

JL
Jm2, 1194
N20.34
98507

585 586

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXIV. No. 7.

OCTOBER, 1927.

NOTES FOR THE MONTH

UNDER the Unemployment Insurance Act, 1920, employment in agriculture, including horticulture and forestry, is specifically excluded from ranking as an insurable occupation. No definition of the precise classes of workers covered by this general exclusion is, however, contained in the Act, and from time to time reference is made to the High Court for decision in regard to particular forms of employment.

In this connexion the following report of a judgment in the High Court is reproduced from the September issue of the *Ministry of Labour Gazette* :—

On July 29, 1927, judgment was given in the High Court on questions referred by the Minister of Labour as to the liability to insurance under the Acts of six persons employed by horticulturists or nurserymen, growers of fruit, tomatoes, plants and flowers, which were sold either to florists or to buyers in Covent Garden or other markets. The employees, one man and five women, were employed in connexion with the cultivation and preparation for market of these products. The women workers were in some cases engaged for the whole year, and in other cases for particular seasons only. Their work consisted in preparing the products of their employers for sale, *e.g.*, by trimming and washing the plants, selecting and bunching cut flowers, grading the fruit and tomatoes, and packing for despatch all these products. The man was employed as a foreman in superintendence over such of these operations as were necessary in the establishment of his particular employers.

The Judge held that the employment of all these persons was employment in horticulture, and was, therefore, excepted from the provisions of the Acts under paragraph (a) of Part II of the First Schedule to the Act of 1920. They were, therefore, not required to be insured.

In the course of his judgment the Judge intimated that he had been asked by Counsel for the Ministry of Labour and Counsel for the National Farmers' Union that he should, if he found it possible, formulate a general rule applicable to the industries of agriculture and horticulture for the purposes of the working of the Unemployment Insurance Acts in the class of case under reference. In response to this request the Judge laid down the

undermentioned formula, but he explained that he did so with some reluctance as it was difficult, if not impossible, to forecast what cases might arise in future. He also added the reservation that he could only state a working rule such as he would adopt himself, on his present information, and such as he would regard as open to correction and modification if circumstances made it necessary or desirable. The rule is as follows:—

Persons are employed in agriculture and horticulture when employed upon any operations done about the production, preparation or transfer of the products of farm or garden or orchard in the best saleable condition to a first buyer or to a salesman or agent for sale if one be employed, or to a distinct business under one proprietorship as in Daniels' case. But if the industrial status and occupations of the employed persons are such that, though they are working about or in connexion with a farm or garden or orchard they may properly be said to be essentially pursuing their own special occupations, they are not employed in agriculture or horticulture within the meaning of this rule.

In the Daniels' case mentioned in the rule it was held that a person employed in a factory, sorting peas which were to be sown again for testing purposes, was employed in horticulture. It was pointed out in the judgment, however, that the employers in this case were horticulturists, that is to say, nurserymen and seed growers, and also seed merchants, and that, in common with other seed merchants, they no doubt had other employees who were not employed in horticulture.

* * * * *

THAT close on half a million acres in the Irish Free State are planted with potatoes gives some idea of the importance of this crop to that small country.

Potatoes for Seed Ireland has long been famous for its in the Irish Free potato culture, and the fact that many State old varieties, such as "Champion,"

"Up-to-Date," "British Queen," "Beauty of Hebron," and "Early Rose," which have almost gone out of cultivation in England and Scotland, are still widely planted, suggests that varieties are able to maintain their vigour longer under the Irish climate and the Irish methods of cultivation than has been found possible in this country. As the belief is now generally held that the deterioration of stocks of potatoes in England is due, in most cases, to the effect of Leaf Roll and Mosaic, it would seem either that these virus diseases do not cause as much damage in Ireland or that they are not prevalent there. If this be true, it would seem that Ireland should become a very important source for the supply of healthy stocks of seed potatoes.

Ireland, especially Northern Ireland, did raise in former years a considerable quantity of potatoes for seed purposes,

and had an export trade of some size to the western ports of England and Wales, to Malta and other parts of the world, but, during the troubled times of 1916-1920, the Irish trade became indifferent to the class of seed exported and, consequently, Irish seed potatoes came to be looked upon as of very uncertain character. Since 1920, however, a definite attempt has been made by Dr. Murphy* on the research and experimental side, and by Mr. W. D. Davidson† on the field side, to effect a steady improvement in the class and standard of potatoes grown for seed purposes, and their efforts have met with a very considerable measure of success.

