato Trials and Diseases)

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NOTICES OF BOOKS

A Tour in Australia and New Zealand: Grassland and other Studies.
 By Professor R. G. Stapledon, M.B.E., M.A. With a foreword by
 Major Walter Elliot, D.Sc., M.P. Pp. xv + 128. (London:
 Humphrey Milford, the Oxford University Press. 1928. Price
 7s. 6d. net.)

This is a fascinating account of the grasslands of the Antipodes
 by a versatile "agrostologist." An agrostologist, in the Professor's
 own words, is a "person who has elected, probably quite accidentally,
 to make grassland the deity to which he devotes his life." While
 this definition may possibly hold good in so far as his work at
 Aberystwyth is concerned, it is quite clear that this book is no mere
 technical treatise. The author has leaped in a joyous spirit to the
 stimulus of new experiences in the exhilarating surroundings of
 countries still in the pioneering stage, and has succeeded in producing
 a most readable book of sociological and general, as well as of great
 technical, interest. The illustrations, from photographs taken by
 Mrs. Stapledon, are of real merit and considerably enhance the value
 of the work.

In describing a visit to the wheat belts of Australia, the author comments on the methods now being adopted to increase yields—the introduction of the fallow as a means of conserving moisture, and of sheep for converting stubble herbage. This “volunteer” herbage is largely leguminous, and, on a 900-acre farm, may support as many as 400 sheep. Thus, the association of wheat and wool tends to reduce the chance of a run of ruinous years, and the author foresees the time when there will be considerable expansion of both products.

The pastoral lands of New Zealand—and 94 per cent. of farming land in that country is devoted to grass—have practically all been reclaimed from forest, scrub and marsh. The methods adopted are graphically described and, particularly in relation to the eradication of bracken, cannot fail to interest farmers of our own hill districts, where bracken is rapidly becoming a veritable plague.

In many respects, pastoral farming in New Zealand resembles that at home. The herbage is composed largely of the same species, but there is an important difference in many parts of New Zealand: the grazing season is an all-the-year-round one. Grass is the principal and almost the sole item in the dietary of sheep and dairy cattle—a fact which goes far to explain the ease with which the New Zealand farmer, despite thousands of miles of ocean transport, can so successfully compete with British farmers in their own home market.

In the management of his pastures, the New Zealand farmer has long since learned the value of rotational grazing, although he has not yet carried the practice of field sub-division to the point suggested by recent work in this country, where intensive manuring is added.

“Grassland is an asset common alike to Britain, to all the great Dominions and to many of the Crown Colonies. It is the basis of the woollen industry: it is the life blood of the dairy industry and of the frozen meat trade. It is a bond between the remotest corners of the Empire, as great as the sea itself; everywhere a meeting place for the British breeds of cattle and of men conversant with the ways of animals; everywhere a something with a character largely resembling its character everywhere else.

“It is our grasslands, therefore, more than any other single raw material of the Empire, which call aloud for some well-thought-out and well-co-ordinated scheme of research and investigation in order that the maximum of new and valuable information may be obtained with the limited scientific resources at the disposal of the Empire, and that, as a whole, they may be used to attain to the highest possible degree of productivity.”

There follow suggestions for lines of investigation and organization, particular emphasis being laid on the need for developing and increasing the supply of indigenous strains of seed.

This is the sort of book which all interested in grassland will sit up half the night to finish.

Power for Cultivation and Haulage on the Farm.—Rothamsted Conferences No. 6. Pp. 61. (London: Ernest Benn, Ltd. 1928. Price 2s. 6d. net.)

The papers which were read at a conference held at the Rothamsted Experimental Station last spring on this subject have now been published in pamphlet form. Dr. Keen, Assistant Director of the Station; after summarizing the data on farm engines and motors contained in *The Agricultural Output of England and Wales*, 1925, gave a number of costings for horse and tractor work at Rothamsted and elsewhere, which on the whole favoured the horse as far as cheapness alone is concerned. The advantage of the tractor is its capacity to do urgent work quickly, and Dr. Keen thought that mechanical power would

undoubtedly play an increasing part in farming operations in the future. Mr. H. G. Burford discussed the design of a general purpose tractor for the farmer, but his views appear to have been embodied already in the latest models of agricultural tractors now on the market. He emphasized the desirability of using, with tractors, implements specially designed and constructed for such use, but this is surely preaching to the converted. Mr. G. W. Watson spoke of the care of the tractor on the farm. While much of his advice cannot too often be reiterated, most of it will be found in any elementary textbook on internal combustion engines, and is, in fact, included in the instruction books issued by tractor manufacturers. Mr. E. Porter gave data of horse and tractor costs from his own farm of 330 acres (225 arable), but these are not sufficiently detailed to enable strict comparisons to be made. For example, horse ploughing costs from 8s. 6d. to 18s. per acre, according to the type of plough used (*i.e.*, single or double furrow) and the acreage ploughed per day, while tractor ploughing was estimated to cost 9s. 9d. to 12s. 3d. per acre. The tractor was apparently seven years old. Mr. R. D. Mozer dealt with rotary tillage. After reviewing the development of the rotary tiller he emphasized the importance of this method of securing a seed bed in one operation, but mentioned the experience of one trial at Rothamsted where roots had not eventually produced such a good crop on land rotary tilled as on plots ploughed and cultivated in the ordinary way. Further trials are, however, to be undertaken at Rothamsted and the result will be awaited with interest. Mr. R. Borlase Matthews concluded the papers with one on Electric Ploughing and Transport. Mr. Matthews' views should be read with caution, and any reader interested in the use of electricity in agriculture would be well advised to consult the Report of the recent Conference on Electricity Supply in Rural Areas (published by H.M. Stationery Office, price 1s.).

A Survey of Milk Marketing.—By F. J. Prewett, Agricultural Economics Research Institute, Oxford. Pp. 74. (Oxford: The University Press, 1928. Price 3s. 6d. net.)

The results of a detailed investigation into the marketing of milk in Wiltshire, Somersetshire and the City of Bristol are contained in a recent publication, entitled “A Survey of Milk Marketing.” The text itself, which is interspersed with many maps and diagrams, amounts to 59 pages, but a further 15 pages are taken up by two appendices, the first of which consists of notes on the organization and finance of the South Wilts Milk Society, and the second a reprint of the explanatory memorandum and contract forms of the Scottish Milk Agency. Among other things, the study deals with the movement of milk from the farms, the factory and depot organization, and the various methods of utilizing milk in the two counties; an account is also given of milk distribution in Bristol and Glastonbury.

In the analysis of the first destination and detailed uses of milk in the two counties, it is probable that the quantity of milk used for domestic cheese-making is under-estimated. This is given for June, 1927, as 126,313 gallons (p. 50). On the basis of 1 lb. of cheese per gallon of milk, this means that the quantity of cheese made on farms in that month was 1,128 cwt., or roughly only 56 tons. Viewing this from another angle, it is stated (p. 54) that the total number of farm cheese-makers was 979; the average June production of cheese per farm, therefore, works out at just over 1 cwt., which would appear to be much too low in June, even for an average. There is also an important misprint in the text (p. 28) which gives the daily *per capita* consumption of milk in Bristol as .35 gallon instead of .35 pint. These, however, are

details which do not detract from the merits of Mr. Prewett's latest work, which shows clearly enough both the need for and the value of intensive *local* study of marketing conditions and problems.

Mr. Prewett's concluding observations are of considerable interest and of more than local significance. He emphasizes the present weakness of producers in collective bargaining with distributors and manufacturers, and reiterates the view that farmers supplying the liquid market should so organize that the quantities entering this market will fluctuate as little as consumption. To do this, farmers must, collectively, keep the whole surplus off the market, and arrange for its manufacture in various small creameries operated under their own auspices. Organization must, however, include all farmers and not only those supplying the liquid market. Were the producers for the liquid "export" market alone organized, the buyers could obtain their requirements from the farmers supplying the manufacturing market. In Mr. Prewett's view, nothing less than complete organization on the farmers' part, with equipment to handle all surplus milk and, in an emergency, to make cheese, temporarily at least, of all supplies going ordinarily into liquid consumption, will give the farmer satisfactory bargaining power.

Bibby's Book on Milk: Section II. The Law Relating to the Sale of Milk. Pp. vi + 487. (J. Bibby & Sons, Ltd., Liverpool.)

This is the most exhaustive study of the law relating to the sale of milk that has come under our notice. The objects of the authors, as set out in the "Editorial Note for Pre-occupied Readers," are (1) to show that the present law is unjust and ineffective, and exposes even the most expert and careful sellers to the risk of prosecution; and (2) to lay down certain principles on which any amendment should be based. The presumption of adulteration raised by the Sale of Milk Regulations, 1901, is examined in the light of a mass of evidence as to variations in the composition of milk, and much useful advice is given to producers and vendors of milk as to how they should endeavour to keep the quality of their milk above the limits of the Regulations, and how they should conduct their defence if their milk falls below those limits and a sample is taken by the Authorities. The adoption of the civil contract scheme discussed in this book would put the sale of milk on much the same footing as the sale of fertilizers and feeding stuffs. The seller would be required to give a warranty, and if he failed to fulfil the warranty he would incur civil liability, but there would be no suggestion of fraud. This would cover cases where genuine milk was below the warranty and cases where there was no proof of adulteration. The wilful sale of adulterated milk would be dealt with separately.

The book contains all the Acts, Orders, Official Circulars and Leading Cases bearing on the subject. It is a mine of information, and well worthy of the study of all who are concerned with the dairy industry or the administration of the Law relating to the sale of milk. For the use of lawyers and others closely interested the publishers supply this book interleaved with plain paper for additional notes.

* * * * *

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NOTES FOR THE MONTH

IN accordance with the procedure laid down in Section 1 (2) of the Rules Publication Act, 1893, the Minister has taken into consideration the representations of various public bodies regarding the Draft Agricultural Produce (Grading and Marking) Regulations, and has, in (Eggs) Regulations, particular, amended the draft by deleting the designation "First Quality" from the grade designations prescribed and adding the words "First Quality" to the definition of "State or Condition," which definition now reads "First Quality, i.e. the egg must not . . ." The effect of this amendment is that whilst there are now only three statutory grades for eggs, i.e. "Special," "Standard" and "Pullet Standard," the term "First Quality" retains a statutory meaning.

The Regulations, as amended, were made on December 15, 1928, and have been published as Statutory Rules and Orders, 1928, No. 984.

ON December 26, last, the Central Sugar Co., Ltd., at its Peterborough factory, made an interesting experiment in the manufacture of dried potatoes for cattle-food.

Potato Drying Experiments at a Beet Sugar Factory The test was arranged by Capt. Mowbray, acting for the Company in co-operation with the March Potato Growers' Association, and was undertaken by the factory interests to determine whether or not potatoes could be properly dried by means of the existing equipment.

The growers, for their part, wished to follow up a suggestion of this kind put forward in the Ministry of Agriculture Report on the Marketing of Potatoes (Economic Series No. 9), particularly in view of its possibilities in a year such as this, when prices are depressed owing to the prospect of there being a certain amount of potatoes surplus to requirements for table

3 x

purposes. Further, this method of disposal would seem to offer an outlet for potatoes falling below grade, when the Ministry's scheme for grading and applying the National Mark to potatoes comes into operation next month.

The experiment was, on the whole, successful; but owing, perhaps, to the fact that this factory is equipped throughout with Imperial driers, which are designed solely for use with beet pulp, the best results were obtained when the potatoes, instead of being dried alone, were mixed with molasses pulp in the process of drying.

A full report of the test and information regarding the feeding value of the product will be available later. It is generally held that one ton of dried potatoes is equivalent to one ton of barley meal for stock-feeding.

A further test is being arranged to take place at the Brigg factory of the Lincolnshire Beet Sugar Company, where, with the co-operation of the National Farmers' Union, it is hoped to dry about 200 tons of potatoes.

A successful outcome of these experiments might well result in the general adoption of potato drying, which should enable farmers to realize a better price for their potato crop by the elimination of any surplus, and emphasize the mutual interests of and promote friendly relations between farmers and the beet factories.

* * * * *

At the suggestion of the Ministry, a course of lectures on agricultural engineering, combined with practical work, for county agricultural education staffs, was

Course in Agricultural Engineering for County Education Staffs given at Oxford at the Institute of Agricultural Engineering from October 15 to 27 last.

The number attending was 13, representing 13 counties. This was lower than had been anticipated, but unfortunately the date chosen, as the only date which seemed possible, was one at which agricultural education staffs are particularly busy preparing for their winter work.

In the short time allowed it was impossible to attempt anything in the nature of detailed instruction, and it was therefore decided to confine the course to such practical instruction as would enable the students to deal with the ordinary problems and difficulties likely to arise with agricultural machinery.

The mornings were usually devoted to lectures at the Institute, and the afternoons to practical work on the Institute farm near Oxford. The practical instruction was divided into two sections, field work and shop work. This made it possible, for example, for half the students to spend an afternoon overhauling tractors in the workshops while the other half was engaged on tractor work in the field, the position being reversed on the afternoon of the next day.

After an introductory lecture by the Director, the first of a series of lectures and demonstrations on the internal combustion engine was given. The series consisted of four lectures and four demonstrations. In the first lecture the elementary principles of the internal combustion engine were briefly explained, and such points as ignition, tuning, valves and oiling touched upon. The possible faults in engines were summarized and the appropriate remedy in each case was prescribed. In the second lecture the general improvement in tractor design during the last few years was discussed, and the question of gripping devices—spuds and strakes—was discussed. The most representative tractors were briefly described, and illustrated by lantern slides. At the third lecture, on draught and draw-bar horse-power, the instruments used for measuring draught were demonstrated. The fourth lecture dealt with brake horse-power, indicated horse-power, draw-bar horse-power, with sizes of pulleys and of belts, transmission by belting, and similar questions.

At the demonstrations two tractors were taken down and assembled by the students, and four oil engines, varying in size from $1\frac{1}{2}$ to 6 h.p., were shown and explained. A travelling workshop, lent by the Ministry of Agriculture and Fisheries, was used for instruction on the magneto and in welding, turning and other engineering work.

On the afternoon of Thursday, October 18, there was a public demonstration of ploughing, cultivating and sub-soiling with tractors, in which the following tractors took part: McCormick Deering and Farmall (U.S.A.), Fordson (U.S.A.), Caterpillar (U.S.A.), Latil (French), Lanz (German) and Vickers Aussie (British). An Oliver two-furrow plough, ploughing 18-in. furrows, a "Killefer" Cultivator and Sub-soiler, and a "Cover-Crop" Disc Harrow were also shown. Smaller machines were represented by the Simar Rototiller and the Auto-Culto Tractor. The demonstration attracted considerable interest and was well attended.

Electricity formed the subject of five lectures and two

demonstrations. The five lectures were planned : (1) to provide a sound working basis for the appreciation of the main principles involved in electrical engineering, without introducing too much elementary theory ; (2) to show the practical application of these main principles to the common uses of electricity for power, light and heat, and explaining alternating and continuous currents ; (3) to discuss the factors governing the supply and sale of electricity, with particular reference to rural electrification ; (4) to give practical directions on such everyday problems as meter-reading, simple methods of checking power consumption, and various small adjustments ; and (5) to trace modern developments in small water-power plants, particularly for use with low falls and for adaptation to disused mill-wheel pits. The lectures were illustrated by lantern slides and by a number of working models and parts of apparatus. For the demonstrations, an automatic lighting plant was used, and the discussions arising proved very helpful in suggesting practical points which required elucidation.

A lecture on subsoiling traced the history of the operation both in Great Britain and abroad. The purpose of the operation and the advantages claimed for it were explained, and the results of the subsoiling trials carried out by the Institute over a period of five years on different kinds of soil were summarized. Tine action in relation to the disruption of the subsoil was examined from the mechanical point of view, and the different types of tine, and most of the existing types of tractor-drawn subsoiling ploughs, were illustrated and discussed.

A lecture on the combine harvester dealt with the evolution of harvesting machinery from the header described by Pliny, and traced the extension of combine harvesting from the dry wheat-growing areas to other parts of the world (hitherto thought unsuitable) such, as Canada, the Middle West of the United States, and Argentina. During the last harvest the combine had been at work in Italy, Austria, the South of France, and Germany. The construction of the machine was described, and the important development of combine harvesting, as a result of the utilization of the internal combustion engine, as a source of power for the cutting and thrashing mechanism, was clearly pointed out. The recent trials in Wiltshire of the combine harvester imported by the Institute were described, the results and the costs of operation summarized, and the question of the suitability of the machine for English conditions discussed.

Milking machines formed the subject of another lecture and demonstration. The relative merits and demerits of mechanical

and hand milking were briefly discussed ; and, in view of the fact that the students had all had considerable experience of milking machines, the lecture was devoted mainly to an exposition of the open-air milking system, based upon frequent observations of its operation.

The methods and machinery employed for sugar beet cultivation were dealt with in another lecture, in which the necessity for deep cultivation was emphasized, and a description given of the tests of spacing drills which had been carried out by the Institute during the last two years. The relative advantages of wide and narrow rows were discussed and the various types of hoe were described. Beet lifters and their possibilities were considered at some length. Finally, methods of cleaning the beet and of transporting them to the factory were described.

In a lecture on refrigeration, general principles were explained with the aid of diagrams, and particulars were given of several of the leading makes of refrigerator. Milk cooling arrangements were specially considered, a full description being given of a type of refrigerator which may be operated by means of paraffin burners.

Two lectures were given on drainage, with special reference to mole draining. The practical aspect was dealt with at length, the chief characteristics of the leading makes of mole ploughs were described, and some figures as to the relative costs of different methods of draining were discussed. The lectures were illustrated by lantern slides, and the work of mole ploughs, drawn by tractors and by a tractor-driven cable outfit, was demonstrated in the field.

Another lecture was devoted to various methods of preparing plans, and the purposes for which plans are used, and some information was given as to practical measurement and survey of land. The course terminated with a lecture on library work, when reference was made to the books and periodicals dealing with agricultural machinery. The value of a literature on this subject was illustrated by reference to recent problems connected with sugar beet and potato harvesting, and the draught of ploughs.

During the course, visits were paid to Messrs. John Allen & Sons' Steam Plough Works and the Morris Motor Works, as well as to the Eynsham Sugar Beet Factory, where a demonstration of crop-drying was given.

This course—the first of its kind ever held at the Institute—was regarded somewhat in the light of an experiment. As an

experiment it was quite successful ; if, as a course of instruction, it was not altogether free from omissions and other shortcomings, the experience gained, assisted by some kindly criticism since received from several participants, should ensure much greater efficiency for any similar venture in the future.

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ACCORDING to returns made to the Ministry by the beet sugar factories operating in Great Britain, the quantity of

Production of home-grown beet sugar manufactured during December, 1928, together with
Home-grown the quantity produced during the corre-
Beet Sugar sponding month in 1927, was :—

	Cwt.
December, 1928	1,299,956
December, 1927	1,170,794

The total quantities of sugar produced during the two manufacturing campaigns to the end of December were :—

	Cwt.
1928-29	3,716,964
1927-28	3,405,239
* * * * *	

THE Ministry is informed that the areas from which the beet sugar factories will be ready to take supplies of sugar beet in 1929 and 1930 will be considerably

Areas for Sugar extended. The movement is one which is
Beet in 1929 calculated to assist the firm establishment
and 1930 of the industry in this country and to give farmers further afield a chance of sharing in the subsidy. There are at present 15 beet sugar companies operating in Great Britain, and they own 19 factories. A Committee representing 18 of these, called the Beet Sugar Factories' Committee of Great Britain, has decided to consider the making of growers' contracts for 1929 and 1930 with any farmer in England and Wales who has suitable land for sugar beet, but whose farm is outside the present areas of the factories. In such cases, any cost over 8s. a ton for rail delivery to the factory will not be charged to growers ; the factories will pay it, so that the Committee is going a considerable way to widen the sphere of the benefit coming from the sugar beet subsidy to the English and Welsh farming community.

It will have to be borne in mind that the capacity of the present factories is not unlimited, that the Committee's concession on these new contracts cannot be held open beyond that capacity, and that preference must be given to present growers and growers within the existing areas. The scheme does

not extend to Scotland and, for its purpose, England and Wales are divided into six areas, so that farmers in each who want to grow sugar beet next year may apply to the local offices of the Beet Sugar Factories' Committee in their particular area.

Area No. 1, South and West of England, under a line drawn from Gloucester to London, will be worked from the local office, 33 Blue Boar Row, Salisbury, under a Contracts Manager, Mr. Arthur Wharton.

Area No. 2, above the Gloucester to London line, and outside operating areas of Kidderminster, Felstead and Peterborough—local office, the Beet Sugar Factory, Peterborough ; Contracts Manager, Mr. Glen Mowbray.

Area No. 3, Monmouth and South Wales—local office, the Beet Sugar Factory, Kidderminster ; Contracts Manager, Major Mockett.

Area No. 4, Cheshire and North Wales—local office, the Beet Sugar Factory, Allscott (Salop) ; Contracts Manager, Mr. F. E. Thornhill.

Area No. 5, Lancashire—local office, the Beet Sugar Factory, Newark-on-Trent ; Contracts Manager, Mr. W. Houghton.

Area No. 6, Northumberland, Cumberland, Durham and Westmorland—local office, the Beet Sugar Factory, Poppleton (York-) ; Contracts Manager, Mr. Harold Wickenden.

Districts Agents are being appointed for sections of each area.

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THE National Mark Egg Scheme, to which reference has been made in previous issues of this JOURNAL, becomes operative on February 1, 1929. About 110

Egg Marketing applications have already been received
Reform for enrolment under the Scheme, and by the end of January the following centres

had been approved by the National Mark Committee :—

LIST OF REGISTERED PACKERS UNDER THE NATIONAL MARK EGG SCHEME.

	Registered No.
South Beds Farm Produce Co., Dunstable	21
South Moreton Poultry Farm, Wallingford	22
H. Inman Taylor, Woodlands, Chieveley, near Newbury ..	23
Messrs. Gotobed & Sons, Stanley House, Littleport, Cambs...	24
Messrs. Fred. Todd & Son, Telegraph Street, Cottenham, Cambs.	25
Messrs. T. Evans & Sons, Carmarthen	26
Arthur Hughes, Tilson Road, Malpas, Cheshire	27
E. A. Luscombe, 2 The Parade, Liskeard, Cornwall	28
W. P. Martin, 12 Pydar Street, Truro	29
The Cumberland Poultry Farmers, Ltd., Penrith	30
H. W. Gilbert, 17 Charlotte Street, Crediton	31
A. E. Phillips, Belle Vue Poultry Farm, Newton Poppleford, Sidmouth	32

	Regd. No.
Geoffrey Davis, Great Canfield, Essex	33
The Gloucestershire Fruit and Vegetable Co-operative Marketing Society, Ltd., Market Street, Cheltenham ..	34
Hampshire Egg Producers, Ltd., Four Marks, Alton ..	35
Mrs. A. Huckle, Fernside, Somersham, Hunts	36
Frank Barber, Rotherwood Poultry Farm, Balmoral Road, Morecambe	37
Fylde Farmers' Egg Supply Co., Holstein Street, Preston ..	38
Stamford & District Co-operative Egg & Poultry Society, Ltd., 51 High Street, Stamford	39
The Counties Egg Co., Bedford Place, Spalding	40
Messrs. C. & A. W. Kidner, Easton, Norwich	41
Norfolk Egg Producers, Ltd., A.B.C. Wharf, King Street, Norwich	42
Messrs. Vallance & Collins, Downham Market	43
Oxfordshire Producers, Black Bourton, near Clanfield, Oxon	44
Percival Ewart White, The "Eggflo" Farms, Market Drayton	45
Messrs. Frampton & Sons, Tower House Street, Somerset ..	46
John Mason, Barn Farm, Walberton, Arundel	47
Southdown Egg Producers, Ltd., Eastergate, Chichester ..	48
Henley-in-Arden Auction Sales, Ltd., Henley-in-Arden, Warwick	49
Wiltshire Egg Producers, Ltd., Eddington, Hungerford ..	50
Huddersfield Egg Producers, Ltd., Brook Street, Huddersfield	51
Clynderwen & District Farmers' Association, Ltd., Carmarthen	52
The Trenear Dairy Co., Ltd., Trenear, Helston, Cornwall ..	53
Joseph Lethbridge, 183 Cowick Street, Exeter	54
S. B. Neill, Sunnyhay Fruit Farm, Woodbury, near Exeter	55
Messrs. C. J. Seymour & Son, Cheriton Fitzpaine, Crediton, ..	56
The Beaminster & District Collecting Depot, Ltd., Fleet Street, Beaminster, Dorset	57
Frederick T. Rowland (Auctioneer), Sturminster-Newton, Dorset	58
E. J. Parker (Auctioneer), Maidstone	59
Melton Mowbray & District Farmers' Association, Ltd., North Street Dairy, Melton Mowbray	60
The Hon. F. Amherst (Trading as "National Poultry Organisation"), Stoke Ferry, Norfolk	61
Donald J. Cook, Holt, Norfolk	62
John B. Barr, Presson, Cornhill-on-Tweed	63
W. B. Sweet, Misterton, Somerset	64
The Yeovil Egg Packing Co., South Street, Yeovil	65
Dunglass Poultry Farm, Little Bookham, Surrey	66
Lunesdale Farmers, Ltd., The Creamery, Barbon, Westmorland	67
Wilts Graded Eggs, Ltd., Hill Street, Trowbridge, Wilts ..	68
D. Parsons, Kyrewood, Tenbury Wells, Worcester	69
Messrs. Peter Keevil & Sons, Ltd., 370 Edgware Road, London, W. 1	70
Messrs. Keevil & Keevil, Ltd., 23-24 King Street, West Smithfield, E.C. 1	71
United Dairies (London) Ltd., packing stations at Streatham, S.W., and West Byfleet, Surrey	72
Messrs. Chivers & Sons, Ltd., Histon	73
H. A. Digby, Bulphan Poultry Farm, Bulphan, Nr. Romford	74
W. H. Lavender, King Edward Road, Brentwood	75
The Prospect Poultry Farm, Gt. Totham, Nr. Maldon	76

	Regd. No.
Associated Welwyn Services, Ltd., Welwyn Garden City ..	77
Messrs. Butsons, 232a Colne Road, Burnley	78
Co-operative Wholesale Society, Ltd., 1 Balloon Street, Manchester	79
The Counties Egg Co., High Street, Taunton	80
Messrs. Lonsdale & Thompson, Ltd., Victoria Street, Bristol	81
The Staunton Egg Association, Staunton Cross	82
Messrs. Leigh, Lineham & Co., Ltd., Winnie Terrace, Whitehall Road, Leeds	83

Applications continue to be received, and further lists of registered packers will be published at intervals. A gratifying feature is the registration of some of the largest wholesale egg packing businesses in the country. It is clear that the Scheme will make a good start and will henceforward develop with its own momentum.

Following on the inception of this Scheme on February 1, certain other compulsory regulations affecting egg marketing will shortly take effect. On and from March 1, it will be an offence under the Agricultural Produce (Grading and Marking) Act, 1928, for anyone to sell or offer for sale any eggs preserved by detectable processes—such as immersion in lime-water, water-glass or oil—unless each individual egg is marked on the shell with the word "Preserved." On and from April 21, it will be an offence under the Merchandise Marks Act, 1926, to import any eggs or to sell or offer for sale by wholesale or retail any imported eggs, unless each individual egg bears on the shell an indication of origin. From the same date, all premises used for the cold storage and chemical storage of eggs must be registered for the purpose, and any British eggs that have been kept in cold storage or chemical storage must be marked on the shell with the words "Cold Stored" or "Chilled," in the former case, and "Sterilized," in the latter case, before they leave the storage premises. Ultimately, therefore, when the imported eggs brought into this country prior to the marking of foreign supplies have been exhausted, the only unmarked eggs upon the British market will be fresh, home-produced supplies.

* * * * *

CORN crops are rolled chiefly in order to consolidate the soil, and so to bring the roots of the young plants in intimate contact with the soil. Rolling, however, is also a very useful measure in the case of attacks on the plants by various insects, notably wireworms, wheat bulb fly, and leather jackets. The effect

of the rolling in these cases is to prevent the pest from burrowing freely from one plant to the next, so that it has to confine its attacks to a smaller number of plants. It is also of great value—especially in the case of such a pest as the wheat bulb fly—in promoting early tillering. If a wheat plant has but one shoot, the destruction of that shoot by a maggot endangers the life of the plant, but if it has three or four it can better afford to lose one of them without suffering seriously in growth. The important point in rolling for the control of insect pests is to begin early enough—as soon as signs of a sick plant can be detected here and there in the field. It then assists the crop and hinders the pests before they have done much harm.

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THE eighteenth Report in the Ministry's well-known Economic Series of publications, dealing with the marketing of agricultural produce, has just been issued.* The Report deals with the marketing of wheat, barley and oats. Some indication of its comprehensive character is afforded by the fact that it extends to 206 pages.

The opening chapters give a brief summary of the world position of international trade in these cereals, dealing especially with the quantity and quality of home-grown and imported supplies, and analyzing the extent and nature of the demand. Prices are discussed in regard to trend, seasonal and local variations, and the comparative values of supplies from different sources. Throughout this preliminary survey, wheat, barley and oats are dealt with separately, since the various factors connected with supply and demand are different, each cereal presenting a distinct marketing problem.

In the general body of the Report, the marketing of the grain is described from the moment of thrashing up to, and including, the processing and distribution of the manufactured products. The practice in regard to sampling, grading and assembling grain in other countries is fully dealt with, and compared with present methods in this country. Storage on and off the farm, and the transport of both bulk and sacked grain at home and abroad, as well as the method and cost of rail, road and water transport, are set out and compared.

* Ministry of Agriculture and Fisheries, Economic Series No. 18, H.M. Stationery Office, Price 6d., post free 9½d.

The function of corn markets and corn and produce exchanges in the sphere of distribution, and the methods adopted by farmers, merchants and agricultural co-operative societies, are fully described. Ample references are made throughout the Report to the practice followed by the farmers' pools of Canada, Australia and elsewhere, in regard to the marketing of their grain.

In order to complete the view, notes have been added on the processing and distribution of cereal products, particularly in regard to flour milling and baking, malting, and meal and provender milling.

The supply, distribution and official control of seed corn are also discussed, and the function of the seed-testing and plant-breeding stations described, while the Appendices include a description of the geographical distribution of varieties throughout the country.

The concluding chapter summarizes the special marketing problems of each cereal, and draws special attention to the need for unified selling and the necessity for more orderly marketing and for a greater degree of quality standardization than exists in the trade at present. The suggestions put forward are of a practical nature, and, it is hoped, will secure the sympathetic consideration of farmers, merchants and manufacturers.

The Report is provided with a plentiful supply of statistical material in the form of 18 tables, and is well illustrated. It is a valuable addition to the Economic Series, and should prove indispensable to all concerned with the production and distribution of cereals in this country. With the aid of a grant from the Empire Marketing Board, the Report is issued at the nominal price of 6d., in order to ensure a wide circulation.

* * * * *

Demonstrations in Marketing Home Produce

DURING the past year, the Ministry has staged at various Agricultural Shows and other centres marketing demonstrations on the following subjects:—

Pigs and pig products	..	13	demonstrations
Eggs	.. ..	10	„
Potatoes	.. ..	10	„
Fruit	.. ..	9	„
Poultry	.. ..	8	„
Cattle	.. ..	4	„

Ocular demonstration is always a more potent argument

than the written word, and these demonstrations of improved methods of grading, packing and marketing have aroused keen interest on the part of farmers and others throughout the country.

The Ministry intends during the forthcoming year to continue these demonstrations with improved exhibits at a few of the principal Agricultural Shows, and to demonstrate particularly the effect on and relation of the Agricultural Produce (Grading and Marking) Act, 1928, to various agricultural commodities. Pressure of work in connexion with National Mark Schemes will, however, limit the number of shows which can be attended. A list of the Shows at which demonstrations will be given will, it is hoped, be included in the March issue of this JOURNAL.

* * * * *

REGULATIONS are about to be made by the Department of Agriculture for Scotland under the Agricultural Produce (Grading and Marking) Act, 1928, pre-

Egg Regulations: scribing grade designations and grade designation marks for eggs produced in Scotland. These Regulations will follow very closely the Agricultural Produce (Grading and Marking) (Eggs) Regulations, 1928 (S.R.O. 984), made by the Minister of Agriculture and Fisheries, on December 15, 1928, except that:—

- (a) the designations prescribed by the Scottish Regulations are "Specials," "Standards" and "Mediums";
- (b) there are no minimum weights prescribed for individual eggs, weights per 120 and per 12 being prescribed;
- (c) the term "First Quality" is not used. The Regulations, also, do not prescribe grade designations for duck eggs.

Grade designation marks for eggs are any one of the three grade designations referred to above associated with the words "Produce of Scotland" and "Empire Buying Begins at Home," and with the following mark, namely, a map of Scotland in silhouette, with, on the left, a design representing the Union Jack, and on the right a design representing the Cross of St. Andrew.

Authority to use grade designation marks will be granted by the Department of Agriculture for Scotland to persons who are able to satisfy that Department that they will comply with such general conditions as the Department may from time to time require.

SENSIBLE SEEDS MIXTURES

J. G. STEWART, M.A., B.Sc.,

Ministry of Agriculture and Fisheries.

SIMULTANEOUSLY with the improvement of existing grassland, the formation and management of new pastures is now being closely studied by the scientific investigator. In particular, attention is being directed to the competitive influence of one species upon another and to the part played by management in this connexion. These questions form the subject of a comprehensive bulletin just issued from the Welsh Plant Breeding Station, and of which the essence will be found in the concluding paper, "Sensible Seeds Mixtures," under the names of Professor Stapledon and Mr. William Davies.

The value of herbage is at its greatest when production is at its lowest—consequently green grass is more valuable per lb. from November to May than from May to November. Winter-green grasses, therefore, such as perennial rye-grass, crested dogstail and rough-stalked meadow-grass, are of immense value in swards. Almost equally valuable are grasses that will start growth early in spring and maintain growth long into autumn. Cocksfoot and meadow-foxtail start early in spring; perennial rye-grass makes good late-autumn growth. Italian rye-grass is, however, the outstanding November-May grass.

The clovers are of negligible significance during the winter: the red clovers are, however, of great value in the late summer and autumn, some of them, such as Montgomery and Cornish marl, being of particular value at this time of the year, and especially in seasons of drought.

On the best fattening pastures, perennial rye-grass, crested dogstail, rough-stalked meadow-grass and wild white clover often contribute in the aggregate over 90 per cent. of the total herbage.

It by no means follows that the species that do well or reasonably well under good or even average conditions are of value under poor or very poor conditions. The first question to be asked in relation to mixtures for long leys is this: What species are suitable to the soil and climatic conditions which the field presents? Suitability is not only a matter of species but also of strain within the species. Thus indigenous cocksfoot (of a good strain) is better suited to high elevations of low fertility than is Danish cocksfoot. Broad red clover,

late-flowering red clover, extra-late red clover (Montgomery or Cornish marl), wild red clover, is the order in which the strains of red clover appear to be suited to conditions of increasing acidity and decreasing fertility. Wild white clover has a far wider range than white Dutch or New Zealand clover, and, where even this invaluable strain fails, the indications are that the running may be taken up by the bird's foot trefoils.

Rough-stalked meadow-grass and crested dogtail are perfect bottom grasses and, as has already been said, are highly winter-green. The former, although very responsive to high fertility, is yet adaptable to relatively low fertility, provided the rainfall is high. (In the Eastern Counties rough-stalked meadow-grass is seldom much in evidence during the summer, but it responds quickly to the autumn rains.) As the conditions become less favourable, crested dogtail must be more and more relied upon.

Speaking in terms of seeds which are commercial commodities, the authors state emphatically that rough-stalked meadow-grass, crested dogtail, an extra-late red clover and wild white clover should be the foundation of the seeds mixture for thousands of acres of our poorer lands; and, of seeds already obtainable to some extent, wild red clover and indigenous or New Zealand cocksfoot should be eagerly sought after.

Of other factors affecting the establishment of a sward, it is noted that small seeds have lower powers of establishment than large seeds, and generally speaking the indigenous strains of a species have lower values in this respect than the larger seeded "Commercial" strains; consequently, the smaller seeded species require much higher seed rates than those generally adopted. Seeds of wild white clover are prone to remain latent in the soil for some time, as are the indigenous strains of many of the grasses.

In sowing, the first essential is to cover the seeds properly. Sowing should be done on a dry day, and the ground should afterwards be peg-harrowed and rolled generously.

In Wales spring sowing is preferable to autumn sowing, particularly in respect of clovers. (In the drier East the reverse often holds good, but even there the sowing should not be too long delayed, as clovers, in particular, require to be well established before winter sets in.) The establishing sward should be properly consolidated as soon as possible; maiden seeds should always be rolled in the spring of the first harvest year. Luxuriant autumnal growth, *e.g.* of the

clovers and rye-grasses, is adverse to successful establishment, particularly of the slower growing species. Any harmful influence in this respect can be largely controlled by intermittent grazing and putting up to hay late, the rye-grass (particularly Italian) then providing valuable spring grazing and acting rather as a protection to the later grasses.

Pasture mixtures, consisting predominantly of bottom grasses and wild white clover, are assured of the greatest success when shading is reduced to a minimum, that is to say when they are grazed intermittently from the very outset and when hay is never taken. Under hay conditions, especially when early put up, competition by shading is at its maximum, and consequently to sow any species in small amount with other species in large amount is to waste seed. Particularly unsuitable are large seedings of rye-grasses with small seedings of timothy, cocksfoot, meadow fescue and the like.

The Compounding of Seeds Mixtures.—Seeds mixtures, it is pointed out, should be adjusted according as the sward is required for (a) 18 months or less; (b) two harvest years; or (c) three or more harvest years. A mixture suitable for a three years' ley is equally suitable for a permanent sward. It is "purpose" much more than "duration" that should predetermine the choice of a seeds mixture. From this viewpoint, mixtures may be divided into four classes: (1) grazing only; (2) hay and grazing each year; (3) hay for the first and perhaps the second year, followed by grazing only; and (4) hay as first consideration.

Only swards intended for three or more years' duration are considered in the paper in question and the examples are all based on results actually obtained in Wales in districts with a rainfall usually exceeding 35 inches per annum. While it is improbable that the same seeds mixture would be equally applicable east and west, north and south, still the fact remains that the standard Cockle Park mixture, with but slight modifications, has throughout England generally found favour wherever it has been tried. The Welsh mixtures are rather more differentiated according to "purpose," and, in the light of tentative experiments by individual farmers up and down the country, seem well worthy of a widespread trial.

Grazing-only Mixtures.—In its simplest form, a grazing mixture may be as under (lb. per acre):—

Italian rye-grass	..	..	..	8
Perennial rye-grass	..	..	..	14
Rough-stalked meadow-grass	..	..	..	4-6
Wild white clover	..	..	..	2-3

It is highly desirable that the perennial rye-grass should be indigenous (ex wild white clover). Such a mixture can advantageously be sown with about 6 lb. of rape and grazed within 8 to 12 weeks after sowing.

Essential modifications may be made by substituting, in whole or in part, crested dogtail for rough-stalked meadow-grass, or, in conditions of the lowest fertility, Chewings fescue. In no case should the place taken by one or other of these species singly, or the sum of two or three of them, be less than 4 lb.

As to possible additions, expense will usually be a dominant consideration. At present there are probably only three species worthy of serious consideration as additions, and these are said to be cocksfoot, chicory, and late-flowering red clover. An extra late red clover (e.g. Montgomery or Cornish marl) will add enormously to the summer grazing in the first and second harvest years, but, if not converted, harm to the sward will result. Ordinary Danish cocksfoot does not last well and cannot be generally recommended. On the other hand wild or indigenous cocksfoot (or reliable New Zealand) should hold the sward for many years, and if properly grazed would repay inclusion, especially on land lower in the scale of fertility than first class. A safe sowing normally would be about 9 lb. each of cocksfoot and rye-grass.

Chicory is said to provide useful winter and spring grazing, and is of high mineral content. Unless, however, hard grazing can be practised, the inclusion of chicory in mixtures will probably not commend itself to English farmers in general.

Grazing Hay Mixtures.—Under this heading are discussed leys which it is intended to graze till the end of April or even into May each year, that is to say, which will be put up late, and from which a light "herby" hay crop will be taken and upon which intermittent grazing will be adopted on the aftermath and throughout the winter. The case for the adoption of such a practice is founded on sound principles. (1) Early spring grazing is more abundant on fields previously yielding hay than on those previously wholly grazed. (2) The persistency of the higher yielding strains is favoured by the plants being allowed a period for full development. (3) The hay will be leafy and nutritious, with a high clover content. (4) The competition between the plants can be so regulated as to bring about the maximum of economic benefit.

Under a system of generous manuring, which should be complete and include nitrogenous fertilizers, productivity will

be high. The point in this connexion is that the best time at which to apply a single nitrogenous dressing is the autumn, that is to say, after, and not before, the hay-producing period. Farmyard manure, for example, applied in autumn while growth is still active greatly favours continued growth and winter greenness, and makes for an early and good start in the spring. As root development is at its maximum after hay-time, the plants are then in an ideal condition to make good use of plant food and consequently pass into the winter in a healthy and well-fed condition, with results that will be splendidly apparent during just those months when grazing is most scarce and most needed.

In designing a mixture for the purpose under review the aim should be to combine early species and strains with late species and strains, the former to provide early spring grazing and the latter to produce the hay crop and to contribute again to the autumn and winter pasturage. Since any particular set of conditions does not favour a large number of species it is usually rather by an informed blending of strains than by an indiscriminate blending of species that the most sensible mixture will be compounded.

The type of mixture to use would be somewhat as follows (lb. per acre):—

Italian rye-grass	6
Perennial rye-grass :—	
Irish, Ayrshire or New Zealand ..	4
Svalöf Victoria	4
Ex wild white	7
Cocksfoot :—	
Danish	3
New Zealand and/or indigenous ..	7
Timothy :—	
American or Ayrshire	2
Svalöf Gloria	3
and indigenous	3
Rough-stalked meadow-grass :—	
Danish	2
Crested dogtail :—	
Irish or New Zealand	2
Broad red clover :—	
English or New Zealand	2
Late-flowering red clover :—	
Montgomery or Cornish marl	3
English late (e.g. Essex)	2
White clover :—	
European	1
New Zealand	1
Wild white	1

A high seed-rate is unavoidable, since if a strain is worth including the amount of seed must be adequate; also rapid

establishment is assisted by a generous seed-rate. (Establishment is more difficult in the drier conditions of the East than in the West. This, however, is greatly assisted by liberal seeding).

The rough-stalked meadow-grass and crested dogstail can be regarded as interchangeable, but the seeding of one or other or both of these, regarded as a unit, should not be less than 4 lb.

If the above mixture is too expensive, economy may be effected by deleting strains altogether rather than by a wholesale reduction of the seed-rate all through. The strains that could be discarded with least loss to the resulting sward would be Danish cocksfoot, the American or Ayrshire timothy, the broad red clover and the European white clover.

Hay-then-Pasture Mixtures.—The most usual demand made on such a mixture is one or two years of hay followed by several years of grazing. The type of mixture that has come into most general use for the purposes indicated is that advocated by the late Professor Gilchrist and commonly known as the standard Cockle Park mixture. From the point of view of the grazing year, this mixture suffers by the exclusion of rough-stalked meadow-grass or crested dogstail. It does not cater for autumn or spring grazing immediately following sowing, and to meet this defect some Italian ryegrass has been included.

Modified Cockle Park mixture (lb. per acre):—

Italian ryegrass	6
Perennial ryegrass	14
Cocksfoot	8
Timothy	5
Rough-stalked meadow-grass and/or crested dogstail	3
Late-flowering red clover	6
Wild white clover	1-2

(Both alsike and trefoil have been discarded from the standard Cockle Park prescription as not having justified their inclusion under most Welsh conditions. In many parts of England, however, they may still be worthy of a place.)

As in the case of the mixture previously discussed, a blending of strains is here also desirable, particularly as regards perennial ryegrass and cocksfoot and extra-late red clovers. The ordinary commercial timothy frequently does not justify itself and may be replaced by cocksfoot, although it is probable that the best indigenous strains of timothy will always be worthy of inclusion.

Hay Mixtures.—An extended adoption of the practice of sowing fields down to grazing only and/or to grazing-hay mixture would, of course, tend to reduce the hay crop, and would necessitate, therefore, the sowing of certain well chosen fields to provide primarily for heavy hay crops year after year. There is little doubt that the Scotch timothy meadow represents exceedingly sound practice. The fields are put up early and are frequently cut late, and heavy crops are demanded year after year as long as the ley will hold.

In drawing up mixtures, heavy manuring should be postulated to favour such species as are high-fertility demanders. Owing to their competitive influences both ryegrasses are better excluded—the hay species from which to select being tall oat-grass, timothy, cocksfoot and meadow fescue, with late-flowering red clover.

With the heavy production of hay year after year it is difficult to retain a good bottom, hence it is desirable to include rough-stalked meadow-grass, and, although the conditions will be far from ideal for wild white clover, experience suggests that on balance this “weed excluder” is also worthy of a place.

The chief question to be decided is whether to include one or more of the large hay-grasses. Cocksfoot is to be regarded as the aggressor species, and will not permit of the full development of either timothy or meadow fescue, so that it is often best to rely on a single hay species.

The following mixture may be regarded as representative (lb. per acre):—

Timothy (fertile conditions, damp or peaty soils) ..	16
or Meadow fescue (fertile conditions, deep rich loams) ..	18
or Cocksfoot (the widest range of conditions) ..	16
or Tall oat-grass (dry situations)	20
Rough-stalked meadow-grass (higher fertility) ..	4
or crested dogstail (lower fertility)	4
Late-flowering red clover	6
Wild white clover	1-2

If it is desired to employ two of the hay-grasses, tall oat-grass and cocksfoot may be combined for the drier and less fertile conditions at the rate of about 9 to 12 lb. each; while timothy and meadow fescue may together contribute to mixtures for richer and damper soils at the rate of about 9 lb. each.

As regards the improvement of poor pastures in Wales, Professor Stapledon and his co-workers have achieved many successes with the method of ploughing out and re-seeding. Along with a dressing of lime, where necessary, and 6 cwt.

per acre of high-grade slag, the selected seeds mixture is sown out in an oat crop in spring or immediately on top of the upturned furrow in July. In the latter case, rape at the rate of 6 lb. per acre usually acts as the "nurse," and the composite herbage resulting is eaten off by sheep in autumn.

By these means pastures of first-rate feeding quality are formed within the space of a few months, and as grass is generally fairly abundant in the late summer the loss of a corresponding grazing period following on the ploughing up is scarcely missed. One great advantage of this system is that it does permit of lime being suitably incorporated in the soil—a condition which always tells heavily in its favour.

In England, improvement of pasturage has generally been sought through the medium of manurial top-dressings, and while in most cases a considerable increase in productivity has resulted, too often such increase has been confined to the summer months. Appreciable late autumn and early spring grazing is dependent fundamentally on the presence in the sward of species appropriate to those seasons. If they are not there they may be induced, by suitable management and manurial treatment, to make their appearance indigenously, but such grading up is usually a slow process.

In cases, therefore, of poor pasture capable of being graded up, where the more useful species are absent or but sparsely represented and where the soil is not too wet or too heavy, the method of improvement by breaking and re-seeding, unquestionably successful in Wales, would seem worthy of trial in different parts of England.

FOUR FEEDING EXPERIMENTS WITH SILAGE—II

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(Concluded from p. 934, this JOURNAL, January, 1929.)

Experiment III, 1923-24.—The third experiment was designed on similar lines to the two previous ones. The cattle in this case numbered 16. The basal ration at the commencement was :—

Straw chaff	..	..	..	..	..	..	3 lb.
Roots	..	..	..	..	..	..	14 "
Bean meal	..	..	..	..	..	..	1 "
Barley meal	..	..	..	..	..	..	1 "

The comparison was between 8 lb. of oat and tare hay on the one side, and a quantity of silage containing an equal quantity of dry material on the other, up to January 8, when

the hay was increased to 10 lb. per day and the silage increased in proportion. The quality of the hay was fair. The tare seeds were immature and properly digested, but the hay was slightly weathered in making and contained some self-sown wheat, the stalky ends of which were coarse and in some cases partly rejected by the stock. The silage was good throughout, being of the acid type in the early part and changing to the green fruity type from March 1 onwards. The self-sown wheat in this was completely eaten.

The basal ration was varied during the period as the appetite of the animals increased.

December 15	Straw chaff increased to 5 lb. per head.
December 17	Swedes increased to 21 lb. per head.
January 1	Straw chaff increased to 7 lb. per head. This was done owing to a misunderstanding on the part of the feeder, and was reduced on
January 8	to 6 lb.
January 8 } January 20 }	Mangolds were gradually substituted for swedes.
February 15	Mangolds increased to 28 lb.

On January 26, both lots of cattle left about 14 lb. of their ration when littered with a particularly sweet lot of barley straw. It was also observed on two or three occasions during this experiment that the cattle getting silage appeared to consume rather more of the wheat straw in their bedding than did those given hay.

The cattle were divided into two equal lots on November 15, gradually accustomed to their rations, and weighed on December 7, when the experiment started. They were weighed again on February 5, after a period of 60 days, which constituted the first part of the experiment. Between February 5 and February 22 the rations were gradually changed over as in previous years. The second part of the experiment terminated on April 4, when the cattle were weighed for the last time. The second period, therefore, lasted 42 days.

Table VI gives the result of the experiment in terms of live weight increase of the animals, and shows three very disturbing features. Bulls Nos. 4 and 5 actually lost weight whilst on hay during the first part of the experiment, as did bullock No. 6 during the second part of the experiment. The animals suffered from no obvious disorder, but failed to increase in weight, chiefly from lack of appetite. It is perhaps significant that both Nos. 4 and 5 gave satisfactory increases when fed on the silage ration. The facts were, none the less, most disturbing, making it difficult to get a satisfactory interpretation of the results, not only because of the loss in

weight of these animals, but also because the other cattle in the same pen may have consumed a larger proportion of food. During the first period of 60 days, the eight hay-fed bullocks made an average live weight increase of 61 lb. or, neglecting bullocks Nos. 4 and 5, which lost weight, 87 lb. This latter figure is equivalent to an increase per day of 1.45 lb. The eight silage-fed bullocks during the same period made an average live weight increase of 94 lb.=1.57 lb. per day. During the second period of 42 days, the eight hay-fed bullocks made an average live weight increase of 53 lb.=1.26 lb. per day. The eight silage-fed bullocks during the same period made an average live weight increase of 61 lb., or, neglecting No. 6, which lost weight, 76 lb. This latter figure is equivalent to an increase per day of 1.81 lb. The difference in live weight increase is largely in favour of the silage-fed cattle whether the sick animals are included or not, so that the results confirm those of the two earlier experiments.

TABLE VII.—SUMMARY OF INCREASES OF LIVE WEIGHT PER DAY. BULLOCKS FED HAY AND SILAGE DURING THREE EXPERIMENTS.

		<i>Fed hay</i> lb.	<i>Fed silage</i> lb.
1920-21	First period (49 days) ..	1.00	1.61
	Second „ (41 „) ..	1.10	1.16
1921-22	First Period (63 days) ..	1.41	1.67
	Second „ (49 „) ..	1.18	1.61
1923-24	First Period (60 days) ..	1.45	1.57
	Second „ (42 „) ..	1.26	1.81
	Average (arithmetical) ..	1.23	1.56

Table VII is a summary of the three years' experiments, in which altogether 56 cattle were concerned. All of these were fed hay for one period and silage for the other. It is significant that, although the average live weight increases vary considerably, the cattle fed silage gave a larger live weight increase in every period than the corresponding cattle fed hay, there being an arithmetical average difference of 0.33 lb. in favour of silage feeding. These results are in conformity with the results of experiments* on the comparative digestibility of oat and tare silage and oat and tare hay made by Dr. Woodman.

Some of the difficulties of feeding experiments with animals have already been described, and the weaknesses of the particular experiment under review have been mentioned. The qualities of the hay and of the silage have varied in

* Woodman: Comparative Determinations of the Digestibility and Metabolizable Energy of Green Oats and Tares, Oats and Tare Hay, and Oat and Tare Silage. *Jour. of Agric. Sci.*, April, 1922.

TABLE VI.

Number	Sex	FIRST PERIOD Hay Feeding				SECOND PERIOD Silage Feeding			
		Weight, December 7		Weight, February 5		Weight, February 22		Weight, April 4	
		C. Q. lb.	lb.	C. Q. lb.	lb.	C. Q. lb.	lb.	C. Q. lb.	lb.
1	Heifer	5 0 14	..	5 3 21	91	6 0 24	..	6 3 18	78
2	"	5 5 2 14	..	6 1 14	84	6 3 4	..	7 1 17	69
3	"	..	..	7 1 0	84	7 2 4	..	8 0 21	73
4	"	..	..	6 1 0	-17	6 1 4	..	6 3 12	64
5	Steer	..	..	5 1 7	-14	5 1 4	..	6 0 23	103
6	"	..	..	6 2 0	77	6 1 17	..	6 0 5	-40
7	"	..	..	6 2 0	70	6 2 26	..	7 1 7	65
8	"	..	..	6 3 17	115	7 0 25	..	7 3 20	79
Total, 8 Bullocks		46 2 17	..	51 0 3	490	52 1 24	..	56 3 11	491
Average ..		5 3 9	..	6 1 14	61 (87*)	6 2 7	..	7 0 12	61 (76§)
9	Heifer	4 2 14	..	4 3 14	..	5 1 12	..	5 3 12	56
10	"	5 5 2 0	..	6 1 0	28	6 2 13	..	6 3 18	33
11	"	6 0 18	..	7 0 0	84	7 1 7	..	7 3 3	52
12	"	7 0 0	..	7 3 21	105	8 0 11	..	8 1 14	31
13	Steer	5 0 14	..	6 1 7	133	6 2 18	..	7 1 4	70
14	"	5 1 14	..	6 0 21	91	5 2 14	..	6 0 16	58
15	"	5 1 22	..	6 0 10	72	6 1 17	..	7 0 1	68
16	"	6 1 4	..	7 2 7	143	7 3 0	..	8 0 24	52
Total, 8 Bullocks		45 2 2	..	52 0 24	750	53 3 8	..	57 2 8	420
Average ..		5 2 21	..	6 2 3	94	6 2 25	..	7 0 22	53

(*) Excluding Nos. 4 and 5. (§) Excluding No. 6.

different years, as must be inevitable in practice. Efforts were made in these experiments to eliminate the disturbing factors by the number of animals used, by repeating the experiment in three periods, and by changing over the rations in the middle of each feeding period. If these efforts have been successful and 0.33 lb. live weight increase per day represents a true measure of the difference of feed value between 8 lb. of average oat and tare hay and the weight of silage containing an equal amount of dry matter in average oat and tare silage, then, over a six-months' winter feeding, the silage-fed cattle would gain 60 lb. more in weight than the hay-fed cattle. During this period the hay-fed cattle would have consumed 13 cwt. of hay and the silage-fed cattle about 2 tons of silage, the produce in each case of about $\frac{1}{3}$ acre of a good crop of oats and tares. Such a difference of 60 lb. in the live weight of such young cattle as were fed in these experiments might well make the difference between fat baby beef and half-fat animals at the end of the period.

From the practical point of view it is to be remembered that the cost of making the hay is less than that of making the silage. On the other hand there are two opposite considerations: (1) that ensilage can be undertaken upon "factory" methods, so that if one plans to fill one's silo in the first week in July it can be accomplished under almost any weather conditions except during actual rain, this not being true of hay; (2) the weight of the silage crop, at any rate on heavy land, can be increased by about one-third by substituting beans for some of the tares and oats, this not being practicable in the case of a hay crop because beans cannot be satisfactorily made into hay.

Experiment IV, 1926-27.—The experiment carried out in 1926-27 differed from the trials in previous years, the silage being made from maize and compared with roots instead of with hay. Trials with a very large number of varieties of maize, collected from many parts of the world during previous years, had led to the finding of one variety eminently suitable for ensilage in southern and eastern England. This variety, named *Jaune Gros du Domaine*, originated in France and was obtained through the kind offices of Monsieur J. Godfernaux, an enthusiast in the development of silage in his country.

On May 28, 1926, three acres of light gravel soil, after being manured with 12 loads of farmyard manure per acre, were drilled with this variety at the rate of one bushel per acre, in rows 19 in. apart. Just before the seedlings appeared

above ground, on June 4, the field was lightly harrowed to kill seedling weeds. Later it was hand-hoed and roughly thinned to 8 in. apart. It was also horse-hoed twice.

The summer was a good one for growth and development of the crop, being characterized by plenty of sun and sufficient rain, so that on September 23, when cut for silage, the crop was excellent. It stood 6 to 7 ft. high; almost every stem carried one and occasionally two cobs with maize grains in the glazed condition. This condition under American practice is considered ideal for silage. The crop weighed 17.6 tons per acre, and contained 19.25 per cent. of dry matter, so that the dry crop equalled 3.39 tons per acre.

The period of ensiling was rather showery, so that the crop contained added water when ensiled. This resulted in some draining of juice from the silo, but the resulting silage was excellent, with a pleasant smell and showing plenty of maize cobs and grains. The dry matter in the silage varied between 17.9 and 19.9 per cent. during the experimental period. This is considerably lower than that of oat and tare silage, which commonly varies between 25 and 35 per cent., but is characteristic of maize silage.

Maize silage is essentially different from oat and tare silage in other respects. Table VIII gives typical analyses of the dry matter in oat and tare silage, maize silage and mangolds.

TABLE VIII.—ANALYSES OF DRY MATTER.

			Oat and tare silage	Maize silage	Mangolds
Crude protein	..	..	16.4	8.6	8.7
Carbohydrates	..	..	37.1	48.6	78.0
Crude oil (ether extract)	..	..	5.2	4.3	0.8
Crude fibre	..	..	32.0	31.8	6.0
Ash	..	..	8.8	7.5	6.5

In crude protein content maize silage is comparable with mangolds, but contains only half the quantity contained in oat and tare silage; in carbohydrates it is intermediate between oat and tare silage and mangolds; in crude oil, which includes the organic acids, it is more comparable with oat and tare silage than with mangolds; in crude fibre it is comparable with oat and tare silage and not with mangolds, and in ash it is intermediate between the two.

It will generally be recognized, however, that for purposes of balancing a ration the fact that maize silage contains similar quantities of crude protein makes it suitable for a feeding trial with mangolds and other roots. The disparity between the two foods as regards fibre influencing the bulk of the ration, can easily be rectified by feeding the equivalent

of straw chaff with the root ration, a much less objectionable procedure than attempting to balance the crude protein by the use of some cake high in this constituent.

In the experiment to be described, 12 calves, aged about nine months at the beginning of the experiment, were divided into two lots as in the previous experiments. The one lot was fed a ration containing maize silage, the other lot a root and straw chaff ration containing a like percentage of dry matter, of digestible protein and approximately of starch equivalent.

TABLE IX.—NUTRIENTS IN COMMENCING RATION COMPARED WITH STANDARD FOOD REQUIREMENTS FOR CATTLE WEIGHING $3\frac{1}{2}$ CWT.

	Dry matter	Digestible crude protein	Starch equiv- alent
$1\frac{1}{2}$ lb. linseed cake	1.2	0.33	0.99
$1\frac{1}{2}$ lb. bean meal	1.1	0.27	0.88
$1\frac{1}{2}$ lb. crushed oats	1.1	0.11	0.79
6 lb. meadow hay	5.1	0.33	1.84
Ration common to both lots of cattle	8.5	1.04	4.50
14 lb. maize silage (18.5 per cent. dry matter).. ..	2.6	0.11	1.20
Total nutrients	11.1	1.15	5.70
Standard requirements for $3\frac{1}{2}$ cwt. cattle*	10.05	1.08	

* Wood and Halnan: Composition and Nutritive Value of Feeding Stuffs.

Table IX shows the food nutrients given in the commencing silage ration at the beginning of the experiment, and distinguishes between the concentrates and hay which were fed in identical quantities to the cattle on both sides of the experiment. It also shows the standard requirements of $3\frac{1}{2}$ cwt. cattle to which it was approximated, since it was known that the weights of the cattle for the experiment were but slightly greater than this. As soon as the cattle got well on to their rations the silage was quickly raised, on November 29 to $17\frac{1}{2}$ lb., and on December 5 to 21 lb. per head, at which figure it continued to the end of the experiment. There was no subsequent increase in the weight of silage fed, but as the dry matter steadily increased from 18 per cent. at the beginning to 21 per cent. at the end, an automatic increase resulted from this cause.

The ration to the root-fed cattle contained identical quantities of hay and concentrates, together with roots sufficient to bring their starch equivalent value up to that

of the silage. Since the actual amount of moisture in the silage and in the roots was liable to continuous variation samples of both were taken once a week for dry matter analysis, so that as soon as the results were known the rations could be recalculated and accuracy assured. A concrete example will explain. On December 2, samples of maize silage and pulped kohlrabi were taken for analysis. On December 4, analyses were complete as follows:—

Maize silage, 19.44 per cent. dry matter.
Kohlrabi, 11.99 „ „

Wood and Halnan give the following dry matters and starch equivalents for maize silage and kohlrabi:—

Maize silage: 18.5 per cent. dry matter, 8.6 starch equivalent.
Kohlrabi: 12.3 „ „ 8.3 „ „

Hence the quantity of kohlrabi (11.99 per cent. dry matter) which contains the same starch equivalent as 21 lb. maize silage (19.44 per cent. dry matter)

$$= 21 \times \frac{19.44}{18.5} \times \frac{8.6}{8.3} \\ = 23.5 \text{ lb. kohlrabi.}$$

The deficiency of dry matter in the root ration was made good by adding to and mixing with the cut roots the appropriate quantity of straw chaff.

Care was taken to keep the ration slightly less than the appetites of the animals required, so that it was always completely consumed, but both lots of cattle were given equal opportunities of consuming clean straw used as bedding. As far as could be observed each lot of cattle ate approximately equal quantities of this.

The roots used during the experiment had to be changed as the season proceeded. The first period consisted of kohlrabi and swedes, the second of mangolds. In each case the quantity fed was calculated to supply a quantity of starch equivalent the same as that in the maize silage.

TIME TABLE OF EXPERIMENT.

- November 4. Preliminary weighing of experimental cattle.
- November 11. Cattle divided into two pens of six each and put on to commencing rations.
- November 18. Cattle re-weighed and experiment proper commenced.
- November 29. Weight of maize silage increased to $17\frac{1}{2}$ lb. per head and root ration in proportion.
- December 5. Weight of maize silage increased to 21 lb. per head and root ration in proportion.
- Dec. 5 to 10. Swedes gradually substituted for kohlrabi.
- January 20 and 21. Cattle weighed at conclusion of first part of experiment.

January 21 Rations interchanged so that those fed silage in to 27. first part were fed roots in second part. Roots changed from swedes to mangolds.

January 27 Cattle weighed at commencement of second and 28. period.

April 7 and 8. Cattle weighed at end of second period.

In the actual experiment the cattle were weighed on two successive days at weekly intervals throughout the experiment. The mean of weighings on two successive days serves to eliminate some errors due to variation in stomach contents of individuals. Weekly weighings serve to draw attention to any animal that may be temporarily indisposed. No important changes in health were observed during the experiment, but No. 5 was noticed to be the most nervous animal of the lot.

Table X gives the result of the experiment in terms of increased live weights of the animals. During the first period the average increase in live weight of the six animals fed roots (kohl rabi and swedes) is practically identical with those fed maize silage, being $123\frac{1}{2}$ lb. and $122\frac{1}{2}$ lb. in 63 days respectively. During the second period the respective gains in weight were 126 lb. in 71 days for the six animals fed roots (mangolds) against 136 lb. for the six fed maize silage. This represents a slight advantage for the maize silage. It is important to record that this advantage coincides with the results obtained in a digestibility experiment carried out by Dr. H. E. Woodman upon sheep with the sample of maize silage.* In this paper it is shown that, both by chemical analysis and by digestibility, the maize silage is better than the standard sample of American maize silage quoted by Henry and Morrison in the American text-book on *Feeds and Feeding*.

The conclusion to be drawn from this experiment is that the maize silage as fed is possessed of a starch equivalent at least as good as, and possibly better than, that assigned to it in the tables quoted.

Summary.—(1) A short account is given of the difficulties to be overcome in conducting feeding experiments with silage.

(2) Three feeding experiments comparing oat and tare silage with oat and tare hay and one experiment comparing maize silage with roots are described. In all 68 animals were concerned in the experiments.

* *Jour. Agric. Sci.*, 1928.

TABLE X.

Number	Sex	FIRST PERIOD Root Feeding				SECOND PERIOD Silage Feeding			
		Mean weight, Nov. 18 and 19		Mean weight, Jan. 20 and 21		Mean weight, Jan. 27 and 28		Mean weight, April 7 and 8	
		C. Q. lb.	lb.	C. Q. lb.	lb.	C. Q. lb.	lb.	C. Q. lb.	lb.
1	Heifer	3 1 15	118	4 1 21	118	4 2 9	140	5 3 9	140
2	"	3 3 12	123	4 3 23	123	5 0 10	128	6 0 26	128
3	"	4 2 25	138	5 3 23	138	6 0 3	144	7 1 7	144
4	Steer	3 2 23	123	4 3 6	123	4 3 17	131	6 0 8	131
5	"	3 3 14	93	4 2 25	93	4 2 27	117	5 3 4	117
6	"	4 1 5	145	5 2 10	145	5 2 23	156	7 0 11	156
Total, 6	Bullocks	23 3 10	740	30 1 24	740	31 0 5	816	38 1 9	816
Average ..	..	3 3 25	123½	5 0 8	123½	5 0 19	136	6 1 15	136
7	Heifer	3 2 27	123	4 3 10	123	4 3 25	115	6 0 0	115
8	"	4 0 11	136	5 1 7	136	5 1 21	119	6 2 0	119
9	"	4 1 4	147	5 2 11	147	5 2 19	123	6 3 2	123
10	Steer	3 2 13	104	4 2 5	104	4 2 15	128	5 3 3	128
11	"	3 3 21	119	5 0 0	119	5 0 24	147	6 2 3	147
12	"	4 0 23	107	5 0 18	107	5 1 5	126	6 1 19	126
Total, 6	Bullocks	23 3 15	736	30 1 23	736	31 0 25	758	37 3 27	758
Average ..	..	3 3 26	122½	5 0 8	122½	5 0 23	126	6 1 9	126

- (3) The average daily increase in live weight of three experiments of animals fed oat and tare silage was 1.56 lb. compared with 1.23 lb. of similar animals fed oat and tare hay—an advantage of 0.33 lb. gain per animal per day in favour of silage, and equal to 60 lb. over a period of six months.
- (4) In the maize silage experiment, in which maize silage was compared with roots on a basis of equal starch equivalents (theoretical), the increases in live weight were to the advantage of maize silage, thus indicating that its actual starch equivalent is at least as good as the theoretical figure.

The writer desires to thank Professor Sir R. H. Biffen for allowing the experiments to be carried out on the farm controlled by the Plant Breeding Institute; Mr. Neville Langridge, his manager, for facilitating the same; Messrs. W. M. Davies, H. V. Garner, S. T. Johnson, and J. W. K. Fair, who attended most carefully to the weighing of the rations and the cattle, and lastly to Dr. H. E. Woodman, who has supervised the analyses and given much helpful advice and criticism.

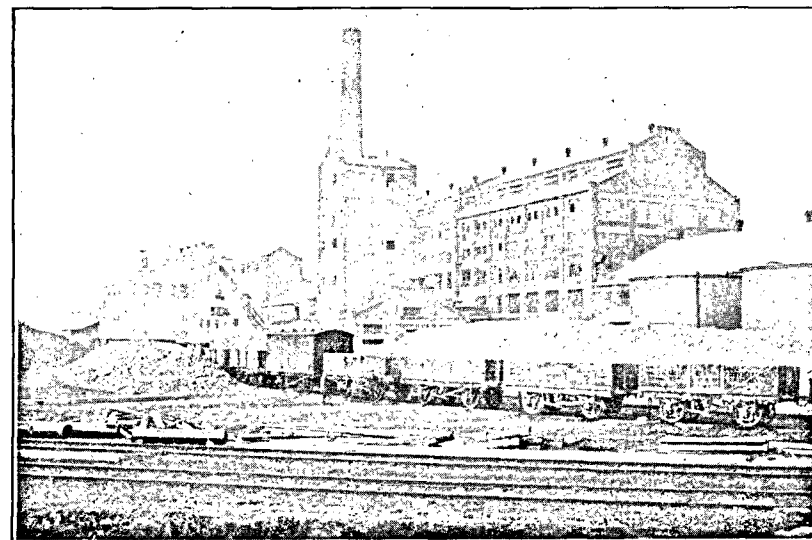
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THE BARDNEY AND BRIGG BEET SUGAR FACTORIES

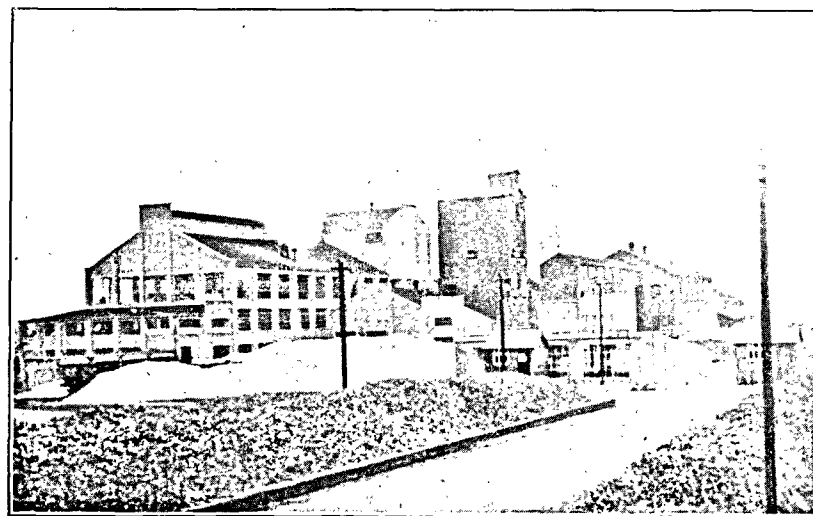
THE two factories (Figs. 1 and 2) belonging to the Lincolnshire Beet Sugar Company, Ltd., and the Second Lincolnshire Beet Sugar Company, Ltd., respectively, which are the subject of this article, were both built under contracts with Sir Robert McAlpine & Sons from designs by The Dyer Company of America, whose experts supervised the erection of the machinery.

The larger factory, which has a guaranteed capacity of 1,000 tons of beet per day, was erected at Bardney in 1927; the smaller, at Brigg, rated at 700 tons a day, was put up in 1928. Both factories have proved themselves able to work at nearly 30 per cent. above their guaranteed capacity.

The general arrangement of the machinery is very similar in both factories, except that at Bardney the Oliver Borden thickeners and Oliver vacuum filters are used, whereas, at Brigg, the usual plate and frame filters are installed. The relative merits of these appliances are the subject of much discussion, which is, however, outside the scope of this article. Apart from this, the processes employed in the two factories are much the same, and it will suffice, therefore, to give a brief description of the methods of manufacture as followed at Bardney.

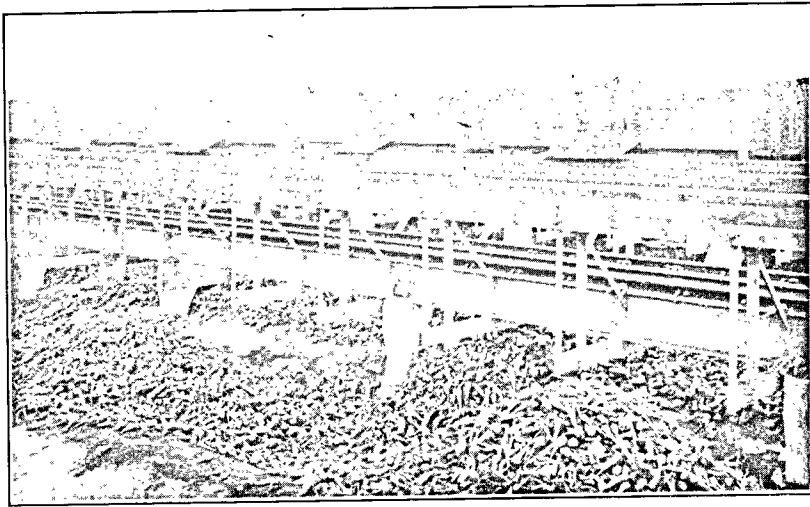


The Bardney Factory: View from the south-west.

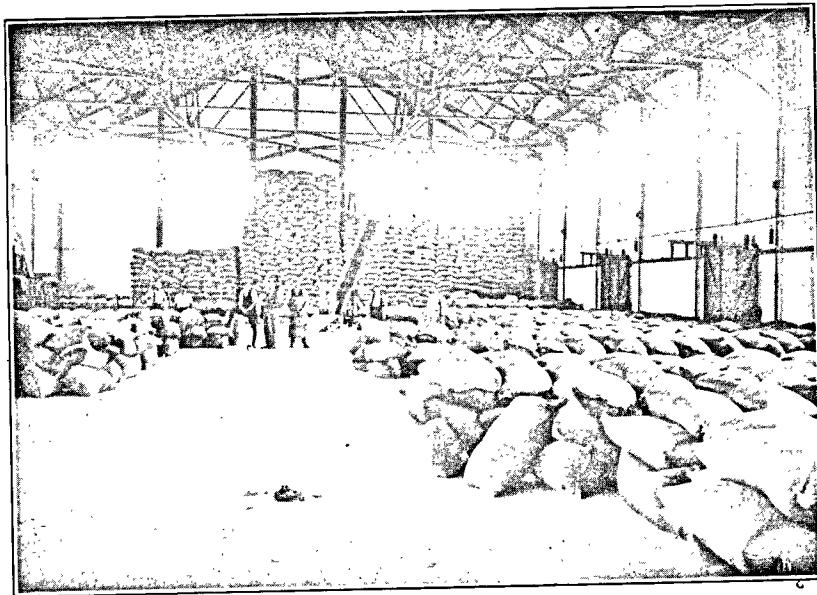


The Brigg Factory: View from the south-west.

LINCOLNSHIRE BEET SUGAR FACTORIES.



The Flumes at Bardney.



Sugar Store, Bardney.

LINCOLNSHIRE BEET SUGAR FACTORIES.

Delivering, Washing and Slicing of Beets.—The beets are delivered by road, rail or river into large concrete storage bins (Fig. 3) from which they are flumed by means of water to the factory. Here they are passed into a washer by means of a beet wheel and, after washing, elevated to the top of the factory, where they are automatically weighed and delivered through a hopper to the slicers. The slicers cut the beets into cossettes, *i.e.*, slices about 4 in. to 6 in. long and triangular in section, in order to expose a maximum of vegetable cells to the action of water in the diffusion battery.

Diffusion.—The cossettes are delivered by means of a chute to the diffusion battery, which consists of 14 cells or tanks arranged in a circle, the cells being connected by pipe-lines in such a manner that water passes from one cell to another, beginning at the cell containing the most nearly exhausted cossettes and finally being drawn off as diffusion juice from the cell containing the freshest cossettes. The principal objects to be kept in view in operating the diffusion battery are :—

- (1) To extract as much sugar as possible from the cossettes ;
- (2) To obtain juice of the highest possible purity ;
- (3) To obtain the highest possible density of diffusion juice.

The necessary conditions to accomplish these objects are, in order of importance, as follows :—

- (1) Fine, even, clean-cut cossettes.
- (2) Careful control of temperature with the maximum at head of battery, *i.e.* cells nearest that being filled with fresh cossettes.
- (3) Rapid circulation with proper pressure and arrangement of chains to relieve screens of excessive weight and to prevent channelling through the mass of cossettes.
- (4) Pure water.

The exhausted cossettes, now known as pulp, are discharged from the bottoms of the cells and, after pressing to remove the bulk of the water, are pumped to a dryer. The dried pulp or, if mixed with molasses, the dried molasses pulp, is a valuable cattle food.

Defecation and Carbonation.—The diffusion juice, after withdrawal from the battery, is pumped through heaters to the liming or defecation tanks, where milk of lime is added, the amount being determined by the nature of the beets that are being worked. The action of the milk of lime is both chemical and physical. There are present in the juice certain complex organic substances (non-sugars) which combine with the lime to form the corresponding lime salts, most of which are insoluble in an alkaline solution. The juice, now containing an excess of lime, is alkaline and these substances

are therefore precipitated. In addition the excess lime (as also the lime carbonate after carbonation) mechanically removes a certain amount of impurities during settling and filtration. From the liming tanks, the juice passes into the first carbonators, where it is treated with carbon dioxide gas until most of the lime has been precipitated as calcium carbonate. After completion of the carbonation to the desired point, the whole mixture is pumped from the carbonator through a heater to the first filters, which in the Bardney Factory consist of thickeners, where most of the juice is drawn through the filtering medium, leaving behind a thick mud. This mud then passes to drum-type-vacuum filters where the remainder of the juice is retained and the resultant lime-cake, consisting of precipitated lime and impurities, is washed free from sugar by means of a water spray. This cake is discarded. The purified juice from the first filter is known as first press juice, and is subjected to a second carbonation, in which most of the lime still remaining is precipitated by means of carbon dioxide gas. The carbonation process is carried out in two stages, for the reason that some of the precipitated lime compounds will go back into solution if the alkalinity is reduced below certain figures. It is, therefore, necessary to remove these by filtration before proceeding with the final carbonation.

The alkalinity at the close of the first carbonation may be anywhere from .06 to .12 per cent. of calcium oxide, depending on the amount of lime added and the nature of the juice or beets being worked up. Alkalinity at the end of the second carbonation may vary from .01 to .025 per cent. of calcium oxide. This variation is also due to the nature of the beets or juice. The degree of alkalinity is measured in the laboratory. After the second carbonation, the juice is sent through heaters to the second thickeners and vacuum filters, where the precipitated calcium carbonate is removed as second lime-cake. The filtrate known as second press juice is then treated with sulphur dioxide gas. The purpose of this treatment is two-fold, (1) to bleach the juice, and (2) further to reduce the alkalinity.

Evaporation.—After treatment with sulphur dioxide, and a further filtration through the thin juice filters, the juice enters the evaporators, where it is concentrated to a syrup containing about 50 per cent. of sugar. The juice, on leaving the evaporators, goes to the melter, where melted sugar is mixed with it and the mixture is pumped to the "blow-ups"

or thick juice sulphur station. Here it is treated with sulphur dioxide gas and filtered through the thick-juice filters. It is now known as blow-up thick juice.

Crystallization, Separation and Granulation.—The blow-up thick juice is now drawn into a white-sugar vacuum pan where it is concentrated to such a point that the sugar crystallizes out. The whole mass of crystals and liquor surrounding it, called "white massecuite," is then spun in centrifugals containing a perforated basket. The syrup, now known as "high green," is spun off, leaving the crystals on the screen. Since some of the syrup still remains on the crystals, these are now washed with a spray of hot water, the syrup made by this washing being called "high wash." The washed crystals are dried by hot air in the granulators and sacked as white granulated sugar (Fig. 4). The "high wash" goes back to enter the next white pan and the "high green" is drawn into a re-melt or raw pan, and concentrated to such a point that crystallization takes place. This mass of sugar crystals and the syrup surrounding them is known as re-melt massecuite, and the crystals are separated from the syrup by centrifugal force in the same manner as was done with the white massecuite. The syrup spun off is known as "low green," the washed crystals as "re-melt sugar," and the syrup obtained during the washing as "low wash." The re-melt sugar is melted and added to thick juice at the melter, the low wash goes back to the next re-melt strike for boiling, and the low green is sent out of the factory as molasses, or mixed with beet pulp in order to make dried molasses pulp.

Chemical Control.—The laboratory work is organized to serve two main purposes (a) to furnish an accurate accounting of all sugar that enters the factory, and (b) to serve as a continual guide to those in charge of the manipulation of the process in the manufacture. The total number of pounds of sugar entering the factory for a period, as determined by the weight of beets entering and by cossette analysis, should be equal to the sum of pounds sacked and delivered to warehouse plus that lost in pulp, pulp water, lime-cake or slimes, sewers, molasses, plus a small amount known as unaccountable loss which is due to caramelization and other more or less vague and indeterminable causes. It is known, however, from long experience that, in a well-operated and properly chemically-controlled factory, this loss will always exist, but within well defined limits. Analyses are made in the laboratory at regular intervals, usually every hour, of the products at each station throughout the factory.

General Organization of Factories.—The organization of the two beet sugar factories consists of (1) an operating department divided into mechanical organization and sugar organization, and (2) an agricultural department dealing with the growers of the raw material. Diagrams A, and B give an indication of the way in which the first is arranged.

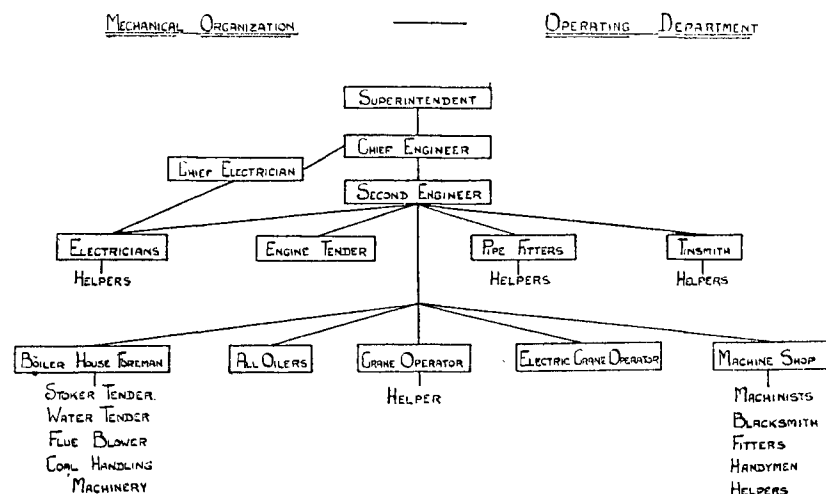


Diagram "A."

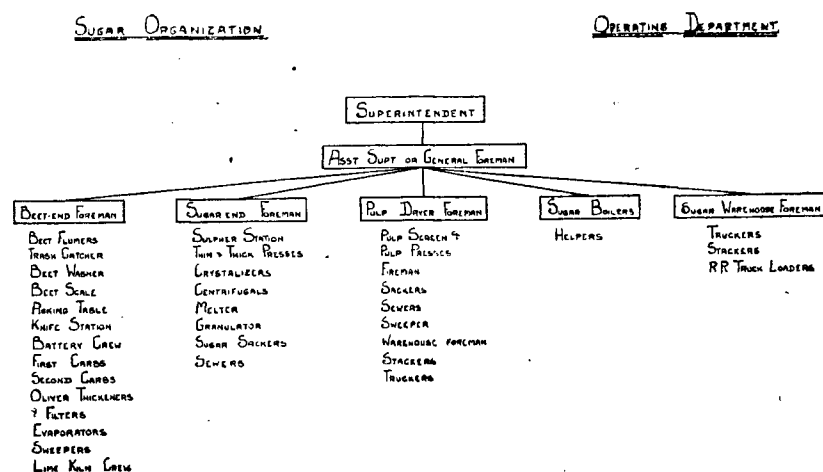
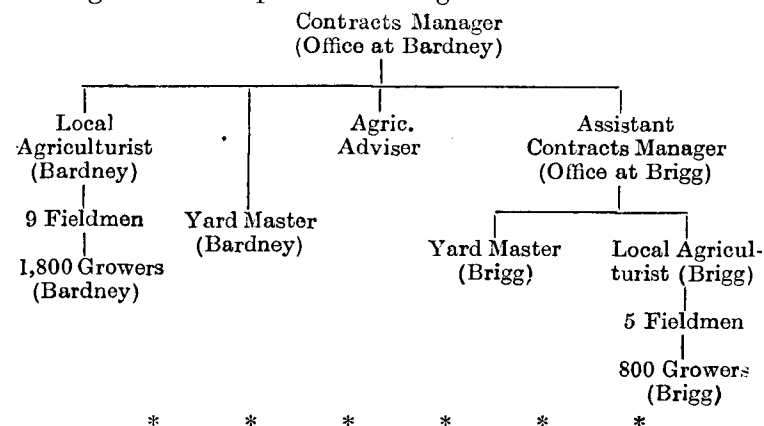


Diagram "B."

The agricultural department is organized as follows:—



INTERNATIONAL INSTITUTE OF AGRICULTURE

THE ninth General Assembly of the International Institute of Agriculture met in Rome on October 10-18, 1928, and was attended by representatives of 67 Governments. Altogether there were present 172 delegates and 10 other persons representing special bodies. The representatives of the United Kingdom were: Sir Charles J. Howell Thomas, K.C.B., C.M.G., Sir Daniel Hall, K.C.B., F.R.S., and Mr. R. J. Thompson, C.B., O.B.E., of the Ministry of Agriculture; Mr. J. M. Ramsay, O.B.E., of the Department of Agriculture for Scotland; Mr. D. A. E. Harkness, of the Ministry of Agriculture for Northern Ireland; and Mr. R. R. Robbins, C.B.E., of the National Farmers' Union.

The business of the meeting was mainly concerned with questions directly or indirectly affecting the internal administration of the Institute, such as the appointment of a new Secretary-General, the finance of the Institute, its relations with the League of Nations, and the possibility of making its work of greater value and utility. As a basis for discussion the British delegation presented a Memorandum to the Assembly dealing with some of these points, and it may be of interest to reproduce a few paragraphs from this Memorandum as an indication of one aspect of the problems under consideration.

At recent meetings of the General Assembly there has been a tendency to propose a constantly increasing number of subjects for investigation by the Institute without paying much regard to the limitations which are in practice imposed by the capabilities of the staff and by the financial resources available. All aspects

of agriculture in its widest sense have been regarded as coming within the scope of the Institute, and it has been encouraged to deal with a multitude of questions of very varying degrees of interest and importance.

It is a platitude to say that the scheme of work to be undertaken by any organization should be determined by its financial resources and by the extent to which the staff employed is able to fulfil the duties imposed on it, but this limitation has been too much ignored in the desire of the Institute to meet all the demands which might be made upon it in the name of agriculture. Since it is impossible for the Institute to cover the whole field, it seems desirable that an exact and precise programme of work that can worthily be carried out within the resources of the Institute should be drawn up annually by the Permanent Committee in consultation with the principal officers of the Institute, and that the execution of this programme should be constantly under supervision.

One of the purposes for which the Institute was founded, as defined in the Convention of 1905, was to secure the collection and publication of statistical, technical and economic information of value to agriculture in the international field. The Convention made no distinction between technical and economic information and regarded all these subjects as of equal importance. Since 1905, however, the situation has changed, and whilst the demand for statistical and economic intelligence has increased, the demand for technical information, that is for information as to the application of science to agriculture, is being increasingly supplied by other agencies. The demand for technical information of this kind is now largely met nationally by the scientific and educational service which each country maintains for the benefit of agriculture, and internationally by the specialist associations and journals which are devoted to each of the many subjects making up agricultural science. The Institute itself has not the scientific personnel necessary to carry out the gigantic task of surveying the world's scientific literature bearing on agriculture either with credit to itself or with profit to the agriculturists who might use the publications of the Institute. Nor, indeed, is it necessary to attempt it, for the field is already largely covered by other institutions.

To avoid overlapping, the work of the Institute in this direction should be restricted to special problems which do not fall within the scope of other institutions. The task of attempting to record the results of scientific and technical experiments and the publication of such results in the Institute's *Monthly Bulletin* might be definitely abandoned. On the other hand, the publication of information as to outbreaks of diseases of plants and animals, and of legislative and administrative measures taken to combat them, is an international function which is not fully performed by any other body. Allied to this is the question of the international control of such diseases. In order that the scientific side of agriculture should not be ignored by the Institute, members of the International Scientific Council might be invited to contribute to the *Monthly Bulletin* from time to time articles explaining, in a more or less popular language, recent progress in their branch of science and its bearing upon practical agriculture.

It is, however, in the two allied subjects of statistics and economics that the activities of the Institute can be most usefully

developed. The importance of agricultural economics in its widest sense has been emphasized by the report of the World Economic Conference, and it is along these lines that the Institute can most usefully be of service to agriculture throughout the world. . . .

In order properly to fulfil this function something more is needed than merely to distribute information. The collection and publication of data is only the first step. What is equally, if not more, important is the interpretation of the facts, and a defect of the Institute is that it has in the past devoted itself almost entirely to the collection and publication of information, without adding that criticism and review which makes the material of real service to the reader, be he statesman or student, journalist or agriculturist. There has been a tendency to publish isolated facts and pieces of information without any clearly defined plan and without any attempt to place the facts in relation to one another, or to draw deductions which would make them of value to the reader.

No doubt such review, dealing as it does with weighty international questions, demands judgment and discretion, but if the Institute is to perform the functions for which it was founded it must aim at presenting facts in such a way as to constitute a definite contribution to knowledge. This involves a change of outlook and is linked up with the limitation in the scope of the work suggested above. But the principle may be reaffirmed that the Institute, instead of attempting to cover all branches of agricultural activity, should concentrate on a limited number of questions in a thorough and exhaustive manner.

There was on the whole general agreement with the views expressed in the foregoing paragraphs, and a resolution was passed in the following terms:—

That having regard to the situation in which the Institute finds itself owing to its restricted income, the main work of the Institute shall be concentrated upon the preparation and presentation of (1) statistics of the world's agriculture, with such documentation and discussion as will render them of prime authority; (2) economic reports and inquiries that may arise out of the statistical work or throw light upon it.

That for the same reasons of economy the scientific and technical work shall be directed principally to publishing reports on particular developments of importance to agriculture to be obtained from competent authorities in any country.

Although this resolution was accepted with unanimity, there was also a great deal of support for the maintenance and extension of the technical and scientific work, though not necessarily in its present form. Many countries of the world, especially those whose agriculture is not very advanced, wish to receive from the Institute technical information which is of more direct value to them than statistics or economics. There was also pressure to improve and extend the existing publications, and, as soon as financial conditions admit, to take up again the publication in English of the *Year Book of Legislation*.

Apart from the above, most of the subjects discussed had reference to the administration of the Institute, and are not of general interest, though in this respect exception must be made as regards the proposals for a World Agricultural Census. This question was, however, fully dealt with in the issue of this JOURNAL for December, 1928, p. 813.

* * * * *

THE CO-OPERATIVE SUPPLY OF FARM REQUISITES IN WALES

A. W. ASHBY, M.A. and J. MORGAN JONES, M.A.

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ONE feature of the industrial and commercial history of this country, during the past 50 years or so, has been the growth of associations of individuals and business units for the protection of mutual interests. This is shown by the network of trade unions, trade associations and federations which cover the country, while the trust movement is another aspect of the same thing. So far as farming is concerned, this spirit of association has taken the form of agricultural unions and societies on the one hand, and the application of co-operation to the business aspects of farming on the other. Among the several ways in which the co-operative principle can be applied to agriculture and rural life, the co-operative purchase of requisites has been the most uniformly successful.

Number of Societies.—Some indication of the expansion and present scope of this form of co-operation in Wales is indicated in the following table :—

REQUISITE SOCIETIES IN WALES, 1903-26.

			Number	Members	Total Sales
1903	..	..	15	1,768	£17,067
1913	..	..	61	8,036	£330,567
1923	..	..	81	22,437	£1,258,777
1926	..	..	75	23,310	£1,215,784

The favourable opportunity, presented by war-time conditions, for the expansion of supply societies was taken up, and the comparison between 1923 and 1926 shows that societies had so won the confidence of farmers during the difficult times which followed as to ensure their continuation when conditions became more normal. Although there has been some decline in the number of societies, this may be an advantage to the movement. The slight decline in the

value of turnover since 1923 conceals the fact that the total tonnage handled has actually increased, since the decline in prices has been greater than the decline in the value of trade done by these societies.

Membership and Trade.—On the basis of the 1921 *Census of Occupations*, about 57 per cent. of the farmers of Wales are members of co-operative requisite societies. The membership, in fact, represents about one-half of the people who get their living by farming. Although it would be unsatisfactory to judge the scope of the movement from membership statistics, owing to the need for revising share registers and the extent of trade with non-members, the statistics still show that co-operative purchase is an important feature of the agricultural activities of the Principality. There are, however, wide variations in the degree to which these societies hold the trade of farming areas, and some of these are indicated by the following comparison of conditions in North and South Wales.

MEMBERSHIP AND TRADE, 1926.

Number of Societies	Members	Sales			Member-ship as percentage of No. of farmers
		Requisites	Produce	Total	
North Wales 33	8,252	£373,927	£27,381	£401,308	47.0
South Wales 42	15,058	£782,269	£32,207	£814,476	67.0
Wales .. 75	23,310	£1,156,196	£59,588	£1,215,784	54.4

Measured in terms of membership and trade, about two-thirds of the movement's activities are in South Wales. Societies are fairly evenly distributed over the Principality, apart from the border areas of Radnor, Brecon and Monmouth, but the extent to which farmers' needs are met is much smaller in North than in South Wales. It is difficult to find adequate reasons for this difference. Probably more organizing work has been done in North Wales, since it had a branch of the A.O.S. for about four years before the formation of a South Wales Committee. It is possible that ethnological differences may be of some importance. The farming systems of North and South Wales, however, differ in several respects, and on the whole the purchase requirements per farm are smaller in the north owing to the prevalence of sheep farming on land at high altitudes. The following

statistics, pertaining to 1913 and 1926, indicate the main differences :—

DISTRIBUTION OF AGRICULTURAL AREA, 1913 AND 1926.

	North Wales		South Wales	
	1913	1926	1913	1926
	Per cent.		Per cent.	
Proportion of arable land..	18.3	16.3	15.6	14.6
„ „ permanent pasture	46.8	42.3	55.1	51.7
„ „ rough grazing	34.9	41.4	29.3	33.7
Sheep per 100 cattle	516	550	427	459

The greater relative importance of sheep in North Wales and of dairying in South Wales materially affects the scope for trade in farm requirements, although the limitations of the movement in North Wales cannot be entirely accounted for by differences in farming systems.

Types of Business.—Individual societies differ very greatly in the extent to which they concern themselves with supplying the purely agricultural as distinct from all other material needs of their customers. Some reasons for these differences have been discussed elsewhere,¹ but the statement of individual differences may be helpful. Some societies trade only with farmers, and the whole of their trade is in goods required for the actual production of crops and stock. Other societies are in reality doing a country “household” business. In the extreme case, less than 5 per cent. of the trade is in farm requirements and 90 per cent. of the members have no land under their control. The type of variation which exists is shown in an analysis of five groups of societies.

TYPES OF BUSINESS, 1926.

	No. of societies	Average sales per Socy.	Sales per member	Percentage of Total Sales				
				Feed-ing stuffs	Imple-ments	Seeds	Ferti-lizers	H. and M.*
		£	£					
North Wales	10	2,809	21.35	41.99	1.54	4.29	6.58	45.3
North Wales	14	6,605	31.15	54.4	0.9	6.4	6.4	31.5
South Wales	12	13,800	42.0	63.0	3.3	6.3	8.4	19.0
North Wales	9	28,151	63.8	82.8	2.0	1.9	5.4	7.9
South Wales	14	30,216	57.0	85.0	0.08	4.4	5.4	5.12

* H. and M.=Household and Miscellaneous Goods, such as grocery, drapery and coal.

¹ *Agricultural Co-operation in South Wales*, page 10, seq. J. Morgan Jones, Agricultural Economics Dept., U.C.W., 1927.

Two considerations emerge from the above comparison. In the first place, societies in North Wales are catering to a much larger extent for the needs of the farm family in respect of food, clothing and coal than those in South Wales. The proportion of *bona fide* farmer members is much smaller in the north, as, in several areas, “agricultural” societies are partly composed of quarrymen, some of whom may be landless; others have a little live stock, or operate about 15-20 acres of land. If the scope of the movement is measured in terms of the sale of farm requirements *on the average of all farmers*—irrespective of membership—in the two areas, the difference can be easily recognized. The comparative figures are £18 per farmer in North Wales against approximately £30 in South Wales. This indicates that there is ample scope for the development of trade by requisite societies all over the Principality, but especially in the North.

The previous table also shows a clear relation between the type of trade conducted and the size of the business. In both areas there is a marked tendency for small societies to concern themselves with the sale of household requirements, while the sales of the largest societies consist almost wholly of farm requisites. It is not surprising, therefore, that the movement in North Wales should be characterized by the small society

SIZE OF BUSINESSES, 1926.

Sales grouping	Number of societies	Average sales per society	Average members per society	Sales per member
£5,000 or less		£		£
South Wales	5	4,033	181	22.2
North Wales	10	2,809	131	21.35
£5-£10,000				
South Wales	7	7,410	170	43.7
North Wales	14	6,606	212	31.15
£10-£20,000				
South Wales	7	15,725	365	43.1
North Wales	3	14,615	619	48.7
£20,000 and over				
South Wales	12	44,989	777	57.9
North Wales	6	37,816	477	79.0
Totals and averages				
South Wales	31	23,290	450	51.7
North Wales	33	12,162	250	45.4

covering a limited area, with no branches and only one or two employees. Topographical conditions contribute to this situation, for there are, in North Wales, several narrow valleys which naturally form compact trading areas, and where expansion is limited by reason of difficult communication and the natural coincidence of mountain sheep-walks. All the larger societies in North Wales are situated in the low-lying areas.

About two-thirds of the North Wales societies do a trade of less than £10,000, whereas the position is practically the reverse in South Wales. The column showing sales per member indicates that there is considerable variation in the extent of trading with non-members between various groups of societies, and on the whole it would seem to be more prevalent in North Wales.

Societies show wide variations in their aims and policies, and in services offered to members; and the business problems with which they are confronted are determined to a certain extent by the scope of their activities. The small truck-load society benefits from the advantage of low working costs, but is commonly handicapped by the lack of business acumen in the purchase of goods; and, where farms are large, the society cannot always offer terms more favourable than those which the individual action of members can secure. The small storage society is, also, generally faced with the problem of securing good management, although a concentration on household trade often results in fair profits, because the gross margins on such goods are wider than in the case of farm requisites. Larger societies generally secure better service in the matter of management, and this is a vital necessity where the successful carrying of large stocks demands keenness in purchasing on a fluctuating market. Moreover, the larger societies have to exercise greater care in price fixing, in determining the terms of sale, and in the control of credit. Further, much organizing ability is required when several depots are operated and goods have to be delivered to the farms. On the other hand, the bigger societies benefit from the economies of bulk purchase, and their turnover is generally sufficient to effect a reduction in overhead charges per unit. While the small conservative society is useful, it would seem that the future expansion of the movement will partly depend on the extent to which larger businesses can be established, provided that the movement is willing and able to attract the men who can handle big businesses successfully.

Control of Credit.—Whatever differences exist between societies in the matter of size and the type of goods handled, there are some problems which are common to all types and sizes. Among these the control of credit is the most urgent at the present time, and the effect of agricultural depression is clearly seen in the growing seriousness of the credit position of societies during the last two or three years.² It must be admitted that societies, in fulfilling their functions to farmers, are almost duty bound to grant some credit, and that customers should consider the value of this service in estimating the financial advantages which they derive from trading with the society. It may be argued that a co-operative society, by the very reason of its existence, should give credit, and thus enable the weak member to benefit by the stronger financial position of his neighbour. Without departing from the fundamental principles of co-operation, the majority of societies in Wales can justly strive to restrict trade credit, since, in some cases, the position is serious enough to threaten the financial stability of the business. The scarcity of ready cash among farmers should not prejudice societies in their examination of the ultimate results of giving credit. Admitting the farmers' need for short-term credit, societies may well consider that the results of granting excessive credit are such as to justify restriction on their part, and to suggest other and more satisfactory means of meeting the need. Customers on their part must realize that, however it is obtained, credit must be paid for, although the charges made for it by distributors may not be evident on superficial examination.

The following table shows that, on the whole, the position is a little better in North than in South Wales, and it is interesting to consider the cause of this difference. All over Wales the offering of discounts for early payment is common, but, as stated elsewhere, this does not seem to have any clear effect on the results.³ The conclusion is again invited that the strength and policy of the management and committee is the most important factor in restricting credit. An examination of several individual cases shows that there is quite a clear connexion between the credit position and the type of goods handled. The table on p. 1040 shows that household goods form a much larger part of societies' trade in North than in South Wales. A high proportion of trade in personal and

² *The Control of Credit.* A. W. Ashby and J. Morgan Jones, Agricultural Economics Dept., 1927.

³ *Agricultural Co-operation in South Wales.* *Op. cit.*, p. 26.

household requirements is often accompanied by a good credit position, since a counter trade is generally a cash trade. In fact, several societies are anxious to extend their trade in grocery and household goods for the very reason that money comes in quickly in this trade.

INFLUENCE OF CREDIT ON EXPENSES AND PROFITS, 1926.
(Grouping According to Amount of Credit Given.)

		Per Cent. of Sales						
Debtors as percentage of sales	No. of societies	Debtors	Ex-penses	Profit or loss	Trad-ing profit or loss	Finan-cial re-ceipts	Finan-cial pay-ments	Bal-ance of finan-cial trans-actions
15 per cent. and under—								
South Wales..	13	12.2	6.4	+1.5	+1.34	0.39	0.23	+0.16
North Wales..	17	11.4	7.72	+1.64	+2.03	0.33	0.72	-0.39
16-25 per cent.—								
South Wales..	10	20.7	7.5	+1.1	+1.01	0.70	0.61	+0.09
North Wales..	9	20.15	8.54	+0.85	+1.55	0.15	0.85	-0.7
25 per cent. and over—								
South Wales..	8	32.6	9.9	-1.7	-1.33	0.42	0.79	-0.37
North Wales..	7	36.6	7.97	+0.72	+2.78	0.22	2.28	-2.06

This table shows very clearly the extent to which giving extensive credit increases working expenses, and restricts the possibilities of trading profitably. It is impossible to measure in exact terms the final effects of long credit on trading results, and on services to members, but some important consequences can be isolated. Long credit usually creates conditions of finance which make profitable trading difficult. Delay in payment means that the society's capital is being used by customers to finance their own businesses, with the result that the society becomes heavily capitalized in proportion to its trade. Unless the society has strong reserves, the extra capital has to be borrowed, and heavy interest charges must be met, and such costs materially affect financial results and the prices at which goods can be offered to customers.⁴

An attempt to measure some of these influences is made in the above table. The items of income and expenditure of a business can be roughly distinguished as to whether they are

⁴ For fuller discussion see *Agricultural Co-operation in South Wales*, *op. cit.*; and *Agricultural Co-operation in Wales*, A. W. Ashby and J. Morgan Jones, Horace Plunkett Foundation Year Book, 1928.

attributable to "trade" or "financial" conditions. In co-operative business, "trade" income usually resolves itself into gross profit and C.W.S. dividend⁵, and trade costs into expenses of management and depreciation. "Financial" receipts include discounts for cash and all interest from investments, loans, and deposits; whereas financial costs comprise discounts given, interest on overdue accounts, and payments for loans and overdrafts. A comparison of columns 4 and 5 shows the effects of financial conditions on the final result of trading and financial transactions. With the exception of two groups of societies in South Wales, the trading result is much more favourable than the final result, because financial charges are greater than financial receipts. The varying difference between trade and final results points to fundamental differences in finance, and the significance of the adverse balances on financial transactions among societies granting long credit is very marked. Space will not allow the statement of the position of individual societies, but there are many cases in which, while the "trade" results showed a profit, the final result showed a loss owing to heavy payments of interest.

Conditions of Finance.—Although the credit position is better in North than in South Wales, it is seen that the balance of financial transactions is heavily against the North Wales societies. This indicates a sharp difference in the sources from which societies derive capital in the two parts of the Principality. The amount of owned capital (members' interest) in a society depends on the share subscription of members, and the degree to which profits have been made and conserved in the society's business. The following comparison illustrates the different methods of capitalization which are found:—

SOURCES OF CAPITAL, 1926: PER CENT. OF TOTAL.

	South Wales	North Wales	Wales
Number of Societies ..	31	33	64
Total capital used* (see note overleaf)	£273,000	£184,200	£457,200
Paid-up share capital ..	12.8	29.8	19.7
Reserves and accumulated profits† (see note overleaf) ..	52.3	18.7	38.8
Total members' interest ..	65.1	48.5	58.5
Loans and mortgages ..	4.1	3.65	3.9
Trade creditors	24.5	24.8	24.6
Bank overdraft	6.3	23.05	13.0
Total borrowed	34.9	51.5	41.5

⁵ C.W.S. dividend is included with trade income because it is not dependent on the financial position and policies of societies but on their buying policies.

* It is difficult to state with exactitude what the "total capital used" should represent. The amount here includes all "Trade Creditors," although for some societies this does not exceed the normal trade credit and does not entail payment of interest on overdue accounts or difficulty in buying at "cash" prices. In other cases the "Trade Creditors" amount does represent real additional capitalization. The Reserves and Accumulated Profits include a little capital invested outside the businesses, but these are often used as collateral security against bank overdrafts at certain times of the year, and in a few cases overdrafts which are more or less continuous. The totals and items as given fairly represent conditions over the whole of the two groups. The amount of "Trade Creditors" here given is that outstanding at the end of the financial year—usually December 31. The amount varies from month to month, but is usually highest in April and May. "Trade Creditors" and bank overdrafts are alternative methods of obtaining credit. The position as regards one or the other varies within the year in the case of groups of societies, and within the groups the relative positions of these items vary very considerably from one society to another.

† Including bonus shares issued to members.

It is clear that, although the share contribution is relatively much greater in North Wales, the proportion of owned capital is very much less because the proportion of reserves and accumulated profits is very much smaller. It would seem that this is due rather to a smaller total volume of profits having been made in the past than to indiscriminate distribution of profits among members. There are several large societies in North Wales working with heavy deficits, and their efforts to make profits are crippled by heavy payments to the lenders of capital.

The intimate connexion between business results and methods of finance has been emphasized elsewhere, but the table opposite giving comparisons for North and South Wales summarizes the position. Unsatisfactory conditions—whether viewed from the standpoint of credit, expenses, or profit and loss, are always associated with heavy capitalization, scarcity of working capital and extensive borrowing from external sources. For the examination of the effects of different methods of capitalization and of different proportions of credit trading on financial results, societies have been grouped according to the varying relation of sales to credit given, expenses incurred and profits and losses made.

Reading from left to right—that is, from good to poor conditions and results—it will be seen that the proportion of "trade" and "borrowed" capital to sales increases, whereas the societies' working capital and members' interest show a clear tendency to decrease. Although there are several ways whereby societies could improve their methods of capitalization and the general capital position, conditions in the Principality are so variable that it is difficult to lay down any

CAPITALIZATION AND FINANCIAL RESULTS.

Trade Capital, Outside Capital, and Society's Working Capital as percentage of Sales. Members' Interest as percentage of Total Capital used.