Dr. Murphy's work, on Leaf Roll, Mosaic, and virus diseases of potatoes, generally, is well known and widely accepted. He has tested numerous stocks of potatoes in Ireland, ascertained their freedom from these diseases, and grown sample plots which he believes are quite free from troubles of this kind. Mr. Davidson, realizing that the varieties of potatoes ordinarily grown were not the kinds usually in demand for seed purposes by English and Scottish growers, has endeavoured to improve matters by persuading certain potato growers in the Free State to plant "King Edward," "Majestic," "Sharpe's Express," and other varieties favoured in the British markets. In some instances the seed for this purpose was obtained from Scotland, and care was taken, both by Dr. Murphy and by Mr. Davidson, that only specially selected stocks, which had been awarded a super-certificate by the Board of Agriculture for Scotland, were taken over to Ireland for seed raising. In addition, the Irish Free State started a scheme of inspection and certification, in which a very high standard is set; and if this standard is achieved in practice, the class of seed exported should be a very good one.

Generally, the areas in which Dr. Murphy and Mr. Davidson are attempting to get seed potatoes raised fall into two distinct groups—(a) the Dundalk region and County Donegal, where main crop varieties are grown, and (b) the Athlone district, where early varieties are grown. Main crop and early varieties are also grown in County Sligo.

In Donegal, the potatoes are grown by smallholders on a fairly red, loamy soil, and so should have a good appearance when sold in bulk. The potatoes growing there this year were

* Of the Albert Agricultural College, Glasnevin, near Dublin.

† Of the Department of Lands and Agriculture, Irish Free State.

chiefly of the main crop varieties, such as "King Edward," "Up-to-Date," "British Queen," "Arran Chief," "Great Scot," "Arran Consul," and "Kerr's Pink," although smaller quantities were to be seen of "Majestic," "Epicure," and "Sharpe's Express," and there were, also, a few patches of Mr. McKelvie's new seedling, "480" ("Arran Banner").

At the beginning of July, active spraying operations were in progress as a preventive measure against blight, which had not then appeared, the ordinary knapsack sprayer being used, and Burgundy Mixture of the double strength which is so common in Ireland. The time for roguing had not then arrived, but an inspection of the fields showed that the purity of the crops, in most cases, was particularly satisfactory, and in no single instance would the rogues have amounted to more than 1 per cent. of the crop. No case of Leaf Roll was seen, and both Dr. Murphy and Mr. Davidson aver that this disease does not exist in the Free State except in districts where much imported seed has been planted. Some crops looked practically free from Mosaic, but, generally speaking, the mild forms of Mosaic, and even the more serious form (Crinkle) could be found in most crops, although the percentage present in crops to be offered for certification was inconsiderable. Crops not grown for seed purposes were considerably affected with diseases of the Mosaic type, although the conditions at the time the crops were seen certainly favoured the detection of Mosaic.

Blackleg, however, was present in larger quantities than are normally found in the potato fields in this country, and it is to be hoped that this disease will receive serious consideration by all those concerned.

For marketing the seed produced in Donegal, the potatoes are packed in special bags, which are sealed in the presence of an inspector, and are distributed through a selected merchant, with whom it is wiser to deal than to trade direct with the small growers.

In the region around Dundalk, a few growers are also specializing in the production of seed potatoes, and will offer their fields for inspection and certification. In fields of "Great Scot," "Arran Chief," "Arran Consul," "British Queen," and "Majestic," inspected at the beginning of July, the standard of purity and health was similar to that of the potatoes in Donegal, although these crops were then more backward and had produced less haulm. A large acreage of

potatoes grown in County Sligo, by Sir Josslyn Gore-Booth, of Lissadell, was also examined. It included such varieties as "King Edward," "Great Scot," "Arran Consul," "Epicure," and "Arran Chief." These, also, were very true to type and quite free from Leaf Roll, but somewhat infected with Mosaic and Blackleg.

In the Athlone district, the potatoes are grown by small-holders, cultivating small fields of black, peaty soil in the Bog of Allen. It is not an early district, but, since 1900, early varieties have been grown for seed purposes, and, at the time of inspection, early varieties predominated, "Epicure," "Sharpe's Express," "Beauty of Hebron," "Duke of York," and "May Queen," being the main crops growing, although, here and there, some later kinds, such as "King Edward," "British Queen," and "Great Scot" were being tried. On the fields seen, the varieties were very pure, with practically no rogues; the crops were quite free from Leaf Roll, although a little Mosaic was present and some Blackleg. No blight was apparent, and spraying was in progress. The crops in this area, again, were extremely satisfactory, and the district should be suitable as a source of seed.

Irish growers who are not producing specially for seed purposes under the Free State Government Scheme, take little or no trouble in roguing; the varieties were very much mixed and Mosaic diseases and Blackleg prevalent. Growers here, therefore, should be very careful about purchasing the Free State seed other than that certified by the Government, and marketed in sealed bags in accordance with the official scheme.

* * * * *

THESE competitions have now been put into practice in over forty counties in England and Wales by the Local Education Authorities, in accordance with the Scheme outlined in the Ministry's *Guide to the Conduct of Clean Milk Competitions*,* and the movement has extended therefore throughout practically the whole of the country.