Classification	Group 1		Group 2		Group 3		Group 4	
	South Wales	North Wales	South Wales	North Wales	South Wales	North Wales	South Wales	North Wales
<i>Credit Classification :</i> Debtors as per cent. of sales	15 per cent. or less		16-25 per cent.		25 per cent. and over			
Trade capital	24.9	21.82	30.6	31.4	43.9	54.5		
Outside capital	7.4	20.59	13.9	23.55	27.4	51.07		
Society's working capital	17.5	1.23	16.7	7.85	16.5	3.42		
Members' interests per cent. of total capital ..	70.7	48.8	56.25	49.1	50.8	48.0		
<i>Expenses Classification :</i> Expenses per cent. of sales	Under 6 per cent.		6-8 per cent.		8 per cent. and over			
Trade capital	28.6	25.38	28.1	24.64	37.7	30.36		
Outside capital	11.0	7.59	11.5	15.89	20.7	37.72		
Society's working capital	17.6	17.79	16.6	9.55	17.0	4.61		
Members' interests per cent. of total capital ..	67.0	75.48	65.8	60.4	55.4	26.1		
<i>Profit Classification :</i> Profit per cent. of sales	2 per cent. and over		1-2 per cent.		Under 1 per cent.		Losses	
Trade capital	28.6	27.68	28.4	18.18	29.4	20.29	42.8	31.19
Outside capital	5.8	11.29	12.4	10.39	13.2	20.29	29.9	52.60
Society's working capital	22.8	16.39	16.05	7.79	16.2	9.0	12.9	0.88
Members' interests per cent. of total capital ..	88.0	69.14	63.0	62.3	61.2	47.26	35.8	31.63

hard-and-fast rules. Several societies have appealed to farmers for more capital, but such appeals have met with little response, as is natural, in view of the present state of the industry. Within limits, however, all societies can increase their effective working capital by a restriction of credit. The good credit position of some societies, whose trade is almost entirely in farm requisites, proves that a better credit position is not impossible even in the present agricultural depression.

Competition and Marketing.—The question of credit restriction is closely allied to the problem of meeting competition. Competition in the supply of farm requisites is now extremely keen, and private distributors attract custom by reason of the apparently lenient credit terms which they offer. Societies can effectively meet such competition by offering superior services to their members. Already, except in the counties of Brecon, Radnor and Monmouth, there are comparatively few farmers who cannot find a co-operative depot within 10 miles of their farms. Several large societies in low-lying areas each have five or more trading centres, so that farmers are provided with convenient purchase points.

It is now, however, generally recognized that the stage has been reached in which future development will take the form of delivery to farms rather than the extension of trading centres. The growing demand for delivery to the farm has been met by about 20 societies who own steam and motor vehicles, while several others hire lorries to do the work. The expansion of delivery will raise new problems in management, especially in supervising the running of vehicles in order to secure the maximum economy from their use, and to maintain contact with customers. It is significant that several delivery societies now employ outdoor representatives who visit farms and markets and thus keep members informed of the society's offers of goods and prices.

The demand for delivery presents the smaller societies with a different problem, since their turnover is not sufficient to justify their owning vehicles. This is especially the case in North Wales, where two-thirds of the societies do a trade of less than £10,000, which is the limit under which the owning and running of delivery vehicles becomes too expensive to be economical. It would seem that the very small societies must soon look for expansion or consider the possibilities of amalgamating with others. There are several districts in which the topographical conditions are favourable to working in larger units, and where a centralized delivery service could be operated with success. It may be argued that the amalgamation of societies in the past has not justified the extension of the principle, but it must be admitted that where three or four societies are situate within a circle of 10 miles diameter, a little careful organization would result in substantial savings to customers. It is possible that, so far as delivery is concerned, the urgency of increasing the size of the business may be offset by the probable extension of the road transport powers of the

railway companies. Several societies are already delivering to depots and some farms through the medium of the railway companies; and it is stated that their competition has considerably reduced haulage charges in several districts. Even assuming that this development would provide societies with the services which they require, the advantage derivable from larger purchases, and the reduction of overhead charges by amalgamation would remain, and should be seriously considered by certain groups of societies.

Another aspect of the problem of meeting competition is foreshadowed by the attitude of farmers and societies to the question of marketing farm produce. In asking the farmer for his custom, societies are often met with the taunt that they do not help him in the solution of his marketing problem. On the other hand, there are many dealers in farm produce who sell farm requirements, and the fact of their buying the former enables them to secure the farmers' custom for the latter. For example, butchers and cattle dealers in some districts are agents for foodstuffs; corn merchants usually sell seeds and often fertilizers; wool merchants sell seeds, and grocers buy butter and eggs. One concrete example will illustrate this problem. In parts of North Wales, where wool is an important product, the wool merchant sells seeds, and both transactions are settled when the cheque for the wool is written out. It is fairly obvious that requisite societies could often expand their trade in farm supplies if they were able to relieve the farmers of their produce.

It is true that many societies are actually selling some farm produce. About a dozen societies in different parts of Wales sell butter and eggs for farmers, whereas only two societies in North Wales arrange for the sale of members' wool, and one society has been consigning fat stock to wholesale markets for sale on a dead-weight basis. Many societies buy corn and potatoes from members and transfer it to others or export it into other areas, but the amount of this trade is small in proportion to the total farm sales of this produce.

The whole problem of marketing produce, especially live stock and live stock products, remains to be tackled, and so far, where requisite societies have taken up the sale of produce, they have done little to build up reliable markets by raising and steadying the standard of quality of goods. It is, of course, open to question whether the marketing of produce can best be undertaken by supply societies; experience in other countries seems to show that development should take place

on commodity lines. The essential point is that farmers are, to an increasing extent, looking to the nucleus of organization which they already possess in the form of requisite societies to assist in the solution of the marketing problem. The extent to which requisite societies will actually undertake the sale of produce will depend on local conditions, but everywhere supply societies can offer a useful basis for the initial organizing work.

Problems of Control.—The lines of development in the future, and the extent to which co-operation will embrace the whole of the farmers' buying and selling transactions, will depend largely on the mental attitude of those concerned in the movement. In fact, the majority of co-operative problems—the relations between individuals and the society, the constitution and functions of management committees, the apportionment of responsibility between committees and the manager, the efficiency of management, and the attitude of societies to each other—can be solved, given the correct mental outlook.

There are several directions in which lack of appreciation of the aims, business requirements and principles of control of co-operation is responsible for considerable friction and inefficiency, both in the internal and external working of societies. Individual managers and committees often regard a neighbouring society as a rival rather than an ally in the battle for the farmer's economic freedom. In some societies there is little sympathy between the manager and committee, either because the former's business acumen leads him to under-estimate the worth of his committee's advice, or because he has not displayed that efficiency which wins confidence. In some cases, where "the manager is the society," results are so satisfactory as to lull members to a state of passive onlooking. Such a state of affairs is not satisfactory in the long run, since members lose active interest in their own organization, the success of which is linked up too intimately with the career of one person. On the other hand, some societies are suffering and have suffered from the excessive interference of incompetent committees, which may be responsible for actual losses or merely restricting developments which the manager is personally anxious to execute. Generally speaking, not sufficient trouble is taken in the election of committees; and societies do not always benefit by the business knowledge and experience of their most capable members.

Ultimately, the attitude of the general body of members

contributes largely to the harmonious government of the society and even to the efficiency of management itself. While the great majority of managers are competent and willing servants of their society, there are isolated cases of positive mismanagement, and others where the level of efficiency is capable of being raised. In too many cases, the remuneration offered to managers is far from sufficient to attract men who are capable of rendering good service.⁶ It is true that the paltry salaries now paid to managers of some small societies are a heavy burden on turnover, but it is almost equally true to say that the societies are small and unprogressive merely because managers have little incentive in expanding the business. Better remuneration will attract better service, and farmers need only apply to the society's affairs a principle which they have found to be true on their own farms—that low-priced labour is often the dearest.

The maintenance and fostering of individual members' personal interest in the society is a necessity to successful co-operation, and this will demand closer attention with the expansion of delivery and the possible increase in the size of societies. On the business side, more attention is being, and will have to be, given to salesmanship, canvassing and advertising, to meet the keen competition of to-day.⁷ As regards fostering the co-operative spirit, the meagre attendances at general meetings show how much needs to be done in this direction. It is true that, in the case of a society covering a very wide area, perhaps serving farmers who visit different market towns, it is often difficult for members to attend. In this connexion, the practice of one society may be worth copying: one committee is chosen for each branch and is responsible for purely local matters, whereas the representation of each area is ensured on central committees. The result is that the rank and file of members actively participate in the society's affairs.

The tendency to disparage the idealistic side of co-operation is general, and agriculturists often maintain that co-operation can be judged only by its business results. In reality the cleavage between the idealistic and material standpoints is more apparent than real. It is true that co-operation will not be sustained by mere propaganda, but it is equally true that efforts to secure better financial results are hampered by

⁶ *The Co-operative Purchase of Agricultural Requisites*. Economic Series, No. 5, p. 46, Ministry of Agriculture and Fisheries.

⁷ *Salesmanship in Agricultural Co-operation*, A. W. Ashby. Welsh Journal of Agriculture, Vol. III, 1926.

ignorance of co-operative and general business principles on the part of members and those controlling societies.⁸ In the past, farmers have criticized their own movement, often unfairly. They have judged its benefits by short-period results only, without realizing that in it they have the foundation of a system which they can themselves control, and which has immense possibilities in moulding the agricultural and rural life of this country.

* * * * *

VARIETIES OF CEREALS FOR SPRING SOWING

F. C. HAWKES, M.A.

National Institute of Agricultural Botany

OBSERVATION plots of 6 varieties of spring wheats, of 15 spring barleys and of 34 spring oats, were grown in 1928 by the National Institute of Agricultural Botany at six trial centres—Cambridge, Good Easter (Essex), Cannington (near Bridgwater), Long Sutton (Hants), Newport (Salop), and Sprowston (near Norwich). Thanks to the ready co-operation of the Agricultural Organizers for Cheshire, Devon, Lincolnshire (Lindsey and Holland), East Suffolk and West Sussex, and of the Rothamsted Experimental Station (Herts), certain of the varieties were also grown in those counties.

The following notes are based on the observations made by the Recorders at these centres, and have been written in the light of advice from members of the Crop Improvement Committee of the Institute and its Manager of Field Plots, Mr. S. F. Armstrong. *The notes do not necessarily apply to the North of England and, as they refer in the main to a single season's work, they are subject to certain limitations; but it is hoped that they will assist farmers to pick out the most remunerative varieties to grow in other parts of the country.*

The year provided no serious test of lodging, and there is reason to suppose that a number of the varieties which stood well in 1928 would have gone down in a more normal year. Diseases again were rare and slight in the case of the barleys and oats, and differences in the susceptibility of the varieties were therefore masked. A few stocks of well-known varieties, coming from more than one source which should be above suspicion, proved to be either very mixed or of low germination. The choice of the most suitable variety or strain must

⁸ *The Co-operative Purchase of Agricultural Requisites*, op. cit. p. 72. Ministry of Agriculture and Fisheries.

always be the first consideration, but healthy germination and reasonable freedom from admixture of other varieties are necessary qualities which the farmer has the right to expect if he purchases from a seedsman.

The notes on the quality of the grain are not based on milling and baking trials, malting trials, or analyses, for such information, except in the case of a few varieties, is not available. They represent merely the opinions of one or more trained observers, and as such they can be considered to correspond with the opinions a buyer would form when trying to assess the value of wheat for bread-flours, of barley for malting and of oats for feeding.

Spring Wheats.—None of the varieties gave a yield which even approached a normal crop of winter wheat. It can, indeed, only be in very exceptional circumstances that the growing of spring wheat in England is profitable. April Bearded is certainly the earliest ripening variety of spring wheat; it gives the best quality grain; and it is comparable for yield with the variety which is probably the more generally sown, Red Marvel. The latter takes longer to ripen and gives a poorer quality grain, but is stronger in the straw. Red Admiral could not be distinguished from it in the field. A.1 is on much the same level of merit as Red Marvel, but may be a shade longer in ripening and rather less susceptible to disease. Challenge White and White Marvel could not be distinguished in the field, and are certainly not suitable for spring sowing. All these varieties suffered from mildew, rust and loose smut, April Bearded and Red Marvel rather more than the others.

Spring Barleys.—Examination of the barleys grown in 1928 has confirmed the belief that, if regard be had to a combination of quality and yield, Plumage-Archer 1924 and Spratt-Archer are the leading two-rowed barleys of the day for most soils. Spratt-Archer may be rather the better yielder, but the quality of Plumage-Archer 1924 is unsurpassed. Archer, or Sunrise, which is of the Archer type, is another barley still worth growing, whether for yield or quality, especially on the lightest soils. Archer-Goldthorpe is of nice quality, but it does not crop. There is a group of very early barleys from Scandinavia: Brage, Brewers, Gold, Millenium and Victory—of which Brage, a Chevallier type, looks to be the most satisfactory. Millenium and Victory are difficult to distinguish in the field, though Victory in 1928 was free from the loose smut which occurred in Millenium. They produced nice samples of grain. Brewers and Gold cannot be recommended. Princess,

which may be of good quality, and Standwell, are also comparatively early, but they are of interest only in districts where early-ripening varieties are essential. Abed Rex is another early variety; it was grown at one centre only and did not show much promise as regards either yield or quality. Two recent varieties are Triumphant and Plumage (No. 63). Triumphant has a long and stout but probably brittle straw, ripens late, and did not, in 1928, show particular promise as regards either yield or quality. Plumage (No. 63) probably stands and yields better and is of good quality. There seems, however, little to choose between it and the ordinary Plumage, though it is distinct from the latter in being earlier and having a longer neck and a downy rachilla. Not one of these last three varieties seriously competes with Plumage-Archer 1924 or Spratt-Archer.

Two other stocks were included in the plots—Goldthorpe, the seed of which turned out to be too impure to justify the making of notes, and Kinver Chevallier, which could not be distinguished from Archer. Many of the stocks grown in recent years under the name of Chevallier have, in fact, turned out to be nothing but Archer, and difficulty has been experienced in obtaining true stocks of Chevallier.

Spring Oats.—The outstanding feature of the large collection of oats grown in 1928 is that the quality of Abundance is seldom equalled by any other variety. Moreover, it is one of those varieties which can be relied upon for a respectable yield over a wide range of soils. Victory, a white oat of excellent quality, and Golden Rain, a yellow oat also of good quality, both often outyield Abundance by from 10 to 15 per cent. Farmers who have not yet grown these two varieties would be well advised to give one or both of them a trial. The most promising of the other varieties are two Swedish oats, Golden Rain II, a yellow oat, which is very similar to Golden Rain, and Star, and looks like giving good yields of grain of much the same quality as Victory. Of the other Scandinavian varieties King has a strong straw and yields well, but the grain is coarse; Sovereign ripens later than Abundance and promises to give satisfactory yields of nice quality grain; Abed Silver is also of nice quality, but is rather later and does not look like yielding; Odal is some days earlier than Abundance, but is otherwise unattractive.

The more promising of the English varieties are Thousand Dollar, which is of good quality, outyields Abundance, and may stand better; Superb, an early variety, with satisfactory

yield and quality and a short stout straw; Waverley, a later variety; Record, also rather late, with a short stout straw and fair quality grain; Yelder, a good yielding but coarse-grained early variety, with a short and strong straw, which is apt to break when fully ripe; and Ascot, which somewhat resembles Abundance. Marvellous, the strongest-strawed of all, yields heavily, particularly when very early sown, but its grain is coarse. All these oats are white or yellow.

Of the black-grained varieties the Swedish Black Great Mogul, a rather late variety of which the straw inclines to be long and the grain lean, though of very fair quality, looks to be one of the best. Black Bell III does not seem to yield as well and the grain is no better. Supreme gave poor yields in 1928. Black Tartarian should be reserved for soils of low fertility where other varieties do not thrive. Earl Haig germinated too poorly in 1928 to allow of any reliable observations.

There were several other varieties. No grounds were apparent for recommending White Horse, Cropwell, Goldfinder, Crown and Fortuna as grown in 1928. Giant Black Cluster could not be distinguished in the field from Bountiful; nor Ligowo II, Newmarket, and Giant Lizo from Abundance; nor Challenge and White Cluster, except possibly for slight differences in time of ripening, from Potato. The latter is a variety which is useful only in cool climates where the rainfall is good, but its quality is then excellent.

NOTE.—Descriptions and fuller information about these cereal varieties can be obtained on application to the Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge.

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THE CONTROL OF APPLE SAWFLY

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and

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FOR a number of years the apple sawfly (*Hoplocampa testudinea*, Klug.) has been a serious pest of apples, particularly Worcester Pearmain, in the Eastern Counties. James Grieve, Cox's Orange, Emneth Early and Lord Derby also suffered badly in some orchards last year.

The chief injury is caused by the larva of this pest eating out a large irregular cavity in the developing fruitlets. From the outside, this damage is noticed as a small hole in the skin of the apple through which wet frass is exuding. Attacked

fruits rarely attain any size and soon fall off. This larva does not enter the eye of the apple as is the case in the normal or early attack of the Codlin Moth. It may be mentioned that there was a second generation of Codlin Moth caterpillars in 1928, and, as these bore into the sides of the apples, their damage has been confused with that of the apple sawfly.

Grubb and Bagenal* have shown that the application of lead arsenate after blossoming greatly reduced the number of fruits injured by sawfly; this was not the case where arsenate was used before blossoming.

The experiments described below were carried out in an orchard kindly lent by the late Alderman J. P. Pentelow, and later by Mr. E. Allen, both of Somersham. The trees used in the experiments are Worcester Pearmain, and form part of a mixed orchard of apples, pears and plums. The Worcesters are in two rows of 46 trees each, and are separated by a row alternately Cox's Orange and Gascoyne's Scarlet. They are bush trees with open centres and were planted in 1914.

Practically no crop was marketed from these trees until 1927, as the apples were always spoiled by sawfly attacks. In 1926, the situation was so serious that the owner was considering the advisability of top-grafting these trees.

In 1926, lead arsenate, at the rate of 6 lb. per 100 gallons of water, was applied to Row 1 before the last petals had dropped. No appreciable difference in crop was noticed as the result of this spraying, and practically the whole of the crop was lost owing to the falling of the fruit through sawfly injury.

In 1927, Row 1 was sprayed with :—

Nicotine (95-98 per cent.)	..	..	4 oz.
Soft Soap	..	..	4 lb.
Water	..	..	40 gallons

immediately following the drop of the petals.

From this row, thus sprayed, 75 bushels of apples were marketed.

From Row 2, which was not sprayed and consisted of the same number of similar trees, 35 bushels of apples were marketed.

In 1928, experiments were carried out on the same trees to see if a repetition of this result could be obtained. The spray used was similar to that used in 1927 on Row 1 (see above). A hand pump giving a pressure of 120 lb. was used, and a nozzle giving a coarse spray.

The amount of wash used in the first application on the 46 trees was 85 gallons, 25 of the sprayed trees being in Row 1,

* East Malling Research Station, Annual Report, 1923.

and 21 in Row 2; the 25 control trees in Row 2 were opposite the 25 sprayed trees in Row 1. For the second spraying 15 gallons of wash were used for the last six trees in Row 2.

The first spraying was done seven days after the last petals had fallen. The second spraying was done seven days later.

There was a remarkably good set of fruit on all the trees. About a fortnight after the second spraying an examination of the fruit showed that the attack on the unsprayed trees was very severe; that on the once-sprayed trees was moderate, and that on the twice-sprayed trees was slight.

An estimate of the damage resulted as follows :—

Unsprayed	..	..	85-90 per cent. of damaged apples
Once sprayed	..	..	about 30 " " "
Twice sprayed	..	..	about 5 " " "

The injured apples fell from the trees, and an examination of the rows later showed that a big percentage of the fruit from the unsprayed trees was on the ground, a fair percentage from the once-sprayed trees had also fallen, but very few from the twice-sprayed trees. When the apples began to colour there was a remarkable difference in the sprayed and unsprayed trees. The sprayed trees were carrying about 6 stones of fruit per tree, whereas the unsprayed trees were carrying only about 1 stone per tree. There was a difference, also, between the once-sprayed trees and the twice-sprayed trees. The former had been nicely thinned by the sawfly attack, whereas the twice-sprayed trees were carrying too many apples and, as a consequence, the apples were smaller than those on the once-sprayed trees. It is fair to add that the apples on the twice-sprayed trees would have been thinned by an up-to-date grower but were left on the trees for the purpose of the experiment.

The apples were picked the first week in September, and the fallen apples are not included in the following table, which shows the weight of apples picked from the various plots.

WEIGHT OF APPLES PICKED.

Row 1 (also sprayed with Soft Soap and Nicotine in 1927) :

	Number of Trees	Weight of Apples	Weight of Fruit per Tree
		lb.	lb.
Control	21	336	16
Sprayed once	25	2,016	80½

* Row 2 (not sprayed in 1927) :

		210	8½
Control	25		
Sprayed once	15	1,281	85
Sprayed twice	6	462	77

The table shows that the 46 sprayed trees yielded 28½ cwt. more fruit than the 46 trees which were left unsprayed.

From what is known of the life-history of this sawfly, it is probable that the time of application of the wash will be an important factor in its control. The sawfly lays one egg on each blossom, just outside the calyx. These hatch from a week to a fortnight after they are laid, and soon begin to burrow into the apple, but in many cases their burrowings are in the form of a tunnel under the skin.* This suggests that the spraying is likely to be more efficacious if applied soon after the caterpillars have hatched.

How to Control Apple Sawfly.—From the above data the best treatment for a bad attack of apple sawfly would appear to be as follows:—

On a Small Acreage which can be Sprayed in Two or Three Days.—Spraying should be started five or six days after the petals have fallen, the wash consisting of:—

Nicotine (95-98 per cent.)	..	..	4 oz.
Soft soap	..	..	4 lb.
Water	..	..	40 gallons

This should be followed by a similar spraying seven days later. It should be noted that with hard water more soft soap may be necessary and, in districts where the water is too hard to use soft soap, some other spreader, such as Agral I or sodium caseinate, should be substituted for the soft soap.

On a Large Acreage where the Spraying would take rather more than a Week.—Spraying should be commenced as soon as the petals fall and be followed by a second spraying seven to ten days later.

In the above experiments, one spraying on a badly attacked crop ensured a good yield.

For a Moderate Attack.—One spraying between petal fall and a fortnight later should ensure a good yield. This spraying should also be of value in reducing capsid bugs and aphides where these pests are troublesome.

Growers are always anxious to add nicotine to a fungicide, but the results obtained are often disappointing, as the amount of wash applied as a fungicide is so very much less than that applied as a contact wash.

In view of the results obtained by Grubb and Bagenal, lead arsenate should be added to fungicide sprays, such as lime-sulphur and Bordeaux mixtures, when these are applied soon after the fall of the petals.

Summary.—In 1927, spraying with nicotine (95-98 per cent.) 4 oz., soft soap 4 lb., water 40 gallons, immediately the petals

*Petherbridge, F. R.: *Jour. of Pomology*, Vol. VII, July, 1928, p. 60,

had fallen, increased the crop of Worcester Pearmain from 30 lb. per tree to 65 lb. per tree.

In 1928, a similar spraying seven days after the petals had fallen increased the crop from 12 lb. to 82 lb. A second spraying, whilst further reducing the number of damaged apples to a very small percentage, did not further increase the *weight* of the crop, although the *number* of apples was much increased.

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OPPORTUNITIES FOR STUDENTS OF BIOLOGY

THERE is a large and growing demand throughout the British Empire for men trained in the biological sciences. This demand the Universities have not hitherto succeeded in satisfying. The dearth of men so qualified was a complaint made from all quarters at the recent Imperial Agricultural Research Conference. This deficiency is largely due to the predominance of the physical over the biological sciences in all educational institutions, from the elementary schools to the Universities, and can only be met with the co-operation of those institutions, which naturally require to be assured of the demand for students trained in biology.

Demand.—The demand arises principally from the fact that the Governments of the countries of the Empire have awakened, especially since the war, to the services that trained biologists can render in increasing the production from agriculture; in particular by combating insect and fungus diseases of crops; breeding improved varieties of crops; improving the yield and quality of crops; breeding improved races of live stock; increasing the output and quality of meat and dairy produce; combating animal diseases; and preventing losses in storage and transport of agricultural produce.

Commercial and other concerns are also making increased use of the services of biologists, notable examples being the Empire Cotton Growing Corporation, the Rubber Associations of Malaya and Ceylon and various associations of planters of tropical crops. An increased supply of biologists is also required in the industries of the home countries for full use to be made at home of Imperial resources. Further, resulting from the need for increased biological training, there will come an increased requirement for teachers of biology in secondary schools in

this country, especially those who combine zoology, botany and chemistry.

The demand for men trained in the biological sciences comes alike from the home countries, the big Dominions, and the Colonial Empire (in particular, the tropical colonies). *The prospects before able young biologists promise to be very bright for a long time to come, and it is important that parents and boys should recognize this fact.*

This demand shows every sign of growing; an index of growth in this country is given by the tenfold expansion of expenditure on agricultural research since pre-war days (*Note 1 below*). For the Colonies alone in the last 8½ years over 500 biologists have been recruited in addition to some 700 medical officers (*Note 2*). A recent survey, confined to directors of biological institutes in the Empire and their principal assistants only, showed that 1,200 such research workers were engaged in biological work—plant breeding, plant physiology, horticulture, mycology, entomology, animal breeding and nutrition, animal pathology, dairy bacteriology, etc.—and this in spite of the fact that most of the countries are now standing only on the threshold of development.

Recently the Empire Marketing Board have entered the field and are making grants for biological work of varied nature in all parts of the Empire.

Salaries in Great Britain range from £300 to £800 per annum, with higher salaries for directors of institutes; in the Colonies they usually range from £500 to £950 or more per annum, and some of the highest appointments carry salaries of £1,200 to £2,000 per annum.

Training.—Schools should afford better opportunities for introducing their pupils to biological science. There is need in schools for science teachers with a wider outlook. Some elementary teaching of biology is desirable as part of the normal curriculum in boys' schools, and the institution of courses at the 16–18 year stage on scientific subjects, or aspects of science other than those dealt with in the normal course up to 16, is also desirable. The character of degree courses taken by teachers at the Universities is partly responsible for the lack of school teachers who have interested themselves in science, other than physics and chemistry.

At the University, an undergraduate who intends to qualify for a biological career should aim at a good grounding in the principles of biological science, and leave specialization until

after graduation; physics and chemistry should not, however, be ignored. An undergraduate who aspires for an appointment of the nature specified above should endeavour to obtain acquaintance with practical agriculture.

A number of post-graduate scholarships in Great Britain offered by the Departments of Agriculture, the Colonial Office and the Empire Cotton Growing Corporation afford excellent opportunities for specialization and qualification for specialist biological posts. Full particulars of these will be found in a pamphlet, to be obtained, free, from the address below.

The Department of Scientific and Industrial Research, as part of its scheme for increasing the supply of trained scientific investigators, awards Maintenance Allowances to properly qualified graduate students to enable them to avail themselves of existing facilities for obtaining training in research in various branches of science, including biology. Particulars of these allowances and of other awards made by the Department will be found in the pamphlet, "Notes on the Grants to Research Workers and Students," published by H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2., price 2d.

The bulk of the appointments in the Colonial agricultural and forestry services are naturally attractive to the average man with a taste for organization and an out-of-door life.

Research work in agriculture does not mean that the worker is shut up all his days in a laboratory; such work will as often as not take the worker into the field or the plantation, and should attract those who have inventive genius, who love the pursuit of knowledge, and who like their work to be as untrammelled as possible.

The work of a biological advisory officer as envisaged in this country (and there are counterparts in overseas countries) combines an outdoor life and intercourse with practical men on the one hand, with laboratory research and co-operation with fellow scientists on the other.

Provided the elementary rules of tropical hygiene are not neglected, life in the tropics nowadays usually proves to be a healthy one; if a man will lead a reasonable, temperate life and take a moderate amount of exercise there is no reason why he should not enjoy as good health as at home; and it must not be forgotten that leave or furlough is commonly allowed on a generous scale; that posts are usually pensionable; that in many cases free quarters and medical attendance are provided; and that there is no local income tax in the majority of the Colonies.

Note 1.—The increase in the research and advisory services financed by the Ministry of Agriculture for England and Wales in the last 10 years has been as follows. Experience in Scotland is similar :—

	Present Posts	Posts 10 years ago
Directors	15	9
Chemists (largely biochemists) ..	34	20
Entomologists	24	11
Helminthologists	3	1
Mycologists	24	4
Physicists	4	1
Pomologists	7	3
Bacteriologists and Microbiologists	17	2
Geneticists	14	5
Plant Physiologists	8	3
Animal Physiologists	5	3
Animal Pathologists	14	1
	169	63

Note 2.—These posts were as follows :—

Administrative agricultural posts	140
Other agricultural posts, e.g., produce inspectorships	30
Botanists and mycologists	60
Entomologists (agricultural departments) ..	25
Botanists and entomologists (chiefly the latter) for medical, veterinary or game investigations ..	30
Forestry officers	140
Veterinary officers	90

These figures relate to the non-self-governing Dependencies which are administered under the direction of the Secretary of State for the Colonies; and do not include vacancies in India, the Sudan and various other portions of the Empire which lie within the tropics.

Amongst new appointments recently created may be mentioned :—

- Five senior posts on the staff of the East African Agricultural Research Institute at Amani, in Tanganyika Territory, at £1,000 a year each, for a geneticist, a plant physiologist, a plant pathologist, an entomologist and a soil chemist.
- A plant breeder and an entomologist for Iraq on starting salaries of £800-£900, rising to £1,600 a year.
- An entomologist for Barbados at a salary of £1,000 a year.
- A plant physiologist and plant pathologist for banana research in Trinidad at salaries from £600-£800, rising to £1,000, together with a house.

These were only some of the posts recently vacant, and in spite of the attractive salaries offered it did not prove easy to fill them.

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FEBRUARY ON THE FARM

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Seasonal Notes.—February has a reputation for wetness and snow, but this feature is not supported by meteorological evidence; in many districts this is one of the driest months of the year, when dryness is expressed in terms of inches of rainfall. Nevertheless, the accumulated moisture of the preceding winter months and the slow rate of evaporation and percolation of such rain as does fall in February give the land and the atmosphere those properties which the mind naturally associates with the idea of heavy rainfall. It is not often that the soil shows a dusty face in this month, and tradition does not favour such a condition, probably owing to the likelihood of hindering wetness at the ordinary time for spring sowing.

The farmer's activities this month vary according to the nature of his business, but, generally, February includes a considerable amount of work that comes within the category of spring operations. There is nearly always manure carting when road and soil conditions permit; there may still be leas to plough for oats; and whenever opportunity affords, much good may be done by cross-ploughing heavy land intended for roots. Probably little wheat land remains to be sown, and farmers are not inclined to extend the acreage of this crop on present prices and outlook; but the chance of sowing oats early, if such chance comes, cannot wisely be missed. Winter varieties may be preferred for sowing at this time of the year in exposed situations, but ordinary spring sorts can recover from the effects of such frosts as ordinarily occur in March. Spring beans and early sowings of vetches for soiling are other crops sown in February; and near the end of the month seed beds of marrow-stem kale, kohlrabi and ox cabbage may be prepared and sown, to provide plants for setting out in the field in April. The boxing of second early and late seed potatoes continues, while in early districts preparations are made for planting and even some of the planting may be done in the case of first early varieties.

In the live stock departments, cattle management is much the same in February as in the preceding month. Young cattle brought indoors after Christmas have now settled down in their winter quarters and begun to make progress; those still out of doors, like the sheep, need a liberal allowance of long fodder. It is in the sheep, pig and poultry departments that the greatest

activity is now displayed, for lambs and litters arrive and the early hatches of chicks appear. In the poultry department, the value of early hatching for winter egg-production is now widely recognized, although it must be mentioned that this month is too early for breeds of the light class. There has been a great increase in farm poultry keeping in recent years, and farmers no longer challenge the profit-earning capacity of the hen. Since 1921, the number of fowls in Derbyshire has increased by nearly 100 per cent. and there is no question that the output per bird has also appreciably improved.

Farm Vehicles.—Although used more than any other implement, the common farm cart has undergone little or no improvement of note for many years. One has criticized the cart on account of the height to which materials must be lifted in loading it; and many farmers agree that a reduction in height would be an improvement which would lighten and cheapen the labour of loading. The cranked axle is an old and familiar device for this purpose.

There are admittedly limits to the extent by which the height of the axle can be reduced. Obviously, if the axle is placed too near the ground, there will be insufficient clearance when passing along neglected roads and over soft ground. Another difficulty would also arise with very low carts, namely that of unloading by tipping. One correspondent, however, mentions a difficulty of a different character which he had to meet 35 years ago. He had designed a low-set cart for use on his farm, but he found the local wheelwright very reluctant to make it. The cart was made, however, and proved admirably suited to its purpose. The farm labourers also disliked the innovation because of the "taunts of inquisitive neighbours" and, adds my correspondent, "I had to bear the comment of giving life to a freak cart till it rotted."

Grassland.—February is about the latest month in the winter for the application of phosphates and potash to grassland where the dressings are expected to produce an effect in the current year. Nitrogenous dressings being quicker in action are frequently deferred until March or April in the case of meadows; but for the production of an early bite on pastures, February is a better time for treatment. Possibly meadow land also would respond better to February than to April applications of nitrogen.

There is a growing body of evidence in favour of increased mechanical treatment of grassland. The subject has been discussed in previous issues of these notes, particularly in March, 1924. Further experience in the subject indicates that

simple turf slitting may be expected to give good results wherever the entry of moisture is hindered either by the presence of a surface mat of fibrous vegetable matter or by the impervious nature of the soil itself. In many cases a heavy harrow will answer the purpose, if the tines are first specially laid and sharpened and if the work is done while the soil is in a moist condition.

As regards the further mechanical treatment of grassland, there is no doubt that, on pastures where the sward is inclined to become matted, very severe cultivation, bringing soil up to the surface, has a good effect. Under these conditions earthworms appear to be deficient in numbers as compared with well-grazed pastures; and the land lacks the benefits which the worms confer by making channels down which water percolates and by casting up earth, which when harrowed down promotes the tillering of the grasses and the rooting of white clover.

It is a noteworthy fact that, however rough a pasture may be, and however thick may be the mat or skin on the rest of the field, there is always a clean soil surface and a short, green clovery herbage on the cattle tracks and where footpaths cross the enclosure. The exact reason for this is not easy to find, unless it is that foot pressure promotes the decay of the kind of dead vegetation which, if not pressed into the soil, gradually accumulates. The improvement which follows the use of part of a rough pasture as a football pitch is a familiar example, and a hunting enthusiast will urge that the best pastures are those which adjoin fox coverts which are frequently drawn and consequently cut up by hoof marks. These are examples of the value of hoof culture.

There are, however, limits to the application of hoof culture in practice. Undoubted benefit may follow the wintering of a heavy head of stock (receiving supplementary food) on rough pastures on land of a fairly porous nature: this may be seen particularly well on farms where the portable milking bail is used, even after allowance has been made for such part of the improvement as may be rightly attributed to the manure left by the cattle. On the other hand, where the soil is so tenacious and retentive that every hoof mark becomes a pool for water, decided injury is done by the treading of cattle when the soil is in wet condition.

It is likely that turf slitting would assist the action of mole drains in relieving heavy land of surplus moisture. If the subsoil also is water-logged, however, turf-cutting without drainage would not facilitate the escape of the excess water. As a general

principle a search should be made for the source of the wetness before deciding upon under-drainage of any kind, as it is better to prevent the entry of the excess moisture if possible than to remove it by draining after it has accumulated in the field. Where the subsoil is impervious clay, however, the field may be wet without seepage water being the cause, and in this case mole draining—which is even yet insufficiently known and appreciated—may be the most necessary and beneficial form of mechanical treatment.

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NOTES ON MANURES

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Potash and Farm Crops.—A useful summary of the agricultural behaviour of potash fertilizers has recently been published in Germany.* That country is, of course, the home of the potash industry, and much experience has been gained there on the agricultural value of potash salts. A few of the conclusions with regard to the effect of these compounds on the common crops may be of interest to farmers. It is pointed out that in considering potash fertilizers other things besides potassium must be taken into account. We have on the one hand relatively pure salts, such as the sulphate and chloride of potash, and on the other the lower-grade manures containing varying amounts of common salt and magnesium compounds. Soda, magnesia and chlorine may all exert effects on the crop, sometimes beneficial and occasionally the reverse. There is also the question of the unit cost of potash in the different forms, and the amount of labour required for their transport and distribution.

Cereals.—Fen soils, peaty soils, and sands are mentioned as the types on which most certain increases in yield are to be obtained with potash fertilizers. Wheat and barley, enjoying higher prices than oats or rye, are more likely to repay the cost of potash manuring, and there may also be an improvement in quality in these crops. Spring corn, with its short growing period, is, other things being equal, more in need of potash than winter corn. Potash fertilizers affect the grain more than the straw, and on the whole kainit is more effective for cereals than sulphate of potash or other high-grade salts. Autumn application of potash salts to winter

* O. Nolte: *Landw. Vers. Stat.*, CVI, 1927.

corn gives the advantage of better distribution, and the young plants are strengthened and enabled to resist frosts; on the other hand, losses of potash by leaching can occur on very light soils. As far as quality is concerned, potash improves the quality of malting barley on light soils—on which the yield is also increased—but on heavy soils the beneficial effect on quality is not so certain.

Leguminous Crops.—Potash supplements the action of phosphate, especially on light soils. As in the case of cereals, the corn of beans and peas benefits more than the straw.

Root Crops.—Potash helps the formation of sugars and starches and hence reacts favourably on these crops. In the case of potatoes all kinds of potash salts increase the yield, but the low-grade salts containing common salt tend to lower the starch content, while sulphate of potash and sulphate of potash-magnesia tend to increase it. If kainit is used for potatoes it should be applied well before planting, whereas the high-grade salts may be given at planting time. Potatoes grown with a short supply of potash frequently store badly. In the case of sugar beet the potash is largely stored in the leaves and is thus kept on the farm. On the whole the lower-grade salts are the best for yield and quality of sugar beet. Potash salts increase the yield of mangolds, but there is sometimes a reduction in the percentage of dry matter, particularly with kainit, but to a less extent where magnesium compounds are used. It is desirable to apply the low-grade salt a few weeks before sowing.

Vegetables and Fruit.—Plants of the cabbage family and also carrots prefer the low-grade salts. Other vegetables do better with the sulphate or chloride (muriate). The flavour and form of vegetables are improved by potash, and in the case of fruit the opinion is that the flavour, form and weight are improved.

Hops, Fibre Plants and Tobacco.—Potash assists in the production of resins and the bitter principles, and high-grade salts should have the preference.

Fibre plants have a large requirement for potash and the salts in kainit are said to assist in fibre production in flax.

In the case of tobacco, sulphate of potash tends to improve the burning quality, while the chlorides seem to be injurious.

Lime for Sugar Beet.—One of the most frequent sources of failure in the sugar beet crop is the lack of lime in the soil. Beet, like barley and red clover, is a plant which cannot stand acid conditions, and where these are found the crop

shows all degrees of damage from poor growth to total failure, depending on the extent of the lime deficiency. The more serious cases of acid soils are readily recognized by farmers by the abundant growth of certain weeds, of which spurrey is perhaps the commonest. When the trouble is not so pronounced the crop usually fails in patches, which may be recognized also in the following barley and clover. The remedy is lime in some form. It may be applied as quicklime after the last ploughing, or in certain cases as waste lime from a near-by sugar factory. Both these substances should be applied in dry weather and be well worked into the surface soil. If the operation is left till near seeding time, ground limestone or one of the dry carbonates of lime may be used. The actual quantity of lime required per acre will depend on the nature of the soil and its degree of acidity, and in this matter the advice of the County Agricultural Organizer should be obtained. The amount will seldom exceed 2 tons of quicklime per acre or be less than 10 cwt. It can be taken roughly that 1 ton of burnt lime is equivalent to 2 tons of chalk or limestone, or 4 tons of "factory lime." It is a matter of interest that too much lime can be applied to beet land, though this is not likely to occur in British practice. Continental investigations have shown that where farmers have repeatedly used large dressings of factory lime and thereby set up alkaline soil conditions, the beet crop is liable to a destructive heart-rot, which is checked when the soil is brought back to a neutral state.

Organic Manures.—These substances are to be regarded mainly as a source of nitrogen and phosphoric acid. Of the common organic fertilizers only Peruvian guano contains an appreciable quantity of potash (2·4 per cent.). The nitrogen varies greatly in availability, ranging from a condition of high activity in dried blood to an extremely resistant state in leather and sewage sludges as usually made, these latter being almost useless for crops taken in the year of application. The bulk of the organic fertilizers contain nitrogen compounds which, without being forcing, are readily available to the plant. In this class fall guano, meat and fish meals, and rape cake. Shoddy and feathers are somewhat slower in their action. The phosphatic compounds in organic manures are insoluble in water and may be compared with bone phosphate in agricultural behaviour. Examination of market prices shows that the nitrogen in the more active organic manures commands at least twice the price per unit compared with

inorganic nitrogen. Even in the slower acting shoddy and feathers the unit costs as much as in mineral fertilizers. Experiments conducted with ordinary farm crops on the clay loam of Rothamsted over a period of years have shown no marked advantage in favour of nutrients supplied in the organic form as compared with equivalent nutrients given as standard fertilizers. Thus in the period 1919-26, when this comparison was made on Little Hoos field in a rotation of crops, the following results were obtained:—

			YIELD PER ACRE	
			<i>Organic Manures</i>	<i>Mineral Fertilizers</i>
Year of application	{	Barley, 1919, '21, '22 ..	30·6 bu.	31·7 bu.
		Wheat, 1924	28·5 „	30·1 „
		Swedes, 1920, '26 ..	15·1 tons	15·9 tons
One year after application	{	Barley, 1921, '22 ..	23·6 bu.	22·8 bu.
		Swedes, 1920	10·4 tons	9·2 tons
		Clover, 1922	54·2 cwt.	54·6 cwt.
Two years after application	{	Barley, 1921, '22 ..	18·6 bu.	20·6 bu.
		Clover, 1923	47·6 cwt.	45·7 cwt.
		Wheat, 1924	18·9 bu.	19·9 bu.
		Swedes, 1926	10·0 cwt.	11·6 tons

The figures for organic manures are the means of the yields obtained with Peruvian guano, rape cake and shoddy. The inorganic fertilizers consisted of superphosphate, sulphate of ammonia and sulphate of potash. All plots received 40 lb. nitrogen, 46 lb. phosphoric acid and 50 lb. potash per acre, as much as possible of this being given in the form of the organic fertilizers and the balance being supplied as minerals. Thus, 352 lb. of guano supplied the full quantity of phosphate, and required 44 lb. of sulphate of ammonia and 86 lb. of sulphate of potash to bring it up to the standard dressing.

Organic manures, though not more effective, unit for unit, than mineral fertilizers, have certain points in their favour. They add a small amount of organic matter to the soil, and if used over a period on the same land this may make itself felt. Thus, on the mangold field at Rothamsted, plots receiving their nitrogen as minerals year after year only showed 80 per cent. of the number of plants found on the plots where rape cake was supplied. The good condition of organic fertilizers finds favour both with farmers and manufacturers, the latter taking up large quantities to improve the condition of mineral mixtures. Organic fertilizers find their best use for special crops such as hops, fruit and market-garden produce. The value per acre of the crop is high, perennial plants can utilize the manurial residues of the slower-acting

PRICES OF ARTIFICIAL MANURES

Description	Average price per ton during week ended January 16th				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%)	10 8f	10 8f	10 8f	10 8f	13 5
Nitro-chalk (N. 15½%)	10 0p	10 0p	10 0p	10 0p	12 11p
Sulphate of ammonia :—					
Neutral (N. 20·6%)	10 11d	10 11d	10 11d	10 11d	10 3
Calcium cyanamide (N. 20·6%)	9 12e	9 12e	9 12e	9 12e	9 4
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%)	11 19g	11 3h	..	..	..
Kainit (Pot. 14%)	3 6	2 19	2 19	3 2	4 6
Potash salts (Pot. 30%)	5 3	..	4 17	5 1	3 5
" (Pot. 20%)	3 15	3 9	3 8	3 12	3 7
Muriate of potash (Pot. 50%)	9 17	9 3	9 2	9 0	3 7
Sulphate, " (Pot. 48%)	11 19	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15½%)	2 3c	1 17c	..	2 4c	2 9
" (P.A. 14%)	1 19c	1 12c	1 12c	2 0c	2 10
" (P.A. 11%)	..	1 7c	1 7c	..	..
Ground rock phosphate (P.A. 26·27½%)	2 10||	2 7||	..	2 5a	1 8
Superphosphate (S.P.A. 16%)	3 0	..	3 6	3 6	4 2
" (S.P.A. 13½%)	2 15	2 12	3 0	3 0	4 4
Bonemeal (N. 3½%, P.A. 20½%)	8 15	8 10	8 12	8 7	..
Steamed bone flour (N. ½%, P.A. 27½-29½%)	5 17b	..	6 15	5 15	..
Burnt Lump Lime	1 7k	1 10l	1 12n	2 2m	..
Ground Lime	1 14k	..	..	1 17m	..
Ground Limestone	1 1k	..	1 8n	2 6m	..
Ground Chalk	..	..	..	1 11m	..
Slaked Lime	..	..	2 14n	3 2m	..

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. 85% through standard sieve.

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. Rebate of 1s. per ton will be allowed.

e Delivered in 4-ton lots at purchaser's nearest railway station. Rebate of 1s. 3d. per ton will be allowed.

f For lots of 1 ton and under 6 tons the price is 5s. per ton extra.

g F.o.r. Gloucester.

h F.o.r. Goole.

k 4 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.

p Prices for 2-ton lots. Rebate of 1s. per ton will be allowed.

forms, and the better tilth which results from the use of bulky organic manures is of value in securing the fine bed so necessary for small seeds.

* * * * *

NOTES ON FEEDING STUFFS

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The Adulteration of Feeding Stuffs.—This subject, which possesses an obvious interest to all feeders of farm animals, was raised by Professor R. G. Linton in a paper read to the National Veterinary Medical Association at its Annual Congress in Newcastle during September, 1928. The writer is indebted to Professor Linton's published paper for much of the information in this month's Notes.

The adulteration of feeding stuffs is happily nothing like so common at the present time as it was some two or three decades ago, when such crudities as sand and sharps, sawdust and maize meal, were not infrequently foisted on unsuspecting farmers. Food adulteration, as Professor Linton points out, is now almost unknown among firms of good standing in the trade.

Several factors have contributed to this welcome state of affairs. For some 20 years past, the operation of the older Fertilizers and Feeding Stuffs Act has given the buyer of feeding stuffs a powerful measure of protection against unscrupulous practices in connexion with the preparation and sale of feeding stuffs, a protective influence which has, if anything, been intensified by the introduction of the more recent Act. During this period, the farmer himself has by no means remained stationary, but has advanced steadily in the knowledge of the scientific aspects of foods and feeding. Ready facilities for obtaining technical advice, and for having suspected foods submitted to expert examination and analysis, have further helped considerably to strengthen the farmer's position, and inasmuch as fraudulent trading requires ignorance for its sphere of operations, it is not difficult to understand why glaring cases of food adulteration are nowadays comparatively rare. It should be noted, to the credit of leading traders in farm feeding stuffs, that they have shown no tardiness in responding to this tendency towards higher standards in agriculture, and in very many cases the processes of preparation and mixing of feeding stuffs are now in the charge of competent scientific men.

The efficiency of the modern mill provides the unscrupulous trader with a means of adulterating certain types of foods in a manner not always easily detected by the purchaser. The new Act, however, is designed to render this form of adulteration as difficult as possible. A concrete example will serve to make this point clear. In the year 1923, the writer was engaged in an investigation dealing with the grading, composition and feeding value of post-war wheaten offals. It was shown that a simple, uniform method of grading offals on the basis of size of particles always yielded fractions which were characterized by a perfectly distinctive chemical composition, both in respect of crude and digestible nutrients, and also by the possession of well-defined feeding values. The composition and feeding values of these grades are shown in the accompanying table.

Composition of Wheat Offals Graded According to Size of Particles (Dry Matter Basis).

	Grade 1 (Bran) per cent.	Grade 2 (Middlings) per cent.	Grade 3 (Fine Middlings) per cent.
Protein	17.32	18.38	19.64
Oil	4.44	5.67	4.83
Carbohydrate ..	60.71	66.05	70.16
Fibre	10.87	5.69	2.62
Ash	6.66	4.21	2.75
Starch equivalent.	49.20	67.95	79.12

On the basis of these figures, it was but natural that the manufacturer of wheaten offals should argue that it should only be necessary, when marketing such commodities, to give a guarantee of the size of the particles, without troubling to furnish any further guarantee in respect of chemical composition. Admittedly this contention would be perfectly sound in a world of honest traders, since manifestly the size of the particles in the sample of offals enables the composition and feeding value of the sample to be predicted. On the other hand, however, it would not be a difficult achievement, with the modern mill, to grind the coarser bran particles to a state of fine division and to include such material in the finer fractions like middlings or fine middlings. How serious this would be from the farmer's standpoint will readily be appreciated by comparing the starch value of bran with that of fine middlings as recorded in the above table.

To prevent such practices, advantage has been taken of the fact that the different grades of offals are characterized by markedly different fibre contents, varying from about 2.5 per cent. in the fine middlings to as much as 11 per cent. in bran or broad bran (dry matter basis). Obviously, no amount of

grinding will alter the percentage of fibre in a sample of bran, so that a simple determination of the fibre content of a sample of middlings or fine middlings will readily reveal the adulteration of such offals with finely ground bran. For this reason, the new Act requires that a statement of fibre content should be made when marketing the various grades of wheaten offals.

In connexion with this phase of the adulteration problem, Professor Linton makes the following interesting statement in his paper: "It is my opinion that adulteration is very seldom done in what are called 'straight' foods, that is, foods composed of one material only, such as the wheat offals and similar foods. The principal wheat milling industry is so conducted to-day that pride in quality of the goods marketed takes prior place in the minds of the manufacturers. There may be, of course, the occasional miller who would not be above adding ground bran to the finer and more expensive sharps and parings, or the addition of ground screenings to the various offals. Screenings consist for the most part of immature cereal grains and weed seeds, and are removed from the wheat before it is ground. If these screenings are reduced to a fine meal and added to the wheat offals in moderate quantity, the addition is not readily noticed, at any rate by the purchaser. In the drafting of the new Act, it has been recognized that this method of utilizing screenings may not be unknown to millers, and the purchaser is protected by the definition of millers' or wheat offals thus: 'A product of wheat separated in the process of milling and containing not more than 4 per cent. of vegetable substances, other than wheat, extracted from wheat in the process of cleaning by the maker of the offals in the production of flour'."

No feeding stuff is viewed habitually by farmer and dairyman alike with greater suspicion than is bean meal. When animals fall ill on a diet containing bean meal, the latter is usually, in the first instance, held to be responsible. This sinister reputation was gained many years ago as a result of cases of poisoning which followed the use of the Java bean. It is, therefore, of interest to record Professor Linton's opinion that bean meal is, in general, a pure food. Adulteration of the food, such as by the addition of bean husks, is not difficult to detect. The new Act defines bean meal in such a way as to exclude the use of the toxic Java bean and also the Soya bean. The meal is made chiefly from British field beans, China beans and Algerian beans, and less frequently from the haricot type of bean. The addition of "bean screenings" and "bean pickings"

from haricot beans is permitted. One point raised by Professor Linton in connexion with the use of bean meal should be noted specially, namely, that it is a food which does not keep well, particularly if it is stored in a damp place, and it is possible that a suspected adulteration may in fact be decomposition, not sufficiently marked to be detected by a casual examination, but sufficient to make the animals ill that have to eat the damaged food.

Pea meal is defined by the Act as "the meal obtained by grinding commercially pure peas, as grown." This definition, therefore, does not exclude the use of gram and of the mutter pea. The composition of gram meal is very similar to that of pea meal, and no great objection can be offered to its inclusion in commercial pea meal. On the other hand, the addition of ground mutter peas should, in Professor Linton's opinion, be regarded as an adulteration. Not only are mutter peas worth from £2 to £3 per ton less than genuine peas, but they may also prove to be poisonous if present in more than slight amount, and they are frequently imported in a dirty condition.

During the autumn of 1928, an interesting case of alleged ill-effects from the use of a variety of *imported* barley was reported. It was stated that the barley had become mouldy, and had been chemically treated in bulk in an attempt to make use of it. Large quantities of the barley had been sent to the Continent, and, after its injurious nature had been discovered, some of it had been diverted to this country. A certain amount of disease in some areas was attributed to the use of meal from this barley. In other areas pigs refused to touch it. The case was being closely investigated at the time these Notes were being written.

Writing of the effects of adulterated foods on animals, Professor Linton described in detail a case which will be worth while quoting, because of certain peculiar features which appertained to it. "A well-known firm of oil-seed crushers of high repute bought some Eastern decorticated earth nut cake. An agricultural analytical chemist of great experience had tested the cake on importation and found only the merest trace of castor seed. Three hundred tons of the cake were purchased, incorporated into a mixture and made into feeding cakelets. Of the mixture, a 20-ton batch was made at one time and distributed over a wide area. No complaints were received except from one dairy farmer, who gave 11 lb. daily to his cows, and on the second day of use found them all to be ill with very profuse diarrhoea. I investigated

the case on behalf of the manufacturers, who were anxious to find the cause of the trouble. The cake was tested for castor seeds by two chemists on our behalf; one reported the merest trace of the seeds and the other could find none. Notwithstanding these reports, it was not possible to clear the cake of responsibility for the trouble, even though inquiry showed that no other farmers had any complaint to make. The manufacturers removed the cake and issued it to two other farmers to try, and at one farm it soon became evident that the cake was

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	9 2
Maize	81	6.8	9 17
Decorticated ground nut cake	73	41.0	12 10
" cotton cake	71	34.0	11 10

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

The cost per unit starch equivalent works out at 2.46 shillings, and per unit protein equivalent, 1.94 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, 1928, 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	9 16
Oats	60	7.6	8 2
Barley	71	6.2	9 7
Potatoes	18	0.6	2 5
Swedes	7	0.7	0 19
Mangolds	7	0.4	0 18
Sugar Beet Pulp, dried	65	5.2	8 10
Beans	66	20.0	10 1
Good meadow hay	31	4.6	4 5
Good oat straw	17	0.9	2 4
Good clover hay	32	7.0	4 12
Vetch and Oat silage	13	1.6	1 15
Barley straw	19	0.7	2 8
Wheat straw	11	0.1	1 7
Bean straw	19	1.7	2 10

DESCRIPTION	Price per qr.		Price per ton	Manu-rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Pro-tein equiv
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British..	—	—	9 12	0 13	8 19	72	2 6	1.34	9.6
Barley, British feeding	—	—	9 5	0 10	8 15	71	2 6	1.34	6.2
" Canadian No. 4 Western	34 6	400	9 13	0 10	9 3	71	2 7	1.38	6.2
" " feed ..	30 6	—	8 10	0 10	8 0	71	2 3	1.26	6.2
" American ..	30 9	—	8 12	0 10	8 2	71	2 3	1.20	6.2
" Persian ..	34 6	—	9 13	0 10	9 3	71	2 7	1.38	6.2
Oats, English, white ..	—	—	10 0	0 11	9 9	60	3 2	1.70	7.6
" " black and grey ..	—	—	10 0	0 11	9 9	60	3 2	1.70	7.6
" Scotch, white ..	—	—	10 10	0 11	9 19	60	3 4	1.78	7.6
" Irish, black ..	—	—	10 0	0 11	9 9	60	3 2	1.70	7.6
" Canadian No. 2 Western	32 9	320	11 10	0 11	10 19	60	3 8	1.96	7.6
" Argentine ..	28 6	—	10 0	0 11	9 9	60	3 2	1.70	7.6
" Chilian ..	29 6	—	10 7	0 11	9 16	60	3 3	1.74	7.6
" German ..	29 3	—	10 5	0 11	9 14	60	3 3	1.74	7.6
Maize, American ..	41 9	480	9 15*	0 10	9 5	81	2 3	1.20	6.8
" Argentine ..	43 0	—	10 0	0 10	9 10	81	2 4	1.25	6.8
Beans, English, winter ..	—	—	10 7†	1 5	9 2	66	2 9	1.47	20
Peas, English, blue ..	—	—	14 0†	1 2	12 18	69	3 9	2.01	18
Millers' offals—									
Bran, British ..	—	—	7 17	1 3	6 14	42	3 2	1.70	10
" broad ..	—	—	8 15	1 3	7 12	42	3 7	1.92	10
Middlings, fine, imported ..	—	—	9 15	0 18	8 17	69	2 7	1.38	12
" coarse, British ..	—	—	8 0	0 18	7 2	58	2 5	1.29	11
Pollards, imported ..	—	—	7 12	1 3	6 9	60	2 2	1.16	11
Meal, barley ..	—	—	10 0	0 10	9 10	71	2 8	1.43	6.2
" maize ..	—	—	10 15	0 10	10 5	81	2 6	1.34	6.8
" " South African ..	—	—	10 5	0 10	9 15	81	2 5	1.29	6.8
" " germ ..	—	—	10 10	0 16	9 14	85	2 3	1.20	10
" locust bean ..	—	—	9 10	0 8	9 2	71	2 7	1.38	3.6
" bean ..	—	—	12 15	1 5	11 10	66	3 6	1.87	20
" fish ..	—	—	19 10	3 9	16 1	53	6 1	3.26	48
Maize, gluten feed ..	—	—	10 10	1 0	9 10	76	2 6	1.34	19
" cooked flaked ..	—	—	11 15	0 10	11 5	85	2 8	1.43	8.6
Linseed—									
" cake, English, 12% oil	—	—	13 17	1 10	12 7	74	3 4	1.78	25
" " " 9% "	—	—	13 7	1 10	11 17	74	3 2	1.70	25
" " " 8% "	—	—	12 17	1 10	11 7	74	3 1	1.65	25
Soya bean " 5½% "	—	—	11 15	2 2	9 13	69	2 10	1.52	36
Cottonseed cake, English—									
" Egyptian, 4½% "	—	—	7 17	1 9	6 8	42	3 1	1.65	17
" " Egyptian, 4½% "	—	—	7 12	1 9	6 3	42	2 11	1.56	17
Decorticated Cottonseed Meal, 7% oil	—	—	12 12*	2 3	10 9	74	2 10	1.52	35
Coconut cake, 6% oil ..	—	—	11 5	1 5	10 0	79	2 6	1.34	16
Ground-nut cake, 7% oil ..	—	—	10 17*	1 8	9 9	57	3 4	1.78	27
Decorticated ground-nut cake, 7% oil	—	—	13 5*	2 3	11 2	73	3 0	1.61	41
Palm kernel cake, 4½-5½% "	—	—	10 2†	0 18	9 4	75	2 5	1.29	17
" " " meal, 4½% "	—	—	10 12†	0 18	9 14	75	2 7	1.38	17
" " meal 1% "	—	—	9 10†	0 19	8 11	71	2 5	1.29	17
Feeding treacle ..	—	—	6 0	0 9	5 11	51	2 2	1.16	2.7
Brewers' grains, dried ale ..	—	—	8 15	1 0	7 15	49	3 2	1.70	13
" " " porter ..	—	—	8 5	1 0	7 5	49	3 0	1.61	13
Malt culms ..	—	—	7 15*	1 8	6 7	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 December 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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. 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. 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 1.43d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 4d.; P₂O₅, 3s. 10d.; K₂O, 8s. 5d.

faulty because one of the bullocks to which it was given became ill with diarrhoea. A further examination revealed that *this portion of the cake examined* contained no less than 1.16 per cent. of castor seeds, a very dangerous amount. This experience, which is not singular, is referred to for the purpose of illustrating the difficulties one has to encounter when dealing with 'adulteration' of this nature."

* * * * *

MISCELLANEOUS NOTES

THE Ministry of Agriculture and Fisheries will continue during the coming season to test, at the Potato Testing Station of the National Institute of Agricultural Botany at Ormskirk, potatoes and potato seedlings as to their immunity from or susceptibility to wart disease on the conditions stated below.

Wart Disease Immunity Trials, 1929.

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 the Station as early as possible, but in any case *not later than March 1, 1929*.

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—35 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 10s. per sample.

5 samples or more from one grower 8s. per sample up to 20, and 6s. 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 at once be tested in the laboratory. Any stock which shows infection with wart disease during the course of this test will be regarded as susceptible and the sender will be so informed without delay. Such stocks will, however, be grown in the field for one season only in order to identify the variety.

Any stock which does not develop the disease during the laboratory test will be grown in the field, and if it remains free from infection and is declared by the Potato Synonym Committee of the National Institute of Agricultural Botany to be distinct from existing varieties the sender will be advised accordingly. If he then proposes to develop the variety, and desires that it shall be officially approved as immune from wart disease, he must forward a further 35 seed size tubers for testing in 1930.

(f) When the Ministry is satisfied, as a result of the laboratory tests and field 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 (e) 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 up to March 1 not fewer than two tubers, and not more than five tubers, of any seedlings for testing in the laboratory, and to furnish a report on the results obtained without payment of a fee. A report of the result will usually be sent within five or six weeks of the receipt of the tubers. 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 (f). 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.

* * * * *

A CONSIDERABLE number of egg-packing stations have been and are being established all over the country in connexion with the National Mark Egg Scheme which was

An Auction Egg-Packing Station put into operation on February 1 (see page 1007), and it is interesting to note the various kinds of units concerned.

They include farmers' co-operative societies, joint stock companies and private individuals; among the last are a few producers, whose output is sufficiently large to enable them to run a packing station solely on their own supplies, and one or two auctioneers.

A notable instance of a packing station organized as an adjunct to an auction is to be seen at the premises of Mr. E. J. Parker, auctioneer, of Maidstone. Mr. Parker has been conducting weekly egg auctions for the last 18 years, drawing his supplies from places as far away as Sittingbourne, Sevenoaks, Ashford and Hawkhurst. On an average, he disposes of about 50,000 eggs a week. In order to participate in the National Mark Egg Scheme, he has secured the lease of a wooden building of 1,150 superficial feet, and has equipped this somewhat on the lines of the Cheltenham Packing Station to deal with about 10,000 eggs a day.

Wooden collecting cases, with "Raylite" fittings, are supplied to the producers, who fill and return them to the station at frequent intervals. On receipt at the packing station, the eggs are emptied into trays and carried by a conveyor to the candling apparatus. The eggs which pass the candling test (i.e., "First-quality" eggs as defined in the regulations) are then carried by the conveyor to the grading table where they are transferred to a Baker grader. The graded eggs are then packed according to grade in 15-dozen fiberite cases, sealed with adhesive tape and labelled with the appropriate

grade labels. The cost of material and labour for these operations averages 1d. per dozen eggs.

The eggs are then sold expeditiously by auction and demand has been keen. Retailers have been quick to seize the opportunity of buying eggs guaranteed as "First-quality" English and graded to the national standards, and prices have been encouraging. Producers are paid on the "grading out" results for the eggs they send in. They receive the average amount which each grade realizes, less a deduction of 1d. per dozen for material and labour, and 5 per cent. for Mr. Parker's commission. After these deductions are made, the enhanced prices at which the eggs are selling means definitely improved returns to the producer.

This is the first egg-packing station to be run in conjunction with an auction, and is a promising development which will be watched with interest in all parts of the country. A photograph of an auction is reproduced opposite.

* * * * *

SUGAR beet pulp is now generally known to be a very valuable foodstuff. It is usually dried at the factory and sold to contracting farmers. In previous years a

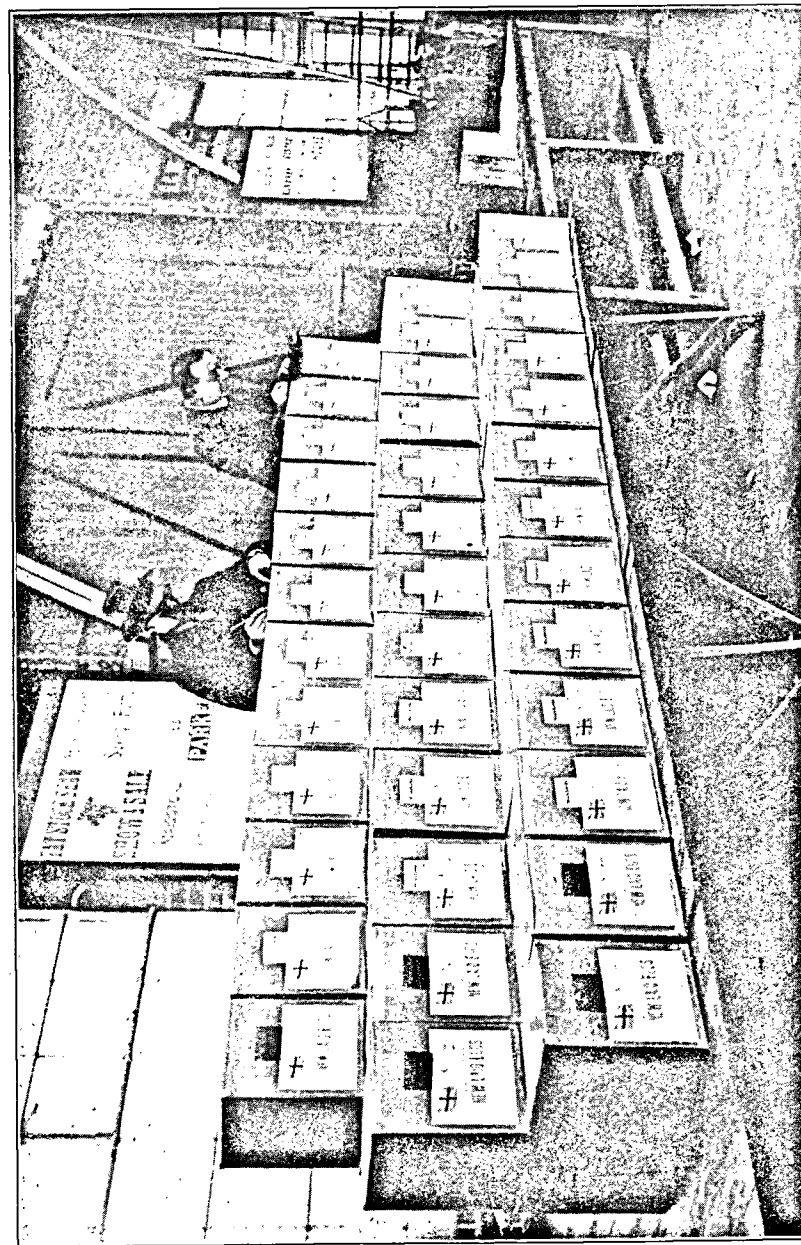
Sugar Beet Pulp

good deal of it was exported, but many farmers in this country have learned to appreciate its merits as a

feeding stuff for various classes of live stock.

The Beet Sugar Factories' Committee informs the Ministry that they have decided, in selling dried beet pulp to the farmer, to charge no more than 15s. a ton as a maximum for rail freight to the farmer's railway station. That is to say, that the distant farmers who grow sugar beet under the new concession will get this additional advantage in rail carriage when they buy back dried pulp from the factory. Each contracting farmer is allowed a quota of sugar beet pulp under his beet-growing contract, and it is that quantity in respect of which this further carriage concession will operate. To participate in this advantage, however, farmers will have to place their orders for dried pulp before July 1 in each season. The price of the pulp to the grower, ex factory, under the present sugar beet contract is £5 a ton, so that the maximum price, delivered at the grower's station, of the quantity to which he is entitled, would be £5 15s.

* * * * *



An Auction, Egg Packing Station. A block of packed, standardized eggs being offered for bidding.

THIS Act has recently been passed by the Government of Northern Ireland to amend the existing legislation regarding the trade in eggs in that country and to bring it into line with the provisions of the Agricultural Produce (Grading and Marking) Act, 1928, which provides, *inter alia*, for the marking of preserved, cold stored and chemically stored eggs and the registration of premises used for the cold storage and chemical storage of eggs.

* * * * *

THE general level of prices of agricultural produce in December was 40 per cent. above that in 1911-13, or one point lower than in the previous month and two points higher than in December, 1927. Eggs and potatoes were cheaper than in November, while fat cattle, sheep and pigs and hay were dearer. At this season, it is usual for prices of fat stock to advance owing to the better quality and demand at the Christmas sales, but, as the rise in values of fat cattle and sheep this season was proportionately less than in 1911-13, the index numbers for these two classes of live stock showed a decline, this being primarily responsible for the fall of one point in the general index number.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1923 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13					
	1923	1924	1925	1926	1927	1928
January ..	67	60	71	58	49	45
February ..	63	61	69	53	45	43
March ..	59	57	66	49	43	45
April ..	54	53	59	52	43	51
May ..	54	57	57	50	42	54
June ..	49	56	53	48	41	53
July ..	50	53	49	48	42	45
August ..	52	57	54	49	42	44
September ..	52	61	55	55	43	44
October ..	50	66	53	48	40	39
November ..	51	66	54	48	37	41
December ..	55	65	54	46	38	40

Grain.—Wheat was 3d. per cwt. and barley 5d. per cwt. cheaper on the month at averages of 9s. 7d. and 10s. 3d., respectively, per cwt., but oats advanced by 1d. to 9s. per cwt. The index number for wheat remained unaltered at 31 per cent. above pre-war, for barley it fell by 1 point to 24 per

cent., while for oats a rise of 2 points was recorded to 29 per cent. above 1911-13.

Live Stock.—The December average for second quality fat cattle, at 45s. 6d. per live cwt., was 1s. 9d. higher than in the preceding month, and this compares with a rise of 1s. 6d. to 41s. 6d. per live cwt. in the corresponding period of 1927. The index number for fat cattle, however, showed a fall of 4 points to 27 per cent. above the base years, owing to the fact that there was a proportionately greater rise in price in the period November-December, 1911-13. A year ago, fat cattle were 16 per cent. dearer than pre-war. An increase also occurred in the price of fat sheep in December, the average being $\frac{1}{2}$ d. higher at 1s. per lb. estimated dressed carcass weight, although the index number fell by 3 points to 50 per cent. above pre-war. The corresponding price in December, 1927, was 11 $\frac{1}{2}$ d. per lb., and the index number 44 per cent. above pre-war. Bacon pigs were dearer by 2d. and pork pigs by 3d. per 14 lb. stone, and the index number for the former advanced to 26 per cent. above 1911-13 and for the latter to 36 per cent. Slight increases were recorded for store cattle, sheep and pigs, while dairy cows were cheaper by about 10s. to 15s. per head. In all cases except store cattle the relative index figures were lower than in November, but as compared with December, 1927, the prices and index numbers of dairy cows, store cattle and sheep were higher, whereas in the case of store pigs a decline has occurred.

Dairy and Poultry Produce.—Milk was unaltered on the month at a level of 71 per cent. above pre-war. A slight seasonal increase in the price of butter was recorded, but, proportionately, it was less than that in the base period, and the index figure declined 2 points to 50 per cent. above 1911-13. Cheese also increased slightly in price and the index number rose by 1 point to 79 per cent. above pre-war. As is customary at this period of the year, there was a fall in the price of eggs, the reduction of 4 $\frac{1}{4}$ d. per dozen and 14 points in the index number to 37 per cent. above pre-war level comparing with a fall of 2 $\frac{3}{4}$ d. and 6 points to 41 per cent. a year ago. Poultry, as a whole, at 45 per cent. dearer than in 1911-13, were 8 points higher than in December, 1927.

Other Commodities.—The changes in wool prices were very slight during the month under review, and the index figure remained unaltered at 66 per cent. above the base years. Hay prices were somewhat higher than in the preceding month and a rise of 4 points in the index number was shown. Potatoes were about 5s. per ton cheaper than in November and the index

number was 8 points lower at 45 per cent. above pre-war. Vegetable prices were little altered from those ruling in November; cabbages and Brussels sprouts averaged about 20 per cent. below pre-war prices, while cauliflowers and celery averaged 50 to 60 per cent. above pre-war. Apples sold at about 60 per cent. dearer than in 1911-13.

Index numbers of different commodities during recent months and in December, 1926 and 1927, are shown below :—

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

Commodity	1926	1927	1928			
	Dec.	Dec.	Sept.	Oct.	Nov.	Dec.
Wheat	61	34	22	28	31	31
Barley	31	35	50	26	25	24
Oats	17	31	33	27	27	29
Fat cattle	28	16	36	31	31	27
Fat sheep	44	44	59	52	53	50
Bacon pigs	63	20	33	26	24	26
Pork pigs	72	33	32	33	33	36
Dairy cows	30	28	34	39	38	34
Store cattle	21	13	27	20	20	21
Store sheep	41	35	66	54	53	49
Store pigs	115	41	28	31	31	30
Eggs	46	41	52	66	51	37
Poultry	49	37	42	51	47	45
Milk	65	66	65	57	71	71
Butter	40	47	54	55	52	50
Cheese	28	55	78	78	78	79
Potatoes	110	75	60	51	53	45
Hay	2	20	14	6	4	8
Wool	29	50	76	70	66	66

* * * * *

THE crowded stands to be seen at Horticultural and Allotment Shows suggest that the popular interest in horticulture,

which has been so evident since the

Allotment Holders war, not only continues undiminished and **Horticultural**

Shows well illustrated in the following extracts

from reports furnished by the Ministry's

Horticultural Inspectors in recent months :—

Walsall Allotments Show.—"I have never seen such a fine display of well-grown vegetables. Considering the district—the heart of the Black Country—and the droughty season, hard work and diligence have had to be exercised in the production of such excellent samples.

"This Show has a co-operative side in the fact that groups of allotments compete against each other, thus bringing about a friendly rivalry. This is good for the cause and creates keen competition.

"There are over 3,000 allotment holders in the borough, with 15 Associations, 10 of which were in competition. The entries totalled between 700 and 800; the produce was at least 50 per cent. better in quality than last season."

"*Birmingham Gazette*" *Great Flower Show and Allotments Exhibition*.—"With each succeeding year this Show has interested a wider circle of people. Since its inception, 11 years ago, up to this year, it has been held in the Town Hall, but owing to its increasing popularity and to pressure on space, the Committee decided this year to remove the Exhibition to the Bingley Hall, the largest building in the city. The venture has proved highly successful. New features were introduced and the schedule largely extended, with the result that the Exhibition can rightly claim to be the largest of the kind in the country. Approximately, 80,000 allotment holders and amateur gardeners are represented.

"The exhibits were of a high standard and most of the classes were well filled with entries. In the collections of vegetables, competition was keen, making adjudication a very difficult task. There were 60 Trade exhibits, representing the leading horticultural trade houses in the country.

"The Ministry's portable seeds exhibit was displayed at the Exhibition and attracted considerable attention. Numerous questions were asked by allotment holders as to how to deal with common pests and diseases."

Land Purchased by Birmingham Allotment Holders.—"At a time when complaints of the difficulty of securing land for allotments in urban districts are often heard, it is encouraging to be able to record the success of an Allotments Association in one of the largest cities of the country in becoming the owners of a considerable area of land.

The final stage of a unique experiment at Witton was recently reached, when the Lord Mayor of Birmingham handed over the title deeds of a freehold property known as Short's Farm to the Trustees of the Witton and District Allotments, Ltd. The land was first acquired by the Corporation under war-time Acts, and the area of 82 acres was turned into allotments in 1917, the allottees forming themselves into an association and eventually into a limited company. Later, a large barn on the allotments was acquired and fitted up as a clubroom, and the

Corporation were asked to acquire the land permanently for allotments, but owing to the financial stringency of the period the suggestion fell through. On behalf of the Association steps were then taken to purchase the estate; the purchase was effected at a cost of £7,000, and after seven years the property is now entirely free from debt.

The Lord Mayor, in handing over the title deeds to the Trustees, extended to the members his hearty congratulations. Reference had been made to the failure of the Corporation to take advantage of the opportunity which presented itself some seven or eight years ago to acquire the freehold property for allotment purposes. However, the Association had succeeded where the Corporation had failed, and their success was a striking example of what could be accomplished by co-operative effort on the part of working men.

* * * * *

DURING last season, Inspectors of the Ministry examined nearly 9,000 acres of growing crops of potatoes with the object of certifying them to be true to

Certified Stocks of Potatoes	type and reasonably free from rogues. Particulars of crops certified as reaching the required standard of purity of not less than 99.5 per cent. are given in the Register of Growers of Certified Stocks of Potatoes in 1928, which was recently issued by the Ministry.
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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 which 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 number of the relative certificate issued under the Order must be quoted. In the case of potatoes of approved immune varieties, the certificate number to be quoted is that given in the Register of Growers, but, in the case of other varieties, the number to be quoted is that of the relative Clean Land Certificate issued to the growers concerned, and not that of the Purity Certificate quoted in the Register.

Copies of the Register of Growers may be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1, price 1s.

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on December 31 at 7 Whitehall Place, S.W. 1, Mr. W. C. Dampier-Wetham, F.R.S., presiding.

The Board considered a notification from the Norfolk Agricultural Wages Committee of a decision fixing minimum and overtime rates of wages, and proceeded to make the following Order carrying into effect the Committee's decision :—

An Order to come into force on January 1 continuing the operation of the existing minimum and overtime rates of wages for male and female workers until March 2, 1929. 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, 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. 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.

Copies of the Order 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 January 15, legal proceedings were instituted against seven employers for failure to pay minimum and overtime 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.	
Hereford ..	Kington ..	1	0	0	1	7	0	10	0	0	1
Salop ..	Wem ..	4	0	0	—	—	—	16	0	0	2
„ ..	Bishops Castle ..	—	—	—	2	9	0	52	18	0	3
Staffs ..	Brownhills ..	1	0	0	0	5	0	7	17	6	1
Sussex ..	Horsham ..	12	0	0	2	4	0	12	3	2	3
Yorks :											
W. Riding	Dewsbury ..	0	18	0	0	18	0	22	6	6	3
Carmarthen	Llandyssul ..	0	2	0	—	—	—	14	9	4	1
		£19	0	0	£7	3	0	£135	14	6	14
		*	*	*	*	*	*	*	*	*	*

Foot-and-Mouth Disease.—Since the report in the January issue of this JOURNAL, only two further outbreaks—both in the Lancashire Infected Area—have been confirmed. These occurred on December 19 and 20. Restrictions were withdrawn in the following Infected Areas on the dates mentioned : Devon, December 21 ; East Sussex, December 24 ; Salop, January 14 ; and Lancashire, January 18, as from which date no general movement restrictions remain in force in connexion with foot-and-mouth disease in any part of Great Britain.

During the year 1928, 138 outbreaks were confirmed, as compared with 141 in 1927, 204 in 1926, and 260 in 1925.

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Latvian Butter.—The Ministry is informed by the Agricultural Adviser to the Latvian Consulate-General in London that, as from

January 1, 1929, all shipments of Latvian butter will be overweight to the extent of 7·04 oz. per cwt. packed in casks, and to the extent of 3·52 oz. per 56 lb. packed in boxes. This addition is to allow for loss of weight in transit. The statistical reports of the Butter Control Board of the Latvian Ministry of Agriculture show that the export of Latvian butter in 1928 amounted to 12,980 tons, an increase of 2,219 tons on that of the previous year, or 20·6 per cent.

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APPOINTMENTS: CHANGES AND CORRECTIONS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Northamptonshire : Mr. A. McVicar, B.Sc., N.D.A., N.D.D., has been appointed Assistant Agricultural Organizer and Warden of the Farm Institute at Moulton, *vice* Mr. W. R. Seward.

Nottinghamshire : Mr. A. Voysey, B.Sc., has been appointed Assistant Agricultural Organizer, *vice* Mr. N. Howard.

COUNTY AGRICULTURAL EDUCATION STAFFS : WALES

Glamorganshire : Mr. G. E. Reddaway, N.D.P., has been appointed Instructor in Dairy and Poultry Husbandry, *vice* Mr. H. Wignall.

TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND

Harper Adams Agricultural College, Newport, Salop : Mr. S. G. Jary, B.A., Dip. Agric., has vacated his appointment as a Lecturer in Botany and Zoology.

National Institute of Poultry Husbandry, Harper Adams Agricultural College : Mr. F. C. Bobby, N.D.P., N.D.A., has vacated his appointment as Senior Research Assistant. Mr. E. B. Lomax, B.A. (Agric.), N.D.P., has been appointed as his successor.

Midland Agricultural & Dairy College, Sutton Bonington, Loughborough : Miss E. M. Crossley, N.D.D., has been appointed Second Instructor in Dairying *vice* Miss K. F. Kaye.

Mr. H. G. Robinson, M.Sc., has been appointed Farm Director *vice* Mr. J. Duncan, Farm Manager.

Mr. W. W. Ballardie, B.Sc., N.D.D., has been appointed Assistant Lecturer in Agriculture and Botany.

University of Reading ; Faculty of Agriculture and Horticulture : Mr. S. G. Jary, B.A., Dip. Agric., has been appointed Advisory Entomologist, Laboratory of Plant Pathology.

Seale-Hayne Agricultural College, Newton Abbot, Devon : Mr. R. Brown, B.Sc. (Agric.) Lond., has been appointed Assistant Lecturer in Biology, *vice* Mr. C. A. Cosway, B.Sc.

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APPOINTMENTS

LISTS of provincial officers connected with the work of agricultural education in England and Wales have been published in the issues of this JOURNAL for April, May, August, September, and October, 1928. These lists covered the teaching staffs employed by County Education Authorities (April and May) ; the teaching staffs at University Departments of Agriculture, Agricultural Colleges, etc. (August and

September); and the Specialist Advisory Staffs of the various agricultural provinces (October). The series is completed with the list of the staffs of Agricultural Research Institutes. Part of the list of these staffs was given in last month's (January) issue; the remainder appear below. For a general description of the work undertaken by these Institutes, readers should consult Dr. V. E. Wilkins' book, "Research and the Land," obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. Price 2s. 6d. net, paper covers, and 3s. 6d. net, cloth covers.

STAFFS OF AGRICULTURAL RESEARCH INSTITUTES

University of Oxford

(a) AGRICULTURAL ECONOMICS RESEARCH INSTITUTE

<i>Director</i>	C. S. ORWIN, M.A.
<i>Advisory Economist</i>	A. BRIDGES, M.A.
<i>Assistants</i>	R. N. DIXEY, B.A., F. J. PREWETT, B.A., and J. R. LEE, B.Sc.

(b) INSTITUTE OF AGRICULTURAL ENGINEERING

<i>Director</i>	B. J. OWEN, M.A., M.Eng., D.Sc.
<i>Mechanical Engineering</i>	E. B. BLACK, B.Sc.
<i>Agricultural Physics</i>	J. H. BLACKABY, B.Sc.
<i>Agricultural Physics and Chemistry</i>	W. H. CASHMORE, B.A., N.D.A.

University of Bristol

(a) LONG ASHTON FRUIT RESEARCH STATION

<i>Director</i>	Prof. B. T. P. BARKER, M.A.
<i>Deputy Director and General Chem- istry</i>	T. WALLACE, M.C., M.Sc., A.I.C.
<i>Bio-Chemistry</i>	F. TUTIN, M.Sc.
<i>Entomology</i>	C. L. WALTON, M.Sc., Ph.D.
<i>Mycology</i>	R. W. MARSH, M.A.
<i>Pomology</i>	G. T. SPINKS, M.A.
<i>Pomologist</i>	J. G. MAYNARD, M.A., Dip.Hort.
<i>Plant Physiology</i>	T. SWARBRICK, M.Sc., Ph.D.
<i>Cider</i>	O. GROVE, M.Sc.
<i>Willow Officer</i>	H. P. HUTCHINSON, B.Sc.

(b) FRUIT AND VEGETABLE PRESERVATION RESEARCH STATION (CAMPDEN, GLOS.)

<i>Acting Resident Director and Micro- Biologist</i>	F. HIRST, A.R.C.Sc.
<i>Demonstrator in Food Preservation</i>	Miss MARGARET L. ADAMS
<i>Assistant Chemist</i>	W. B. ADAM, M.A., A.I.C.

University College of Wales, Aberystwyth WELSH PLANT BREEDING STATION

<i>Director</i>	Prof. R. G. STAPLEDON, M.B.E., M.A.
<i>Plant Breeding and Genetics</i>	T. J. JENKIN, M.Sc., R. D. WILLIAMS, M.Sc., E. T. JONES, B.Sc., and MARTIN G. JONES, M.Sc.
<i>Agronomy</i>	WILLIAM DAVIES, M.Sc.

Rothamsted Experimental Station, Harpenden, Herts

<i>Director</i>	Sir E. JOHN RUSSELL, O.B.E., D.Sc., F.R.S.
<i>Assistant Director</i>	B. A. KEEN, D.Sc., F.Inst.P.
<i>Heads of Departments :—</i>	
<i>Bacteriology</i>	H. G. THORNTON, B.A.
<i>Bctany</i>	Miss WINIFRED E. BRENCHLEY, D.Sc., F.L.S.
<i>Chemistry</i>	E. M. CROWTHER, D.Sc., F.I.C.
<i>Insecticides and Fungicides</i>	F. TATTERSFIELD, D.Sc., F.I.C.
<i>General Microbiology</i>	D. W. CUTLER, M.A., F.L.S.
<i>Soil Physics</i>	The ASSISTANT DIRECTOR
<i>Statistical</i>	R. A. FISHER, M.A., Sc.D.
<i>Entomology</i>	A. D. IMMS, D.Sc., F.L.S.
<i>Mycology</i>	W. B. BRIERLEY, D.Sc., F.L.S.
<i>Other Members of Graded Staff :—</i>	
<i>Assistant-Physicists</i>	G. W. SCOTT BLAIR, B.A., G. H. CASHEN, M.Sc.
<i>Assistant Microbiologists</i>	Miss L.M. CRUMP, M.Sc., H. SANDON, M.A., Ph.D.
<i>Assistant Mycologists</i>	J. HENDERSON SMITH, M.B., Ch.B., R. H. STOUGHTON, B.Sc., A.R.C.Sc.
<i>Assistant Bacteriologist</i>	P. H. H. GRAY, M.A.
<i>Assistant Entomologists</i>	D. M. T. MORLAND, M.A., H. F. BARNES, M.A.
<i>Assistant Statistician</i>	J. WISHART, M.A., D.Sc.
<i>Assistant Chemist</i>	R. G. WARREN, B.Sc.

Experimental and Research Station, Cheshunt, Herts

<i>Director</i>	W. F. BEWLEY, D.Sc.
<i>Entomology</i>	E. R. SPEYER, M.A.
<i>Chemistry</i>	O. OWEN, M.Sc., A.I.C.
<i>Mycology</i>	P. H. WILLIAMS, B.Sc.

Horticultural Research Station, East Malling, Kent

<i>Director</i>	RONALD G. HATTON, M.A. (Pomology)
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Chemical Department Capt. J. GOLDING, D.S.O., F.I.C.
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E. C. V. MATTICK, Ph.D.

Dairy Husbandry Department .. J. MACKINTOSH, O.B.E., N.D.A.,
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NOTICES OF BOOKS

British Food Control. By Sir Wm. H. Beveridge. Pp. xx + 447.
(Oxford: The University Press, on behalf of the Carnegie
Endowment for International Peace, 1928. Price 17s. 6d. net.)

This interesting volume presents in narrative form the course of food control in Britain from 1914, with "business as usual," to the establishment of the Ministry of Food in December, 1916, and onwards to the period of liquidation in 1920-21. All the main incidents of control are described, dated, and documented. There are 31 statistical tables dealing chiefly with stocks, supplies, and prices throughout the period, and also a general appendix dealing in detail with such matters as the Meat Rationing Scheme, Regulation of Milk Prices, etc.

The author, in his preface, claims that what he has written makes no pretence to be history, "robed for impartial judgment," and that he has deliberately drawn on a larger scale certain parts of the work with which he was most intimately concerned. Owing to this lack of balance in the perspective, the reader is throughout apt to get a misleading impression of the part played by the Ministry of Food, and particularly in regard to cereals, after the Food Controller took over the small mills lying outside the scope of the Wheat Commission.

It was admittedly not the author's function to describe in detail the work of other departments or bodies concerned with control, as, for instance, the Board of Trade in regard to meat, the Food Production Department, or the Wheat Commission. Those, and the Sugar Commission, were entirely free from the Ministry of Food, and indeed, so far as the last-named is concerned, it is observed (page 121) that "If the Commissioners are to be believed, they had to threaten to go

on strike for their liberties, and did so." The operations of these other bodies have already been described, but are again referred to here. There is, however, not always a clear distinction drawn between their operations and those of the Ministry of Food.

The author states that while the maintenance of supplies was not the work of the Ministry of Food alone, the distribution of supplies was the Ministry's own achievement. Presumably, he is here referring mainly to the system of rationing, which he claims did all that was required of it, although as a means of restricting consumption, it was never really tested. The actual system of rationing adopted by the Ministry was, it seems, practically forced on it by the Local Committees, who took the initiative in the matter. Meat queues, in the winter of 1917-18 were also a compelling circumstance, and they, in turn, were largely the result of a shortage of supplies caused by the range of prices as fixed on the advice of the Ministry of Food. The situation at that time was saved, not by rationing only, but also, it appears, by the Ministry constituting itself, for all practical purposes, another Commodity Commission for the purchase of pork and provisions.

In the concluding chapter, the author describes the story of British Food Control as a "back-stage episode in the world's tragedy, which limelight would make laughable." "The work had to be done, and might be done well or badly, but the doing . . . had no decisive influence." This verdict may, perhaps, apply to the operations of the Ministry of Food, but hardly to the work of those other bodies, organized mainly on a commodity basis, which were concerned with the maintenance of essential food supplies.

The author suggests (p. 335) that the success of the Ministry of Food as a trading concern was made possible by the suspension of Parliamentary and Treasury control which are normally applied to Public Departments. He enters a protest (p. 330) against a system of presenting public trading accounts to Parliament, with the comments of the Auditor-General, which led the Press to give prominence to criticisms of certain transactions involving comparatively small losses, while almost entirely ignoring the fact that, without aiming at making any considerable profit, the Ministry did actually make a profit of over £6,000,000 after paying overhead charges of every description.

This record of British Food Control is written in a pleasant and readable style: despite its subject no one would describe it as a dull book. Indeed, the chapter on the enforcement of control, with a humorous account of some of the prosecutions, is thoroughly entertaining. The volume constitutes a valuable addition to the series published by the Carnegie Endowment for International Peace, but one might well apply, in connexion with it, the words of the Editor's Preface—"The tangled threads of events have still to be woven into the pattern of history."

Dairy Cattle Feeding and Management.—By Carl W. Larson, M.S.A., Ph.D., and Fred S. Putney, M.S.A. Second edition, revised by H. O. Henderson, M.S.A. Pp. xxiii + 450. (London: Chapman & Hall, Ltd., 1928. Price 20s. net.)

This is a second and revised edition of a book originally written for the benefit of the American student. It deals very widely and thoroughly with all phases of the feeding and management of dairy stock; and many of the chapters will be of interest to English readers, although, in the main, its usefulness will be more appreciated in the American agricultural teaching institutions.

Agricultural Conditions and Production in Czechoslovakia.—The State Office of Rural Accountancy and Economics at Prague, of which

Professor Dr. Ing. Vladislav Brdlik is the Director, has issued the first part of a stupendous work on "Conditions of Production, Organization and Results of Agricultural Undertakings in Czechoslovakia." As the title indicates, the work is the outcome of an exhaustive investigation by the survey method, on the lines adopted by Laur in Switzerland, Larsen in Denmark, and Orvin and other agricultural economists in this country. This first part, extending to 3,378 pages, comprised in four volumes, describes the conditions, methods of production and results obtained on 1,652 farms of various sizes and classes in Czechoslovakia. The produce raised is stated in terms of quantity and money, the figures being averaged over five years under pre-war conditions. The aim of this valuable statistical summary is to assist in elucidating the conditions governing agricultural production on different methods by providing material for scientific research and practical application. To make the survey of general international interest and wider utility, the text, tables and terms have been translated into 11 languages. The second part of the publication, to be issued later, will contain "An Elaboration of the Results of Research."

The Welsh Journal of Agriculture.—The Journal of the Welsh Agricultural Education Conference. Vol. IV. 1928. (Cardiff: The University of Wales Press Board. Price: paper covers, 2s. 6d.; cloth covers, 4s.)

This issue contains 20 articles dealing with agriculture in Wales. Necessarily, a number of them deal with pastures, meadows and grass culture, while others cover questions relating to wool and mutton, dairying and the feeding of cows, and swine husbandry. Potatoes and oats also come under notice; and the meteorological conditions at Aberystwyth from 1894-1927 are made the subject of an interesting exegesis. Abstracts, Reviews and Bibliographical Notes, giving an indication of the relative technical literature published in 1927, are added and should prove of interest and value.

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SELECTED CONTENTS OF PERIODICALS

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The Incidence of Taxation in Agriculture. *J. A. Venn.* (Econ. Jour., xxxviii, 152 (Dec., 1928), pp. 560-572.) [336.2; 336.22.]

Agricultural Workers and Agrarian Reform in Central Europe. *Adam Rose.* (Int. Lab. Rev., xviii, 3 (Sept., 1928), pp. 307-338.) [331 (4); 333.5 (4).]

Studies in Soil Cultivation: IV, A New Form of Traction Dynamometer. *W. B. Haines* and *B. A. Keen.* (Jour. Agric. Sci., xviii, 4 (Oct., 1928), pp. 724-733, pl. xii and xiii.) [63.17.]

"Single Value" Soil Properties: A Study of the Significance of Certain Soil Constants. *B. A. Keen* and *J. R. H. Coutts.* (Jour. Agric. Sci., xviii, 4 (Oct., 1928), pp. 740-765.) [63.113.]

Some Comments on the Hydrometer Method for Studying Soils. *B. A. Keen.* (Soil Sci., xxvi, 4 (Oct., 1928), pp. 261-263.) [63.111.]

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Contribution to the Chemical Composition of Peat: II, Chemical Composition of Various Peat Profiles. *S. A. Waksman* and *K. R. Stevens.* (Soil Sci., xxvi, 3 (Sept., 1928), pp. 239-251.) [662.6.]

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Wintering of Bees. *J. Tinsley.* (Scottish Jour. Agric., xi, 4 (Oct., 1928), pp. 434-441.) [63.81.]

The Canning of Peas. *F. Hirst.* (Food Manufacture, iii, 8 (Dec., 1928), pp. 535-540.) [664.84.]

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Some Preliminary Experiments on the Value of Small Quantities of Whole Cows' Milk when fed to Pigs. *A. H. Blissett* and *J. Golding.* (Jour. Agric. Sci., xviii, 4 (Oct., 1928), pp. 642-648.) [612.394; 63.64; 043.]

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The Mechanism of Cellulose Digestion in the Ruminant Organism: II, The Transformation of Cellulose into Glucose by the Agency of Cellulose-Splitting Bacteria. *H. E. Woodman* and *J. Stewart.* (Jour. Agric. Sci., xviii, 4 (Oct., 1928), pp. 713-723.) [612.394.]

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Investigations on Chlorosis of Fruit Trees: III, A Chlorosis of Plums due to Potassium Deficiency. *T. Wallace.* (Jour. Pom. and Hort. Sci., vii, 3 (Dec., 1928), pp. 184-198.) [63.21 ; 63.41.]

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- The Common Green Capsid Bug. *F. R. Petherbridge* and *W. H. Thorpe*. (Ann. App. Biol., xv, 3 (Aug., 1928), pp. 446-472.) [63.27.]
- Studies on *Oscinella frit* Linn. Observations on Infestation and Yield, Susceptibility to Infestation, Recovery Power, the Influence of Variety on the Rate of Growth of the Primary Shoot of the Oat and the Reaction to Manurial Treatment. *N. Cunliffe*. (Ann. App. Biol., xv, 3 (Aug., 1928), pp. 473-487.) [63.27.]
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NOTES FOR THE MONTH

At the present time, farmers are daily wrestling with the question of expenditure, the object being to reduce costs.

Such items as labour and feeding stuffs **Farm Management** call for critical examination. Broadly **and Labour** speaking, there is little or no surplus farm labour available. Year in, year out, the farm must carry a regular staff, and conditions are such that useful, productive work must be found for the normal staff at all seasons. Few farmers are in a position to take on or pay off staff at will, even if they desired to do so. They consider themselves fortunate if at specially busy seasons they can call upon migrant or other casual labour to help them out.

Nowadays, no farmer can afford a slack time at any season: cropping and stocking have to be so arranged as to keep a regular staff fully employed throughout the year. This sometimes entails readjustments of the farmer's general plan of campaign. The grass farm, except where it is run on the principle of the shepherd and his dog, is unbalanced in respect of whole-time productive employment. The labour, horses and equipment required for dealing with it are capable of undertaking some arable cropping which, in the circumstances, means relatively cheap production. There is then, with the arable, a smaller cash outlay for expensive feeding stuffs for the cattle in the off-season of the year; for good cattle food can usually be grown at present more cheaply than equivalent concentrates can be purchased.

Here we have a definite relationship between labour and feeding stuffs. The fact is, we had become so used to cheap feeding stuffs in convenient form that home-grown foods were not sufficiently considered: at any rate, their value was in real danger of being overlooked. Force of circumstances is now directing our attention once more to the feeding methods of former times—grass, as far as it will go, followed by hay, straw, roots, or similar vegetable forage, and home-grown corn, with just a hint of cake as a ketchup. Production per cow, or

per bullock, may suffer a little by the change, but that does not necessarily mean that output per acre will fall, and the straitened farmer stands to gain not only in pocket but in peace of mind.

An arable farm may similarly be unbalanced in respect of the spread of labour. Too great an area of roots may mean scamped cultivations and a heritage of weeds. Varieties of seed, manures, methods of drilling, and so on, all play their part in obtaining satisfactory crops, but they only begin to operate after the plant is up. The fundamental requirement of good arable cultivation is a full and regular plant, and that depends mainly on a proper seed-bed. It is generally more economical to cultivate a small area thoroughly than a large one inadequately; and, in most circumstances, any surplus arable may usefully be devoted to other food crops, such as temporary ley or lucerne. There is no proof that modern seed mixtures are unsuited to most soils for this purpose, even to the somewhat peculiar conditions of East Anglia. Temporary grass, too, relieves the pressure of summer work, provides employment for men and horses in winter when other land is unploughable, supplies hay of the highest feeding quality, or grazing for sheep during the greater part of the year, and, when broken up, gives a seed-bed enriched and made friable by the beneficent action of nature.

* * * * *

REFERENCE has in the past been made in this JOURNAL to the fact that the Pig Industry Council is working by means of committees, to each one of which the Council has referred one or more matters of primary importance. One of these committees, which is inquiring into veterinary problems, has been asked to ascertain the swine mortality from certain known diseases and to suggest steps to reduce this mortality.

Whereas, however, there are in existence certain statistics of swine mortality due to the notifiable diseases, namely, foot-and-mouth disease, swine fever and anthrax, no such records are available in the case of other diseases of pigs, and it is therefore extremely difficult to measure losses due to such diseases as swine erysipelas, worms, tuberculosis and pneumonia.

The Veterinary Committee of the Pig Industry Council has therefore determined to invite the assistance of breeders and feeders throughout the country.

Any breeder or feeder of pigs who will supply mortality statistics kept by him—i.e., figures as to deaths in his herd, enumerated under the different diseases—is therefore asked to write to the Secretary, Pig Industry Council, 10 Whitehall Place, S.W. 1, for a copy of a questionnaire, which will show him the nature of the information required. Letters so addressed need not be stamped.

* * * * *

THE series of practical demonstrations of improved methods of marketing agricultural commodities inaugurated by the Ministry in 1927 will be continued during the forthcoming agricultural show season. A list of selected shows at which demonstrations will be given and the subjects to be dealt with at each is appended. This list is subject to slight revision.

Show	Place	Date	Subject
Oxfordshire ..	Banbury	.. May 14-15..	Pigs.
Bath and West..	Swindon ..	.. May 22-25..	Pigs, cattle, poultry, cereals, potatoes, fruit, the National Mark
Royal Counties..	Southampton	.. May 29 - June 1	Pigs, poultry, cereals, potatoes, fruit, the National Mark
Cambridgeshire	Ely ..	.. June 4 ..	Cereals, potatoes
Three Counties..	Gloucester	.. June 4-6 ..	Fruit
Suffolk ..	Bungay ..	.. June 6-7 ..	Cereals, potatoes
Essex ..	Witham ..	.. June 12-13	Cereals, potatoes
Staffordshire ..	Stafford ..	.. June 12-13	Pigs
Leicestershire ..	Leicester	.. June 14-15	Cattle
Royal Norfolk ..	King's Lynn	.. June 19-20	Pigs, cereals, potatoes, the National Mark
Lincolnshire ..	Sleaford ..	.. June 26-28	Pigs, cattle, poultry, cereals, potatoes, fruit, the National Mark
Peterborough ..	Peterborough	.. July 2-4 ..	Cereals, potatoes
R.A.S.E. ..	Harrogate	.. July 9-13..	Pigs, poultry, cattle, cereals, fruit, potatoes, the National Mark
Royal Lancashire	Blackburn	.. July 31-Aug. 3	Pigs
Royal Welsh ..	Cardiff ..	.. August 7-9	Pigs, poultry, cattle, cereals, potatoes, fruit, the National Mark

ACCORDING to returns made to the Ministry by the beet sugar factories operating in Great Britain, the quantity of home-grown beet sugar manufactured during January, 1929, together with the quantity produced during the corresponding month in 1928, was:—

	Cwt.
January, 1929	183,550
January, 1928	471,655

The total quantities of sugar produced during the two manufacturing campaigns to the end of January were:—

	Cwt.
1928-29	3,898,687
1927-28	3,787,871
* * * * *	

The Minister's Letter to Accredited Egg Packers THE following letter was addressed by the Minister of Agriculture on January 31 to each accredited packer under the National Mark Egg Scheme:—

DEAR SIR,

AGRICULTURAL PRODUCE (GRADING AND MARKING) ACT, 1928.

I am glad to see that you have been registered as a packer under the National Mark Egg Scheme, a distinction on which you will, perhaps, allow me to congratulate you. I hope you will very soon experience the advantages of registration.

The National Mark is the hall-mark of quality for agricultural produce, and its reputation can only be maintained by scrupulous adherence to the conditions under which it may be used. Registration, therefore, carries with it a serious responsibility, since nothing less than the reputation of the National Mark has been confided to your safe-keeping. As doubtless you know, the same National Mark as that you are using is being used by our fruit packers and, quite shortly I hope, will come to be used on all kinds of home produce that lend themselves to grading and marking, so that your responsibility extends, in fact, far beyond the horizon of the egg trade. It is true that the scheme rightly has its own penalties for negligence and, if necessary, these will be rigidly enforced in the interests of all concerned. But the question of penalties will never arise if everyone remains *loyal to the scheme*. Prevention is far better than cure. The Mark must not be let down by the packing stations!

I, therefore, appeal to you very earnestly to regard it as a matter of personal honour to see that the conditions which you have accepted as governing registration under the scheme are strictly observed in all ways and at all times. I know that I shall not appeal in vain.

Yours faithfully,

(Sgd.) WALTER GUINNESS,

Minister of Agriculture and Fisheries.

* * * * *

THE Ninth Annual Report of the N.I.A.B. Council records some interesting points regarding the progress of the Institute during the 1927-28 season. Arrangements

National Institute of Agricultural Botany have been made for the equipment of the headquarters' trial ground with a granary and seed-drying and cleaning plant. This equipment is intended to

ensure that reliable and uniform supplies of seed shall be ready in good time for each year's trials, but it will also enable the Institute to keep the growing and cleaning of any new varieties for market in its own hands until they are in comparatively large bulks, and it will be possible to offer regularly to seed and corn merchants pure stocks of non-proprietary varieties of proved merit. The original supplies of seed will be drawn from the Cambridge Plant Breeding Institute, and will be renewed at regular intervals. It is proposed, for the present, to aim at building up a stock of Square Head's Master, Yeoman, Little Joss, Wilhelmina and Iron III wheats; and Grey Winter—a stock of Abundance that has been kept free from *Helminthosporium*—Thousand Dollar and Golden Rain oats. A number of new varieties of barleys and wheats are under trial, and it is hoped that some of these will soon be approved for placing on the market.

The number of samples tested at the Official Seed Testing Station during the 1927-28 season has broken all previous records, the total being only seven short of 30,000. The number shows an increase of 14 per cent. over the 1926-27 season, and is due principally to the receipt of 2,800 more samples of cereals and pulses than in the previous season. Other special activities of the station include the growing on of more than 600 plots of white clover in order to check the distinctions made in the laboratory between wild white and

Dutch white clover samples. Similar work is being carried out with the object of discriminating between early and late flowering types of red clover, and also to determine their nationality.

In addition to the normal work of the Potato Testing Station in connexion with yield, immunity and synonym trials, the Staff of the Station have been successful in developing a method, originally devised by Miss Glynn, of Rothamsted, for testing indoors the reaction of potatoes to wart disease; this can be used on a practical scale and give reliable results within a few weeks at any time of the year.

* * * * *

As an indication of the effect of a standard grading system in raising the quality-level of production, no better example could be found than that contained in an address at Belleville, Eastern Ontario, on January 4, 1929, by Dr. J. A. Ruddick, Dairy Commissioner for Canada. Commenting on the position of the Canadian cheese industry in the 1928 season, Dr. Ruddick emphasized the influence of quality both on demand and on the pockets of the cheesemakers themselves.

Before the year 1923, when standard grades for cheese were adopted in Canada, little progress was made in the improvement of quality. With grading and the publication of grading records, however, a wider recognition of the importance of quality became apparent, so that a definite increase in the proportions of cheese classified in the higher grades has taken place. This is shown by the following figures :—

		Boxes Graded	Per cent. Special and First Grade	Per cent. Increase Special and First Grade
1923	..	1,458,129	78.0	—
1924	..	1,584,359	84.7	6.7
1925	..	1,895,112	85.9	1.2
1926	..	1,845,581	88.3	2.4
1927	..	1,472,333	87.4	0.9 Dec.
1928	..	1,567,182	93.1	5.7 Inc.

These figures illustrate the efficacy of grading in stimulating a higher quality production. The important point is that an increase in the proportion of the total output which realizes the best prices means that relatively better returns accrue to the industry as a whole.

THIS Society was formed in 1920 by a small group of prominent Kent sheep breeders, and in its first year handled 25,000 fleeces. Its progress since that date has been consistent, as indicated in the following table :—

<i>Year</i>	<i>Members</i>	<i>Capital</i>	<i>Fleeces handled</i>	<i>Net Sales</i>	<i>Overhead charges (per lb.)</i>
		£		£	d.
1920	.. 75	611	25,000	12,500	1½
1921	.. 101	688	25,000	8,500	1½
1922	.. 165	894	45,000	16,501	1½
1923	.. 407	1,517	95,000	51,617	1
1924	.. 501	1,813	120,000	74,418	$\frac{3}{4}$
1925	.. 705	2,201	149,000	71,888	$\frac{5}{8}$
1926	.. 765	2,298	163,000	76,727	$\frac{3}{4}$
1927	.. 824	2,399	164,000	83,212	$\frac{3}{4}$
1928	.. 1,024	2,728	209,460	127,315	$\frac{3}{4}$

A full description of the working of the Society will be found in two of the Ministry's Reports, namely, Economic Series No. 1, *Co-operative Marketing of Agricultural Produce in England and Wales*, and Economic Series No. 7, *Wool Marketing in England and Wales*.* The Society has the support of the Kent County Branch of the National Farmers' Union. Full particulars can be obtained from Mr. F. C. J. Swainson, Kent Wool Growers, Ltd., Dover Place, Ashford, Kent.

* * * * *

As a corollary to clean milk competitions, many county authorities organize milkers' contests among the employees of the competitors and other regular milkers as a test of their capabilities, and as a convenient and fruitful method of effecting and maintaining a high standard of efficiency. These contests arouse great interest among milkers throughout the country, as they may properly be regarded as the preliminary rounds of a national competition culminating in the final contest organized by the British Dairy Farmers' Association at the London Dairy Show, in which selected representatives from many counties take part.

With the object of securing some measure of uniformity of judging in the county milking competitions, the Ministry

* These Reports can be obtained from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, price 1s. 8½d. and 7½d. post free, respectively.

in 1925 issued a scheme which was drawn up by the committee appointed to advise on the conduct of clean milk competitions. This scheme was widely adopted by county authorities and, in addition, was used in connexion with the competitions at the London Dairy Show.