A report on clean milk competitions held in 1924-25,† which dealt in detail with all aspects of the movement, was issued

* Miscellaneous Publications, No. 43. Price 4d. post free, direct from the Ministry.

† Miscellaneous Publications, No. 56. Price 4d. post free, direct from the Ministry.

County	Competitions April, 1925 -March, 1926				Competitions April, 1926 -March, 1927			
	No. of competi- tors	Total No. of cows	No. of sam- ples exam- ined	No. of samples reach- ing graded stan- dards	No. of competi- tors	Total No. of cows	No. of sam- ples exam- ined	No. of samples reach- ing graded stan- dards
Berkshire ..	25	940	632	388	22	891	264	222
Buckinghamshire ..	39	787	283	192	28	576	164	121
Cheshire ..	22	680	200	149	17	506	170	117
Cornwall ..	17	226	102	94	22	342	264	261
Cumberland and Westmorland ..	12	304	99	42	25	859	175	103
Devon ..	18	328	108	88	29	413	208	164
Dorset ..	21	750	168	84	33	1,160	384	181
Durham† ..	12	274	130	100	—	—	—	—
Essex ..	21	1,003	126	108	61	2,198	854	678
Gloucester ..	—	—	—	—	22	537	129	101
Hampshire ..	—	—	—	—	72	2,594	424	98
Hertford ..	28	960	224	125	33	1,280	264	238
Kent ..	22	825	213	512	32	850	420	287
Leicester ..	8	260	56	42	8	167	56	42
Leicestershire ..	38	583	228	68	27	400	162	46
Lindsey ..	—	—	—	—	21	242	252	162
Middlesex ..	13	442	78	53	15	570	180	92
Northants ..	—	—	—	—	30	571	174	70
Northumberland ..	10	227	90	60	24	504	206	148
Nottinghamshire ..	21	431	245	143	17	345	204	130
Oxford ..	15	518	104	80	15	473	179	113
Rutland ..	—	—	—	—	13	237	94	45
Salop ..	10	327	60	32	17	493	102	76
Somerset ..	73	1,620	501	343	85	2,109	960	653
Staffordshire ..	—	—	—	—	20	616	120	113
Suffolk E. & W. ..	22	450	110	100	29	700	348	232
Surrey ..	37	852	363	234	39	1,132	470	357
Sussex East ..	97	2,300	369	65	68	1,929	204	35
Sussex West ..	32	859	279	145	40	1,047	475	316
Warwickshire ..	—	—	—	—	26	645	312	167
Wiltshire ..	97	2,773	553	330	50	2,016	639	450
Worcester ..	9	166	54	45	14	346	168	136
Yorkshire ..	21	534	231	133	28	442	252	220
Anglesey ..	—	—	—	—	9	238	81	51
Brecon & Radnor ..	10	186	90	88	—	—	—	—
Cardigan ..	—	—	—	—	24	269	198	150
Carmarthen ..	13	272	104	70	9	204	18	11
Denbigh ..	17	403	129	81	—	—	—	—
Flint ..	10	150	60	39	12	200	86	37
Montgomery ..	10	149	80	56	13	193	86	64
Pembroke ..	8	116	48	27	13	226	104	82
Total ..	818	20,695	6,717	4,146	1,062	28,520	9,859	6,569

† A further competition is in progress in Durham, but particulars are not included as it was not commenced until May, 1927. Derbyshire is also omitted from the statement as the scheme in that county is organized on modified lines, and the results are not therefore comparable. The Derbyshire scheme comprised five local short-time contests, lasting for about six weeks each, and covering approximately 100 competitors.

§ These competitions are still in progress and the figures given relate to samples examined up to the end of August, 1927.

by the Ministry in November, 1926, and the comparative statement (on the opposite page, relating to competitions commenced during the years April, 1925-March, 1926, and April, 1926-March, 1927, indicates the considerable progress which has since been made.

Interim reports are issued to competitors relating to the results of bacteriological and chemical examination of samples, and giving the comments of the inspecting judges after their surprise visits. The chief educational value of the competitions, however, lies in the advisory service provided. In many cases clean milk demonstrations are held in association with the competitions, and in addition advisory visits are paid to all competitors by members of the staff of the Local Authorities for Agricultural Education. As a rule these advisory visits are distinct from the judges' visits of inspection, and the actual number paid in connexion with competitions commenced during the year 1925-26 was 2,913; the total number for the following year is not available, but it may be stated that, in general, an advisory visit was paid to each competitor at least three or four times—a sufficient indication of the extent of this service.

Instructors and judges, alike, commented favourably upon the keenness of competitors and employees, and the judges stated that whilst buildings in many cases were poor and equipment out of date, sound methods, with as light expenditure on utensils and improvisation in plant, overcame obstacles and led to very good results.