The experience of the last few years, however, has made it evident that some modification of the original scheme is desirable, and the Ministry, with the assistance of experienced judges, whose co-operation was arranged through the British Dairy Farmers' Association, has revised the scheme accordingly. The main alteration is the omission of marks for "time taken in relation to quantity of milk produced," and the substitution of an allowance for carrying through the whole of the operations without undue loss of time. The amount of milk produced in relation to the time occupied is largely influenced by the characteristics of a particular animal and in many cases an unfair estimate of the capabilities of a competitor resulted from this comparison. A further modification of the original scheme provides that the cleanliness of the milk shall be judged on the result of the filter pad as obtained by the use of an approved sediment tester.

The revised scale of marks is as follows :—

Cleanliness and type of equipment used	5
Personal cleanliness of milker and suitability of dress ..	4
General style of approach and management of cow ..	5
Preparation of cow	6
Management of foremilk	5
Skill in milking (grip, motion and style)	25
Efficient stripping	15
Cleanliness of milk (Sediment Test).. .. .	20
No undue waste of time in any of above operations ..	15
	—
	100

Copies of the revised scheme (Form A 241/T.D.) have been circulated to Local Education Authorities in England and Wales, together with some notes on the practical application of the score-card, and steps are being taken to bring the scheme to the notice of local societies which may be concerned with the management of milking competitions.

It is hoped that the new scale of marks will be adopted by the British Dairy Farmers' Association and that the judging of their contests at the London Dairy Show will be carried out in accordance with the conditions of the revised scheme.

THE PRODUCTION OF EARLY LAMB ON A GRASSLAND SMALL-HOLDING

THOMAS SHAW, M.C., N.D.A.,

Seale-Hayne Agricultural College.

THE small-holding on which this work was conducted is one of 26 acres, devoted in the main to the production of milk. The holding, which is entirely grass, is farmed intensively under a recently introduced system of management. It comprises what were originally two outlying fields of the College estate, situated at an elevation of 460 ft., and overlying the Upper Devonian system, the characteristic rocks of which are the sandstones and shales. The latter, locally known as "shillet," constitute the sub-soil of these fields, and lie very near the surface.

One of the fields consists of 16 acres of old pasturage of fair quality, mainly perennial rye-grass, the meadow grasses, and some wild white clover. This field, for the purposes of farming the holding, had, at an earlier date, been divided into eight paddocks, each of 1·8 acres, with a paddock of one acre in which are now situated the farm buildings. The other field is a 10-acre hay field, which was seeded down with a complex mixture in 1922. It has a northerly aspect, and is very weedy, but has a herbage which is mainly good.

The poor nature of the soil of the holding, and its comparative lack of depth, make the land very susceptible to drought, and the general situation is such as to give the maximum exposure to the prevalent south-westerly winds.

A flock of 50 South Devon ewes was purchased towards the end of July, 1927, from local markets in the Ashburton district. For the most part they were in only fair condition, and this made it possible to keep them in an improving state whilst they were still with the ram. Many local flocks in the same season were in an almost half-fat condition during the tupping season, which was due to the flush of grass prevailing in July and August, following the much delayed growth in the spring. This tended to reduce the chance of good lamb crops; and, by going to the higher and poorer districts for the ewes which were to comprise the "flying flock," it was hoped to avoid this limitation. A certain measure of success attended this policy; during a most difficult lambing season, a higher percentage of lambs was obtained than was common in the south-west of England during the same year.

Management before Lambing.—The ewes were brought on to the holding on August 1, when they were run with a good

type of shearling Hampshire ram on the aftermath of the 10-acre hay field. This cross is very extensively employed in the south-western counties for the production of lambs suitable for early fattening, the Hampshire sire being generally preferred to the Suffolk or Dorset Down on account of its size, although the latter are also used to a considerable extent.

The ram was with the flock from August 1 to September 18, and during this period the ewes were receiving an allowance of $\frac{1}{2}$ lb. crushed oats per head per day. The practice of "flushing" the ewes before tupping is not usually followed in the locality, but, where it is observed, it is usual to rely on concentrated food up to as much as 1 lb. per day, rather than on the more effective clover aftermath, which is for the most part reserved for the dairy herd.

It would have been difficult to obtain on the holding the changes of keep that are necessary to maintain the ewes in thriving condition whilst still with the ram; and arrangements were therefore made whereby the flock could be agisted in the locality on several grazings in fresh condition. This practice of "agistment" was followed intermittently through the winter, the local custom being to provide all keep—no concentrates—and all labour for a charge of 4d. per ewe per week. The flock was accordingly away from the holding from August 22 until October 1, during which time they were getting regular change of keep. The ram was removed on September 18, and all concentrated food was discontinued.

The following table shows the movement of the flock until the commencement of the lambing season:—

TABLE I.		
Date	Locality of grazing	Concentrated food
Aug. 1-10	Aftermath on holding..	$\frac{1}{2}$ lb. crushed oats pr. ewe pr. day
" 10-22	Paddocks 6, 7 and 8 on holding	" "
" 22-Sept. 18	Agisted ..	" "
Sept. 18-30	" ..	—
Oct. 1-30	Paddocks 1-5 on holding	—
Nov. 1-30	Agisted ..	—
Dec. 1-8	" ..	—
Dec. 8-27	Hay field on holding ..	—

During the period August 22 to September 18 the flock was moved on to fresh keep every four or five days, and their condition was an improving one until the end of the tupping season.

The ewes returned to the holding on October 1 and were grazed over the first five paddocks, which had been rested for four or five weeks. There was, approximately, six days' keep

on each of the paddocks, and after these had been completely grazed the ewes were again away from the holding until brought back on December 8 for lambing.

After the removal of the sheep, paddocks 1 to 5 were eaten down by bullocks and in-calf heifers until November 20, when they were harrowed, and each paddock was given a top-dressing of 1 cwt. per acre sulphate of ammonia. It was intended to apply this top-dressing during the first week of November, but as there was still keep on the grazings, the application was delayed until early in December. The applications of sulphate of ammonia were made on the respective paddocks at intervals of six days, so that paddock 4 received its nitrogen six days after paddock 5; and paddock 3 six days after paddock 4; and so on. It was the intention to fatten both ewes and lambs off this specially treated grazing, and it was hoped that by varying the dates of manurial treatment a succession of early grazings would be obtained, which would make it possible to fatten out the lambs in good time for the early spring lamb trade.

Management after Lambing.—The ewes most advanced in lamb were drafted from the holding on to convenient fields situated in the neighbourhood, where lambing took place. For 14 days before lambing, the ewes received $\frac{1}{2}$ lb. per head per day of concentrated food, consisting of a mixture of equal parts linseed cake, crushed oats and maize meal. This was increased very shortly after lambing to 1 lb. per head per day. No hay was given throughout the feeding, and the cake allowance was all the more necessary on account of the comparatively poor nature of the keep available. It was essential to keep both ewes and lambs thriving until the grass was ready for them, and by February 20 the cake allowance had reached 1 $\frac{1}{2}$ lb. per head per day.

On March 4, there was sufficient growth on paddock 5 to accommodate, at any rate, the more forward lambs and their dams; and on that day 27 ewes and 34 lambs were drafted on to it.

Management of Ewes and Lambs on the Early Grass.—Three factors operated against any earlier use being made of the manured grazing:—

1. An excessively wet and cold winter resulted in much delayed growth.
2. The nitrogenous top-dressings did not go on as early as had been originally intended, so that whatever stimulus was to be derived from these applications was delayed.
3. The paddocks could have been stocked quite a week earlier, but it was considered sounder policy to wait until there was

ample keep in front of the sheep, rather than to have derived whatever advantages there might have been in the slightly earlier stocking, and have with it the serious risk of a shortage of keep.

With regard to this latter point, it must be remembered that the whole flock had to be fattened off the specially treated nine acres of grazing, and that once the flock was established on it, there it had to remain until ready for market. It was of the utmost importance to the success of the undertaking to have an ample supply of good grazing for fattening; and the date of drafting the flocks on to the grass was delayed for longer than seemed necessary.

On March 4, the grass on paddock 5 was several inches deep; it was very thick, and appeared, by the extreme fineness of the leaves, to be very tender. It presented an altogether unusual appearance; it was spring grass with more succulence, and a better colour. In order to make the fullest possible use of it, it was decided to fold the ewes over each paddock, and to allow the lambs to run in front of the ewes and so have the pick of the herbage.

This method of folding was secured by the mode of fencing illustrated in Figs. 1 and 2. Sheep netting was employed at each end of the "folding" fence, the middle portion of which consisted of iron hurdles sufficiently spaced to allow of easy access to and fro of the lambs. There was thus only one fence to move, the ewes being allowed to run back over the folded ground.

Table II illustrates the movement of the ewes and lambs the first time that they were folded over the paddocks.

TABLE II.

Paddock 1	Paddock 2	Paddock 3	Paddock 4	Paddock 5
<i>Fold 19</i> March 30	<i>Fold 12</i> March 22	<i>Fold 11</i> March 21	<i>Fold 4</i> March 11	<i>Fold 3</i> March 10
	" 23	" 20	" 12	" 9
<i>Fold 18</i> March 29	<i>Fold 13</i> March 24	<i>Fold 10</i> March 19	<i>Fold 5</i> March 13	
			" 14	<i>Fold 2</i> March 8
<i>Fold 17</i> March 28	<i>Fold 14</i> March 25	<i>Fold 9</i> March 18	<i>Fold 6</i> March 15	" 7
<i>Fold 16</i> March 27	<i>Fold 15</i> March 26	<i>Fold 8</i> March 17	<i>Fold 7</i> March 16	<i>Fold 1</i> March 6
				" 5

The vertical lines in the above table are the permanent fences running north and south between the paddocks; the

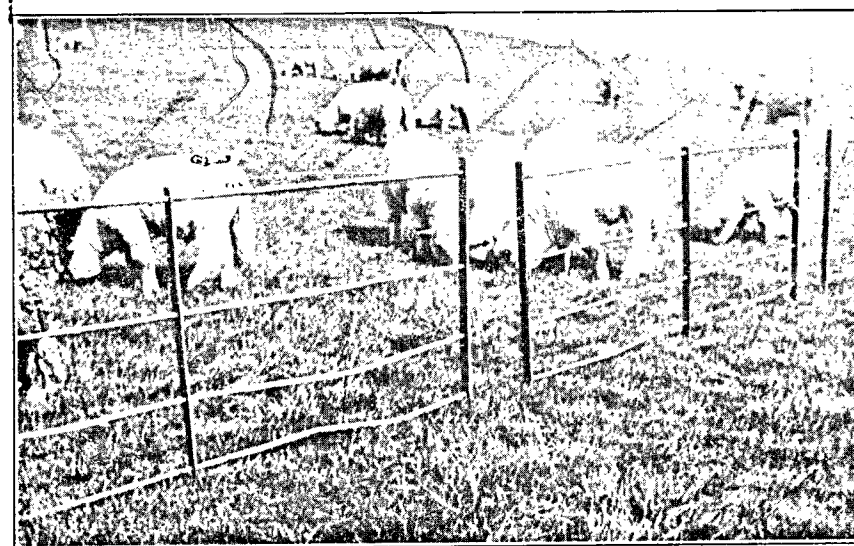


FIG. 1.—Photograph, taken March 15, 1928, illustrating condition of lambs and type of lamb hurdling. Note state of grass in foreground.

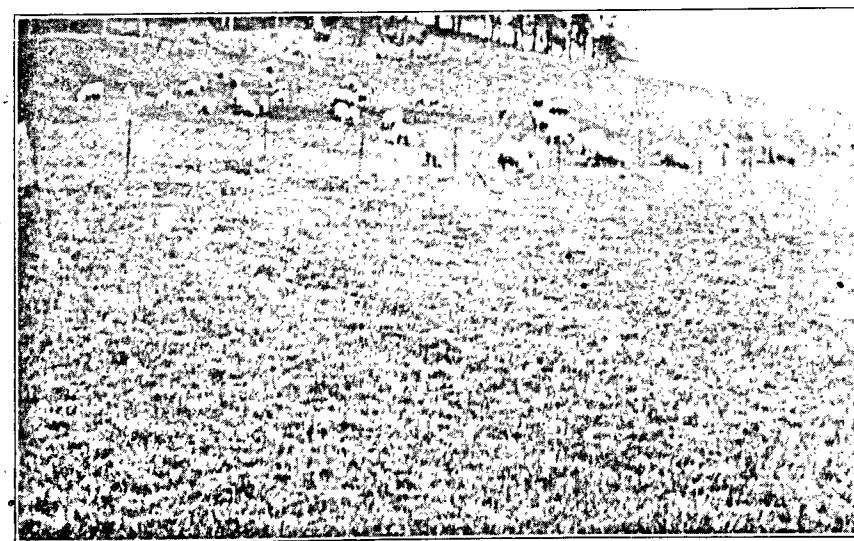


FIG. 2.—General view of one of the folds in Paddock 4.

horizontal dotted lines show the positions of the fold in each paddock.

After the completion of the grazing on paddock 5, it was decided to make four folds per paddock rather than three, as this would give a greater change of keep and also minimize waste of keep due to damage by treading. The approximate size of each fold was very slightly less than half an acre; the flock thus got a change of fodder almost daily.

During the period March 10-14, there were several severe frosts, which resulted in some damage to the herbage in the fold. The flock were removed from the paddock by night for these few days, and the difficulty did not present itself again. There seems to be little doubt that the class of herbage obtained from this treatment is more susceptible to damage by frost than what may be termed "ordinary" grass. The whole area suffered slightly from blackening during the cold spell, but only on the stocked folds was the damage at all serious.

After a paddock had been eaten down it was harrowed and the droppings were effectively distributed.

On March 31, the flock commenced to go over the paddocks for the second time, and during this period, for reasons to be explained later, only three folds per paddock were employed. Again the flock was moved daily on to a fresh fold, except on one or two occasions where there was unevenness in the keep available.

Cake Allowances.—The ewes had been receiving up to $1\frac{1}{2}$ lb. of concentrated food each per day before being drafted on to the early grass. The nature of the keep was such as to make this necessary to maintain their milk, but the fresh grass on the paddocks offered something very much better than the grazings they had hitherto been on. The cake allowance was therefore reduced steadily from $1\frac{1}{2}$ lb. as at March 4 to $\frac{1}{2}$ lb. per head per day by March 25. It was possible to effect this economy without any loss in condition of either ewes or lambs.

For the first few days on the grass, there was a tendency to scour, but a modification of the cake mixture eventually corrected this. The mixture fed from March 5 onwards was one of equal parts decorticated earthnut cake, crushed oats and maize meal.

The lambs, which were running over the grass in front of the ewes, commenced to receive concentrated food outside the fold on March 4, their first day on the paddocks. A mixture

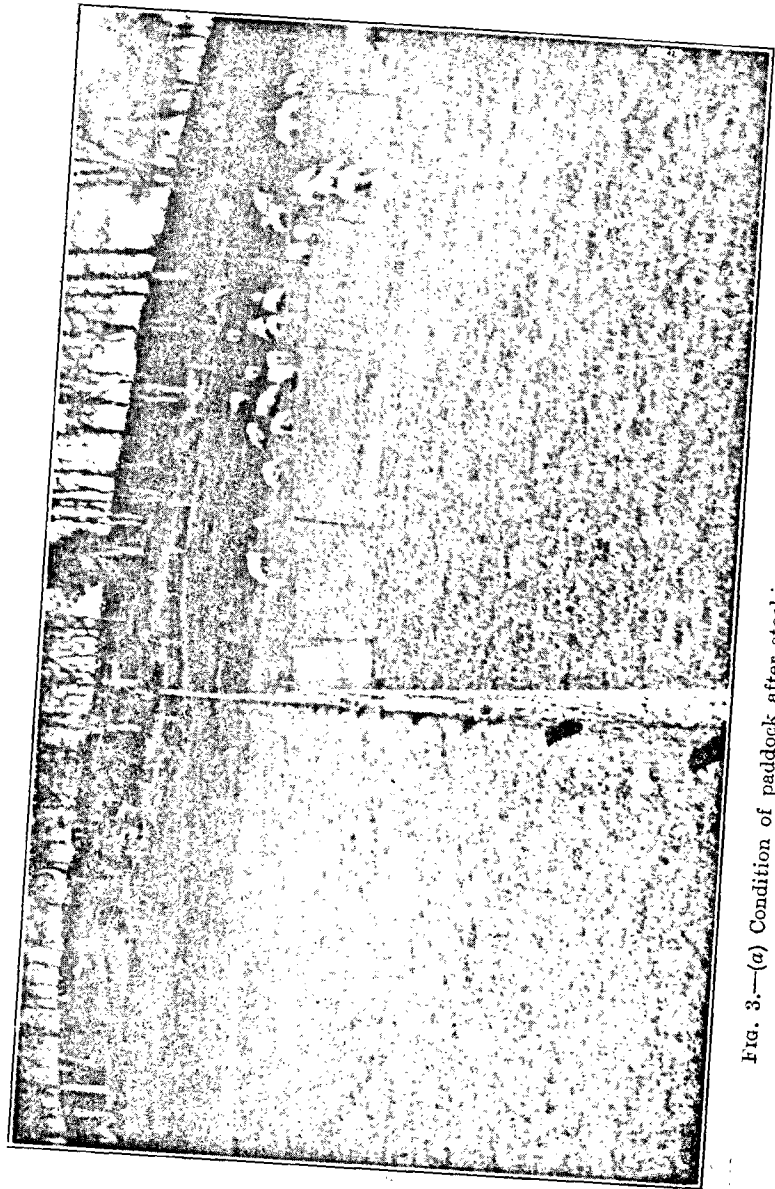


FIG. 3.—(a) Condition of paddock after stocking.

(b) A freshly stocked paddock.

was fed consisting of equal parts linseed cake, bran, crushed oats, flaked maize, locust beans, malt culms, and broken peas.

It was several days before they began to avail themselves of it, and on March 7 an allowance was made up to the limits of their appetite, viz., $\frac{1}{4}$ lb. per head per day fed in two feeds. The grass, as has been explained, was not available as early as it was hoped it would be, and it was therefore necessary to push on the lambs as rapidly as possible.

Everything was done to encourage their consumption of concentrated food. From March 5 to March 23, the cake allowance per lamb was raised from $\frac{1}{4}$ lb. per day to something between $\frac{1}{2}$ lb. and $\frac{3}{4}$ lb. per day, and it remained at this until the end of March when they had been through the paddocks for the first time.

On March 31, the flock commenced its second series of folds over the paddocks. The grass had made an excellent recovery, and as will be seen from the number of folds secured—three per paddock—there was ample keep. In spite of this, however, neither ewes nor lambs, and particularly the latter, continued to thrive as they had been doing previously. In an endeavour to improve on this state of affairs, a larger fold was used, and the cake allowance of the lambs was increased wherever possible. Their average daily allowance during this second period of folding was over $\frac{1}{2}$ lb. per lamb per day—practically double that during their first folding; yet they did not maintain their previous rates of growth.

The average weekly gain of the lambs from March 4 to March 30 was from $3\frac{1}{2}$ -4 lb. per lamb per week live-weight increase: whereas, even with the extra caking, this figure fell from April 1 onwards to from 2 - $2\frac{1}{2}$ lb. live-weight increase per lamb per week.

Disposal of Ewes and Lambs.—The flock for fattening consisted of 46 ewes and 61 lambs, and of these only 27 ewes and 34 lambs were used in the first instance on March 5 for grazing on the paddocks.

On March 26, the number was increased to 33 ewes and 43 lambs, and after that date the depletion in the fattening flock due to sales of fat lambs and ewes was made up from the 13 ewes and 18 lambs not at that time on the paddocks. After March 26, the number of sheep on the grazing paddocks fluctuated from week to week, and this should be borne in mind when considering their caking and their response in live-weight gains. The whole of the flock was eventually fattened off from these nine acres of specially treated grazing.

The ewes and lambs were sold fat in local markets, one or two being disposed of privately. The best of the lambs went off the holding by the middle of April, and it was difficult to bring the remainder into really good fat condition. After the third week in April, the best grazing on the holding had to be given to the dairy herd, and all sheep sold after that date, 10 ewes and 2 lambs, were in only a half-fat condition.

Profit and Loss Account.—The following account is a statement of profit and loss on the flock from the date of purchase until final disposal.

Profit and Loss Account.				Profit and Loss Account.			
		£	s. d.			£	s. d.
1927				1928			
July 31.	To 35 ewes	84	4 0	Mar. 14.	By 4 ewes, 6 lambs	18	4 0
Aug. 1.	To 15 ewes	39	7 6		@ 91s.†		
	To 1 ram	9	19 6	28.	5 ewes, 10 lambs,	21	0 0
July 31	Cake prior to tup-				@ 84s.		
to	ping: $\frac{1}{2}$ lb. per			3	barren ewes @	9	15 0
Sep. 18.	head per day for			65s.	...		
	7 weeks	4	16 0	5	fat lambs—2 @	13	8 0
Dec. 27.	Cake prior to			59s., 3 @ 50s.	...		
	lambling: $\frac{1}{2}$ lb.			April 5.	1 fat lamb	3	2 6
	per head per day			11.	2 fat ewes @ 57s.	5	14 0
	for 14 days	1	11 4		9 fat lambs @ 43s.	19	7 0
1928				12.	1 fat lamb	2	13 7
Jan. 1.	Cake after lamb-	21	0 0	14.	1 lamb	1	14 5½
	ing, to ewes, totals			15.	26 lambs, 15 ewes	87	0 0
April 5.	Cake to lambs	2	4 1	25.	5 fat ewes @ 68s.	17	0 0
	Agistment charges*	22	6 0	June 5.	10 ewes, 1 ram, 2		
	Labour	7	1 0		lambs	29	15 0
	9 cwt. S/A	5	1 3	Sep. 21.	Hiring out of ram	5	0 0
April 5.	Rent, rates and			(1927)	Sales of 5 ewe and		
	sundries†	1	12 0		2 lamb skins	4	0 0
	Balance, being						
	PROFIT	38	10 10½				
		£237	13 6½			£237	13 6½

* The agistment charges have been made to include all grazing on the holding up to March 5.

† Sundries include proportionate charges for fencing, unexhausted manurial values, and similar entries. No allowance has been made for unexhausted values of feeding stuffs fed to sheep.

‡ Auctioneer's fees and market tolls have been deducted from the actual selling price, the figures given representing the net receipts.

In spite of an exceptionally difficult winter, with its correspondingly heavy losses in both ewes and lambs, a very fair return was made. This in the main was due to the possession of really good grazings throughout March and April, on which it was possible to bring both ewes and lambs into fat, or in some cases half-fat, condition. It will be noticed

that ewes were sold out fat concurrently with the lambs, and in many cases they realized prices in excess of their cost. After the removal of their lambs, the ewes fattened extremely well, and their very favourable sale is another factor to be credited to the grazings.

Conclusions.—In view of the results obtained, and in the light of the experience gained in the management of the flock on the “out-of-season” grass, it seems reasonable to conclude :—

1. That, provided land is in good condition, and that there is no reason for supposing it to be lacking in phosphate or potash, then an application of a suitable dressing of sulphate of ammonia in early November will provide a considerable amount of good keep as early as February or March.

In the particular instance under review, grass was obtained two months before there was effective grazing in fields in the same district, and it was made possible to fatten out lambs successfully for the early and more profitable markets. In this connexion it should be noted that the nine acres of grass so treated was stocked very late in the autumn—a circumstance that might conceivably have operated against an earlier growth than was actually obtained.

2. The grass obtained under such a treatment has a feeding value that makes it possible to fatten ewes and lambs successfully without the use of excessive supplies of concentrates. In the case described there is little doubt that, had it been possible to get the sheep on to the paddocks a week or two earlier, the cake consumption could have been appreciably lowered.

3. It was possible to put into the markets fat lambs from grass, at the same time that lamb was reaching the market from the arable land.

4. Where a system of folding can be practised in the manner described, it would be advisable to employ a greater area of grass than was possible in this particular case, and so avoid the dangers and drawbacks attendant when folding over the same land twice. The second fold is in the nature of “stale-keep,” and, as indicated, is not conducive to good growth.

5. If such grassland is stocked too heavily during the very early months of the year, such stocking will have a very serious limiting effect on the capacity of the grazing in May and June.

The writer desires to acknowledge the co-operation in this work of his colleagues on the Agricultural Staff of the Seale-Hayne College and, particularly, that of Mr. R. Little, the manager of the small-holding.

EDUCATION FOR AGRICULTURE

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DESPITE the dominance of industrial and commercial pursuits, a large number of English boys still feel a call towards farming or some form of country career. The sources lie deep in the history of the race; and to many a man there is no occupation so intimately and permanently satisfying as that of drawing his living out of the land by growing crops or raising stock. However, as the towns increase and populations swell, the contacts between the great mass of boys undergoing education and the countryside become less, and the means of entry upon a rural career more remote, until it might almost seem that farming would become an hereditary career open in practice only to the sons and connexions of farmers. The present depressed condition of agriculture, and the comparatively small returns it appears to promise either for labour or for the employment of capital, further restrict the entry of boys into a business which now engages only about one-tenth of the population. But agriculture is still the indispensable basis of our civilization and the basal industry of the Empire as a whole. Indeed, in any survey of agriculture as a career the employment open in our overseas Dominions and Colonies must bulk large.

Granting that many boys have a desire to live upon and by the land what openings are there before the boy who is still at school, and how should he direct his education in order that it should enable him to make his living by farming or some kindred occupation?

At the outset one limitation should be recognized. To a great extent farming in Great Britain is carried on by small one-man businesses, employing, say, from four to 20 labourers, but no sub-managers or skilled assistants above the rank of bailiff or foreman, *i.e.* a specially experienced man of the labourer class. It follows that farming offers few or no subordinate posts into which an educated boy can normally enter at a comparatively low salary, but which will enable him to keep himself and will lead step by step, as he proves his efficiency, to the highest posts. This is the way in which

the great industries recruit their staffs. But only in a few cases is farming organized on these lines, and thus the opportunities for apprenticeship in a subordinate position of responsibility are few and occur irregularly. Roughly speaking, the boy who wants to farm at home on his own account must have a call upon some capital. Posts there are, and manager-ships are to be found, but they are not the normal ordinary way of entry into the career of farming.

Let us now consider what the openings actually are for the boy who can afford a training, but then must make his own way.

In the first category we may place what may broadly be termed "the services." There is a limited but growing demand for young men possessed of expert knowledge of agriculture, or of the cognate sciences, for the public services at home and abroad. In England, for example, the Ministry of Agriculture requires a certain number of inspectors, live stock officers, veterinary officers, and other officials with a technical equipment. There are a number of research stations, employing a staff of investigators, and there are agricultural colleges requiring teachers and advisory officers. The County Councils also employ agricultural organizers and instructors. There are, again, the Indian and Colonial services which employ administrative officers possessing general agricultural knowledge as well as specialists to deal with matters such as soil, plant diseases and plant breeding. Again, many of the great corporations, growing crops like cotton, rubber, copra, tea, etc., require both agricultural managers and scientific specialists.

It is necessary that the candidate for this type of post should possess a degree or the diploma of an agricultural college. Further, we may divide the appointments into two classes, agricultural and scientific. In the first class come the administrators, the teachers of agriculture, the agricultural organizers, and the estate managers of the business corporations. To the second class belong the investigators, the teachers of subjects like agricultural chemistry and botany, the economic entomologists and mycologists (who are concerned with insect pests and fungi), the plant breeders, and so forth.

Scientific Appointments.—Considering first the latter group of men, there is general agreement that the scientific officer should begin by obtaining a degree in pure science, followed by a post-graduate training in his special subject. Indeed, the boy should take up his bent already at school, and the

openings and prospects are sufficiently attractive to suggest that parents and schoolmasters might put this career before boys of the right type, *i.e.*, boys possessed of definite ability in a scientific direction with some inclination towards the country.

The school course should be on the scientific side, and the boy will find more openings if this takes a biological rather than a mathematical trend. Agricultural chemists are, of course, wanted, and all the biological sciences should have a background of chemical knowledge, but the outfit of chemistry, physics and mathematics, which is the usual equipment of the boy passing through the scientific side of a secondary school, opens fewer doors to a career of an agricultural character than a more biological training. It is a matter of common knowledge at the present time that it is difficult to find men for the official posts offering themselves in such subjects as entomology and genetics, whereas plenty of chemists are available, and one of the sources of this shortage is the neglect of biology in the schools, which reacts in turn upon the number of students of botany and zoology in the universities. It is not that highly specialized instruction is demanded from the schools, but rather that boys should then be made acquainted with the broad processes of life, should learn to understand how a plant grows and how an animal breathes and feeds. There is a general biological science which ought to be part of the equipment of every educated man, valuable for its own sake as adding to the meaning and interests of life, without regard to its possible professional use. It should include some acquaintance with the main features of the animal and vegetable kingdoms, their distribution and origin, and the elements of animal (and human) anatomy and physiology. This kind of knowledge at the school stage is essentially an affair of stimulus and interest rather than of exact knowledge; it lacks the discipline and logic of physics or chemistry, and can rapidly be assimilated by a boy of reasonable intelligence; but it is none the less a good preparation for life. In the schools it demands neither expensive equipment nor a large share of the time-table, provided that the teacher aims at stimulus rather than examinations, and directs the boy towards the books—and there are books—which will kindle his imagination.

Meantime also the boy should be using his summer holidays to get some touch with farming. He will have no time to take a specific course of instruction in agriculture, and yet, since

his later work will deal with problems of farming, his treatment of them will be all the better if he has some appreciation of the ordinary routine of the business. He will have to talk to farmers, not indeed as a farmer but perhaps as a chemist or mycologist, and he will talk more convincingly if he knows something of the way in which the members of his audience go to work, and can understand the limitations imposed in practice by men and money. The boy should get employment upon a farm during some of his summer holidays and long vacations: he may be called upon to pay a little on the first occasion, but he will soon be worth his keep, at least after he has learned to go out with the horses.

School leads to the university; and by this time the boy should know his bent sufficiently to decide upon his subject—chemistry, botany, or zoology—though in many universities his option will not have to be taken until after his preliminary (or intermediate) examination. For the study of a biological subject it will not matter if his school training has been but sketchy; many professors prefer a fresh mind if only the student be interested. It is now his business to stick to the accepted routine and to get the best degree he can: he need not trouble himself as yet about applied science, but as his course progresses he will begin to develop an attraction towards one or other branch of his subject, *e.g.*, if he is a botanist, towards plant physiology or mycology or genetics.

Having secured his degree, the student has still to obtain his professional training, and he may not be in a position to continue his education unassisted. There are, however, certain scholarships open. The Ministry of Agriculture awards annually research scholarships of the value of £200 for three years, the holders of which work at a research institution at home and then abroad. No guarantee of employment is given, but the holders have never failed to find immediate employment. The Colonial Office also offers scholarships, tenable for one year at a research institution at home, and for the second year at the Imperial College of Tropical Agriculture at Trinidad. These scholars, if satisfactory, are drafted into the Colonial Agricultural Service. The Empire Cotton Growing Corporation awards similar scholarships in order to recruit the technical officers which it requires. The Department of Scientific and Industrial Research also offers scholarships without any conditions as to the character of the research, whether pure or applied, in which the scholar will engage. There are other less regular and formal opportunities, but in one way or other

the man who seeks a career on the scientific side of agriculture must begin with a degree in pure science and continue with some specialized post-graduate training.

Agricultural Appointments.—The other group includes the administrators and teachers concerned with agriculture proper, not with agricultural science. As far as school is concerned they should follow the same course as the boys who are going to qualify in agricultural science; they should acquire as much science as the school permits, especially on the biological side, and they should take every opportunity of gaining experience of practical farming. From school they must pass to an agricultural college, of which there are the two types—agricultural departments of a university (*e.g.*, Edinburgh, Glasgow and Aberdeen, Oxford, Cambridge, the Armstrong College at Newcastle, Leeds, Reading, Bangor and Aberystwyth), or the resident colleges (Wye, Harper Adams at Newport, Salop, the Midland College at Sutton Bonington, and the Seale-Hayne college in Devon). The course leading to a degree or diploma requires two or three years, and in some cases the qualification is not obtained until the student has also put in a year's practical work upon a farm. There are a certain number of scholarships obtainable, particulars of which may be obtained from the Education Office of the county in which the student resides.

At the end of the college course there are again a few scholarships available. The Ministry of Agriculture offers annually four or five post-graduate scholarships which give the holders a year's special study at home, *e.g.*, in agricultural economics, and a year abroad, in order that the student may enlarge his experience by contact with a different system of agriculture. The Colonial Office offers scholarships leading to posts of an administrative character in the Colonial Agricultural Service, tenable for one year at home and for the second year in Trinidad. The Empire Cotton Growing Corporation also selects men for further training before appointment. There are, however, not so many scholarships open to the agriculturist who has graduated as to the scientific worker, and the man we are considering will be best advised to consolidate his knowledge by a year or two of practical work upon a farm before he seeks an appointment.

Of course this is more necessary to the town-bred student than to the man who comes from a farm and has early acquired a background of experience. A man of the latter type will make himself more valuable if he can put in a further period

of study in agricultural economics. While economics (and its grammar—book-keeping) forms part of every course of agriculture, it is so essentially the basis of sound management, and the guiding principle governing the teaching of agriculture, that it well repays a period of special study. A man thus equipped with a college degree or diploma in agriculture, some experience of practical farming other than that of the college farm, and an insight into economics and farm costing, should have no difficulty in obtaining an appointment.

Students who Wish to Farm.—We have now to consider the boy who wants to farm but who has no scientific bent nor much likelihood of distinguishing himself in a college course. The determining factor must be whether he will be able to command some capital, say £1,500 or upwards for ordinary farming, something less if he takes up market gardening or poultry keeping. He should still obtain some basis of technical instruction, and should join either a college for the course of two years, or one of the Farm Institutes, which give a course of a more restricted character extending through the winter months. It is a matter of divided opinion whether this course should precede or follow a period of one or two years' work upon a farm. On the one hand it may be argued that only after he has acquired some acquaintance with farming will the boy appreciate the meaning and importance of the instruction which he receives; on the other hand, there is the danger that if he breaks the habit of bookwork he will never come back to it.

It may be suggested that the break between school and technical training ought not to be too long, and as in either case the boy must gain experience, after study at his college or institute, before he can set up in business for himself, the initial introduction to farming need not be a long one. Let the boy leave school at the Easter before he is going to join an institute or college, and put in the six spring and summer months at work on a farm.

During his course of instruction the boy will get some idea of what kind of farming he wants to follow, and this will determine the sort of farm to which he should afterwards go. The head of the college or institute will generally be able to help him to find the right farmer. The old way of learning farming was to pay a premium and become a "pupil," but in all too many cases the pupil got little more for his money than his board and lodging and the run of the farm. It is much better that the youngster should make up his mind at

the outset to put in a year or two's work as a labourer. No experience will be more helpful to him afterwards, in dealing with his men and in securing from them a reasonable day's work.

After a year or so on his first farm he may seek a more responsible place which will give him contact with management and marketing. He should not be in a hurry to take a farm of his own; experience is a large factor in the preparation for farming, and he needs to make sure of the kind of business he can best embark upon and the farm that will answer his purpose. Many a young man has crippled himself at starting by rushing into a poor farm before he has realized how costly poor land may be, and how unresponsive to the routine he has learnt on a better soil. The case, however, of the boy with capital is a comparatively simple one: all one need insist upon is the practical value of some early technical training, enough to give him when a farmer the power of making use of the scientific developments that are quietly taking place in agriculture, and to introduce him to the economic considerations and methods of criticism that should govern his business.

Far more usual is the case of the boy who wants to farm but must look in the main to making his own living as an outcome of his education. It must be realized that, for the reasons before stated, the prospects are not good for a boy who wants to remain in this country. They are not good in the sense that he must expect a long period of apprenticeship, when his work and his pay may be little more than that of a farm labourer, and even when he does pull out and obtain a responsible managerial position the reward will be less than attaches to positions involving less skill and initiative in the ordinary walks of commerce or industry. This is a defect inherent in agriculture at the present time; it is, comparatively speaking, an unremunerative business for all concerned—capitalists, managers and labourers.

Assuming, then, that we are dealing with a boy who wants to have an agricultural life at home, he should follow pretty much the same course as has been indicated for the farmer with capital, *i.e.*, he must get some systematic instruction in college or a farm institute and then make a start as a labourer. But there are directions in which he can specialize so as to lead to a better start. He can take special dairy courses, so as to be able to offer himself as a cheese maker, or as a cowman in charge of a herd producing Grade A tuberculin-tested milk.

Again, he can learn the methods of cost book-keeping; there is some outlet among the larger farmers for assistants who can keep accounts and work out costs of production. Poultry keepers are also sought, men who can be trusted to manage a thousand birds at a profit. In both market gardening and fruit growing a young man can find openings for special work at better pay.

Openings in the Empire Overseas.—Undoubtedly, however, some advantages are offered to the boy of energy in the Dominions as compared with England. He will have to work, and that as a labourer, but thereby he does not lose caste, as it is too often imagined he does at home; his cash earnings are greater and he can put by money, whereas only by the sternest resolution could he save anything at home. He can eventually start farming on a much smaller capital, and though the actual profits may be small there are many and various opportunities in a new and developing country. It is often said that land is cheaper and the returns from it greater in England than in any of the Dominions, if it is attacked in the same way; it is the speculative element, the possibilities of rising land values and outside ventures, that make life overseas in some ways more attractive.

Our immediate question, however, is what training should the English boy receive before he goes overseas? It is not necessary, or even desirable, that he should go through a grounding in the routine of a British farm. Canadian or Australian farming is of necessity a much more primitive affair: the land has to do the work, and labour is not available for our methods, in the acquisition of which the boy may lose some of his native adaptiveness. This is the quality that is most valued overseas, where the English boy has often a bad name because of his supposed unhandiness and hesitation in tackling what is regarded as a duffer's job. At school the intending colonist should get as much workshop experience as he can, not so much in fine carpentry as in rough constructional work. A few lessons from a saddler and a little practice in leather working will prove useful up country when harness has to be repaired or made on the spot. Let him go on a farm long enough to learn how to handle a horse, harness it and drive a wagon, how to plough, to handle cattle, and to milk a cow. He should learn to ride, and still more, nowadays, he should learn the driving and care of a tractor.

As to an introduction, if no friends are available, the great thing is to travel straightway from the towns into the real

farming country and then to go from farm to farm until work is found. But if less of a plunge is desired it is a good plan to enter at one of the agricultural colleges in the Dominion chosen. There the boy will work off his first strangeness, will be introduced to the sort of farming he will have to follow, will make friends and get information as to where he can obtain a start.

But again it may be repeated that in the present phase of the world's history, agriculture is not the pursuit likely to lead to a rapid fortune or even a big income. But it does yield a strenuous and healthy life, with enjoyments on the credit side for which the town dweller has to pay dearly.

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AN EXPERIMENT IN GRASSLAND MANURING, 1928

G. T. GARRATT.

MR. G. K. CHESTERTON once suggested that "the much admired individual who made two blades of grass grow instead of one was a murderer." Perhaps a little experience of running a mixed farm on gault or boulder clay would have led him to modify his views about the iniquity of laying down that intractable land to grass. Further, where the pastures already exist, there must be some virtue in making them as productive as possible. A considerable proportion of the heavy land belt which runs through the Eastern Counties is now being allowed to fall down to grass. Much of it is fourth- or fifth-rate pasture land, and sometimes it is merely a worn-out sainfoin ley which has grown so dirty that it did not seem worth ploughing up. The poor appearance of this land has encouraged the belief that it is impossible to produce good grass on heavy land in those counties which have a low rainfall. As the area under grass seems likely to increase rather than decrease, this question is of some importance, and a year's experience of treating some mediocre pastures intensively may be of interest.

Treatment.—The writer's farm is in Cambridgeshire, on the heavy land which covers so much of the north-west of the county. The area taken was about 30 acres of grassland, most of which had been laid down to grass shortly before the war, but nine acres (Plots 1 and 2) were less than eight years old. The land had been treated moderately well during the last five years, but no one would have described the pasture as better than a poor second-class. This land was divided into

five plots of about $4\frac{1}{2}$ acres each, the remaining 7 acres being kept as a reserve, and a hay crop taken off them. All five plots received 4 cwt. per acre of superphosphate in November or December, 1927, and in 1928 were treated as follows:—

Plot 1.— $1\frac{1}{2}$ cwt. of calcium cyanamide per acre were applied on January 9, and another equal dressing a fortnight later. 1 cwt. of nitrate of lime was applied per acre on April 7, after the plot had been grazed once.

Plot 2.— $1\frac{1}{2}$ cwt. of sulphate of ammonia per acre were drilled on February 8. Another 1 cwt. per acre was applied after the first week's grazing (March 27), and a further $\frac{1}{2}$ cwt. after the second grazing (April 21).

Plot 3.—This received 2 cwt. of nitrate of lime on March 14, and 1 cwt. on April 11 after the first grazing.

Plot 4.—Two dressings of calcium cyanamide were given at the same time, and at the same rate as on Plot 1. No nitrates were applied subsequently till much later (July).

Plot 5.—3 cwt. of nitro-chalk per acre were applied on March 21, and the same quantity on April 29 after the plot had been grazed once. Two further dressings of 2 cwt. per acre were given in September and October.

The usual rotational grazing procedure was adopted. There were arrangements for watering in each plot. Fifteen milch cows were moved in rotation from plot to plot, and followed by 11 heifers and yearlings. The stores were subsequently reinforced by three calves, and sometimes by one of two dry cows. Three horses and a pony usually went with them for part of the day. After the stores had left a plot, it was harrowed fairly drastically, and sometimes rolled. The cows are recorded, but no attempt was made to weigh the stores.

Up to June, the system worked according to rule, except that Plots Nos. 2 and 4 had less grass than the others, and the first rotation, which began on March 20, was somewhat uneven. It was soon apparent that the weather is an all-important factor. A spell of drought—there were two or three during the summer—upsets the experiment in several ways. If a plot has been eaten bare, then harrowed and perhaps a second dose of nitrates applied, it is not likely to “move” until there has been at least one heavy shower. In very dry weather it is useless to apply the nitrates at all. A shortage of grazing in the other plots, due to drought, means curtailing the week during which the cows would normally be on one plot, and they tend to follow too closely on the heels of the stores. In practice the regular rotation was considerably modified, and the five plots were given about three weeks' rest in August, while the cattle were kept on the reserve plot, and in an orchard which was outside the experiment. It would, therefore, be dangerous to draw

too definite conclusions from the number of days' grazing on each plot, or the amount of milk produced in specified weeks. A single shower of rain might entirely alter the carrying capacity of a plot, while the “drying off” of a cow before calving would upset the figures for milk produced.

General Observations.—Certain general observations can, however, be made.

(1) The sulphate of ammonia applied in February gave a good “bite” of grass by March 20, and cows were able to begin grazing at least a fortnight earlier than is usual in this district. The nitrate of lime seemed equally rapid in its effect, but not the cyanamide or the nitro-chalk, though the latter acted very quickly when applied in September.

(2) The plot system of grazing undoubtedly made some improvement in the milk yield from April to September, but it would be impossible to give exact figures for the increase. The year's average of 8,817 lb. per cow showed a considerable advance on the previous year.

(3) The condition of the stores at the end of September was a noticeable feature. The stores, unlike the cows, had received no other food, but they were almost “fat” at the end of the summer. This fact undoubtedly impressed local farmers who are used to heavy land pastures, and saw the stock.

(4) The herbage on all plots had improved. There were hardly any signs of moss or “fog,” both of which had been much too common on Plots 1 and 2.

(5) The amount of feed at the end of October was considerably more than on any surrounding grassland. The effect of the September dressing of nitro-chalk on Plot 5 was remarkable, any places which the drill had missed being quite obvious within a few days.

(6) Though the plots suffered from the long drought, they kept their colour, and the grass was always palatable.

It would be difficult to translate these advantages into terms of hard cash, which could be set against the yearly cost of nitrates, the capital cost of extra fencing, and the comparatively small item of extra labour. Another factor which must be considered is the risk of over-stocking in a dry season. Eleven weeks' drought early in the summer—such as occurred in 1927—would reduce the plots to little more than their ordinary carrying capacity in a dry season. A farmer who had reckoned on being able to keep, say, another 30 per cent. of stock would either have to feed his cows at

great expense, when milk was at summer prices, or sell stores at a time when no one would want to buy them. Few farmers in the drier counties, therefore, would care to risk carrying more than a small percentage above their usual stock, and in a favourable season the effect of using nitrates would be to let them mow a larger area for hay. The profit and loss account would therefore be further complicated by considerations of the price of hay, and reliable costings would have to be based on several years, including some wet and some dry ones. Even the advantage of three weeks' or a fortnight's earlier grazing is one which must be reckoned chiefly in terms of hay.

Application of the Intensive System.—There would seem to be many ways in which this system of intensive grassland cultivation could be applied on dairy and grazing farms, or to the pastures of mixed farms.

(a) A much less intensive method could be used. Farmers who usually divide their pastures into three parts, and move their stock round these, might apply some nitrates to one part in February, and give a second dose after those fields had been grazed down. They would thus get an earlier "bite" on a third of their land, and probably a slight permanent improvement of the pasture.

(b) Farmers might run the same stock as at present, but keep an extra field or two for hay, and expend the value of the hay on nitrates for the area to be grazed.

(c) The plot system, as described above, has certain advantages, but there is no doubt that at least eight plots are needed in those counties where the rainfall is small. It is also essential that there should be a good water supply in each plot. On any farms where the division into plots and the supply of water would entail heavy capital expenditure and daily pumping, it would probably be best to adopt a simpler and rougher method.

(d) A still more complicated and intensive system might be tried experimentally. The method of using equal plots is not ideal. The milk yield is apt to vary considerably during the week or more which the cows spend on each plot. The yield probably rises soon after they have been moved, and then falls towards the end of the time, so that the farmer is tempted to move them on too quickly, and so jeopardize the whole system during a spell of drought. The cows also waste some of the best grazing, when they move on to the new plots, by roaming over it, trampling and soiling it. This

occurs chiefly at night. The method of tethering cattle, used on the Continent, would prevent this, but is hardly likely to be adopted in England. The best alternative is to allow the cows to graze for a few hours only during the first two days in the new plots, and this has been tried on a few farms. These two disadvantages of the present system suggest that the ideal arrangement would be to have four or five fairly large plots, which need not be equal in size, but must have water available. These may be called A, B, C, D and E, and from them would lead off several much smaller plots, Aa, Ab, Ba, Bb, etc. The latter need not have water laid on to them, and they could also vary in size. They would be manured much more intensively than the large plots, and some of them might even be watered or treated with liquid manure in order to counteract the effects of drought, and the difficulty of making the nitrates available in dry spells of weather. The cows and stores could be moved round the large plots as at present, but after the cows had been two or three days on, say, plot A, the gate of plot Aa, and subsequently of Ab, would be left open for a few hours daily, until the grass was fairly short. This would slow down the rotational movement of cows and stores round the main plots, and would keep the food value of the grazing much steadier during the periods when the cows were on them.

While the whole system of grassland manuring is still in an experimental stage, most farmers who wish to try it would probably be wise to adopt some very simple variation, and content themselves with the application on part of their land of some slow-acting nitrates in the autumn, or of quick-acting nitrates in February, following these up with some very light doses of nitrate of lime or sulphate of ammonia after the stock have eaten each piece of land quite bare.

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NOTES ON CIRCUMSTANCES AFFECTING THE QUALITY OF MILK

THE marked development of dairy farming in recent years has given rise to an increasing interest in modern methods of milk production. That interest has not been confined to producers and consumers; the distributors, both wholesale and retail, are giving more attention to the chemical as well as the bacteriological composition of milk. There have been several cases of buyers of milk offering a special bonus for high fat and low bacterial content. The time may be

approaching when the buying and selling of milk as between the producer and the distributor will be conducted mainly on a quality basis.

During recent years much progress has been made in the improvement of milk supplies with respect to bacterial content. For that purpose schemes of lectures, demonstrations and technical advice are provided and are in operation, and there are many producers who are in a position to benefit by a bonus for bacteriological quality. In respect of chemical quality (*i.e.*, the proportion of fat and of solids-not-fat), however, there is room for producers to exercise a consideration which is not always given.

In many respects the dairy farmer is helpless in the matter of the chemical quality of the milk yielded by his herd; the percentages of both fat and solids-not-fat are apt to fluctuate without any obvious reason. Repeated experiments have shown that if a cow is well nourished no alteration or improvement in feeding will permanently alter the quality of her milk. The known factors, however, some of which are controllable, and all of which are associated with variations in the quality of milk secreted, should be carefully considered by all milk producers if they wish to help both the community and themselves.

The following factors have been found to be associated with variations in the quality of milk.

Breed and Strain.—There is a marked difference between British dairy breeds in regard to the quality of the milk they yield: the Channel Island breeds produce by far the richest milk. Again, there are individual differences within a breed: it is not infrequently found that certain cows in a herd give, on the average, milk of high chemical quality, whereas others in the same herd may be, continuously, low-quality yielders.

It is by no means certain that the breed or cow which produces the largest yield secretes milk of inferior quality, although it is more or less true that the highest yielding breeds do not as a rule produce the highest quality milk.

In the first place, considering these known facts, the herd owner who desires to make the best of his business will be well advised to keep careful yield and quality records of the milk produced by individual members of his herd, so that he may be guided in the selection of the cows from which to breed. Much can be done in this way to grade up a herd. The ability to produce rich or poor milk seems to be hereditary, and this hereditary trait appears to apply equally to both

parents; therefore, every care should be exercised in the selection of the sire. Secondly, if it is desired to persist with a herd of a particular breed on the ground of quantity production, and it becomes the aim of the owner to raise the quality immediately, then it is usually advisable to include a percentage of animals of a "high quality" breed, such as the Guernsey or Jersey.

Intervals between Milkings.—Uneven intervals between milkings are perhaps the commonest cause of wide variations in quality. The butter fat may easily vary to the extent of 2 or 2.5 per cent., and, in the case of high yielding herds, the solids-not-fat may also be affected, though not to the same extent. Uneven intervals are often due to labour conditions, transport and train services; but the farmer should aim at a night interval of not more than 13 hours, and the heavy-yielding cows should be milked last in the evening and first in the morning.

The Efficiency of the Milker.—Inefficient milking can, and often does, affect the quality of the milk. The operation should be carried out quickly, quietly and thoroughly, and in all cases the cow should be treated with every consideration. Particular care should be taken to ensure thorough stripping, as the fat content of the last milk so obtained is often as high as 7 or 8 per cent. Moreover, rough stripping will result in loss of butter fat, and injury to the udder muscles.

Proper Bulking of Milk.—Owing to the variation in chemical quality of milk from individual cows, it is necessary to ensure that the milk is bulked in churns or other vessels in such a way as to represent the average quality of the herd. Where high quality cows are included in the herd, they should be housed in such a way that an even distribution of their milk throughout the bulk will be certain. This precaution is particularly important where milk is bottled on the farm; neglect of it has led to wide variation of fat content in the highest grades of milk.

Health.—Contentment, which is fostered by comfortable housing, ample light and ventilation, tends to increase the general quality of milk produced. It is important to ensure that full advantage is taken of these conditions. In the case of individual cows, quality is often affected by temporary indisposition, recent calving, chill of the udder, abnormal conditions, and any unusual excitement. Stockmen should, therefore, pay attention to the general condition of individual

cows, and during any abnormal period the milk should either be tested, or withheld temporarily from the bulk.

Food.—Although indisputable evidence is incomplete, it is generally held that, provided a herd is receiving a properly balanced ration, and the cows are fed according to milk yield, food has little permanent influence on the chemical quality of the milk. There are many herds in existence, however, where the rations are unbalanced, containing too great a bulk, too much starchy matter or oil, and an insufficient albuminoid and mineral content; in such cases improved feeding might raise the general quality, particularly in the case of a solids-not-fat deficiency.

The solids-not-fat content is sometimes adversely affected when the herd is turned out to spring grass. The reason has not yet been sufficiently studied to enable any definite recommendation to be made; but it is worth while to try the judicious use of suitable concentrates, preferably those low in albuminoid content. Similar care is needed towards the end of the grazing season.

Period of Lactation and Age of Cow.—It is found that there is frequently a slight depreciation of the chemical quality of the milk yielded where lactation is extended to a period beyond the normal (9-11 months), and in abnormal old age. These factors are unlikely to influence the quality of milk from the whole herd, unless the average age of the cows is unduly high and calving down is practised only at a certain period of the year. In such cases the remedy is simple and obvious.

Summary.—It is improbable that all the above factors will be found in any one herd, but in cases where the chemical quality is somewhat low, some of these factors will probably be present. In order to determine the exact cause, definite information and investigation are essential.

"The first necessity, therefore, is the taking and keeping of accurate records of yield, fat content, and solids-not-fat content, both for the herd as a whole and for individual cows; only by these means can reliable information be obtained. Should the producer experience difficulty in keeping such records, and also in estimating the efficiency of his system of rationing, it is advisable that he should approach the County Agricultural Organizer, who is available to give expert advice and to assist in improving the general standard of milk production on any farm in his county.

THE NORTH OF ENGLAND DUAL-PURPOSE SHORTHORN

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It is generally accepted that there is a distinct type of Shorthorn peculiar to the north of England. Indeed, in the north itself it is even more locally known as the Cumberland and Westmorland Dual-Purpose Shorthorn. Of course the dual-purpose type is not confined to any district, nor does the ideal vary, but there do seem to be several reasons for the recognized preponderance of this type in the north-west.

First of all, while Cumberland and Westmorland are not the original home of the modern Shorthorn, there is probably no district where so few cattle of other breeds are to be found. On the higher fells, particularly in the north and east, there are herds of Galloways. In the north, also, are a few Ayrshire herds, while Friesians are few and scattered. In nearly every case the lakeland farmer is a Shorthorn owner, and consciously or unconsciously develops an eye for a good Shorthorn beast.

The physical difficulties of the country have largely enforced the specialized stock rearing practised on all farms not near railways or markets for milk. The farmer has kept a stock of Shorthorns for milk production, the milk being skimmed and butter sold. The young stock are well reared on the separated milk. The heifers are kept to go into the herd, replacing the older cows sold out, while the bullocks are brought into the market and sold as store stirks to feeders. Very few of the breeders fatten their own stock except on some of the better low-lying farms.

These conditions have produced an excellent type of Shorthorn. As already indicated, nearly every farmer brought up amongst pure Shorthorn stock is a judge and takes a pride in his own herd. As most of them are working farmers they are able to give the animals a great deal of individual attention so that even if milk recording is not practised nor regular pedigrees kept, the owner has a fair idea as to which are his best milking beasts, while he has also a very good memory for the breeding of each of his beasts.

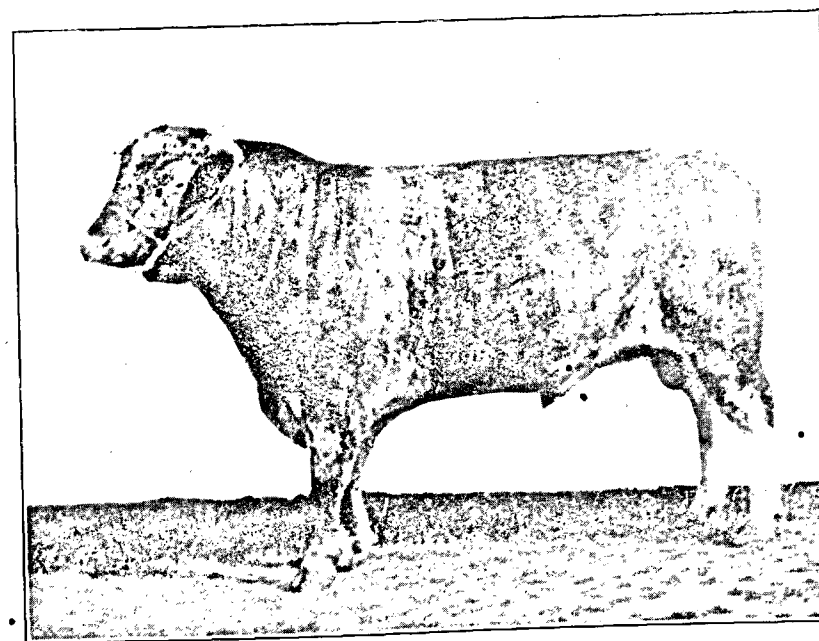
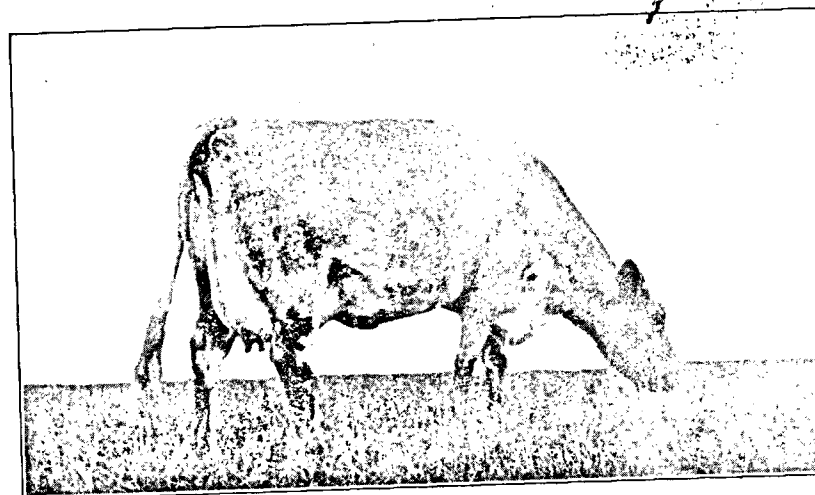
What the farmer wants is a cow with a good constitution, able to summer on high land, often over the 750 ft. mark, and one which not only milks well but will breed him regularly a useful heifer, or a bull calf which will make, when about 12 months old, a first-class store bullock for feeding on

lower land at 18-30 months old. In other words, he, indirectly, aims at a dual-purpose stock. He does not want beef on the female side, but the male must make a feeding bullock.

To maintain such a herd, close attention should be paid to the bull, and in most cases this is given. Some of the most successful herds have been closely bred on the lines "backward and forward, backward and forward." A bull calf from the most satisfactory cow would be kept and used on all the stock, and be replaced in two years' time by a bull from another good cow. This in-breeding has, in a few cases, been carried to extremes, but it has undoubtedly resulted in a very fine-boned, even, and prepotent stock of the desirable type mentioned above. This is one of the most distinctive features of the Cumberland and Westmorland non-pedigree Shorthorn; it breeds very true to its desirable type because, although non-pedigree in name, its breeding has been most carefully watched for many generations. No animals have been kept because they belonged to some so-called fashionable family or strain; usefulness has been the only object.

The typical cow produced under these conditions is almost the ideal of the Shorthorn breeder. She is fine boned and stands on a moderately short leg, which makes her look rather smaller than she is. Her head is fine with symmetrical horns, which show the pureness of her breeding by the absence of black tips. The neck is fine, covered with a loosely-wrinkled skin, and running neatly into well-set shoulders. On top the blades meet at the desired wedge-shaped point. Between the forelegs there is plenty of room, allowing for the development of heart and lungs necessary for a good constitution. The ribs are well sprung, giving a good barrel which runs smoothly into broad long quarters. One of the most distinctive features of this type of cow is the development of the udder. The maximum capacity is obtained without approaching the pendulous vessel so common among other dairy breeds, excepting the Ayrshires, whose close proximity has probably influenced the Cumbrian breeder. Colour, while admittedly more of a show point, has been considered in the course of the breeding, and roan is most popular and probably the most common colour. All reds should be dark and free from any yellowness. Light socks or too much white on the face or head are not popular.

Under her natural conditions, such a cow is capable of producing milk up to 800 and 900 gallons with her third calf on the high-lying pastures and short hay of the fellside



THE NORTH OF ENGLAND DUAL PURPOSE SHORTHORN. TYPICAL COW AND BULL.

farm, with very little additional feeding. Carting is an important item on most of the farms, and only the absolute minimum of concentrated food is used. Partly on this account, and partly owing to the milder conditions, such cows are able to give higher yields when brought on to lower farms where milk is more scientifically produced. It is generally accepted that a certain amount of food of a definite analysis is required to produce a gallon of milk, but it would seem reasonable to assume that stock accustomed for generations to short, plain keep, are able to produce milk more economically than more highly favoured herds. In addition to this milk production, the cow is expected to produce a calf every year, the heifer to be drafted into the herd and become such a cow as the dam. The male calves, unless from particularly good cows of good ancestry and themselves of good colour and conformation, likely to grow into good bulls, are kept as store bullocks and sold at about a year old. The type of cow already described, in spite of her fine feminine nature, is able to throw a good male calf which will develop both size and quality.

It has been stated with regard to the old draught cattle that the best and heaviest oxen were bred from the finer and more feminine cows. This is where the Cumberland and Westmorland Shorthorn shows its dual-purpose qualities. Without in any way suffering as a milk cow, it is able to breed a bullock which commands a good price as a store and finishes to a good weight of first quality beef. If, as is bound to happen occasionally, it is necessary to fatten a heifer, very fine small-weight animals are produced. It is not claimed for the cow herself that she, as beef, is very much better than a purely dairy cow. Even the strongest supporter of dual-purpose cattle will acknowledge that an old cow of any type is bad to sell.

As has been shown, the dual-purpose cow is the result of the type of farming in the district and does suit the local farmer. More than that, an animal has been produced which is becoming increasingly popular in the south of England. When the south country farmer buys a Cumberland dual-purpose cow he gets a shapely, good quality cow of the kind described above, and one which will improve under the milder southern conditions. Not only does she do increasingly well as a milk producer, as the result of more scientific feeding and greater use of concentrates, but she herself will improve in condition and make a larger, heavier cow when fed. So much for the individual cow. Another and more important

use of the dales-bred Shorthorns is as the foundation for a dairy herd of good constitution and type. In this connexion, far more important than her visible qualities as a cow, is the long period of careful breeding towards one good type. Provided the correct bull is used, it is practically certain that the resulting stock will be not only as good in type, udder, colour, and dairy properties as the dams, but will have a little more size and substance, and give more milk, owing to the more generous treatment when growing.

The south country Shorthorn is often a very good milk beast, and often quite a good feeder, but no one would say there was any uniformity of type or of performance. These are essential when founding a herd. Obviously most farmers are limited to the use of one or two bulls at the most and, unless there is some uniformity among the cows, there can only be a portion of the herd which will be suited by the cross; others may have their defects more deeply fixed. In the dairying districts of the south, the dual-purpose characteristics of the north country Shorthorn are often not wanted. She is kept for milk and, while the bought-in north country cow is satisfactory for this purpose, she breeds, when carefully crossed, even more satisfactory stock—stock, too, which retains the type and character of a good Shorthorn.

The keenest north country breeder of dual-purpose cattle is not beyond conviction that, in certain districts, a more specialized type, either beef or dairy, is better. He does, however, know that he is forced to breed a dual-purpose stock through the type of land, and the farming which it entails. This same dual-purpose cow, because of its breeding and type, is splendidly fitted to be the foundation of any type of Shorthorn stock. She is a reliable article and gives a reliable product.

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THE COMMON GREEN CAPSID BUG

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THE Common Green Capsid Bug (*Lygus pabulinus*) is a native of this country and very widespread. It is common in every district that I have visited, being found in hedges and on a large number of herbaceous and woody cultivated plants and weeds. In recent years it has become a serious pest of black and red currants, gooseberries, and strawberries interplanted with these; and although first found on apples in 1926, it is now quite common on them in many districts.

Life History.*—This pest lives through the winter only in the form of eggs, which may be found from October to April in the last year's shoots or sometimes in two-year-old stems of woody plants such as currants, gooseberries, and apples. Most of these eggs are laid in the bark with the cap on a level with the surface, but in red currants some may be found with one-third or more of their length outside the bark. If the bark is peeled carefully, the eggs can be seen on its inner surface, but if only its brown cork layer is peeled the eggs remain *in situ*. The eggs are creamy white in colour, just over one-twentieth of an inch long and curled as in Fig. 4. The largest number of eggs so far found in a female is 56.

The commencement of hatching varies with the season, but is usually in April and rather later than in the case of the Apple Capsid (*Plesiocoris rugicollis*). In the last three years, the period of hatching has occupied about three weeks in the Cambridge district, but in some districts appears to have been longer than this. The period is likely to be longer in seasons where a long spell of cold weather closely follows the commencement of hatching. In this district hatching has usually finished when the petals of the apple, Bramley's Seedling, begin to fall. As soon as the young bugs hatch, they move to the young leaves at the growing point, which they puncture and suck, and, with each puncture, they inject poison which kills the neighbouring cells and causes the well-known "capsid spots." The spots are brownish in colour, but vary according to the host plant; in pears they are almost black and in currants they are sometimes almost transparent. In the case of a very bad attack, the young leaves may be killed

* A more detailed account of this pest is to be found in an article by Petherbridge and Thorpe, *Annals of Applied Biology*, Vol. XV, No. 3, August, 1928.

without becoming fully expanded, especially in the case of red currants. If an attacked leaf continues to grow the areas killed by the bug fail to expand, and the leaf becomes riddled with characteristic holes.

In warm weather, about a week after hatching, the young bugs cast their first skin, and before becoming fully winged cast their skins five times. They become bigger at each moult.

At the end of April, or in May, after moulting once or twice, the young bugs begin to leave the winter host, and most of them go to herbaceous plants such as strawberries and potatoes, or to weeds like groundsel, dandelion or buttercup. The strawberry is a favourite host at this stage, and plants growing near infested currants or gooseberries are often severely punished. A few of the bugs may remain on the woody host rather longer, and some appear to stay on throughout the year.

The bugs feed on strawberry plants for a few weeks and then leave them for other herbaceous hosts, on which they grow to the winged or adult stage. Towards the end of June, or in July, eggs are laid in the stems of these plants, *e.g.*, potato, groundsel, white dead nettle, nettle, and bindweed. These eggs are easily found, as often half their length projects above the surface of the stem.

The bugs hatching from these eggs in July, and sometimes August, feed almost entirely on herbaceous plants, but when fully winged they fly back to woody hosts, such as currant and apple, to lay their eggs in September and early October, although even at this time, most of the feeding may be mainly on herbaceous plants and bugs may be difficult to find in numbers on the woody hosts. Damage to woody hosts, *e.g.*, apples and currants in August and September, is caused by this bug and not by the apple capsid, as the latter dies towards the end of July or early August.

An interesting case* of a typical migration was observed in 1927 near Wisbech. "In a mixed plantation the gooseberries (no currants present) were very badly attacked early in the season. Early in May, whilst in the second instar stage, migration took place to the strawberries between the rows of gooseberries. Later on they were found on herbaceous weed hosts. They continued to feed on the gooseberries, strawberries,

* Petherbridge and Thorpe, *Annals of Applied Biology*, Vol. XV, No. 3, August, 1928.

and weeds until the beginning of July, but in the second week in June the adult bugs began to migrate to potatoes in the neighbouring field on the east side separated by a dyke. By the first week in July migration to the potato field was almost complete. On this date only a few bugs could be found in the mixed plantation, whereas hundreds were present in the potato field. The rows of potatoes nearest the mixed plantation were very badly damaged by the bugs; further away the attack became gradually less, but extended for about 30 yards.

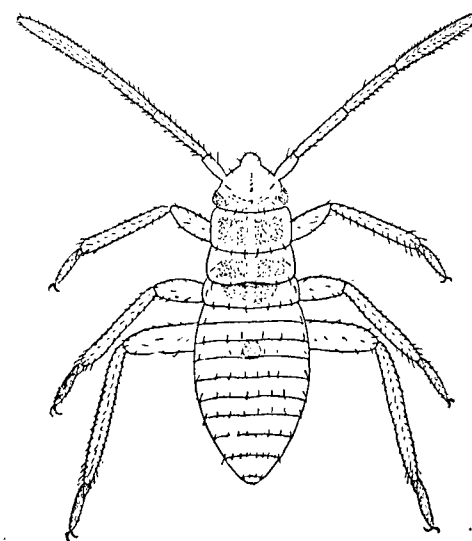


FIG. 1.—*Lygus pabulinus*. The newly-hatched bug.

"The second generation of bugs were abundant on the potatoes, but when they reached the adult stage in August they migrated, some back to the gooseberries and large numbers to a nursery and a young mixed plantation across a railway line on the south side. Here they attacked apple and apple stock, plums, cherries and cherry stock, and roses, and a number of eggs were laid on young apples."

Description.—On hatching, the young bugs are about 1-20th inch in length, and of a yellow-green colour. Immediately after the first moult they are pale green, but soon change to bright green, and in the later stages they are a shining green colour. In all these stages the terminal joint of the antennæ is a dusky orange colour.

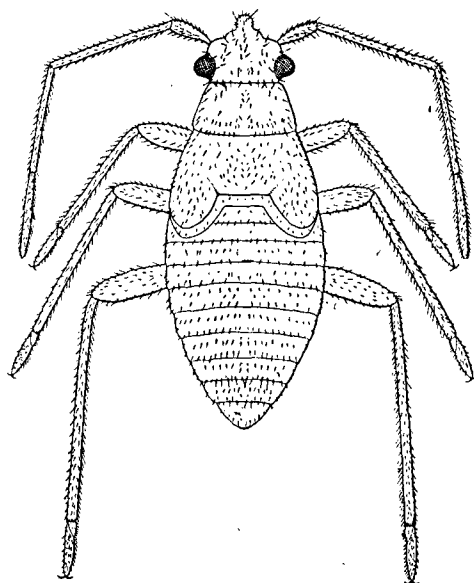


FIG. 3.—*Lygus pabulinus* after three moults.

The chief differences between these bugs and *P. rugicollis* are—longer legs—longer antennæ—longer proboscis and the dusky orange colour of the terminal joint of the antennæ (in *P. Rugicollis* this is reddish brown or, in newly moulted specimens, red).

In the first stage the dark markings on the thorax are more pronounced in *P. rugicollis*. The adults of *L. pabulinus* may be distinguished from those of *P. rugicollis* by their darker and more shining green colour (in *P. rugicollis* the outer edges of the wings are yellow)—the dusky orange tips of the antennæ (not reddish brown)—the longer antennæ almost as long as the body—the longer legs and the longer proboscis reaching the base of the third pair of legs (they reach the base of the second pair in *P. rugicollis*).

Damage Caused by the Bugs : Currants.—The damage to currants is similar to that caused by *P. rugicollis*. Red currants normally suffer more than black currants, but the damage is similar. On very young leaves, the young bugs produce almost transparent dusky brown spots, which, as the leaves grow, form holes with brownish edges (see Fig. 7). In the case of a very bad attack, the young leaves may be killed without becoming fully expanded, especially so in red

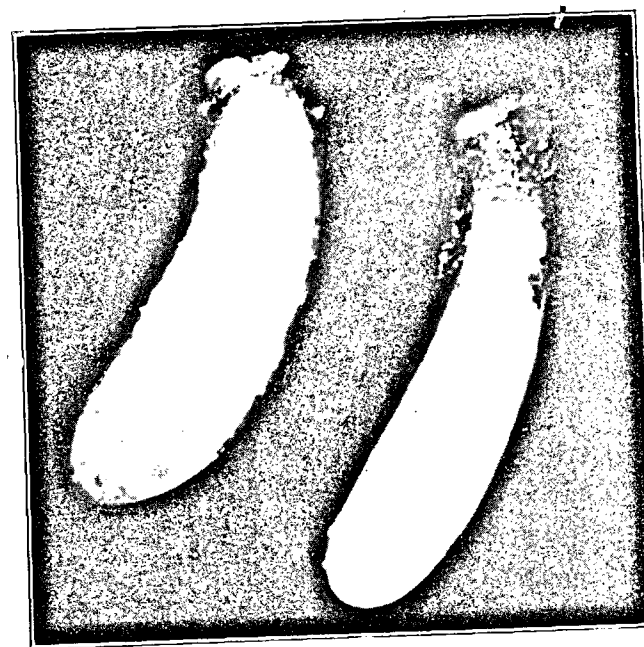


FIG. 4.—(Left) Egg of *Lygus pabulinus* (Common Green Capsid Bug). (Right) Egg of *Plesiocoris rugicollis* (Apple Capsid Bug). (Both dissected from stems.)

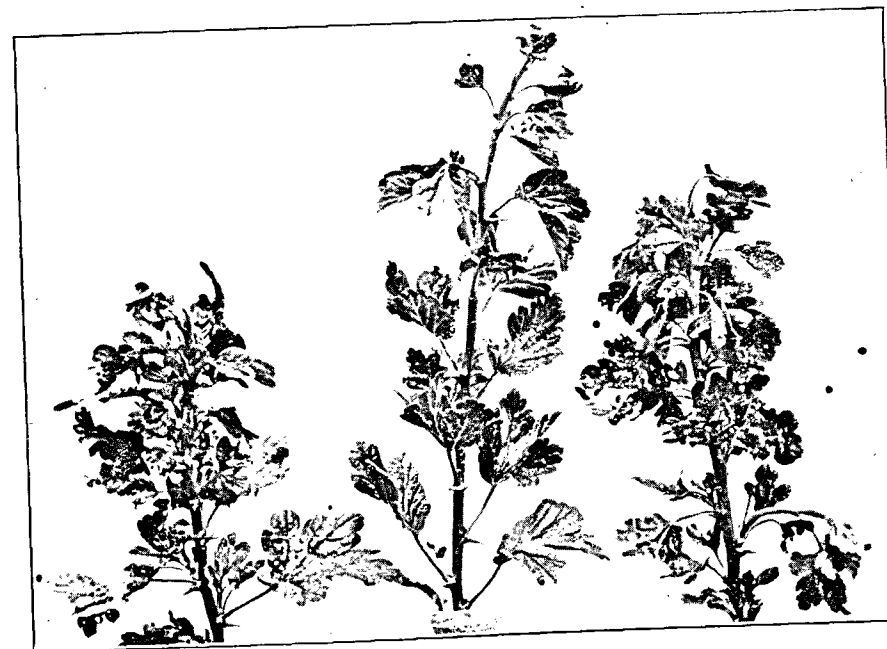


FIG. 5.—Shoots of Gooseberry, showing side shooting (A and A1) due to injury of the growing tip by *Lygus pabulinus*. B shows normal shoot.

THE COMMON GREEN CAPSID BUG.

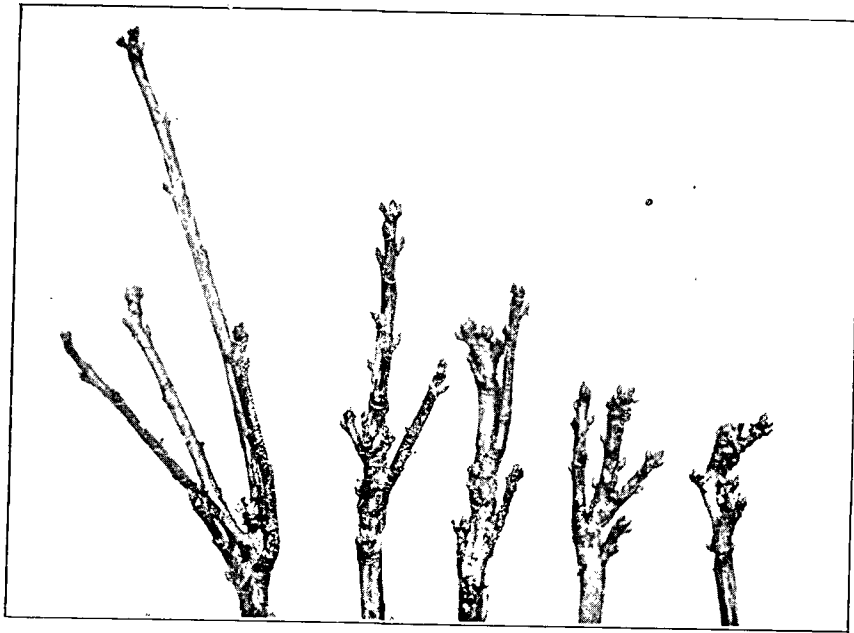


FIG. 6.—Malformation of Red Currant shoots due to injury of the growing tip by *Lygus pabulinus*.

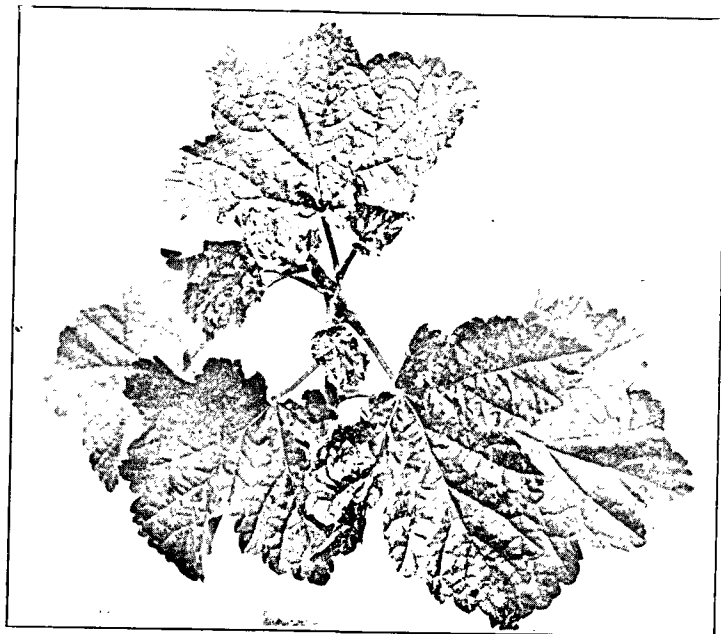


FIG. 7.—Showing damage to Red Currant leaves by *Lygus pabulinus*.

currants. A bad attack is often sufficient to injure the tip of the shoot and so cause side-shooting, *i.e.*, a number of buds in the current year's growth develop into side shoots. This has been more noticeable in the red currants (Fig. 6). Little damage is done to the berries, although the bugs do occasionally suck them. Most of the injury is done by the young bugs of the first generation.

Gooseberries.—The damage to gooseberries is similar to that with currants, but some of the damage may appear as pale raised spots on the upper surface of the leaf. The injury to the tip of the shoot, when severe, causes side-shooting (Fig. 5). The damage to the fruit is of a serious nature. It first shows itself as brownish yellow patches under the skin; later the berries may become dimpled and dark brown, cracked and scabbed areas may be formed. Injured fruit often falls off.

Apples.—The injury to the leaves and shoots is very similar to that due to *P. rugicollis*, *viz.*, brown spots and, later, holes in the leaves and brown scars in the stem. This damage starts rather later, but continues in September long after the apple capsid is dead. This latter damage is caused by

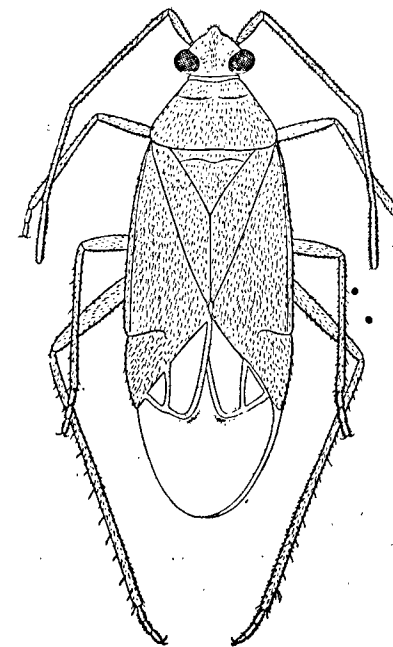


FIG. 2.—The Common Green Capsid Bug (*Lygus pabulinus*).

the bugs which have usually returned from herbaceous hosts. The damage to the shoot may cause a malformation due to excessive branching near the scars. The writer has seen very little damage to fruit which could be attributed to this pest in the orchard; but, in 1928, a number of young bugs from gooseberries were put on some pot apple trees, and here they caused brown spots and scars on the apples similar to those caused by the apple capsid bug. This bug, therefore, is capable of marking apple fruits, although it apparently does so very little in orchards.

Pears.—Pear leaves are marked with small, almost black, spots; and as the leaves grow these form holes with yellowish brown edges. The damage to the fruit attributed to this pest is rather different from that done to apples, the scars formed being deeper. Cases of damage to pears, however, have not yet been found sufficiently often to justify definite conclusions.

Plums.—Characteristic brown spots, followed by holes, are formed in the leaves; also scars on the young stems, similar in appearance to those on apples. Suckers usually suffer most, but young nursery trees may be attacked. Damage to older trees is rare.

Cherries and Peaches may also be attacked.

Strawberries.—Strawberries near badly infected currants and gooseberries are usually badly attacked, the damage consisting of spots and holes in the leaves.

Raspberries.—The damage to these is much less severe than on previous hosts, but similar in character.

Potatoes.—Potatoes near infected bushes are very liable to attack by the later stages of bugs of the first generation, and also by the second generation. Comparatively large spots are formed on the developing leaves and, later, holes with yellow edges. If a very young leaf is attacked the lower leaflets fail to develop properly; this causes a reduction of the leaf area and consequently of the crop.

Beans.—Runner beans and dwarf beans may suffer badly when growing near infected bushes. Broad beans are also attacked.

Roses.—Roses of all kinds are affected. Both generations cause brown spots and holes in the leaves, and the buds are also injured, some being killed.

Hedgerows.—In hedges, apart from herbaceous plants, it is most usually found on blackberries and wild roses, but it can also be found on hawthorn, privet, ash, elm, and sycamore.

Herbaceous Borders.—Its presence in herbaceous borders is best determined by examination of dahlias, as these plants are very attractive to the bugs and the leaves are severely injured. *Salvia splendens* is also badly injured, while many other plants, such as fuchsias, chrysanthemums, marigolds, michaelmas daisies and poppies are also attacked.

Weeds.—It attacks a number of weeds such as bindweed (*Convolvulus arvensis* and *C. sepium*), creeping buttercup (*Ranunculus repens*), white and red dead nettle (*Lamium album* and *L. purpureum*), polygonums, docks, groundsel, wild solanums, sow thistle, dandelions, and stinging nettles. It does not attack chickweed, shepherd's purse, or veronicas.

Control.—This pest is readily killed by contact washes in the same way as the apple capsid bug (*P. rugicollis*), but there are difficulties in reaching the bugs with the wash.

They readily fall to the ground and the currant bushes form such a dense mass of foliage that the spraying of bushes sometimes gives rather disappointing results. The method which has given the best results is first to shake the bushes and then spray very thoroughly the ground underneath them.

If it is to have its maximum effect, the wash should be applied after all the bugs have hatched. The actual date will vary from year to year, but it is about the time that the petals of Bramley's Seedling apple begin to fall. If spraying is delayed much later than this, some of the bugs may have migrated to strawberries and weeds. When spraying is delayed, weeds should be kept down to prevent this migration. At present the best wash to use is nicotine 8 oz. (95-98 per cent.) to 100 gallons of water, or its equivalent, together with a spreader. With soft water and ordinary waters which do not form much scum, soft soap at the rate of 8-10 lb. to 100 gallons of water is the best spreader to use. With very hard water, where soft soap is uneconomical, sodium caseinate or some other suitable spreader may be used.

A high-pressure pump and a coarse nozzle should be used for spraying. Spraying during the second generation on currants and gooseberries is hardly likely to be profitable, as the bugs are also present on neighbouring hosts.

When weed hosts are prevalent, it may prove profitable to leave these until shortly after the eggs have been laid in them (i.e., until the newly hatched bugs of the second generation are found in the middle of July or rather later, according to the season) and then fork them in.

This pest is very likely to be troublesome in nurseries. Here a trap crop, such as potatoes, might be used. The eggs will be laid in the potato tops and weeds, and these could be cut off and destroyed as soon as the young bugs of the next generation are found.

In the case of apples, trees should be sprayed immediately after blossoming, and the ground round the trees should also be sprayed.

It is useless to knock these bugs off the trees and grease-band, as has been suggested for *P. rugicollis*, for these capsids, unlike the apple capsid, normally live on herbaceous hosts, usually found growing underneath.

In small private gardens, a cheap method is to shake the bugs off on to trays made from an old sack (or other material), or into an open umbrella, and destroy them, or to shake them on to sticky trays.

Summary.—This capsid bug, *Lygus pabulinus*, has become a serious pest of currants, gooseberries, strawberries, potatoes, and dahlias, and is also present on apples, pears, plums, cherries, and peaches, and a large number of cultivated plants and weeds.

Characters are given for the purpose of distinguishing it from the apple capsid bug (*P. rugicollis*) which causes similar damage on currants and apples.

There are two generations per annum. Eggs are laid in the autumn in woody plants such as currants, gooseberries, apples, and roses, and in spring there is usually migration to herbaceous hosts, where the summer eggs are laid, the second generation returning to the woody host to lay their winter eggs.

In the first generation, a secondary migration from strawberries to other herbaceous hosts takes place. Details are given of the damage done to the important host plants and of the habits of the bug in its various stages. Control measures are given.

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COUNCIL OF AGRICULTURE FOR ENGLAND

THE twenty-ninth meeting of the Council of Agriculture for England was held at the Middlesex Guildhall, Westminster, on January 24. Mr. R. G. PATTERSON (Staffs) was in the Chair, and the Minister of Agriculture, Mr. WALTER GUINNESS, M.P.; the Parliamentary Secretary, Lord STRADBROKE; and the Permanent Secretary, Sir CHARLES HOWELL THOMAS, K.C.B., were present.

Liming and Income Tax.—Arising out of the minutes of the last meeting, *Mr. Chas. Roberts* (Cumberland) asked whether the Minister could make any statement in regard to the resolution passed at that meeting as to landlords' income tax and allowances for liming. *The Minister* replied that, as a result of the resolution, the Inland Revenue had been approached and had made a concession to meet the point. That Department was prepared, where a remission of rent was allowed by the landlord for liming, to set it off against his Schedule A payments. *Mr. Roberts* thanked the Minister.

Better Marketing of Eggs.—*Mr. Denton Woodhead* moved the adoption of the Report of the Standing Committee on this subject (for copy, see Appendix A following).

He thought that the Ministry's Scheme of a National Mark for eggs was a sound means of helping agriculture, profitable not only to the producer but to the consumer, and likely to encourage greater production. The egg packing station, where eggs could be candled so that stale ones and those with blood spots and other defects might be removed, was a most useful stage in the process, as also was the grading and packing in non-returnables. Each producer was paid according to weight of eggs and not according to number. Imported eggs in 1928 reached a total of no less than 31½ hundred millions. Producers in this country should attack that figure and supply fresh home-produced eggs to take the place of the imported ones. The packing station collected the eggs, tested them, graded, packed and sold them at a cost of from 2d. to 3d. a dozen. Every package went out marked with the National Mark, and the housewife could be certain when she bought National Mark eggs that she was buying English eggs of a guaranteed quality. Foreign eggs, preserved and cold-stored eggs, would soon have to be marked so that there would no longer be any danger of the consumer being misled as to the origin of the article. *Sir Douglas Newton, K.B.E., M.P. (Cambs),*

seconded the adoption, saying that the Council owed a debt of gratitude to the Committee for the care they had taken and the work they had put into the Report. He emphasized the point that standardization was necessary to meet overseas competition. *Mr. Chas. Roberts* suggested that there might be difficulty in extending the use of cold storage. The insurance premium was heavy and it might be that eggs would not always come out in a satisfactory condition.

The Minister of Agriculture welcomed the Report. He said that it arrived at a critical time when the National Mark was about to be applied to English eggs, and a month or two before the marking of all imported eggs became obligatory. One hundred and ten applications for packing stations under the National Mark had been received, most of which had been accepted. Large stations with smaller proportionate overhead charges could offer better terms to producers than the smaller ones. The task now was to transfer plans from paper to practice. He was sure that the Ministry had the co-operation of producers. He particularly appealed to the housewife and to the distributor. The housewife had to learn that British eggs were reliable and better than foreign eggs, and her demand had to be backed up by the distributor. A sustained and concentrated effort was necessary to achieve success.

Mr. W. R. Smith considered that the Report was even more important than appeared on the surface because it represented the beginning of a new system of marking agricultural products. Especial care had therefore to be taken, as, if the scheme failed, the whole movement would be damaged, possibly beyond recovery or recall. The guarantee of quality would have to be maintained so that the confidence of the consumer would be retained in regard to English eggs. *Mr. Guinness* said that he appreciated the point, and would make a special appeal to packers to see that even in the smallest units, the eggs sold did not fall away from the high standard laid down.

Sir Francis Acland pointed out that the production of eggs in Canada remained steady until they adopted a grading and marking Order to help their export trade. The Order had first to be extended to their home trade; and, within four years, the production of eggs per head of the population was found to have doubled. Now, they consumed practically all the production within the country. If the home egg was not up to standard, the scheme might give imported eggs a

great advantage when it became compulsory for them to be marked as such. It was necessary, therefore, to carry out the scheme thoroughly from the beginning, and not wait two or three years to see how things went.

Mr. Denton Woodhead, in reply to the discussion, said that cold storage was a process which should only be resorted to in the last extremity. Not only were the costs of storage heavy, but when the eggs came out of store they would be preserved eggs, and therefore of less value.

The Chairman said that the history of the co-operative movement in this country had shown how serious could be the damage to a movement by initial mistakes. He hoped that the scheme would prove a very great success. The Report was adopted.

Canning of Fruit and Vegetables.—*Mr. Denton Woodhead* moved the adoption of this Report on behalf of the Standing Committee. He drew attention to the great variety of imported canned fruits and vegetables for sale in retail shops. Even some with the label of English firms proved on close inspection to be imported foreign produce. He was quite sure that the country could do better than this. Dried peas could be bought at 5d. a lb., foreign canned peas worked out at over 4s. a lb. The Campden Research Station had proved very helpful in assisting the home canning industry to a start. We had now no fewer than 30 canning stations, and the National Food Canning Council were saying that they could not get sufficient produce to can. Here was a chance for the producer! Only the best produce was of use for canning. We could not displace peaches, apricots and pineapples; but we could assist the sale of very excellent canned Victoria plums.

He then referred to the progress made in the art of canning and to the 100,000 tons of tins imported from abroad in the form of cans; also to the need of careful lacquering of the insides of the cans. He strongly recommended that the Campden Station should be provided with a canning plant, and urged that the Empire Marketing Board be asked to give a special advertisement to canned fruit for the benefit of the producer in this country. *Mr. A. E. Bryant* (Bucks) said he was afraid that growers of fruit would lag behind the demand for tinned goods and would not trust the new industry. He considered that blackberries might usefully be canned, as the crop came in when other fruit had finished.

The Minister said that if the industry could get the support of the consumer it would have a great future before it. The

Ministry would certainly consider the suggestion that the Campden Research Station should be provided with a canning plant. The work there had tended to become more and more developed on the industrial side, and to fall, therefore, within the province of the Department of Scientific and Industrial Research. That Department would in future become responsible for the investigations of the Station, although the Ministry would retain responsibility for its educational work. The new industry was capable of dealing with one of the greatest of difficulties in the fruit industry, *viz.*, gluts. He hoped that a system of growing on contract would be adopted in the same way as was done in the case of sugar beet. There was no doubt that we could put a better canned product on the market than competing countries could send us. British retailers would have to be stirred up in the matter of sales, and he hoped that the dictates of patriotism would lead them to do all they could to forward this new industry.

Mr. R. F. Aubrey (Hunts) said he was surprised that only one vegetable—peas—had been mentioned. He would like to know whether other vegetables could not be included. *Mr. Christopher Turnor* raised the question of marrow-fat peas. He thought they were not produced in any other country, and that there was room for stabilizing and building a market which would be quite outside competition. *Lady Mabel Smith* said that she used a system of bottling young cockerels, and many of her friends had asked her for the recipe. *Mr. Geo. Dallas* said that the Committee had gone carefully into the question of whether it was profitable to can vegetables in this country. It was a cultivated taste which the British had not developed to any great extent. It might be made very profitable where people could not get vegetables fresh. Canned peas were a great improvement on the ordinary dried peas. One station in the Eastern Counties last year had canned a million tins and sold them out completely in three months. *Mr. Haman Porter* emphasized the point that it was of no avail to advertise a product which could not be got in the shops. *Mr. R. C. Grey* (Hunts) said he doubted whether it was good policy for the farmer to encourage blackberry hedges.

Mr. Denton Woodhead, replying to the discussion, thought that the canners and growers should have little difficulty in coming to terms as to contracts. Increased acreages were essential, and everyone should pull together. As to vegetables, fresh vegetables of one kind or another could be obtained

fairly cheaply all the year round. Nevertheless, there was room for canning certain kinds (peas, tomatoes, etc.). He would like to see the National Food Canning Council set up definite standards for their products under the National Mark.

He thanked the Council for the expressions of appreciation of the Committee's work. It had been engaged for about 18 months on questions of marketing, and the attendance had never fallen off. He invited members of the Council to go back to their Counties and practise some of the methods that had been suggested to them.

The Chairman said he would like to supplement what had been stated about the work of the Standing Committee by adding that they were greatly indebted to *Mr. Woodhead* and to the Secretary for the work they had done. The Report was adopted.

Proposed Private Motor Road to Brighton through Surrey and Sussex.—*Col. Sir G. L. Courthope, K.B.E., M.P.* (East Sussex), moved :—

"That the Council of Agriculture for England is strongly opposed to the proposed Scheme of a privately-owned toll Motor Road from Kingston to Pyecombe, regarding it as a retrograde movement, being no part of a carefully devised National Scheme for new road-making, and likely to cause annoyance and severe loss to many rural dwellers with no compensating advantages; and regarding it as certain to cause untold inconvenience to the farms through which it passes, and to destroy the beauty and amenities of the countryside."

He said that the proposal emanated from a syndicate called the Motor Roads Development Syndicate. It was more than a local matter, as if it were successful similar motor roads would be suggested for other parts of the country. He described the provisions of the Bill, and discussed many objections to it from the point of view of agricultural and rural interests. *Brig.-Gen. H. Clifton Brown, M.P.* (West Sussex) seconded the motion. *The Minister* said that the Government was in no way concerned with the Bill, though he would see that the resolution, if passed, was conveyed to the proper quarter. If the Bill went to a Select Committee he would consider the advisability of making a representation to it embodying the criticisms that had been brought forward. *Mr. J. O. Adams* (Northants) thought that this road might take a good deal of the motor traffic, and also the ordinary transport, off the other road, so relieving traffic. As a private road, it would be rateable, and therefore an asset to the two Counties through which it passed. He did not, however,

oppose the resolution. *Mr. G. M. Maryon-Wilson* (Sussex) supported the resolution, which was put to the meeting and carried.

Home-produced Meat for Services.—*Mr. H. W. Thomas* (Hants) moved :—

“That in view of the increased price of Chilled Beef (imported), His Majesty’s Government be requested to provide the members of the Army, Navy and Air Force with home-produced meat instead of imported.”

He said that since he moved a similar resolution a big change had taken place. The imports of chilled meat had gone up very considerably and the disparity of price between English and imported chilled meat had diminished. He was surprised that in a certain case the lowest tender for English beef had fallen below that for imported chilled beef. He hoped that the resolution would be carried and that the Minister could persuade his colleagues in the Cabinet to take suitable action. *Mr. A. R. White, O.B.E.* (Wilts), seconded the motion. At an institution in Wiltshire, a contract had been taken out for English beef at 4½d. a lb. *The Minister* said he thought that the resolution was based to some extent on a misapprehension of the present system of purchase. Both proposer and seconder had alluded to foreign chilled meat as a source of supply. The Services, apart from bully beef which came usually from Empire sources, were supplied with frozen beef. The arguments, therefore, did not apply. Frozen meat had not risen in price to the same degree as fresh meat had, and there was an even wider margin between Empire frozen meat and home-killed fresh meat than there was a couple of years ago. The extra cost of feeding the Forces on home-grown fresh meat would be about £640,000 a year. That was the figure given to the Department last May. He regretted very much, therefore, that he did not think it at all possible to face this very increased cost. *The Chairman* asked whether the mover wished to press the resolution. *Mr. Thomas* stated that last May the price of English beef had been abnormally high. During the autumn months when it was low there might be advantage in using English beef. *The Minister* assured him that if the gap between the prices diminished to a sufficient extent, with the preference there is for the English meat under the present system, the Forces would be fed upon it.

Mr. J. M. Paine (Bucks) opposed the withdrawal of the motion.

The Chairman explained that he had not asked the Honourable Member to withdraw the motion, but whether

he desired to persist in it. He hoped the Council would not ask for impossible things. It was better to direct its attention to objects reasonably capable of attainment. The motion was put to the meeting and carried by 26 votes to 14.

Acreage needing Tile-draining.—*Mr. A. Wearmouth, J.P.* (Durham), moved :—

“That this Council asks the Ministry of Agriculture and Fisheries to request each occupier of agricultural land in filling in his schedule of Agricultural Returns on June 4 of this year, to state the number of acres on his holding which would be improved by tile-draining.”

He thought that work on tile-draining would be very useful to the unemployed miners of Durham at the present time. Waterlogged land was not a paying proposition, and the first charge on cultivation should be drainage. Undrained land would carry away the capital put into it like a river. First of all he would like to see the statistics of land requiring drainage. *Mr. R. Anderson* (Northumberland) seconded the motion. He said that tile-draining schemes did not come under the Government schemes of drainage in England as they did in Scotland. In Northumberland very large areas were quite undrained. There were 13,000 men in Northumberland out of employment who could be used for making the tiles and cutting the drains. Miners would soon become efficient at this work.

Mr. Chas. Roberts drew attention to the fact that his motion also dealt with this subject of drainage and miners’ unemployment, and it might be convenient if the discussions were taken together. The new Drainage Scheme put forward by the Ministry in the Circular of December 17 was not workable in the Cumberland area at present, as it was put forward in order to help miners in other depressed areas. It was a transference scheme. In one area in Cumberland there were 2,300 miners out of work and unlikely to be employed again, and in another area in the county overlapping into Northumberland, the unemployment was up to 33 per cent. It was clear that they could not import distant-county unemployed miners. As to housing, he did not know any area in Cumberland which had even a dozen or 20 cottages vacant at the present time. There was, he thought, also a provision that 75 per cent. of the men should be ex-Service. He did not know why tile drainage could be assisted in Scotland and not in England. *Mr. J. P. Terry* (Gloucestershire) said that he thought they were lucky perhaps in his County in having an excellent Land Drainage

Officer, but he would suggest that these officers could give the statistical information asked for without the inconvenience of going to each farmer.

The Minister said he was sure the Council had heard with sympathy the appeal from the northern areas stricken by unemployment. The Government had a few weeks ago announced the special terms that would be given to enable land drainage to be put in hand for the purpose of giving employment, and a condition had been that it would apply only in case of transference. The condition of 75 per cent. ex-Service men did not apply to these new schemes. In many cases the work would not be very temporary, and he instanced the scheme of the Middle Level Commissioners which would cost about £36,000 and last for five years. The Ministry had always limited its drainage provisions to improvement of arterial drainage. Scotland got 11-80ths of the total sum provided, and, as he understood it, had not the need or the desire for so much arterial drainage improvement as existed in this country. It preferred, therefore, to use some of its share on pipe drainage. It was no use looking after pipe drains unless the outfall, that is, the arterial drainage, was in good order. As to including a request with the circulars of returns for June 4, the Ministry had no power, as the particulars defined by legislation were the only ones which were compulsory. Any return could only be voluntary and would also be a matter of opinion, and so inconclusive. Mole drainage was, moreover, and generally speaking, of better value on suitable soils. The Agricultural Output of England and Wales for 1925 had given certain information of acreages requiring drainage, and the Ministry proposed to obtain further similar information in a later year. *Sir Francis Acland* thought that the transference idea in these schemes was an absurdity when you were considering Counties like Northumberland, Durham and Cumberland. He did not think it could be the final decision of those in authority. He was sure that much of our land was going back year after year for want of drainage, and he hoped that the Council would not lose sight of this important matter. *Mr. R. Bruford* (Somerset) instanced the case of Somerset as being similar to that of Cumberland and Durham. In his County they had their own unemployed, and could not let them go for the sake of housing and working miners from other depressed areas. *Mr. W. R. Smith* said that it would be unfortunate to leave the impression that pipe drainage was no good, as positions had been discovered where existing

drains were not functioning through lack of arterial drainage. It was far better to concentrate on arterial drainage first. *Mr. A. R. White* agreed. He said the cost of tile drainage was at present quite prohibitive—£16 to £18 an acre. Mole drainage in Wiltshire cost about £2 an acre. *The Minister* pointed out that, apart from the transference scheme, there was another system in force to help drainage, which was controlled by the Ministry. He would bring the difficulties in the transference scheme to the notice of the Ministry of Labour. He could not say what their view would be, though he knew that they attached great importance to the principle of transfer. After some further discussion, *Mr. Wearmouth's* motion was put to the meeting and carried. *Mr. Chas. Roberts* then withdrew his resolution, which was as follows:—

"That this Council draws attention to the new drainage scheme for the improvement of agricultural land, and asks the Minister of Agriculture to make the scheme more elastic and to modify the restrictions which make it difficult to get it into operation."

Tractors on Farms.—*Mr. A. Wearmouth, J.P.* (Durham), moved:—

"That this Council asks the Ministry of Agriculture and Fisheries to request each occupier of agricultural land in filling in his schedule of Agricultural Returns on June 4 of this year, to state the number of tractors used on his holding."

The resolution was seconded by *Mr. R. Anderson* (Northants). *The Minister* explained that the objection to the previous resolution applied in this case also. There was no power to extract the information. He added that particulars had been given in the report on the Agricultural Output of England three years ago. The resolution was put to the meeting and carried.

APPENDIX A

REPORT FROM THE STANDING COMMITTEE ON THE SUBJECT OF BETTER MARKETING OF EGGS.

(1) In its Interim Report to the Council, dated January 19, 1928, the Standing Committee considered certain general steps that might be taken to improve the marketing of home-produced eggs. It was assisted very considerably in this by the Report on Egg Marketing which had been issued by the Ministry of Agriculture as "Economic Series No. 10." Its recommendations, based on the Ministry's Report and on the demonstrations of better egg marketing given by the Ministry at Agricultural Shows, were:—

- (i) that definite standards should be laid down for first, second and third quality home-produced eggs, which should be sold according to those standards;
- (ii) that collecting, packing and grading depots should be set up at which home-produced eggs should be dealt with; and
- (iii) that cold storage facilities for home-produced eggs should be more widely used in order to hold over larger quantities from times of plenty to those of scarcity.

(2) The Committee has now examined the various questions more closely, and is confirmed in its view that these points cover the essential needs in egg-marketing reform. It is indeed glad to find that the Ministry of Agriculture is proceeding vigorously in pushing reform along those lines by means of the National Egg Marketing Scheme and otherwise. This Scheme may be briefly stated as follows:—

All egg packers who are prepared to carry out its conditions may be registered as accredited packers, their names being sent, in the case of country packers, to the National Mark Committee through the National Farmers' Union and the National Mark Egg Trade Committee, and in other cases through the last-named body only.

The National Mark Committee has the power to accept or reject an application for permission to act as an accredited packer, and it may also take away the permission so to act if the conditions to which an applicant subscribed before registration are not carried out. Hen eggs are to be graded as "Special," "Standard" and "Pullet Standard," the minimum weights for each being $2\frac{1}{2}$ oz., 2 oz. and $1\frac{1}{2}$ oz., respectively. All eggs packed are to be of "First quality," which means that their shells are clean and sound, the yolk translucent, or faintly, but not clearly, visible, the white translucent and firm, and the air-space not exceeding $\frac{1}{4}$ inch in depth. The quality of an egg is seen at once upon proper candling at a packing station.

The minimum quantity of eggs to be handled by each packing station is 30 cases of 30 dozen each week from January to July (inclusive), 20 such cases in the weeks of August and September, and 10 such cases in the weeks of October to December. The premises used are to be clean and dry and provided with suitable and adequate accommodation and equipment. All eggs are to be candled singly before a strong artificial light within 48 hours of despatch from the station.

Hen and duck eggs are to be packed separately, according to grades, in new wooden non-returnable 30-dozen cases packed with wood wool, or with fillers and flats, or cartons holding a half-dozen or one dozen eggs and sealed with the National Mark Label. In order to facilitate trade with small buyers and also to enable "Specials" to be packed in small units, 10-dozen, 15-dozen and 20-dozen cases of fiberite, fibreboard or corrugated board, in addition to the 30-dozen size commonly in use in the trade, are also permitted; any special concessions granted at the outset for the use of returnables are to apply only to an existing stock of cases. The Marketing Leaflets of the Ministry, Nos. 5 and 5a, give full particulars of the 30-dozen wooden non-returnable cases recommended for this service. The premises of a packer are to be open to inspection at any reasonable time by duly authorized persons, and all packers are to become members of Area Associations as soon as they are formed.

(3) These particulars are sufficient to show the broad outlines of the Scheme. Private dealers, country wholesalers and co-operative societies, whether already in existence or formed for the purpose, as well as wholesale buyers or salesmen who operate in large consuming centres, are all eligible to become accredited packers under the Scheme provided they can carry out the conditions. It is expected that there will be at least 100 of these registered by February 1. A later stage in the Scheme, as the Committee understand it, is that the National Mark Committee may transfer the power to authorize the use of the National Mark to Area Associations of accredited packers to be set up for individual counties or for a group of counties. Each

such Association would register a special Association mark to be used on packages of eggs and organize its own local inspection service, and supervise quality and packing of members' supplies.

(4) The National Mark Scheme, which is entirely voluntary in character, has been supplemented by the compulsory marking of eggs preserved in lime water, water-glass, or other substance, before sale, so that these cannot be mistaken for fresh eggs; that requirement will come into force on March 1 next. At the end of April, when the Order under the Merchandise Marks Act for the marking of all imported eggs comes into operation, home-produced gas-stored and cold-stored eggs will also be required to be marked as such.

(5) The Committee would wish to congratulate the Ministry, the Poultry Advisory Committee and the National Farmers' Union on this Scheme and on the excellent progress which has been made in so short a time since the matter was first taken in hand by the Ministry's Marketing Branch. The Scheme is well devised, and appears complete so far as concerns the object of giving home-produced fresh eggs fair play in the home market. It will also have the effect of encouraging production for it provides the means for placing large quantities of graded eggs on the many considerable markets in cities, towns and industrial districts, with an even greater efficiency and promptitude than is customary in those foreign countries which have a large export trade with this country.

(6) The Committee found it occasionally urged that the Scheme could have only a limited effect inasmuch as a large proportion of the eggs produced in this country were best sold as they are now, *i.e.*, direct to private individuals, shops and small dealers, and that in that way they passed quickly into consumption. While this is true in regard to many eggs, the Committee feels that the Scheme will provide a new outlet for a large and increasing number, and that, when it is in operation, the quantity dealt with locally by direct sale will proportionately diminish rather than increase. The direct sale of eggs will continue, no doubt, to be a feature in the districts of small production where eggs are sold to meet the relatively small local demand. Wherever they are, or come to be, produced in large quantities, it seems to the Committee clearly to be to everyone's benefit that they should be candled, graded and packed for sale in standardized lots so as to compete effectively with the properly graded and packed imported eggs which they will meet on the markets up and down the country. It is unthinkable that the home industry of egg production could ever flourish and increase if eggs continued to be turned out as they are to-day, all sizes together, with no guarantee whatever as to their freshness. All poultry keepers know how easy it is for stale eggs, which have escaped collection at the proper time, to find their way into market consignments. These, as well as eggs of bad quality and others with blood spots in them, are immediately seen on candling at a packing station, so that, under the Scheme, it will be impossible for them to be included in the packs. The unreasonableness of selling eggs of mixed sizes at the same price is sufficiently obvious to need no comment.

(7) As regards the general question of price, it is not easy to predict the exact effect of the Scheme, though some witnesses anticipated that the market for home eggs would expand considerably to meet the demand under the Scheme, and that, after the Scheme had been running a few years there would be no low-priced periods of glut—especially with the development of adequate cold storage facilities—nor any very high-priced periods of shortage.

(8) At first sight, it appeared that the costs of the new services of candling, grading, etc., at the stations must be definite additions to

the marketing costs for which the consumer would have to pay more, or the producer receive less, than formerly. An examination of the position, however, shows that these services are something which can be given in as part of an entirely new organization dealing with large numbers of eggs in a wholesale way. It goes without saying almost that the packing stations must be of a sufficient capacity to bear the overhead expenses without undue strain.

The cost for the station's services under conditions which will prevail at the start may be as high as 3d. a dozen; on a turnover of five million eggs a margin of 2d. per dozen would be sufficient. This charge would, however, cover the cost of collecting the eggs from the established collecting points, conveying them to the station, management charges and costs of labour involved in candling, grading and packing in non-returnables, and delivery to the centres of consumption; though it would not suffice to meet fully interest on capital, expenditure on premises, plant, vans, etc., which, according to estimates given in an article in the Ministry's JOURNAL for November, 1928, may amount to as much as a year's working and running expenses of the station. Nevertheless, as will be seen, it covers items which must make up part of the heavy costs under the present ordinary conditions.

It is claimed that a station properly run can perform these services much more cheaply than the small dealers. Take the item of transport, for instance: the Committee was informed that against an ordinary railway charge of 5s. 6d. a cwt., or £5 10s. 0d. a ton in cwt. lots to London from Cheltenham, the charge for $\frac{1}{2}$ -ton lots packed in container trucks was £2 1s. 8d. a ton, and that the station's transit was quicker all the way to the retailer, so that its eggs could be put fresher on the market. It is obvious that a station owning a good motor transport service can save still further on time, and possibly also on cost.

The provision of non-returnables is another item in running expenses—at present about 2s. per 30-dozen case—but this is to be set off against the cost of the present system of returnables and the greater convenience and value of the new method as a selling point which must be reflected in the prices obtained, or in better sales.

(9) From the producer's standpoint, therefore, the Committee considers that, in all the circumstances, the stations should be able to pay an average price for eggs at least as high as local dealers, and, if the producer has a chance of joining as a member in a co-operative egg-packing station, venture he would do well to take it, and share in the profits of distribution as well. In any case, he can feel assured that the packing station's services are all necessary parts of an improved method of marketing, which will take his eggs to a market capable of almost indefinite expansion and which was previously closed against him.

(10) Turning to the stations themselves, it seems clear that the larger they are, and the more eggs they are capable of dealing with and do deal with, the less the proportion of running costs per dozen eggs. The co-operative packing station, if a good business manager can be found (and this is a matter of the highest importance), should, as already indicated, give the best return to producers. But whatever the kind of station, whether private or co-operative, it is essential that the greatest care should be taken to see that the best business methods are employed, otherwise the running costs, through poor organization and selling, bad debts, etc., will become unduly high and the station may not, in time, find itself able to offer competitive prices for eggs. As a later development of the successful co-operative egg-packing station, a dual-purpose station may come at which fruit and vegetables may also be graded and packed for selling.

(11) Before concluding, there is one point as to which the Committee would wish to put unwary producers on their guard. Instances may occur where local buyers will be prepared to give higher prices than are offered by the station. This is to be expected at times when the station is taking up most of the local output, and thereby creating a shortage in the district. But the local buyers will be unlikely to give the steady prices of the station with its far larger market when the times of general plenty come.

(12) In any case, the National Egg Marketing Scheme should not be allowed to be jeopardized by producers who agree to support a station being drawn from their allegiance by temporary better prices which the existence of the station makes possible. In the case of co-operative egg stations, therefore, contracts should be made compulsory on producers supporting the scheme to supply all their eggs for sale to the one buyer, *viz.*, the station, and the producers should be made to realize that default of such contracts is punishable by law.

(13) A point in the Scheme of advantage to individual producers which might be overlooked among the many other considerations is that reports as to doubtful and unsaleable eggs, etc., which will in the ordinary course be sent from the station to producers, will be of great benefit to them in checking their breeding and feeding methods. Close touch between the Station Manager and the producer cannot but lead to the greater efficiency of the latter in the business of supplying a high percentage of sound, large-sized eggs. It is to be remembered that he will be paid strictly according to results, and that, to improve his business, he will need to make himself acquainted with the most up-to-date scientific knowledge as to laying breeds, feeding trials, winter egg-production and so forth, now in course of being sent out from Harper Adams College, Salop, and elsewhere.

(14) It is estimated that last year's production of hen eggs in England and Wales from occupations of over one acre was in the neighbourhood of 1,800 million, being an increase of about 800 million over 1913. The fact of the increase of poultry on farms in recent years is, indeed, well known, and cases have been stated where poultry properly managed have paid the farmer's rent. County Poultry Instructors are now employed in nearly every county of the country, and their services are usually very much in request. This points directly to the fact that the cultivator—who can as a rule keep poultry cheaply—is taking more and more a keen interest in the principles of poultry husbandry. The Committee thinks that the time has come, now the National Mark Egg Scheme is about to be launched, for all farmers, smallholders and other country dwellers to set up poultry establishments under the best advice procurable, *viz.*, that of the County Poultry Instructor.

(15) The imports of eggs into the United Kingdom before the war were nearly 26 hundred million (1913) and, having dropped during the war, regained their high-water mark of 1913 in 1925, and last year (1928) were no less than 31½ hundred million. There is, therefore, plenty of scope for increased production in this country, and the consumption of home-produced fresh eggs must increase considerably when reliable grades and packs are placed upon the large industrial markets at fair prices in competition with imported eggs. To make satisfactory purchases the wholesale egg merchant buys hundreds of cases at a time to supply his weekly demands. He can only deal in home-produced eggs when they are sorted, graded and packed in non-returnable cases as is provided for in the National Mark Egg Scheme of the Ministry of Agriculture and Fisheries.

Adopted by Council,
January 24, 1929.

January 10, 1929,

APPENDIX B

REPORT FROM THE STANDING COMMITTEE ON THE SUBJECT OF THE CANNING OF FRUIT AND VEGETABLES.

(1) In the Report to the Council on the Better Marketing of Home-Grown Fruit, presented on October 18 last, the Standing Committee dealt briefly with the subject of the canning of fruit. Its remarks there were equally applicable to the canning of vegetables. The Committee said that this method of preservation provided means for dealing not only with the surpluses of any heavy crops from present acreages, but also with the produce of suitable crops from almost indefinitely extended acreages; that canning was very common abroad; and that large quantities of canned produce were imported which could very well be supplied at home from home-grown products. It added that the National Food Canning Council, a Council of producers, tinplate and can manufacturers, canners and distributors, had already been set up, and were actively engaged in assisting the development of the industry; and it recommended that the Government should help in the movement in whatever way was open to it, for example, by assisting research in canning, and in stimulating the provision of larger acreages for crops for canning.

(2) That statement summed up the position as the Committee then found it. Since it was made, the Committee has interviewed many persons engaged in the industry, including representatives of the National Food Canning Council, and it now discusses the matter in greater detail in this Report.

(3) The retained importations of canned or bottled fruit amount to about $2\frac{1}{2}$ million cwt. per annum (value about £6,000,000), and canned and bottled vegetables about $\frac{3}{4}$ million cwt. (value about £1,000,000). The corresponding pre-war importations retained in this country were fruit 850,000 cwt. (value £1,100,000) and vegetables 460,000 cwt. (value £450,000). Probably the larger part of the fruit importation consists of pineapples, peaches, apricots and other kinds of fruit not normally produced in this country but which have secured a hold on the national taste and on the distributing trade. The remainder is of fruit of kinds which we produce ourselves—apples, plums, gooseberries, cherries, and soft fruits such as strawberries, raspberries, loganberries and black currants. Nearly all the canned vegetables are of kinds which can be produced in this country. It is well known that the country is capable of producing excellent varieties of both fruit and vegetables very suitable for canning, and that canners can supply the finished product at competitive rates, quality for quality, with imported goods. There seems also little doubt that home-produced, home-canned goods give, on the whole, greater satisfaction to the consumer.

(4) It is possible that there still remains some prejudice among consumers against tinned foods; it persists probably from the days when canning was not so well or thoroughly done as it is in England to-day, when solder was used in the making of cans and the putting on of lids. To-day, the cans are made absolutely air-tight by what is known as double seaming, the edge of the lid being rolled under the lip of the can, and the joint squeezed together by means of a second roller. Only the best and freshest products are used, and it is fairly well-established that tinned foods are on the whole less likely to convey infection than ordinary unpreserved foods, which are liable to deterioration. It also seems to be established that in well-canned fruit and vegetables practically the whole of the original food value, vitamins and other, of the product, is retained. The public, therefore,

should not hesitate to employ these foodstuffs wherever and whenever the fresh equivalents are not available.

(5) At the cannery, the fruit is placed in cans, covered with syrup, and after the lids have been spun on by special machinery, the cans are heated to a suitable temperature and kept at it for a time varying with the kind and condition of the fruit. The same general course is followed in canning vegetables, except that a brine solution is used instead of syrup. The heat treatment given to the cans destroys any infection in the product, but not its shape or texture.

(6) There are about 30 canneries now established in this country, eight of them having been started only in the last 12 months or so. Most of the 30 are at present dealing in a short season with fruit only. Two at least, however, have a larger equipment—about five canning lines—and are able to deal with practically any sort of canning of animal or vegetable foodstuff. The remainder have, for the most part, one or two sets of machinery only. The cost of a canning line is in the neighbourhood of £2,000, but a smaller plant can be installed for £500-£750, which would be capable of turning out 800 to 1,000 cans per hour. Where, however, the fruit is available, and a sales side is in operation, a full canning line is usually installed so that the outturn for the short period of operation may more surely cover the overhead costs for the year. It is imperative that the goods are canned while they are still fresh, and they must be of the first quality. The Committee was informed that on one occasion only 20 of 200 tons of strawberries sent from Wisbech to a canning factory arrived in a state fresh enough to can. Furthermore, such goods cannot be held for any length of time in cold storage without becoming unsuitable for canning. Usually, the first quality produce, firm-ripe, goes for canning; and the next quality, well-ripe, for jams, preserves, or sale as fresh fruit and vegetables.

(7) The important considerations of the canner which concern the grower are (1) the kind and quality of seed or fruit grown, and (2) the time when it will normally be ripe and ready. The more the Committee pursued its researches, the more it became convinced that it is essential for growers to grow types of fruit and vegetables which will serve the dual purpose of fresh fruit and canned fruit. By no means all varieties which are excellent when eaten fresh will stand up to canning, e.g. some varieties of raspberries tend to disintegrate when canned. In the case of peas for canning in Belgium, the question of seed is reckoned to be so important that the canners supply it to the growers at less than cost price and indicate to them when to sow it, so ensuring as far as possible regular successional supplies to the cannery. The growers sow under contract at a definite price per 100 kilogrammes of sound produce, and it is a significant fact that the best seed, not only of canning peas, but also of spinach, carrots, and other canning vegetables, comes from England. It is not, so far, the general practice in England for a cannery to contract for fruit and vegetables at definite prices. Arrangements are made with growers under contract agreement or not as the case may be, and the canner indicates what quantities and varieties he will take, though the price is left over until harvest time.

(8) It should be realized that, in this country, we are only now in the stage of selecting our best canning crops, and in this selection both growers and canners are receiving valuable help and advice from the Director of the Campden (Glos.) Fruit and Vegetable Research Station attached to the University of Bristol. The National Food Canning Council expressed itself as highly appreciative of the efforts of the Director and his staff in elucidating some of the many difficult

problems, practical and scientific, which have beset this young industry, and hopeful that means would be found to continue this help to the industry in its present form, and, if possible, to extend it.

(9) In considering the costs of canned fruits and vegetables in this country and abroad, we were assured that in practically all cases the raw products are grown much cheaper abroad. For instance, we were told that the fruit contents of a tin of apricots cost $\frac{1}{2}$ d. to produce, whilst the contents of the same size tin of plums in this country might cost 4d. Labour was represented as the chief item of difference, being costly in this country and usually lower abroad, though not so in some parts of America; but there must be other considerations, such as higher rent, and, where the most modern methods of cultivation are used, the cost of extra manuring, spraying and pest-prevention, to be added to the other costs in this country, as against the probably cheaper total costs of the industry in America.

The Committee did not, however, find it possible to go minutely into details of these costs, nor was it prepared to accept at face value figures given to it. It was informed, for instance, that $2\frac{1}{2}$ lb. of canned American produce could be sold in this country at the same price as 1 lb. of canned English fruit of high quality. Inquiries at retail shops did not show anything like so great a discrepancy and the figures cannot, in the Committee's view, represent anything near the ordinary selling position. Indeed, quality for quality, English canned fruit and vegetables hold their own in the market as regards price. Home costs of production may be higher than foreign costs; the canning costs, through the high expense of canning machinery, which has mostly to be imported, may be heavier; yet the fact that there are no overseas transport charges to meet may be the factor responsible for our canned foods holding their own in the home market. If the price at which the products are marketed could be further reduced, it would seem that the complete success of the home canning industry must immediately be assured.

(10) As it is, the canners appear to be organized somewhat in advance of the growers. It was stated on authority before the Committee that the canners last season could have conveniently dealt with another 1,000 tons of strawberries, which were not to be had in the country, and that the pea-canning section would before long be able to deal with the produce of 100,000 acres in place of the 2,000 that are dealt with to-day.

(11) It appears to the Committee, then, that the step of prime importance that should be taken is for growers and canners to co-operate more closely with one another. The information and advice issued from the Campden Research Station, and from the Department of Scientific and Industrial Research, should be well known amongst both canners and growers, and, perhaps most important of all, the canners should be prepared to enter into contracts with growers for the delivery of sound produce at prices fixed at the time of contract.

(12) In the establishment of new canneries, the Committee would hope to see them set up as large-size units, capable of canning a variety of food products during the greater part of each year at least, and situated within a measurable distance of the place where the bulk of their raw produce is grown. Where goods have to be taken to the factory by railway transport it is advisable, if the goods are easily perishable, like strawberries, for railway vans to be provided with swinging trays or refrigeration, so that the fruit or vegetables may be carried without damage to the delicate tissues. The railway companies are usually ready to meet the needs of a new traffic where sufficient business can be assured to justify the expense.

(13) The Committee considered the possibility of corned-beef canning as an addition to the other items so as to prolong the canning year, especially having regard to the present tendency amongst farmers to increased milk production and the consequent placing of many cows on the meat market whose beef could not be graded either as "prime" or "choice" under a National Mark Scheme. Inquiry, however, showed that the industry was very unlikely to be profitable in this country as the tinned meat imported from the Argentine came from animals unsuitable for any other purpose costing only about £5 or £6 each, and that the tinning industry there was carried on most economically as regards costs. It did not, therefore, seem possible to recommend that canners should consider the possibility of using lean meat from old cows for the purpose of canning, the animals being worth considerably more in this country as fresh meat.

(14) It would be wrong to overlook one advantage which this country enjoys over other countries, in the matter of canning, and that is the possession of one of the largest sources of tinplates for canning in the world, *viz.*, South Wales. That should mean a somewhat cheaper cost of production over competitors. At the same time, it should be remembered that every extension of the canning industry in this country means additional help to the tinplate industry of South Wales. It is estimated that over 100,000 tons of tinplate comes to this country in the form of cans containing imported canned goods.

(15) Then there is the question of machinery for canning. Most of it is made in America, and can usually only be purchased from that country at high prices. It may be possible for English makers of jam-making machinery and others to turn their attention to the manufacture of "canning lines." It is understood that already efficient machinery for sealing the cans is made in this country.

(16) As to the making of cans, it appears that as the industry develops, can-making becomes a separate business, and it shows a tendency to do that in this country to-day. In America can-making firms have long specialized in the work, and one company at least not only supplies the cans, but supplies sealing machines on loan as well. The company takes the responsibility of keeping these in order and guarantees the canner against loss from faulty cans or faulty seaming.

(17) The internal lacquering of cans is also important. As a result of experiments at Campden last year, double lacquering of cans to prevent exposure of the tin, and consequent slight corrosion, and the spoiling of the appearance of the fruit, is now adopted by practically all canners of soft fruit. Excellent lacquers made in Birmingham are widely used in this country and even exported to the Continent. Canners and can-makers should be most careful to see that their systems of lacquering are as perfect as possible, otherwise the high quality of the produce might be impaired through ever so slight a corrosion by the acid of the particular fruit which is being canned.

(18) One further point: the advertising and selling end of an industry which is run on sound lines, as the canning industry is, is always very important. It should be possible to assist it by advertisement by the Empire Marketing Board, and by inclusion in the agricultural products dealt with under the Ministry of Agriculture National Mark Selling Scheme. With regard to the first suggestion, it is clearly right that the public of this country should be urged to support their home canning industry first, and the Empire canning industry second, so that, wherever suitable fruit and vegetables could be obtained from Empire produce, selling, of course, at competitive rates, they should be obtained, and the foreign goods passed by. As regards the second suggestion, all that would be required is that

grades of canned goods should be defined by the growers and the industry, adopted by the Ministry as a basis for the National Mark, and steadily adhered to by all canners, on the penalty of being removed from the list of those entitled to use the Mark in case of failure. The guarantee of quality which the Mark would give should assist sales and maintain the high standard of the produce.

(19) The most important matter from the wider agricultural point of view, however, is the possible extension of the fruit-growing industry as a result of the development of the canning industry. The Committee has stressed the importance to the canners of being supplied with fruit and vegetables of the first quality and freshness and of the right kind for canning, and, if a cannery is to make and keep a name for its goods, the produce must be of a uniform grade and quality. Obviously, as previously observed, success is a matter of close co-operation between the grower and canner. The fact that contracts had been entered into with canners for the sale of the produce of large acreages of fruit and vegetables at fair prices will tend to give greater stability to the prices received for the remainder of the crops, and may in consequence lead to a steady extension of the industry.

(20) In the Committee's view, it is not possible to over-emphasize the value of the Campden Research Station in the working out of the problems which are presented. The Station is in close touch with both growers and canners in the West of England. It is also collaborating with can manufacturers at Worcester and lacquer manufacturers in Birmingham. It is also understood to be working, or about to be working, in close touch with the Department of Industrial and Scientific Research, which has under careful examination the various methods of preservation of foods. The Station, largely through the energy of its Director, has the confidence of the growers on the one hand, and of canners on the other, and is, moreover, recognized as the centre of light and leading on canning matters throughout the country. What is required is that its powers and activities should be increased so that its teaching, so far as the best kinds of fruit and vegetables to grow and the best methods to use in canning, may be extended over the whole country. It seems to be the case that new firms taking up canning find great difficulty in getting experienced men to take charge. At present there is no place in England where men can learn commercial canning. It is suggested for consideration, therefore, whether it would not be wise to install canning machinery at the Campden Research Station, which would not only assist it in its work, but would provide means for the Station to give commercial courses of instruction to persons entering the industry. Not only could the scientific principles underlying canning be taught, but the men would be trained to handle the produce and the machinery, and to understand about syringing, exhaust, closing machines, etc. There are understood to be several schools in America where canning instruction of the kind is given, and there should at least be one in this country. Fruit growers and market gardeners have already the advantage of the advice of the County Horticultural Instructors; it is suggested that these Officers should be specially primed direct from the Campden Station with material for lectures on this particular subject.

(21) Before summarizing its general conclusions, the Committee propose to state in this report some of the chief points arising in the growing and canning of some of the principal canning crops, more as an example of the problems that arise than an endeavour of making a complete statement upon them.

Strawberries.—Strawberries for canning should be of good shape, and free from wrinkles and black seeds which are characteristic of

some varieties. The berries should be firm-ripe when canned, as over-ripe fruit loses shape and, if under-ripe, the product will be lacking in flavour.

Some 31 varieties have been tested at the Campden Research Station for canning during the past fruit season. In many cases the same variety was obtained from various parts of England so as to ascertain the possible effect of soil and district on the canned product. It is not sound to judge the varieties as the result of one year's test, and it is understood that the work will be repeated during the next two seasons. Of the varieties tested, however, the following appear very suitable for canning.

Variety	Districts
Paxton	Topsham, Devon. Long Ashton, Somerset. Bromsgrove, Worcestershire. Kingsley, Bordon, Hants. Wisbech, Cambridgeshire.
Leader	Coombe Martin, Devon.
Lord Grenfell ..	Bridgwater, Somerset. Eckington, Worcestershire.
Oberschlesien ..	Bridgwater, Somerset. Kingsley, Bordon, Hants.
Laxton	Kingsley, Bordon, Hants. Bere Alston, Devon.
Tardive de Leopold	Bridgwater, Somerset. Eckington, Worcestershire. Long Ashton, Somerset. Kingsley, Bordon, Hants.

It is a fact that in recent years the strawberry crop has suffered deterioration in this country, probably through a lack of sufficient care in providing the best runners as new settings, of inadequate cultivation, and of the prevalence of pests which the first two factors may have assisted. The acreage since 1924 has been reduced from round about 30,000 acres to about 20,000, and this at a time when the prospects of record sales of English canned strawberries are of the brightest. It appears to be imperative for growers to open up new areas for this crop if they are to supply the canners with anything like the quantity of fruit required. These new areas should be stocked as far as possible with the first runners from maiden plants. If inferior runners are supplied, or runners from plants suffering from disease, the loss to the grower may be very great, as he would not find out the fault until the season is too far gone to make an alteration, or even in some cases until two seasons are over.

In this connexion, the Ministry of Agriculture started a scheme in 1926 for inspecting plants from which runners are intended to be taken for sale so that they might be certified as sound and true to type. In 1927 about 90 acres were examined, and during last year about 200 acres were dealt with by the Ministry's Inspectors. The Ministry has further endeavoured to encourage the restriction of runners by extending its certification scheme to the granting of "super" certificates to growers who limit the number of runners to not more than five from each plant. The scheme, of course, is voluntary, but it is of great importance that it should be adopted so that the industry of strawberry growing may be saved from disaster.

A list of growers whose stocks are certified can be obtained from the Ministry. It is advised that all those growers who sell runners from their strawberry plants, and have not taken advantage of the Ministry's scheme in the last two years, should apply for inspection during the coming season.

It will be clear, after considering the foregoing, that it is of great importance also that all possible economies should be used in dealing with the fruit that is available from existing acreages, and it becomes all the more important that railway companies should be urged to assist in the supply of refrigerator vans and other special facilities so that none of the crop may be wasted.

As to prices; during the past season, strawberries grown near a factory, stalked, in 6 lb. chips, were sold to canners at £50 per ton. Wisbech strawberries were purchased at £37 10s. 0d. per ton, on stalk, in 24 lb. trays.

Growers could probably be induced to plant strawberries for a price round about £45 per ton for the first year; £42 for the second; £40 for the third; £38 for the fourth year.

Raspberries.—English raspberries are excellent when canned, and the flavour is far superior to the imported canned raspberries. As an excellent crop of fruit can be obtained within three years of planting, there appear to be possibilities of the acreage under raspberries being greatly extended as the canning industry progresses. The following varieties of those tested at the Campden Research Station have given good results: Lloyd George; Calstock Seedling; Semper Fidelis; Baumforths; Devons; Worcester Prolific; and Pyne's Fillbasket. Raspberries deteriorate rapidly, and it is essential for the plantations to be within easy reach of the canners.

Last season's price was £40 to £50 per ton in growers' chips. Growers would probably extend their acreages considerably on a four years' contract at about £45 per ton. Season by season, the price varies from £38 to £52.

Loganberries.—Logans are also excellent for canning, but when grown for canneries they should be well cultivated, and free from the maggots of the loganberry weevil. The presence of maggots in canned loganberries is prejudicial to their sale, and the only way to ensure freedom from this drawback is by control of the pest by the grower.

The price paid during the past season was approximately £37 per ton. The grower would probably extend his acreage for a five years' contract at £35 per ton. Purchased season by season, the price varies between £28 and £42 per ton.

Gooseberries.—When canned in heavy syrup, gooseberries yield a really excellent product, and their sale is increasing yearly. The fruit should be picked under-ripe, but the berries must not be too immature or they will have little flavour. For canning, green varieties of medium size are preferable, and the following are all satisfactory: Whinham's Industry; Keepsakes; Careless; Crown Bob; and Lancashire Lad.

During the past season, gooseberries were purchased for canning at £10 to £15 per ton. Canned gooseberries are becoming more popular, and a fair price to the grower on which he could extend his acreage would be £12 to £14 per ton.

Currants.—Blackcurrants are especially valued for their strong and characteristic flavour, and for their reputed medicinal properties. Good canning varieties of blackcurrants are: Baldwin; Edinas; Victoria; Boskoop Giant; and Seabrook's Black.

The price last season varied from £40 to £50 per ton.

Redcurrants are not canned alone to any extent, but they are often put up as a mixed pack with raspberries. Suitable varieties are: Comet; Ruby Castle; and Laxton's Perfection.

Plums and Damsons.—There are many varieties of plums which give excellent results when canned. The common yellow egg, or Pershore plum, when canned in a heavy syrup, is frequently superior

to the less common varieties. Victoria, Pond's Seedling, Golden Drop, and Magnum Bonum all give good results. Amongst the purple varieties Purple Prolific, Early Rivers, Purple Pershore, and Coe's Late Red have all been found suitable. The prune damson is excellent for canning, as is also the Worcestershire damascene. The Kent prune, whilst not quite so good, is also satisfactory.

Egg Plums.—The price varied during the past season from £15 to £17 per ton. Bought forward under, say, a four years' contract, a fair price would probably be round about £15 per ton. Purchased season by season, the price varies from about £8 to £22 per ton.

Victorias.—There is an appreciable shortage of Victoria Plums for canning. During the past season, the canners purchased at roughly £37 per ton. On a four years' contract, a fair price is probably about £28 per ton. Purchased season by season, the price varies between £12 and £40 per ton.

The Early Rivers Plum is also an excellent plum for canning.

Damsons (Prune).—During the past fruit season, prune damsons were about £36 per ton delivered. The price varies season by season from £15 to £40 per ton. On a four years' contract, a fair price would probably be about £25 per ton.

Kent Damsons.—Price during the fruit season, £30 per ton in Kent, grower's own chips. This damson is not so good for canning as the prune damson.

Apples.—This fruit is available all the year round in the fresh state, by reason of the heavy importations. It may prove a paying business to can by solid pack some of our best apples for cooking, e.g., Bramley's Seedlings, in gallon tins, for use in restaurants, hotels, etc., in the winter-time and through spring and early summer, and also small cans for use by the housewife for single pies. These would be at hand ready for use without any trouble of preparing, and for this reason might be preferred even when the fresh Bramley's Seedlings, etc., are on the market.

Peas.—The preservation of green peas is a considerable industry in France, United States, Belgium and Italy. Peas grow remarkably well in England, and for flavour and yield compare favourably with those from any part of the world. They are at present canned only in three or four centres in England, though it is likely that the scale of canning will soon be much extended. At present there appears to be no difficulty in getting farmers to grow for the purpose, so that the prices paid by the factory appear to be remunerative. In America, more peas are canned than any fruit or other vegetable, with the exception of corn (maize) and tomatoes.

The use of copper sulphate by which many of the packs were kept green in the can may have had some effect in keeping down the consumption of this product in this country. Its use is now prohibited, and the Campden Station have discovered a harmless substitute which has the same effect as the copper sulphate, and are informing English canners of the secret.

The season for pea canning commences in June, and in order to make it as long as possible, it is usual to make successive sowings with early varieties, second earlies, and then maincrop varieties.

At present, there is great need for research by the Horticultural Stations on the best varieties of peas for canning, not only from the point of view of suitability of the peas themselves, but also on varieties that ripen uniformly, so that they may be cut by a viner. If the pods have to be picked by hand, labour will be difficult and costly, and the cost of the product will be much higher than is actually necessary. It is obvious that to build up a large industry large quantities of peas

will be required, and these will not be available if the picking has to be done by hand.

In this connexion it should be remembered that in America, the straw and pods are stacked after removal of the peas, and made into a kind of silage that is much appreciated by cattle.

Pea canning plant can be kept going in the off-season in the canning of beetroot, pork and beans, mixed vegetables, etc.

The price paid is usually between 8s. and 10s. per 80 lb. bag where the canneries receive the pods in bags. Local growers would probably be prepared to grow peas under contract at this price. It must be borne in mind that picking charges work out at roughly 2s. per 80 lb. bag, hence the advantage of using viners. When these machines are used the crop is cut by mowers, and either taken by motor lorry to the cannery and shelled mechanically, or the shelling is done at central stations located in the fields, and the shelled peas only are taken to the cannery. The grower is paid a definite price per acre or on the yield of shelled peas produced.

(22) The chief conclusions of the Committee, therefore, are :—

- (1) Growers in this country should prepare to extend their acreages of fruits and vegetables in order to satisfy the growing demands of the canning industry.
- (2) Growers and canners should co-operate more closely in order—
 - (a) that varieties of fruit and vegetables suitable for canning should be grown in quantity on the most suitable soils in the neighbourhood of the canneries ;
 - (b) that successional ripenings of them should be available in order that the fullest economy be achieved in the industry ;
 - (c) that contracts at definite prices per stated quantity of sound produce should be a regular feature of the industry ;
 - (d) that the costs of production should be carefully scrutinized from the commencement of growing to the sale of the finished article so that they may, where possible, be reduced, and an article sold which will, for quality and price, take undisputed command of the home market ;
 - (e) that canners should take great care to secure proper lacquering of their cans.
- (3) The Ministry of Agriculture, the National Farmers' Union, and the Canning Industry should consider the definition of standards for canned fruit and vegetables with a view to bringing these products under the National Mark Scheme which guarantees the products as home grown and of the stated quality. All English canned produce should be marked as such.
- (4) The Fruit and Vegetable Research Station at Chipping Campden should be assisted in its excellent work of helping the growers who grow for canning and the canners themselves. In the latter connexion the Station should be supplied with a canning plant, and classes of instruction in the scientific and practical aspects of canning should be authorized.
- (5) The Empire Marketing Board should be invited to consider the separate advertisement of English canned goods amongst consumers in this country.

January 11, 1929.

Adopted by Council,
January 24, 1929.

EXPORT OF BREEDING STOCK IN 1928

NUMBER and declared value of animals, living for breeding, exported from Great Britain and Northern Ireland during 1928, with comparative figures for 1927. (From "Annual Statement of Trade" and returns supplied by H.M. Customs and Excise.)

Country to which exported	1928		1927	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	297	48,441	346	104,420
Brazil	80	7,748	26	4,185
Colombia	26	2,253	26	2,943
Russia	106	6,919	0	0
Uruguay	46	8,260	62	12,186
Australia	0	0	46	6,943
British India	11	1,370	15	948
Canada	318	21,825	209	15,820
Irish Free State ..	2,023	40,304	4,536	76,068
Kenya	69	3,256	39	1,975
Union of South Africa ..	94	7,587	45	3,839
Other countries ..	105	7,526	201	8,324
Total	3,175	155,489	5,551	237,651
SHEEP AND LAMBS				
Argentina	737	19,710	878	21,098
Brazil	172	4,018	56	1,861
Chile	118	5,081	65	2,500
Peru	0	0	89	1,143
Russia	1,058	10,418	0	0
Uruguay	275	6,572	133	3,136
United States of America	58	800	155	2,235
Canada	402	5,316	389	6,730
Irish Free State ..	674	4,940	1,575	4,999
Other countries ..	224	2,624	221	3,212
Total Sheep and Lambs	3,718	59,479	3,561	46,914
SWINE				
Argentina	14	578	19	571
Brazil	17	380	0	0
France	43	818	44	686
Hungary	29	830	0	0
Italy	29	984	3	150
Japan	4	292	18	1,064
Portugal	20	367	2	52
Russia	63	2,040	0	0
Irish Free State ..	170	1,765	1,287	3,741
Other countries ..	121	2,188	139	3,191
Total Swine ..	510	10,242	1,512	9,455

MARCH ON THE FARM

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Field Operations.—This month is well named in the sense that it is the time of the year when progress with farm operations begins to accelerate. There are so many parts and departments of the farm to which attention may be given in a favourable weather period in this month, that performance is limited only by the staff of men and horses available. March, with its lengthening days, the gradual increase in duration of sunshine, the appearance of a dry surface on the ploughed fields and of lambs in the pastures, does indicate the opening of a new season.

March is a busy sowing month: oats and barley are the principal crops here concerned; but beans, peas, tares, rye, cabbage and forage mixtures are sown on smaller areas; early potatoes are planted; and towards the end of the month clovers are sown in young wheat. The applications of fertilizers as top dressings to corn and leas are commonly given in March, after the tillage operations which these crops receive.

The pressure of field work that besets the farmer in a fine March shows the desirability of having completed thrashing and delivery of corn, and made good progress with manure carting during the preceding months. Above all it emphasizes the value of autumn cleaning operations, which enable the farmer to concentrate his attention on the production of a tilth without first having to eradicate weeds.

While it is perhaps natural for the farmer to give first attention to the corn land, leaving the root ground until the drilling of spring corn has been completed, there is something to be said in favour of "sliping" the surface of the green crop land at the earliest practicable date. Farmers who have tested this advice have found that this operation appreciably helps tilth formation and reduces the number of hard clods, while the fear of trouble from encrustation has been found to be groundless. The implement is passed over the ground as soon as the surface is dry enough to carry the team, and its action is partly to crush the half-dried lumps of soil and partly to press them into the moist soil, where they will mellow down.

In its simple form the slipe consists of two units each made of six pieces of scantling about 3 in. by 2 in. by 4 ft. 6 in., linked together at intervals of about 12 in. The two units

then form a sort of harrow measuring 9 ft. wide by 5 ft. deep, and they are attached to a draught bar in the same way as a zig-zag harrow. For use on heavy land that has been beaten down by winter rains, the first bar of the slipe should be fitted with short harrow-teeth. The last bar may also be toothed for use on land that tends to run together. Generally two "turns" of the implement are necessary, the first being across the ploughing.

The value of March dust has been expressed in many proverbial sayings; for it has long been known that a drying period at this time of the year enables our clay soils to bear abundant crops of corn. What the wheat grower specially desires is a frosty winter and a dry March. Under such conditions, there would be need for rolling winter corn on light and medium soils and generally where the land had become hollow and puffy. Even heavy soils may benefit from rolling; but this operation cannot be reduced to a matter of farm routine; often on strong land it does more harm than good to both winter and spring corn. In case of doubt rolling should be omitted. Harrowing, however, is less questionable and should be adopted both as a means of breaking a top crust and promoting aeration, and to consolidate the soil below the surface.

Ewes and Lambs.—Much less attention has been devoted to the balancing of rations for suckling ewes than to the rationing of dairy cows. Sufficient is known, however, to indicate the necessity of protein-rich supplements to the bulky diet when this consists of roots and hay, as it does when ewes lamb before there is young grass available. According to the evidence given in the Ministry's Leaflet No. 215 (Sheep Feeding), a suckling ewe weighing 160 lb. and producing 3 gallons of milk per week requires, besides 140 lb. of swedes and 14 lb. of hay, concentrates containing 2 lb. of digestible protein and 7 lb. of starch equivalent. This is somewhat richer in protein than a balanced dairy compound, and could be supplied by a daily allowance of about 1½ lb. of the well-known and approved mixture of equal parts linseed cake and crushed oats. A more complex ration would be equal parts by weight of decorticated ground nut, cottonseed meal, linseed cake, oats, and maize meal. When kale is available, and also when early rye and young grass begin to take the place of roots, a less albuminous supplement is needed.

The Milk Market.—"Milk as a rule is in very plentiful supply, and accommodation milk, which is offered at 12d. to

16d. per gallon, generally meets with little request." This statement in the Agricultural Market Report of February 8—which is only one of a series having the same import that have been issued during the past few months—indicates that the problem of milk marketing has not yet been solved. For some time the official reports have indicated the existence of abundant supplies of accommodation milk at the London, Birmingham and Manchester stations; and from conversation with producers and distributors, further evidence may be gained that, so far from the supply of milk having been short as prophesied, considerably greater supplies have been available for liquid consumption than the market could absorb.

Farmers attribute the increased supplies of winter milk to the superior quality of the 1928 hay—which, it may be incidentally mentioned, is rapidly disappearing. The hay of 1927 was, on the contrary, largely responsible for the scarcity of milk in the winter of 1927-28. With the assistance of good hay and an increase in the price of milk, and in the belief that supplies were unlikely to exceed the demand—owing to the reduction of 67,500 in the numbers of dairy cows and heifers—producers have undoubtedly endeavoured to increase their output. The demand and prices for cows and heifers in milk have indicated this endeavour; increased numbers have been imported from Ireland; and doubtless the increase shown in supplies of dairy cattle at the "representative markets" is in some measure due to the transfer, into herds supplying the liquid market of cows from districts where milk is not dispatched for liquid consumption. The possible influence of the above-mentioned reduction in total numbers of cows and heifers was therefore over-estimated: compared with the 1926 figures, the reduction was only 26,186; and, it may be recalled, there was considerable excess production for liquid consumption in the winter of 1926-27.

From the point of view of the arable farmer who may be turning his attention towards dairying as a solution of his financial problems, the above situation is not encouraging; the established dairy farmer, however, cannot view it without concern for the immediate future. The principal need is admittedly an increased demand for liquid consumption, and it is well known that the quantity consumed per head in this country is low in comparison with that of certain other nations. Regulation of the total output—such as obtains in the production of earthenware, for instance—is perhaps almost impracticable within measurable time. Early consideration

should, however, be given to the question of regulating the supplies of milk that are surplus to the capacity of the liquid milk market. Past experience proves the undesirability of offering accommodation milk at less than contract prices. This question will doubtless arise in connexion with the paper which Mr. A. E. Magee, of the Scottish Milk Pool, will read at the April meeting of the Farmers' Club.

The Dairy Herd.—Before the war a newly calved cow of Shorthorn type was worth from £18 to £23, according to quality and time of the year. The higher figures were realized in the autumn and early winter months. The same class of cow, when ready for sale to the butcher, was worth about £17, so that the suburban dairyman had to suffer a "drop" of about £5 per cow, or 2d. per gallon of milk yielded. At the present time dairy cows are worth £24 to £32 when in full yield and in the best markets about £21 when fat. The difference between the milking and the slaughter values is now about £7, or 2½d. per gallon on a 600-gallon yield, without including the amount attributable to loss by deaths.

Only the suburban dairyman changes his herd entirely in the course of the year. The farmer who endeavours to maintain a regular breeding herd is able to retain his cows for a longer period than one lactation and thereby to reduce the cost of herd maintenance. The average period of retention of animals in the breeding herd is, however, much shorter than is generally believed. In the Food Controller's Investigation of 1919-20, in which 165 farmers co-operated, it was found that with the commencing total of 5,968 cows, there were 1,448 sales and deaths in the following seven "winter" months, which was at the rate of over 40 per cent. per annum. This figure is rather higher than the average as indicated by the annual reports of milk-recording societies, which—according to the Central Council's Year Books for 1922-25—has in 33 societies worked out at 33 per cent. According to this evidence the annual replacement is at the rate of one-third of the herd each year; in other words, the average cow remains in the herd about three years after the date of her first calf.* The cost of herd maintenance is about 1½d. to 2d. per gallon, of which 1d. is due to the difference between the dairy and beef values of the cows fattened off, and ½d. to 1d. is due to loss

* The Ministry does not hold itself responsible for the opinions expressed or the statements made by contributors, and in this instance desires to make it clear that it must not be regarded as agreeing that the milk-recording statistics can be said to prove Mr. Borid's thesis.

by death (about 6 per cent.) and ailments that affect the value of the cow for fattening.

The statistics of the milk-recording societies indicate that the cows drafted out are replaced mainly by heifers. For example, in the year 1923-24 the number of heifers introduced into the herds of 31 societies concerned was 21,759, and the number of cows not retained for the full recording year was 24,993. These figures confirm the deduction that the milking life of the dairy beast is as short as three years, subject to the assumption that the animals drafted out are not sold for further dairy purpose. This assumption is reasonably safe, because it is well known that few farmers who record their cows are willing to sell the animals that have proved their worth at the pail.

It has been stated that the main reason for such a heavy "wastage" in dairy herds is the "modern craze for high milk records." To some extent that is correct, as the recording farmer declines to retain in the herd young cows that fail to attain a satisfactory standard of yield. Too many farmers have cause to complain of the large proportion of their home-bred heifers which prove to be poor milkers; and better results in this respect would relieve them of the necessity of rearing so many calves. The implication, however, that the higher yields which have resulted from more scientific feeding have entailed heavier "wastage" in herds is not supported by the evidence available. The West Sussex results show that tuberculosis, which is so often cited as an important source of loss in dairy cattle of high milking capacity, is responsible for only a small amount of wastage compared with other causes that are not, as far as is at present known, associated with high rather than with moderate milk yields.

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NOTES ON MANURES

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Top Dressing.—In growing winter cereals, the aim should be to grow as big a crop as will stand. This, admittedly, requires considerable judgment as far as the condition of the soil is concerned, while the nature of the summer also affects the question, because certain seasons tend to grow an abnormal amount of straw. The year 1925 will be remembered as a case in point. Since the weather cannot be foretold, this factor is reduced to an estimate of the chances of meeting the abnormal, and most farming operations are carried on under this limitation. As far as soil conditions are concerned there are certain general guides. Phosphates and potash present as residues are decidedly helpful, and under no likely circumstances will they be present in excess. The factor to assess is the quantity of available nitrogen, and the governing circumstances here are (1) the amount of nitrogenous manure added; (2) the nature of the winter as regards drainage through the soil; (3) the resources of the soil itself. We may take these points in turn. The supply of nitrogen will be increased by dung or slow-acting organic manures having been applied to the previous crop, by the turning in of a sod of red clover or a well-turfed old ley, or by folding off the previous crop with sheep receiving hand feeding. The nitrates thus produced may be well held in a retentive soil during a hard winter, or they may suffer considerable loss from an open soil in a mild, wet winter. In the latter case, although the land was originally rich, further nitrogen as a top-dressing in spring may be required. Few soils are so rich naturally that nitrogen is normally in excess; the black fen soils are the most notable exceptions. In relation to the supply of nitrogen, the regional rainfall is to be considered. It appears that more care must be taken with nitrogen in wet districts than in dry ones, for the former usually produce soft luxuriant growth in any case, and this may be pushed to extremes by injudicious use of nitrogenous fertilizers.

Forms of Nitrogen.—The type of nitrogenous fertilizer suitable for top dressing will depend on the soil, and on the time of application. The most important question with regard to the soil is its lime supply. On soils supplied with lime, sulphate of ammonia is a suitable source of nitrogen. On soils which are either acid or on the verge of acidity, it is better to use a manure either supplying a little chalk, such as

nitro-chalk (15½ per cent. N.), or manures, such as nitrate of soda or nitrate of lime, which make no demands on the lime supply of the soil. Calcium cyanamide is not so widely suitable for top dressing purposes as the other fertilizers mentioned, and if used at all it should be applied early, *i.e.*, before vegetation commences growth in the spring. A day when the young corn is dry should be chosen to apply cyanamide. The type of dressing is also chosen to suit the time of application. For immediate action, as, for example, when the dressing has been unduly delayed or the crop is suffering from an insect attack, some form of nitrate is required, *e.g.*, nitrate of soda, nitrate of lime, or nitro-chalk in which one-half of the nitrogen is in the nitrate form. For earlier application, sulphate of ammonia is suitable, and, for very early or even autumn applications, cyanamide may be tried with the precaution mentioned above.

Experiments carried out over the last few seasons at Rothamsted have shown that good increases may be obtained from top dressings (as sulphate of ammonia, or equivalent muriate of ammonia, in this case) applied somewhat later than usual. Dressings to wheat and winter oats applied as late as mid-May have been at least as successful as March dressings in increasing the yield of grain. The following is a summary of the results:—

INCREASE IN GRAIN (BUS.) AND STRAW (CWT.) PER ACRE PER 1 CWT. S/A OR ITS EQUIVALENT.

	Grain, bus. per acre				Straw, cwt. per acre			
	N. at 23 lb. per acre		N. at 46 lb. per acre		N. at 23 lb. per acre		N. at 46 lb. per acre	
	Early	Late	Early	Late	Early	Late	Early	Late
WHEAT								
1921 ..	-0.5	2.3	0.2	1.6	1.6	1.1	1.9	2.0
1922 ..	4.1	5.1	3.2	2.4	3.5	3.8	3.2	2.8
1926 ..	3.0	6.6	3.5	1.9	3.8	3.6	3.5	1.8
1927 ..	2.6	2.4	3.2	2.6	4.1	3.5	4.8	1.6
1928 ..	2.9	5.8	—	—	3.1	6.1	—	—
Mean ..	2.4	4.4	2.5	2.1	3.2	3.6	3.3	2.1
WINTER OATS								
1923 ..	8.1	5.4	8.7	12.3	7.1	3.7	8.3	7.4
1925 ..	10.8	14.6	7.4	9.9	8.3	7.3	6.8	5.5
1926 ..	2.6	4.3	1.1	1.3	7.2	5.2	7.3	2.4
Mean ..	7.2	8.1	5.7	7.8	7.5	5.4	7.5	5.1

NOTE: The Nitrogen was supplied as sulphate of ammonia at 1 cwt. or 2 cwt. per acre, or its equivalent as ammonium chloride. The early dressings were applied at various dates during March, the late dressings during May.

The figures show that, under the conditions of these experiments, the 1 cwt. application to wheat did on the whole rather better when applied late than early. The effect was in the same order in the case of oats. There was a distinct tendency with oats for the late dressings, both single and double, to increase the grain more than the straw. As might be expected, the unit of nitrogen was not so effective in the double dressings as in the single ones. Thus, the increases per 1 cwt. sulphate of ammonia equivalent, taking all times of application together, were:—

Single dressings	3.4	bus. wheat and	3.4	cwt. straw.
Double ..	2.3	" " "	2.7	" "
Single ..	7.7	" oats "	6.5	" "
Double ..	6.8	" " "	6.3	" "

In the case of wheat, the higher dressings hardly seem to have been justified. With oats, however, the efficiency of the higher dressings is better maintained and, at the rate of 2 cwt. of sulphate of ammonia per acre, each cwt. was producing much more grain and straw than was required to cover the cost of the manure.

Against the use of late dressings must be placed the fact that the plots so treated were appreciably later to harvest than those receiving their nitrogen early, while the double dressings, although standing as a rule, were lodged in certain seasons. One might conclude that there seems to be no advantage in applying top-dressings unduly early, and that quantities in excess of 1 cwt. per acre should seldom be used for wheat, although such treatment might be in place for a stiff-strawed variety of oats when the land is in rather poor condition.

Finally, there is the question of the variety of the crop itself. One of the problems of the plant breeder is to produce varieties of cereals which will stand up to generous treatment with nitrogenous manures, which will no doubt be increasingly plentiful in future. Little experimental work on this question has been published, but Yeoman wheat has been reported as standing better than other varieties under heavy manuring (*see this JOURNAL*, November, 1928, p. 760), while certain varieties of oats, for example Marvellous, have a particularly good reputation in highly-farmed districts. The favoured varieties of barley, such as Plumage Archer and Spratt Archer, also have this property well developed.

Lime Surveys.—Much has been written on the need for lime, and there is no doubt that in many districts soil acidity

is the limiting factor in crop growth. One of the reasons why farmers are reluctant to use lime is the cost; for although the acre cost of liming is usually little more than will frequently be spent on artificials for a cash crop, such as potatoes, the immediate returns are not as a rule so considerable. It is rather a case of slow all-round improvement in fertility—a long-period investment, in fact. One method of reducing cost is to ensure that local supplies of liming material should be exploited to the full. The object of regional lime surveys is to ascertain, by chemical test and field observation, the districts and formations most in need of lime, and further, to bring to the notice of farmers the possibilities of the local supplies of chalk, limestone or marl, and the nearest kilns or grinding plants.

Surveys of this kind have been carried out by Porter in Herefordshire, Hanley in Yorkshire, and more recently by Thompson in Northamptonshire, while in many of the counties a systematic examination of the soils from the point of view of lime supply is being undertaken. This work has been of undoubted value to the farmers of those districts. A feature is the decline in the number of small private kilns and the increasing share of the trade obtained by producing units working on a great scale with high efficiency. The essence of the whole position is transport, and work of the kind noted above enables farmers to make an estimate of the cost of obtaining lime products from their nearest local source, as compared with that needed to procure their requirements from a distance. The provisions of the Fertilizers and Feeding Stuffs Act, 1926, enables this to be done most readily, as the grades of commercial lime products must now be stated by the vendor. As is noted on p. 1141 of this issue, where a conditional remission of rent to a farmer is allowed by the landlord for liming, the Inland Revenue will allow a set-off against Schedule A payments.

Nitrogen for Spring Corn.—The same general considerations as are set out above for the nitrogenous manuring of winter corn will apply to spring corn, except that, in this case, it is usual to supply the necessary nitrogen in the seed bed rather than as a top dressing. At any rate, if top dressings are to be used for spring corn they are generally applied early, the quicker acting types of nitrogen being used. In the case of oats, a little more risk may be taken than with barley, where lodging would be fatal to the quality of the sample. Indeed, at Rothamsted, barleys grown with sulphate of ammonia in

PRICES OF ARTIFICIAL MANURES

Description	Average price per ton during week ended February 6th				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%)	10 10d	10 10d	10 10d	10 10d	13 7
Nitro-chalk (N. 15½%)	10 0p	10 0p	10 0p	10 0p	12 11
Sulphate of ammonia :—					
Neutral (N. 20·6%)	10 13d	10 13d	10 13d	10 13d	10 3
Calcium cyanamide (N. 20·6%)	9 14e	9 14e	9 14e	9 14e	9 5
Compound white nitrates of lime and ammonia B.A.S.F. (N. 15½%)	3 6	10 10h	2 19	3 2	4 6
Kainit (Pot. 14%)	5 3	3 9	4 17	5 1	3 5
Potash salts (Pot. 30%)	3 15	3 9	3 8	3 12	3 7
" (Pot. 20%)	9 17	9 3	9 2	9 0	3 7
Muriate of potash (Pot. 50%)	11 19	11 6	11 5	11 5	4 8
Sulphate " "	2 3c	1 17c	2 4c	2 4c	2 9
Basic Slag (P.A. 15½%)	1 19c	1 12c	1 12c	2 0c	2 10
" (P.A. 14%)	..	1 7c	1 7c	..	..
" (P.A. 11%)	..	..	..	..	..
Ground rock phosphate (P.A. 26·27½%)	2 10||	2 7||	3 6	2 5a	1 8
Superphosphate (S.P.A. 16%)	3 7	..	3 0	3 6	4 2
" (S.P.A. 13½%)	3 2	2 15	3 0	3 0	4 4
Bonemeal (N. 3½%, P.A. 20½%)	8 15	8 10	8 12	8 7	..
Steamed bone flour (N. 3½%, P.A. 27½-29½%)	5 17b	1 10l	6 15	5 10	..
Burnt Lump Lime	1 7k	..	1 11n	2 2m	..
Ground Lime	1 14k	..	1 8n	1 17m	..
Ground Limestone	1 1k	..	..	2 6m	..
Ground Chalk	..	1 6	..	1 11m	..
Slaked Lime	..	..	2 14n	3 2m	..

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. 85% through standard sieve.

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

e 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. Rebate of 1s. per ton will be allowed.

e Delivered in 4-ton lots at purchaser's nearest railway station. Rebate of 1s. 3d. per ton will be allowed.

h F.o.r. Goole.

k 4-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.

n Ground limestone, ground chalk and slaked lime in non-returnable bags.

o 6-ton lots delivered Liverpool stations, ground limestone 45% through standard sieve.

p Prices for 2-ton lots. Rebate of 1s. per ton will be allowed.

excess of 1 cwt. per acre have been depressed in valuation although they have stood up at harvest. It may be taken roughly that, on soils in only medium condition, 1-1½ cwt. of nitrogenous manure per acre may be used for oats, and not exceeding 1 cwt. for barley; the latter crop usually receives its nitrogen as ammonia, while recently at Rothamsted good results have been obtained by using cyanamide applied a week or so before sowing.

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NOTES ON FEEDING STUFFS

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The Yield of Pastures.—Under what system of grazing does a pasture yield the maximum amount of nutrient food, or starch equivalent, in a season? This is one of a number of questions to which an answer is being sought in the pasture investigations which are being conducted year by year at Cambridge by the writer and his co-workers. A brief summary of the main results which have already been obtained will reveal the progress which has been made towards the solution of this particular problem.

The results of the first two investigations, carried out during the seasons of 1925 and 1926 respectively, demonstrated that, under a system of cutting at weekly intervals, a pasture will yield, irrespective of its botanical composition, a herbage containing dry matter possessing the character of a protein concentrate of high digestibility and nutritive value. Further, under such a system of treatment, this constitution is retained substantially throughout the season, especially if the rainfall during mid-season is sufficient to maintain the herbage in a condition of active growth.

A third investigation, carried out during 1927, showed that the differences in chemical composition, both organic and inorganic, between grass cut at weekly and at fortnightly intervals are inconsiderable. The dry matter of pasture herbage grown under a system of fortnightly cutting is a protein concentrate equal in digestibility and nutritive value to that obtained by weekly cutting. Moreover, by systematic cutting at fortnightly intervals, these characteristics are retained over the entire season.

During the season of 1928, the investigation was carried a stage further by the adoption of a system of cutting at

intervals of three weeks. Though the herbage obtained under this more lenient system of cutting was somewhat less rich in digestible protein, it was, nevertheless, equal in respect of digestibility and nutritive value to grass grown under weekly and fortnightly systems of cutting. At the end of three weeks' unchecked growth, pasture grass still consists of non-lignified, highly digestible tissue as at the end of a week's or of a fortnight's growth. Although the protein content of the grass shows a slight falling off during the third week of growth, this is unaccompanied by any corresponding diminution in digestibility. It was further demonstrated that the depressing influence of drought on the protein content and digestibility of pasture grass is much less marked under a system of three-weekly cutting than under the severer system of cutting every week.

Since the characteristic of high digestibility is maintained, by cutting every three weeks, over the whole season, it may be inferred that similar results would follow from a system of rotational grazing, where the pasture enclosures, after being thoroughly eaten down by stock, are permitted a three weeks' interval of unchecked growth before being grazed again. It will be the object of future investigations to discover the extent to which the interval between successive grazings may be further lengthened without causing the herbage to lose its highly digestible character. During the coming season, for instance, the work is to be repeated under a system of cutting at monthly intervals, and the results of this investigation should possess a particular interest, because a period of four weeks has been commonly adopted in this country as the interval, in rotational grazing practice, between successive grazings of enclosures.

During the carrying out of the 1927 investigation, it was found that if adjoining plots on a pasture be cut at weekly and fortnightly intervals respectively, then the plot cut fortnightly yields somewhat more heavily than the plot cut every week. Further, this disparity in productivity becomes most marked at those times of the season when the conditions for growth are most unfavourable, as, for instance, during a spell of droughty weather. Since the weather conditions of 1928 were, on the whole, unfavourable to the abundant growth of herbage on pastures (owing to droughty conditions which prevailed during April, July and September), it would be anticipated that the yields from the plots submitted respectively to weekly, fortnightly, and three-weekly systems

of cutting would display unusually striking differences. That this was actually the case is made clear by the accompanying table, in which a comparison is given of the total yields of herbage, in dry matter per acre, which were obtained in 1928 from the respective pasture plots. The yields from the same pasture under the conditions of the 1925 and 1927 investigations are also given.

Summary of Total Yields of Herbage from Pasture Plot in Three Different Seasons of Experiment.

	1925	1927	1928
April 13 to beginning of October	Lb. dry matter per acre	Lb. dry matter per acre	Lb. dry matter per acre
Weekly cutting ..	2,833	—	1,982
Fortnightly cutting ..	—	3,621	2,562
Three-weekly cutting ..	—	—	3,216

It will be noted that under the weather conditions of the grazing season of 1928, cutting at fortnightly intervals produced 29·3 per cent. more dry matter than was obtained under a system of weekly cuts, whilst the yield obtained by cutting at three-weekly intervals was 62·3 per cent. greater than that obtained by weekly cutting and 25·5 per cent. greater than that grown under a fortnightly cutting system. It should be noted in passing that special precautions were taken to ensure that these yield differences were not due to lack of uniformity in respect of the productive capacities of the sub-plots, but were definitely the result of submitting the sub-plots in question to different systems of cutting.

It has already been stated that there is little or no difference, from the standpoint of starch equivalent, between pasture herbage grown under systems of weekly, fortnightly, and three-weekly cuts. The *yield* differences under the three systems of cutting are possessed, therefore, of great practical significance. It may be assumed that a system of weekly cuts is comparable with the system of grazing where it is the custom of the grazier to regulate the stocking of his sheep-grazing land in such a manner as to keep the herbage uniformly grazed down throughout the grass season. If the herbage shows any tendency to grow beyond the very young stage, more sheep are introduced to hold it in check. This practice may be referred to, for convenience, as "non-rotational close-grazing." On the other hand, a system of three-weekly cuts may be taken as conforming with the conditions of rotational grazing, where the interval between successive close-grazings of enclosures is of three weeks' duration. It will be convenient, for the purposes of the present discussion,

to refer to such a system as a "three-weeks' rotational close-grazing system."

The yield results shown in the table bring to light an important advantage which "rotational close-grazing" possesses over a system of "non-rotational close-grazing." To make this point clear, it is merely necessary to imagine that the pasture, on which this series of investigations is being carried out, had been so stocked during 1928 that the herbage was kept closely and uniformly grazed down throughout the season. Under such conditions, the pasture would have produced herbage, for the sustenance of the animals, at the rate of about 1,980 lb. of dry matter per acre over the season. If, on the other hand, the tract of grass had been divided up into smaller areas in such a way that each enclosure, after being closely-grazed by stock, was permitted a three weeks' interval of unchecked growth before being grazed down again, the pasture would have produced herbage at the rate of 3,220 lb. of dry matter per acre over the season. This herbage, moreover, would have been equal, in respect of digestibility and starch equivalent, to that obtained in smaller amount under the system of non-rotational close-grazing, and although it would have been somewhat less rich in digestible protein, this difference would have constituted an advantage rather than a drawback from the standpoint of pasturing stock not receiving supplementary food.

It may be concluded, therefore, that if the management of the experimental pasture had been attempted along the lines of close-grazing, under the weather conditions of 1928, a simple division of the main field into a suitable number of smaller enclosures, for rotational grazing at three-weekly intervals, would have enabled the stock-carrying capacity of such unfertilized pasture to be increased in the ratio of 198 : 322 (*i.e.* roughly 2 : 3). This measurement of improvement naturally applies only to the pasture under investigation, under the weather conditions of 1928, and would probably not be so marked in a season more favourable to the abundant growth of herbage. It will be of interest to ascertain how this factor further operates in the work which is to be carried out during the coming season, when a system of cutting at monthly intervals will be adopted. Obviously, the question of the maximum yield of digestible food from a pasture is bound up with the investigation of the process of lignification, or production of woody fibre, in the herbage, since it is

reasonable to assume that the conditions for such maximum yield will be realized when the interval between successive cuttings, or grazings, is as long as possible. The length of this interval will naturally depend upon the time required by the young shoots of grass to reach the stage of growth at which lignification, with consequent running-off of digestibility, sets in.

The yield data possess further practical significance in relation to the proposals which have been put forward for conserving pasture grass, either by artificial drying and pressing into cakes or by ensiling, for use as a concentrate during winter. Before adopting such proposals, it would be necessary in the first place to decide the frequency with which the grass should be cut during the growing season. From the standpoints of digestibility and starch equivalent, it is immaterial whether the herbage is cut at weekly, fortnightly, or three-weekly intervals. Under the three-weekly system, however, the season's yield of herbage will be greater than will be obtained by cutting at shorter intervals, and the difference will be accentuated during seasons when the conditions are not favourable to growth of grass. In regard to protein content, the average figure, on the dry matter basis, for weekly-cut grass will be about 25 per cent., that for fortnightly-cut grass about 23.5 per cent., and that for three-weekly-cut grass about 21 per cent. It is hoped to secure similar information for grass cut at monthly intervals during the coming season.

The yield data also serve to demonstrate the *primary* importance of the general weather conditions of the season (in particular, those of rainfall) on the growth of pasturage. The weather conditions of 1925 and 1927 were, on the whole, favourable to the abundant growth of pasture herbage. The season of 1928, on the other hand, was a poor pasture year, owing to the prevalence of droughty conditions at three different stages. It is scarcely surprising, therefore, that, by cutting every *week*, the plot produced 42.9 per cent. more herbage during 1925 than during 1928. The influence of the unfavourable weather conditions of 1928 had a more far-reaching effect than this, however, inasmuch as the yield under a system of *fortnightly* cuts during this year was about 10 per cent. lower than that obtained by *weekly* cutting in 1925. To similar considerations of weather is to be ascribed the fact that the plot during 1927, under a system of *fortnightly* cutting yielded 41.3 per cent. more herbage than

was obtained under the *same* system of cutting during 1928, and 12.6 per cent. more than was obtained by cutting at *three-weekly* intervals during 1928.

Within the limits of the systems of cutting which have so far been investigated, it is clear that unfavourable meteorological conditions in a particular season may lead not merely to a much smaller growth of grass than would be obtained, under the same system of cutting, in a more favourable year, but may actually cause the yield under a lenient system of

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	9 17
Maize	81	6.8	10 10
Decorticated ground nut cake	73	41.0	12 10
" cotton cake	71	34.0	11 10
(Add 10s. per ton, in each case, for carriage.)			

The cost per unit starch equivalent works out at 2.68 shillings, and per unit protein equivalent, 1.52 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, 1928, 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	10	8
Oats	60	7.6	8	12
Barley	71	6.2	10	0
Potatoes	18	0.6	2	9
Swedes	7	0.7	1	0
Mangolds	7	0.4	0	19
Beans	66	20.0	10	7
Good meadow hay	37	4.6	5	6
Good oat straw	20	0.9	2	15
Good clover hay	38	7.0	5	12
Vetch and Oat silage	13	1.6	1	17
Barley straw	23	0.7	3	3
Wheat straw	13	0.1	1	15
Bean straw	23	1.7	3	4

DESCRIPTION	Price per qr.		Price per ton	Manu- rial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.		Price per lb. starch equiv.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%	
Wheat, British.. ..	—	—	10 0	0 13	9 7	72	2 7	1-38	9-6	
Barley, British feeding ..	—	—	9 10	0 10	9 0	71	2 6	1-34	6-2	
" Canadian No. 4 Western	36 9	400	10 5	0 10	9 15	71	2 9	1-47	6-2	
" feed ..	34 6	"	9 13	0 10	9 3	71	2 7	1-38	6-2	
" American ..	33 9	"	9 8	0 10	8 18	71	2 6	1-34	6-2	
" Persian ..	36 0	"	10 2	0 10	9 12	71	2 8	1-43	6-2	
Oats, English, white ..	—	—	10 3	0 11	9 12	60	3 2	1-70	7-6	
" black and grey ..	—	—	10 0	0 11	9 9	60	3 2	1-70	7-6	
" Scotch, white ..	—	—	10 10	0 11	9 19	60	3 4	1-78	7-6	
" Canadian No. 2 Western	33 3	320	11 13†	0 11	11 2	60	3 8	1-96	7-6	
" Argentine ..	27 3	"	9 10	0 11	8 19	60	3 0	1-61	7-6	
" Chilean ..	30 6	"	10 13‡	0 11	10 2	60	3 4	1-78	7-6	
" German ..	30 0	"	10 10	0 11	9 19	60	3 4	1-78	7-6	
Maize, Argentine ..	46 0	480	10 15	0 10	10 5	81	2 6	1-34	6-8	
" American ..	44 3	"	10 7‡	0 10	9 17	81	2 5	1-29	6-8	
" South African ..	44 9	"	10 8	0 10	9 18	81	2 5	1-29	6-8	
Beans, English, winter ..	—	—	10 13†	1 5	9 8	66	2 10	1-52	20	
Peas, English, blue ..	—	—	14 0†	1 2	12 18	69	3 9	2-01	18	
" Japanese ..	—	—	20 15‡	1 2	19 13	69	5 8	3-04	18	
Dari ..	—	—	11 0*	0 12	10 8	74	2 10	1-52	7-2	
Millers' offals—										
Bran, British ..	—	—	7 15	1 3	6 12	42	3 2	1-70	10	
" broad ..	—	—	8 10	1 3	7 7	42	3 6	1-87	10	
Middlings, fine, imported ..	—	—	9 5	0 18	8 7	69	2 5	1-29	12	
" coarse, British ..	—	—	8 0	0 18	7 2	58	2 5	1-29	11	
Pollards, imported ..	—	—	7 15	1 3	6 12	60	2 2	1-16	11	
Meal, barley ..	—	—	10 17	0 10	10 7	71	2 11	1-56	6-2	
" maize ..	—	—	10 15	0 10	10 5	81	2 6	1-34	6-8	
" South African ..	—	—	10 10	0 10	10 0	81	2 6	1-34	6-8	
" germ ..	—	—	10 12	0 16	9 16	85	2 4	1-25	10	
" locust bean ..	—	—	9 10	0 8	9 2	71	2 7	1-38	3-6	
" bean ..	—	—	12 15	1 5	11 10	66	3 6	1-87	20	
" fish ..	—	—	19 10	3 9	16 1	53	6 1	3-26	48	
Maize, cooked flaked ..	—	—	12 5	0 10	11 15	85	2 9	1-47	8-6	
" gluten feed ..	—	—	10 15	1 0	9 15	76	2 7	1-38	19	
Linseed—										
" cake, English, 12% oil	—	—	14 0	1 10	12 10	74	3 5	1-83	25	
" " " 9% "	—	—	13 7	1 10	11 17	74	3 2	1-70	25	
" " " 8% "	—	—	13 5	1 10	11 15	74	3 2	1-70	25	
Soya bean " " 5½% "	—	—	12 5†	2 2	10 3	69	2 11	1-56	36	
Cottonseed cake, English—										
" Egyptian, 4½% "	—	—	8 2	1 9	6 13	42	3 2	1-70	17	
" " Egyptian, 4½% "	—	—	7 17	1 9	6 8	42	3 1	1-65	17	
Coconut cake, 6% oil ..	—	—	11 5	1 5	10 0	79	2 6	1-34	16	
Ground-nut cake, 6-7% oil ..	—	—	10 5†	1 8	8 17	57	3 1	1-65	27	
Decorticated ground-nut cake,										
" 6-7% oil ..	—	—	12 10†	2 3	10 7	73	2 10	1-52	41	
Palm kernel cake, 4½-5½% "	—	—	10 0†	0 18	9 2	75	2 5	1-29	17	
" " meal, 4½% "	—	—	10 10†	0 18	9 12	75	2 7	1-38	17	
" " meal 1-2% "	—	—	9 7†	0 19	8 8	71	2 4	1-25	17	
Feeding treacle ..	—	—	6 0	0 9	5 11	51	2 2	1-16	2-7	
Brewers' grains, dried ale ..	—	—	8 15	1 0	7 15	49	3 2	1-70	13	
" " " porter ..	—	—	8 5	1 0	7 5	49	3 0	1-61	13	
Malt culms ..	—	—	7 15*	1 8	6 7	43	2 11	1-56	16	
Dried sugar-beet pulp ..	—	—	7 0a	0 9	6 11	65	2 0	1-07	5-2	

a Carriage paid 5 ton lots.

* 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 January 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 prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £11 per ton, its manurial value is 18s. per ton. The food value per ton is therefore £10 2s. per ton. 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. 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 1-43d. 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 calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices: N, 9s. 4d.; P₂O₅, 3s. 10d.; K₂O, 3s. 5d.

cutting to be smaller, instead of larger, than under a less lenient system of cutting during a more favourable season.

* Space forbids the writer from dealing with the other important factors which influence the productivity of pastures. Among such factors may be cited: (1) The physical character of the soil underlying the pasture. (2) The botanical character of the herbage. (3) The manurial content of the soil (the Cambridge investigations are being carried out, at present, on unfertilized pasture). There is also the interesting question of the very different manner in which meteorological factors may control the yield of pasture and of meadow. These, and kindred matters, must be left over for consideration on a future occasion.

* * * * *

MISCELLANEOUS NOTES

At the Grocers' and Allied Trades Exhibition, which was held in Bingley Hall, Birmingham, from January 15 to 24,

the Ministry, in collaboration with the National Farmers' Union and other associations, organized a display of home produce in the Empire Marketing Board's

pavilion. The display, which comprised almost every type of foodstuff produced in the home country, attracted a considerable degree of attention, but interest centred in the display of eggs graded and packed in accordance with the regulations made under the Agricultural Produce (Grading and Marking) Act, 1928. Grocers and provision merchants made many inquiries in regard to these, and 250 lists of accredited packers were handed out on request to *bona-fide* retailers.

National Mark eggs will form the main feature of the home produce section at the British Industries Fair and the Ideal Home Exhibition, details of which will be given in the JOURNAL for next month.

* * * * *

THE general level of the prices of agricultural produce during January was calculated at 45 per cent. above that

of the base years 1911-13, or the same

figure as that recorded a year ago, but 5 points higher than in the preceding month. It is customary for the index

number to advance on average by about 5 points at this time of the year owing to the fact that prices in January, 1911-13, were usually lower than in December of the same period.

Apart from this feature, however, the higher prices realized for most classes of live stock during the month under review were responsible for a slight rise in the index number.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1924 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13					
	1924	1925	1926	1927	1928	1929
January ..	60	71	58	49	45	45
February ..	61	69	53	45	43	—
March ..	57	66	49	43	45	—
April ..	53	59	52	43	51	—
May ..	57	57	50	42	54	—
June ..	56	53	48	41	53	—
July ..	53	49	48	42	45	—
August..	57	54	49	42	44	—
September ..	61	55	55	43	44	—
October ..	66	53	48	40	39	—
November ..	66	54	48	37	41	—
December ..	65	54	46	38	40	—

Grain.—Wheat was 1d. and barley 2d. per cwt. cheaper on the month, but whereas in the case of the former cereal, the index number declined by 1 point to 30 per cent. above the base level, that for barley advanced 2 points to 26 per cent. above pre-war. Oats became 2d. per cwt. dearer and the index figure 5 points higher at 34 per cent. above 1911-13.

Live Stock.—Fat cattle and sheep sold at higher prices during January, and the relative index numbers rose on the month by 8 and 17 points to averages of 35 per cent. and 67 per cent. respectively above pre-war. Baconers became 6d. and porkers 7d. per 14 lb. stone dearer and the index figures moved sharply upwards to 40 per cent. and 52 per cent. respectively over the 1911-13 levels. Values for dairy cows were on average about 25s. per head lower than in December, but the index number fell by only 1 point to 33 per cent. above the base years. In the case of store cattle, the reduction of 8s. per head was proportionately less than in 1911-13, and the index showed a rise of 2 points.

The January average price per store sheep represented an increase of about 4s. on the month, the index figure advancing 10 points to 59 per cent. above the base level, while a rise of 3s. 6d. per head in the quotations for store pigs resulted in an addition of 22 points to the index.

Dairy and Poultry Produce.—Milk was not materially altered either in price or index number during the period under review. Butter realized the same price as in December,

but owing to a reduction in the base years the index figure appreciated 3 points to 53 per cent. above 1911-13; while cheese became a little cheaper at 78 per cent. above pre-war. Eggs were considerably reduced, although to a lesser extent proportionately than in the base period. The index figure for poultry as a whole was unchanged at 45 per cent. in excess of 1911-13.

Other Commodities.—The index number for wool advanced by 6 points to 72 per cent. above pre-war, and for hay it was 2 points lower than in December. Potatoes were cheaper by about 3s. 6d. per ton and the index declined by 14 points to 31 per cent. over the 1911-13 figure, but vegetables became dearer at 60 per cent. above the base period, as compared with 31 per cent. in the previous month.

Index numbers of the different commodities during recent months and in January, 1927 and 1928, are shown below :—

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

Commodity	1927	1928				1929
	Jan.	Jan.	Oct.	Nov.	Dec.	Jan.
Wheat ..	61	34	28	31	31	30
Barley ..	36	40	26	25	24	26
Oats..	20	39	27	27	29	34
Fat cattle ..	33	28	31	31	27	35
Fat sheep ..	57	63	52	53	50	67
Bacon pigs ..	70	34	26	24	26	40
Pork pigs ..	82	44	33	33	36	52
Dairy cows ..	28	26	39	38	34	33
Store cattle ..	29	24	20	20	21	23
Store sheep..	55	42	54	53	49	59
Store pigs ..	135	47	31	31	30	52
Eggs ..	46	77	66	51	37	56
Poultry ..	38	38	51	47	45	45
Milk ..	65	66	57	71	71	70
Butter ..	37	47	53	52	50	53
Cheese ..	38	61	78	78	79	78
Potatoes ..	95	74	51	53	45	31
Hay..	—1*	18	6	4	8	6
Wool ..	32	58	70	66	66	72

* Decrease.

* * * * *

At its meeting on January 15, 1929, the Advisory Committee on Agricultural Travelling Research Fellowships and International Conference Grants the following grants. These recommendations have been approved by the Development Commission.

- (1) £60 to Mr. A. W. Stableforth, of the Royal Veterinary College, for a visit to Germany to study methods for the control of mastitis in bovines.
- (2) £50 to Mr. R. McG. Carslaw, of the School of Agriculture, Cambridge, for visits to Switzerland and Denmark, to study the technique of agricultural economic investigations of farm practices in those countries.
- (3) £25 to Mr. W. E. H. Hodson, of Seale-Hayne Agricultural College, for a visit to Holland to study methods of control of pests and diseases of the narcissus and other bulbs.
- (4) £30 to Mr. Morley Davies, of Harper Adams Agricultural College, to enable him to attend a meeting of the International Commission of Soil Science at Königsberg, and to visit the Sugar Beet Station at Kleinwanzleben and sugar beet growing areas.
- (5) £100 to Dr. E. M. Crowther, of the Rothamsted Experimental Station, to enable him to attend Commissions of the International Society of Soil Science at Budapest and Königsberg, and to visit leading research laboratories in soils and fertilizers in Germany, Austria, Hungary, Czecho-Slovakia and Denmark.
- (6) £25 to Mr. A. N. Duckham, of the Animal Nutrition Institute, Cambridge, for the study of pig-recording schemes in the Hanover and Malmo (Sweden) districts.
- (7) £50 to Mr. W. J. Morgan Jones, of the University College of Wales, Aberystwyth, for a study of the improvement in the technique of farm processes in Germany.

* * * * *

THE Ministry desires to draw the attention of poultry and rabbit keepers to the facilities available at the Ministry's Veterinary Laboratory, New Haw, Weybridge, for the veterinary examination of chicks, poultry and rabbits. The scale of fees in respect of this service has been revised and is as follows:—

Post-mortem examination of an adult fowl, or a rabbit	3s.
Post-mortem examination of chicks, including full bacteriological examination of any number of chicks necessary to establish identity of disease, if any ..	5s.

Agglutination test of the blood of an adult bird 6d.

These fees are payable in advance.

A memorandum, giving full particulars of the arrangements for this service, together with instructions for the dispatch of birds, can be had on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, S.W. 1.

* * * * *

WITH a view to providing "for the maintenance of proper standards of quality in connexion with the marketing of potatoes, and for the licensing of persons engaged in such marketing, and for other purposes connected therewith," the Government of Northern Ireland have recently passed an Act entitled "The Marketing of Potatoes Act (Northern Ireland), 1928."

Under this Act, exporters of potatoes from Northern Ireland to Great Britain, the Irish Free State or the Isle of Man are required to be licensed by the Ministry of Agriculture for Northern Ireland and to keep such records of the receipt, despatch, transit and delivery of consignments of potatoes as may be required.

All potatoes sent out of the country by a licensed exporter must be accompanied by a certificate to the effect that they have been examined, that they are of the prescribed standard of quality, and that they are graded and packed in the prescribed manner. A fee not exceeding 6d. per ton of potatoes is payable for the certification. The certificate must be produced to any authorized officer or any member of the Royal Ulster Constabulary, on demand, by the person in whose charge the potatoes may be at the time; it must also be produced, if demanded, to the carrier through whom the potatoes are being consigned.

Permits may be granted authorizing the export of specified consignments of potatoes grown by the consignor, and of potatoes for experimental or other exceptional purposes.

For the purpose of enforcing the Act, any authorized officer may enter any premises believed to be used for the potato trade and inspect the potatoes and any process connected with their grading and packing. He may also enter any carrier's premises, ships or vehicles, and open for inspection any cases of potatoes found. When, on examination of potatoes in transit, an authorized officer finds that the consignment does not conform

to the requirements regarding quality, grading or packing, he may direct the consignment to be returned to the consignor.

Refusal to give information regarding potatoes which have been removed or which are believed to have been moved is punishable by a fine not exceeding £20. Power is also given to authorized officers or members of the Royal Ulster Constabulary to seize consignments which are suspected of being exported in contravention of the Act or in breach of the conditions of a licence or certificate; proceedings must then be taken against the offending party. A first offence is punishable by a fine of from £5 to £10, for a second offence from £10 to £20, and for a third or subsequent offence from £20 to £50; in certain cases, second or subsequent offences are punishable by imprisonment for a term not exceeding three months.

The Ministry of Agriculture for Northern Ireland is empowered to make rules to implement the provisions of the Act, and such rules may prescribe standards of quality and methods of grading and packing.

The provisions of the Act do not apply to potatoes merely passing through Northern Ireland in transit, those sent by post or those consigned during certain prescribed months. So far as export to the Irish Free State is concerned, the provisions only apply where it is known that the potatoes are ultimately intended for shipment to Great Britain or the Isle of Man.

* * * * *

THE National Mark Scheme for eggs was put into operation on February 1. Briefly, the aim of the Scheme is to place home-produced eggs on the market with a guarantee as to quality, size and pack, and thus enable them to compete effectively with imports.

Organization.—Participation in the scheme is voluntary, but if a packer wishes to use the National Mark he must comply with certain conditions which have been carefully drawn up and, in the interests of the industry, will be very strictly administered. It is an offence under the Agricultural Produce (Grading and Marking) Act for anyone to use the Mark unless authorized to do so by the National Mark Committee, which sits under the Chairmanship of Lord Darling and is advised by a Trade Committee. Applicants for registration as packers under the Scheme must have an output exceeding a prescribed quantity; their premises and equipment must be such as will conduce to efficient working, and they must undertake that eggs packed by them under the

National Mark shall be (i) produced in England or Wales; (ii) of "First Quality," i.e., not preserved by any process, with clean and sound shells, translucent yolk, translucent and firm white and an air space not exceeding $\frac{1}{4}$ inch in depth; (iii) uniformly graded for weight, the minimum weights laid down by regulations for the three grades of hen eggs being "Special," $2\frac{1}{4}$ oz., "Standard," 2 oz., and "Pullet Standard," $1\frac{3}{4}$ oz., and for duck eggs "Special (duck)," $2\frac{3}{4}$ oz., "Standard (duck)," $2\frac{1}{2}$ oz., and "Ducklet Standard," $2\frac{1}{4}$ oz., and (iv) packed in approved packages, i.e., non-returnable cases and, at the option of the packer, cartons holding one dozen or half-a-dozen eggs.

About 140 packing stations have, so far, applied for registration and, in every case, the premises and equipment are inspected by an officer of the Ministry to ensure that they reach the required standard. Over 100 stations, some of them very large, have been authorized to use the Mark and most of them are now sending out supplies under the Scheme: other applications are under consideration. Officers of the Ministry will visit these stations frequently to ensure that efficiency is maintained. If any packing station is found to be contravening the conditions laid down, its authorization to use the Mark will be suspended or withdrawn.

An important safeguard against the misuse of the Mark lies in the fact that the National Mark labels can be obtained only from the Ministry. They bear serial numbers, and a record is kept by the Ministry of the numbers issued to each packer. In addition, each packer has a registered number which he puts on all labels used by him, so that in the case of complaint from a purchaser, the box concerned can always be traced back to the issuing station. Further, packing stations are required to keep records showing the date of despatch and the consignee of every box; in the event of a complaint, therefore, evidence will always be available which will help to determine whether the fault lay with the packing station or the distributor. Over $\frac{1}{2}$ million National Mark box labels and $2\frac{1}{2}$ million carton labels have been printed and are supplied on payment to packers working the Scheme.

Demonstration Stations.—The Cheltenham depot has, by arrangement, been used as a demonstration station, the Ministry making a grant towards the extra expense thus incurred. Somewhat similar arrangements have now been made by the Ministry in Wales, a maintenance grant of £250 per annum for two years being offered to the Clynderwen

and District Farmers' Association as a contribution towards the expenses of allowing its premises to be used as a demonstration centre and of keeping certain records.

Loan of Weight-grading Plant.—In order that the recently invented weight-grading machine may be demonstrated under commercial conditions for general information, the Ministry has arranged to lend machines with gravity conveyers and supports to three selected stations, subject to the payment of a small hiring fee at the end of two years or to purchase at a specified amount. The stations are those of the Norfolk Egg Producers, Ltd., Melton Mowbray Farmers' Association, and the Pershore Central Market.

Training in Candling.—There is a serious shortage of operators with experience in candling and, in order to remedy this, arrangements have been made for instruction in candling to be given under commercial conditions at four centres: Cheltenham Egg Packing Station, Framlington and Eastern Counties Co-operative Society, Stamford and District Egg and Poultry Society, and Wiltshire Egg Producers, Ltd. Facilities are available only for employees of packers who have applied for registration under the National Mark Scheme, the period of training being normally 14 days. Each training centre is paid a small fee by the Ministry in respect of each trainee. In addition, an expert commercial candler has been engaged by the Ministry to visit and instruct those applicants for registration who are not in a position to send staff away for the purpose.

Leaflets.—Other steps taken to ensure the success of the Scheme include the issue and wide circulation of the following marketing leaflets:—

No. 6, giving a full description of the Scheme. This has recently been revised.

No. 6 (a), which is an appeal to distributors to handle National Mark supplies.

No. 8, describing the Cheltenham Egg Packing Station. This is fully illustrated and gives particulars of the layout and the general method of operation.

The Minister's article in *The Times* of February 1, on the National Mark Scheme, is being reprinted in leaflet form, and will be widely circulated.

Costings.—The article on "Capitalization and Working Costs of Egg Packing Stations," which appeared in this JOURNAL for November last, has been reprinted as a leaflet and is in great demand.

With a view to a continuous economic analysis of the egg packing business, a grant of £42 per annum for one year has been offered to Cumberland Poultry Farmers, Ltd., Norfolk Egg Producers, Ltd., Melton Mowbray Farmers' Association, and the Wiltshire Egg Producers, Ltd., in consideration of these stations supplying the Ministry with detailed working costs at stated intervals and in a pre-arranged form. Similar data are to be furnished by the Cheltenham and Clynderwen depots as a condition of the demonstration grants which they are receiving. *Pro forma* costing sheets have been prepared and circulated for this purpose.

Publicity.—In various ways the Ministry has been able to secure a very wide publicity for the National Mark Egg Scheme. The general and trade Press, almost without exception, have recognized its importance and devoted an unusual amount of space to it. Two London dailies have each issued a coloured poster for display in shops stocking National Mark supplies. As noted above, *The Times*, in its issue of February, published a long article contributed by the Minister. On February 4 *The Farmer and Stockbreeder* issued a special poultry number in support of the Scheme. The periodicals serving the grocery trade have also given very useful publicity to the Scheme, and in some cases have reproduced photographs of shop displays of National Mark eggs.

Broadcast references to the Scheme have been made by officers of the Ministry and of the Empire Marketing Board, and these will be continued. The Board has also undertaken to issue an advertisement in the Press during March in favour of National Mark eggs.

Both the Ministry and the Empire Marketing Board have had posters, display cards and window strips prepared for use in retail shops, and these are being distributed through packing stations and wholesalers handling National Mark supplies.

The Ministry has also been able to arrange with the "Gaumont Mirror" to make a film illustrating the National Mark egg organization. This film will be put into circulation by the beginning of March and will be shown at over a thousand cinemas.

Several prominent provision shops in London have had special displays of National Mark eggs, and others are being arranged. Arrangements were made to give special prominence to National Mark eggs on the Great Britain stand at the British Industries Fair and the Ideal Home Exhibition,

and in the latter case sample cartons containing three eggs are being sold from the stand. At the Birmingham Grocers' Exhibition, which was held during January, much interest was shown in the egg display, and 250 lists of registered packers were handed out in response to *bona fide* inquiries.

* * * * *

THE following extracts from the periodical report on the work undertaken by the Ministry, with

Marketing of the aid of a grant of £40,000 per annum
Home Produce from the Empire Marketing Board, for the quarter ended December 31, 1928,

may be of interest:—

Economic Series of Market Reports.—A number of orders for complete sets of this series have recently been received, and some of the early numbers will shortly be out of print. The demand for the series continues to be heavy; sales during the quarter totalled 6,355 copies, making 66,833 copies sold to December 31, 1928.

Marketing Leaflets.—Marketing Leaflets No. 6 (*Egg Marketing Scheme*), No. 7 (*Fruit Marketing Reform*), No. 7a (*A Handbill appealing to Distributors in favour of National Mark Apples and Pears*), and No. 8 (*A Description of the Cheltenham Egg Packing Station*) were issued during the quarter. The demand for these was very heavy; approximately 99,000 of No. 6, 33,000 of No. 7, and 22,000 of No. 7a were distributed up to December 31.

Marketing Demonstrations.—Eleven marketing demonstrations were given during the quarter at eight agricultural shows.

Grants.—The following grants were sanctioned:—

£488 for one year to the Agricultural Research Institute of Oxford University, for marketing investigations;
£150 per annum (additional) to the University College of Wales, to enable statistical studies of marketing data to be undertaken;

£500 to the Pershore Co-operative Fruit Market, Ltd., for the second year of a grading experiment;

£100 to the Midland Agricultural and Dairy College, to enable an experiment to be made in the marketing of graded celery;

£300 to the Cheltenham Egg Packing Station, in consideration of demonstrational services to the industry during the previous 12 months.

£500 to the English Cheddar Cheesemakers' Federation, for its second year's working;

£100 to the Cottenham Fruit Packing Station, to enable special cost accounts and marketing records to be kept.

* * * * *

Foot-and-Mouth Disease.—Outbreaks have been confirmed at five fresh centres, as follows: at Walton, Peterborough, Soke of Peterborough, on January 21; at Stow Nine Churches, Weedon, Northants, on January 29; at Colburn, Catterick, Yorks, North Riding, on January 30; at Cherry Hinton, Cambridge, Cambs., on February 14; at Halewood, near Liverpool, Lancs., on February 16. The usual restrictions were applied to areas of approximately 15 miles round the infected premises in each case, and in addition, in view of the possibility that Darlington Markets of January 14 and 21 and Stockton Market of January 16 had become infected by the exposure thereof of animals from premises subsequently declared to be infected, "standstill" restrictions were imposed covering a wide area surrounding the Yorks, North Riding, Infected Area. Ten further outbreaks occurred at this centre, two of which were in the "standstill" area and involved extensions of the Infected Area. The "standstill" restrictions referred to, which had been in operation since January 31, were withdrawn on February 11. One further outbreak occurred in the Northants Area, but there has been no spread of disease from the other three centres. Restrictions in the Soke of Peterborough Infected Area were withdrawn on February 19.

Sixteen outbreaks have been confirmed since January 1 last, involving 6 counties, and the slaughter of 360 cattle, 512 sheep, 289 pigs and 4 goats.

* * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on February 6, at 7 Whitehall Place, S.W. 1, the Chairman, 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 into effect the Committees' decisions:—

Dorset.—An Order cancelling as from February 17 the existing minimum and overtime rates of wages for female workers, and fixing rates in substitution thereof to operate from February 18 to December 21, 1929. The minimum rate in the case of whole-time female workers of 21 years of age and over is 24s. per week of 48 hours, except during the period from March 24 to March 30, when the minimum rate is 24s. for a week of 39½ hours, overtime being payable at 6d. per hour. The minimum rate in the case of workers of 18 years of age and over employed by the week for not more than four hours per day or as casual workers is 5d. per hour, with overtime at 6d. per hour.

Lincolnshire (Kesteven and Lindsey).—An Order to come into operation on March 4 fixing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers, and to continue in force until March 2, 1930. 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 30, 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.

Northumberland.—An Order to operate from May 13, 1929, until May 13, 1930, continuing the operation of the existing minimum and overtime rates of wages for male and female workers. The minimum rates in the case of male workers of 21 years of age and over are for stewards, horsemen, cattlemen, stockmen and shepherds hired by the week or longer period, are 39s. for workers who are householders and 36s. for workers who are not householders per week of customary hours, and for all other male workers except casual workers, 32s. per week of 48 hours in winter and 52½ hours in summer, overtime being payable at 1½ times general minimum time rate on weekdays and 1½ times general minimum time rate on Sundays. The minimum rate for casual male workers of 18 years of age and over is 7½d. per hour for all time worked. In the case of female workers of 18 years of age and over the minimum rates are 5d. per hour except for casual workers, for whom the rate is 3d. per hour, overtime being payable at 1d. per hour in excess of the minimum rates.

Denbigh and Flint.—An Order to come into force on February 16, 1929, continuing the operation of the existing minimum and overtime rates of wages for male and female workers until February 15, 1930. The minimum rates in the case of male workers of 21 years of age and over are 37s. per week of 61 hours in the case of teammen, cattlemen, cowmen, shepherds and bailiffs, and 30s. 6d. per week of 50 hours in the case of other male workers, overtime being payable in each case at 9d. per hour. The minimum rate in the case of female workers of 18 years of age and over is 5d. per hour with overtime at 6½d. 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 February 15, legal proceedings were instituted against 11 employers for failure to pay minimum and overtime 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.	
Berks ..	Newbury ..	5	5	0	3	13	0	17	19	4	2
Cheshire ..	Stockton Heath ..	2	0	0	7	0		45	0	0	2
Cornwall ..	Liskeard ..	—	—	—	—	—	—	58	3	7	1
Derby ..	Chesterfield ..	15	0	0	1	14	0	65	6	0	3
Lancs ..	Bolton ..	3	0	0	3	1	0	68	0	0	2
Monmouth ..	Chepstow ..	20	0	0	3	5	0	17	10	9	2
Salop ..	Clun ..	—	—	—	0	8	0	7	9	3	1
Somerset ..	Somerton ..	—	—	—	—	—	—	15	0	6	3
Yorks N.R.	Pickering* ..	—	—	—	—	—	—	—	—	—	1
"	Northallerton ..	10	0		10	0		3	10	6	2
Carmarthen	Carmarthen ..	†			1	2	6	16	10	0	1
		£45	15	0	£14	0	6	£314	9	11	20

*Case dismissed, but the Ministry has lodged an Appeal on a point of law. †Conviction recorded.

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APPOINTMENTS: CHANGES AND CORRECTIONS

COUNTY AGRICULTURAL EDUCATION STAFFS WALES

Carmarthenshire: Mr. William Evans has been appointed Instructor in Poultry-Keeping *vice* Mr. H. E. Breen-Turner. Miss R. Williams, N.D.D., has vacated the appointment of Instructress in Dairying.

CHADACRE AGRICULTURAL INSTITUTE, SUFFOLK

The staff of this Institute, situated at Hartest, Bury St. Edmunds, is now reconstituted as follows :—

<i>Principal</i>	W. R. SEWARD, N.D.A., Dip. Agric. (Wye).
<i>Vice-Principal</i>	GORDON L. MAW, B.Sc. (Agric.).
<i>Secretary and Accountant</i>	P. L. LEIGH-BREESE.
<i>Assistant Lecturer</i>	P. W. L. HOOK.
<i>Instructress in Dairying and Poultry-Keeping</i>	Miss M. C. THOMAS, N.D.D., B.D.F.D.
<i>Matron</i>	Miss JEAN L. HOOK.
<i>*Veterinary Hygiene</i>	P. R. TURNER, M.R.C.V.S.
<i>*Horticulture</i>	A. YOUNGS.
<i>*Carpentry and Joinery</i>	S. CLARKE.
<i>*Smiths' Work</i>	H. RAWLINGS, R.S.S.
<i>*Harness Making and Mending</i>	S. A. DEEKS.

* Non-resident members of the staff.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., ENGLAND

School of Agriculture, University of Cambridge

The name of the University Demonstrator in Estate Management, given in the January, 1929, issue of the JOURNAL should read—Mr. N. DEAN, M.A., F.S.I., M.R. San. I.

Studley College, Warwickshire

The following staff changes are notified, following the resignation of Miss V. E. CHEKE, N.D.D., Lecturer on Veterinary Science and Bacteriology and on Dairying :—

Veterinary Science Lecturers .. Mr. T. N. GOLD, M.R.C.V.S.,
Miss S.E.B. BLAIR, B.Sc.(Agric.).
Bacteriology Lecturer .. Miss M. MADGE, B.Sc., Ph.D.
Dairying; Dairy Bacteriology: Lecturer .. Miss H. M. HATCHWELL, N.D.D.

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Leaflets issued by the Ministry.—Since the date of the list given in the November, 1928, number of this JOURNAL, p. 790, the following leaflets have been issued:—

New:—

No. 217. The Diseases of Animals Acts, 1894 to 1927.

Revised:—

No. 33. Surface Caterpillars or Cutworms.
No. 63. Destruction of Charlock.
No. 72. Purchase of Artificial Manures.
No. 130. Navel Ill and Joint Ill in Newly-born Animals.
No. 188. Fumigation with Hydrocyanic Acid Gas.
No. 363. Insecticides and Fungicides.
No. 400. List of Publications.

Rewritten:—

No. 1. Black Currant Mite.
No. 11. Daddy Longlegs or Crane Flies.
No. 31. The Onion Fly.
No. 37. The Bean Aphis.
No. 41. Red Spiders.
No. 70. The Renovation of Neglected Orchards.
No. 105. Wart Disease.
No. 132. Slugs and Snails.
No. 138. Fowl Pox.

Amended:—

No. 10. Wireworms.
No. 109. Cabbage Caterpillars.
No. 286. Narcissus Flies.

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NOTICES OF BOOKS

Sugar Beet: Costs and Returns for the Year 1926-27.—By A. Bridges and J. R. Lee. (Oxford: Agricultural Economics Research Institute. 1928. Price, 1s.)

This monograph presents the summarized results of the third year of the Institute's inquiry into the financial and economic aspects of the sugar beet crop. By calling on the assistance of the Provincial Agricultural Advisory Centres the Institute has been able to extend the scope of the inquiry, which in the year 1926-27 embraced 270 crops, as compared with 53 in 1925-26 and 34 in 1924-25; and the value of the average figures recorded is thereby enhanced.

The main form in which the figures were presented in the two preceding years has been retained in the present instance, so that comparisons as between year and year are facilitated. The two principal classifications of the costs, *i.e.* by soil groups, and by geographical areas, have been adhered to.

The concluding chapter deals with the very interesting question of the value of the leaves and crowns, and of the factory by-products.

Sugar Beet in France, Belgium, Holland and Germany.—By A. Bridges and R. N. Dixey. Pp. 118. (Oxford: The Clarendon Press. 1928. Price 4s. 6d. net.)

In a consideration of the problems which confront the beet sugar industry in this country, it is evident that a knowledge of the long-

established industry on the Continent is of considerable value, and this book by Messrs. Bridges and Dixey, whose publications dealing with the costings of the crop in this country are well-known, is to be welcomed.

As the authors themselves point out, comparisons between beet growing on the Continent and here are difficult and may, at times, be misleading, but a knowledge of the differences existing is helpful, even if it merely serves to show that, in certain respects at least, the British industry must develop on lines of its own.

The account covers France, Belgium, Holland and Germany, and is the result of three visits, in 1926 and 1927, to the principal beet-growing districts in those countries. It is noticeable that beet seems to be grown in well-defined areas, chiefly on heavyish soil containing clay, lime and humus. The most striking difference between beet growing in Great Britain and in the countries visited is the higher average Continental yields, ranging in recent years from over 12 tons to the acre in Holland to about 10 in France compared with 8½ tons, the highest so far obtained here. That these results are not a recent development is evident from the following records of the last three decades in Holland:—

	Tons per acre			
1891-1900	..	..	..	11.99
1901-1910	..	..	..	12.11
1911-1920	..	..	..	12.15

An important feature abroad is the intensive cultivation given to the crop and, apparently, to be achieved by a lavish use of labour. Most of the beet farms in the countries reviewed are of the small-holding type, and the crop is dealt with largely by the grower's family, but even in Germany, where larger farms are in evidence, the labour supply is supplemented during the season by immigrant labour from Poland and Czecho-Slovakia. In many parts, the school holidays are so arranged that children can assist in the early cultivations. From the point of view of conditions here, it is interesting to note that shortage of casual field labour in Germany has been felt since the war and has prompted the German Government to appoint a Commission to encourage the development of mechanical contrivances in connexion with the beet industry.

The value of the by-products is very thoroughly appreciated on the Continent, and careful measures are taken for their economic utilization. Indeed, as the authors say, the crop in many districts—where fodder crops are not easily grown—probably owes its continued existence to the full use that is made of beet tops and pulp as food for the heavy head of stock usually carried.

At the present time, when the methods of sampling roots at the factories are being widely discussed, the chapter on the practice adopted in Continental factories is worth studying, as also the types of contract used in the different countries, which are contained in an Appendix. It should, however, be noted that as a large proportion of the factories are either owned by the farmers or run on co-operative lines, the question of beet price fixing does not generally assume such great importance as in this country.

The book, although dealing with all technical aspects of the industry from the growers' standpoint, succeeds in covering the ground in a manner thoroughly interesting to the general reader and is a very useful addition to the literature on the subject.

Sugar Beet in the Eastern Counties, 1927.—By R. McG. Carshaw, M.A. (Dip. Agric. Econ.), C. Burgess, B.A. (Dip. Agric. Econ.), and G. Ll. Rogers, M.A. With a foreword by J. A. Venn, M.A.

University of Cambridge, Department of Agriculture, Farm Economics Branch Report No. 9. (Cambridge: W. Heffer & Sons, Ltd. 1928. Price 3s. net.)

This report (No. 9 of the Farm Economics Branch, Cambridge University) is perhaps the most comprehensive report relating to Sugar Beet costings which has yet been published, although a number of reports have appeared in the agricultural Press, and three have been issued from the Agricultural Economics Research Institute at Oxford, while an article on "Sugar Beet Costs," by the Hon. E. C. Strutt and W. Gavin, appeared in the July issue of this JOURNAL.

The investigation carried out by Cambridge covers an area distributed over 11 counties in the East of England. One hundred farms were costed, upon which 2,303 acres of beet were grown during the 1927 season. That season was unfavourable to the growth of the crop, but the voluminous tables and diagrams given in this report will help its readers, if they compare its results with those of costings made in earlier seasons, to form a judgment upon the value of the crop in seasons of varying suitability from the point of view of weather conditions. Again the returns are arranged under five soil groups, and an examination of these groups affords valuable information as to the production under different soil conditions.

The average profit in cash was extremely small, being only 5s. 5½d. per acre, or 8½d. per washed ton, but the addition of credit for tops and net residual value of manures and cultivation brings up the total net profit to £4 4s. 1d. per acre, or 10s. 10½d. per washed ton.

"The farmers' comments on the value of tops" (Appendix H) is interesting as showing the advantages of the crop apart from the actual cash profit resulting from the sale of the roots.

An Economic and Financial Analysis of Five Eastern Counties Farms in 1927-1928.—By R. McG. Carslaw, M.A. (Dip. Agric. Econ.), and W. H. Kirkpatrick, C.D.A. (Glas.). University of Cambridge Department of Agriculture: Farm Economics Report No. 11. (Cambridge: W. Heffer & Sons, Ltd. 1928. Price 1s. net.)

Like Report No. 10, the present Report No. 11 is the final interim report covering a series of farms, in this case the Lady Day entry group. The whole series of these reports will be amalgamated into a comprehensive economic and financial analysis (covering four consecutive years) of a representative sample of East Anglian farms. The type of information conveyed by this Report is already familiar to the readers of the JOURNAL, and it is hardly necessary to give an exhaustive résumé in a brief note of this sort. Similarly, however, to Report No. 10, the writers at present under notice convey a warning that farms covered by the present costings are not the same in every case as those dealt with in earlier issues, and that a direct comparison of the data is to be made only with this point in mind. The Report, while emphasizing the difficulties under which British agriculture is at present working, looks forward to a time when the industry shall have adapted itself to the new conditions with which it is at present confronted. It speaks of the impossibility of reducing farm workers' wages on account of the higher wages earned by the industrial worker, and goes on to say that one of the methods by which agriculture can help itself is by the attraction of more efficient labour and a consequent higher output per man. It is pertinent to ask where the more efficient labour is to come from, where it will be trained, and what it will cost in comparison with that at present employed. The Report ends with the expression of an opinion that agriculture should do its utmost to adopt what may be comprehensively known as commercial methods, when it will no doubt achieve a similar prosperity to modern industrial undertakings.

Starch: Its Chemistry, Technology and Uses.—By Lewis Eynon, B.Sc., F.I.C., and Henry Lane, B.Sc., F.I.C. Pp. viii + 256. (Cambridge: W. Heffer & Sons, Ltd. 1928. Price 12s. 6d. net.)

During the past 45 years our knowledge of the properties of starch has been enormously extended, and the technology of the manufacture of starch and starch products has been greatly developed, both on the chemical and engineering sides. This book is devised as a handbook for the student, analyst, consultant, etc., and the authors have endeavoured to give a concise review of these developments, and an account of the position of starch to-day from the respective standpoints.

The question of the constitution of starch is covered by fully documented chapters on the nature and properties of starch, and a survey of recent investigational work. The technological side, to which the larger portion of the volume is devoted, is of a more definite character, and gives comprehensive information on the various starches, their derivatives, the processes of and plant for manufactured starch products, commercial applications and methods of analysis.

The English Grass Orchard and the Principles of Fruit Growing.—By A. H. Hoare. Pp. 227, 43 illustrations + 5 Tables and Charts. (London: Ernest Benn, Ltd. 1928. Price 32s. 6d.)

In the opening chapter the author gives an interesting—though naturally a short—account of the first Kentish commercial orchard planted at Tenham in Kent, in 1533, by the fruiterer to King Henry VIII, and follows this up with an absorbing story on the species of cherries and the way in which these cherries came from their natural home in Asia Minor via Italy to this country.

Then follows an exceedingly thoughtful chapter—one of the finest in the book—on science and fruit growing. "Nature has succeeded in clothing the surface of the earth with plant life in many shapes and forms. If we look carefully at a given plant in its natural condition, we are led to the conclusion that it is an efficient organism, a machine in a state of perfect equilibrium with its two environments—the atmosphere and the soil." "The science of modern cultivation enables man to modify, within limits, certain natural conditions and so extend the environmental conditions beyond those developed by nature." "It is hardly possible to grow fruit successfully for market in a district with anything in excess of 40 in. of rainfall. At between 30 and 40 in., fruit may be grown, but the orchards are on the grass-orchard principle. In the region of 25 to 30 in., fruit may be grown on either cultivated or grassland. Below 25 in., fruit will do well on good holding lands." These remarks show that the author has made many observations before coming to these conclusions, which are very true for English conditions. Following this the author leads his readers stage by stage from the planning and planting of grass orchards to the marketing of the crop. (Only orcharding in grass is dealt with.) Special attention is given to the cherry crop. "Sweet cherries will do best and be most profitable when grown on grass. Indeed, it might be laid down as a law that there is no other course open to the commercial grower than to lay the land down to grass after the trees are from 12 to 15 years of age." That method is preferred to the planting of trees direct into established grassland or into hop gardens which are nearing the end of their lives.

Two planting schemes are suggested: in the first, the cherry trees are planted on the equilateral triangle system at 40 ft. apart; while square planting at the same distance is adopted in the second system. On the first system, 31 cherry trees are planted to an acre, but only 27 to the acre are possible if square planting is adopted. Early returns from the land

may be obtained by inter-planting with apple and plum: between each cherry tree, a standard or half-standard apple tree—Worcester Pearmain and Lord Derby, these to be inter-planted again with Rivers Early, Czar, Monarch and Victoria Plums. Finally, the land can be filled up with bush fruits, such as black or red currants and gooseberries. The bush fruits are grubbed at the twelfth year and the land may be grassed down. As the cherries grow and need more room the plums and then the apples disappear, leaving a mature and stately cherry orchard. Illustrations with trees drawn to scale illustrate this ingenious scheme of planting.

It is possible, says the author, to recommend for standard orchard trees five apples which possess all-round qualities. These are Bramley Seedling, Newton Wonder, Lord Derby, Annie Elizabeth and Blenheim Orange. Other profitable and reliable varieties which may be grown in grass orchards are Worcester Pearmain, Lady Sudeley, Early Victoria, Grenadier, Royal Jubilee and Bismarck.

"Once a sound foundation is laid down a cherry tree may be left to develop naturally." With apples planted as fillers, as little tipping as necessary should be the rule. With permanent trees, the orchard planter is advised to hard prune in the first two or three years and carry out judicious leader tying subsequently.

When the cropping stage has been reached, the advantages of having the "open centre" tree system is pointed out, although the author states that "no rule of thumb methods of pruning can be laid down, as it must vary for each variety." Such statements are supported by modern research.

The spring is regarded as the best time for sowing the grass seeds, and these consist of a mixture rich in perennial rye-grass, but all have leafy habits. Cocksfoot is thought to be coarse for inclusion in an average orchard mixture, especially for light soils with a low rainfall. The grass in orchards must be kept as short as possible, and sheep are far the best animals for grazing—especially the Romney Marsh, Cheviot and Border Leicester.

Pigs, Geese, Poultry and Bees may be kept on the orchards with advantage to the fruit, and the author has included notes on their management. Insect and Fungus Pests and methods of spraying are dealt with.

The author has produced a valuable book with sound modern views on an old subject, and put these views in such an attractive and logical manner that the reader is able to read with interest and quickly appreciate both the recommendations and the reasons for making them. The illustrations are admirable. It is a book written in good literary style on a practical subject that will be welcomed by all pomologists who can afford to purchase it. The high price is likely, however, to prevent the wide circulation which the book merits.

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ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Watson, J. A. S., and More, J. A.—Agriculture; The Science and Practice of British Farming. (728 pp.) [Second Edition.] Edinburgh and London: Oliver & Boyd, 1928, 15s. [63 (022); 63 (42).]

Ash, E. C.—Farming. (168 pp.+39 pl.) London: Methuen, 1928, 12s. 6d. [63 (022); 63 (42).]

Stapledon, R. G.—A Tour in Australia and New Zealand: Grass Land and other Studies. (128 pp.+7 pl.) Oxford University Press. London: Humphrey Milford, 1928, 7s. 6d. [63 (9) 63 (931); 63.33.]

Scientific Papers of William Bateson. Edited by R. C. Punnett. Vol. I. (452 pp.+7 pl.) Vol. II. (503 pp.+29 pl.) Cambridge University Press, 1928, 42s. each vol. [59; 575.]

Voronoff, Serge.—The Conquest of Life. (201 pp.+24 pl.) London: Brentano's, 1928, 15s. [612; 619.]

Johns, H. J.—The Fertilizers and Feeding Stuffs Act, 1926, with Explanatory Notes. With a foreword by the Rt. Hon. the Lord Bledisloe. (185 pp.) London: Butterworth, and Shaw & Sons, 1928, 10s. 6d. [343.53.]

Waggaman, W. H., and Easterwood, H. W.—Phosphoric Acid, Phosphates and Phosphatic Fertilizers. (370 pp.) New York: Chemical Catalog Co., 1927, \$7.50. [54; 63.16; 63.1672.]

Ernst, F. A.—Fixation of Atmospheric Nitrogen. (154 pp.) [Industrial Chemical Monographs.] London: Chapman & Hall, 1928, 12s. 6d. [668.6.]

Institut International d'Agriculture.—Le Contrôle des Engrais dans le Monde. (123 pp.) Rome, 1928, 15 liras. [343.53; 63.16.]

Emerson, F. V.—Agricultural Geology. (377 pp.) (2nd Edition.) New York: John Wiley; London: Chapman & Hall, 1928, 16s. [55; 63.111.]

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