Other notable features of the competitions were: (1) the number of samples of milk which, on examination, were found to reach the bacteriological standards required for Grade "A," or certified milk; (2) the good keeping qualities of the majority of samples—in general the milk kept sweet and untainted for from two to four days—a factor which will be appreciated by all consumers; (3) the improvement in methods and results between the first and last visits of the judges; (4) the number of competitors who, where a market could be found for graded milk, took out graded licences as a direct result of the competitions; and (5) the general good health of the cows.

Whilst there were six times as many competitors and cows included in competitions for the year 1926-27 as compared with 1923-24—a striking increase—they still represent only a minute proportion of the total dairying population of the country. The value of the competitions, however, lies not only in the work that is achieved but in the example that is

set to all producers of milk. The propagandist value of the competitions is also important, since the articles and notes on them which appear from time to time in the Press will tend to give the consumer confidence in the milk supply and probably lead to an increased consumption.

It has been demonstrated throughout the movement that, without expensive plant and specially constructed buildings, it is possible to produce milk of high hygienic quality which will keep well—and the “open sesame” is intelligent reception of advice offered by the dairy teaching staff of the Local Authorities for Agricultural Education.

In addition to clean milk competitions, 31 milking competitions were held during the year 1925-26, and 43 during 1926-27, either at Agricultural Shows or on the farms of competitors in the County Clean Milk Competitions.

* * * * *

With reference to the note in the May issue of this JOURNAL regarding the general organization and activities of the

International Institute of Agriculture the first meeting of the International Scientific Council, which is sub-divided into 25 consultative Committees, is being held on November 7.

The Institute announces that the preparatory work for this meeting is making good progress. The Permanent Committee has also decided to summon in the same month a meeting of the International Permanent Commission of Agricultural Associations, on which, at the present time, nearly 180 Agricultural Associations of various countries are represented. Consideration will be given at this meeting to the question of establishing more effective collaboration between the Institute and the Associations by means of a regular and systematic exchange of information and views.

In connexion with the World Agricultural Census to be taken in 1929-30, Mr. Estabrook, the Director of the Census, has been engaged for a number of months in visiting the authorities in various countries with the object of securing that the Census shall be taken on the general lines proposed by the Institute. In the April issue of this JOURNAL, it was stated that visits had already been paid to European and North African countries, with generally satisfactory results. Since then Mr. Estabrook has visited the competent authorities in the United States, Canada, Mexico, Cuba, Jamaica, Haiti

and San Domingo, all of which countries have notified their acceptance of the Institute's scheme.

The Fourth International Seed-Testing Conference will take place on May 18, 1928, at the Institute's offices in Rome, and will be preceded and followed by a meeting of the General Assembly of the International Seed-Testing Association.

The adherence of Bolivia brings the total number of adhering States to 74.

* * * * *

ACCOUNTS have been given in this JOURNAL, from time to time, of the various activities of the Ministry, undertaken with the aid of the grant of £40,000 a year for five years made by the Empire Marketing Board for the purpose of carrying out further investigations into the marketing of home-grown agricultural produce, and for demonstrating improved methods. A further brief report of progress for the quarter ended June 30, 1927, may prove of interest.

Publications.—One report in the Economic Series has been issued during the quarter, namely, No. 13, *Markets and Fairs in England and Wales* (Part 1, General Review). With the aid of the grant this report was issued at 6d. net. Two other reports have been completed and are about to be sent to the printer, viz., No. 14, *Markets and Fairs in England and Wales* (Part 2, Midland Markets), and No. 16, *The Marketing of Fluid Milk*.

The total sales of the reports in the Economic Series to June 30, 1927, are as follows:—

No.	Title	Total
1.	“Co-operative Marketing of Agricultural Produce in England and Wales”	2,196
2.	“The Stabilisation of Agricultural Prices”	1,100
3.	“The Economic Resources of Canada”	877
4.	“Large-scale Co-operative Marketing in the United States”	1,274
5.	“The Co-operative Purchase of Agricultural Requisites”	1,110
6.	“The Trade in Refrigerated Beef, Mutton and Lamb”	1,049
7.	“Wool Marketing in England and Wales”	1,152
8.	“Agricultural Credit”	1,646
9.	“Marketing of Potatoes”	1,101
10.	“Egg Marketing in England and Wales”	6,496
11.	“The Marketing of Poultry in England and Wales”	6,865
12.	“The Marketing of Pigs in England and Wales”	3,275
13.	“Markets and Fairs in England and Wales”	2,139
15.	“Fruit Marketing in England and Wales”	5,016
		35,296

Marketing Investigations.—Reports on the Marketing of Pig Products, on the Marketing of Apples, Pears and Plums, and on the Marketing of Cereals are in preparation. Investigations are also in progress into the Marketing of Cattle, Vegetables, and Cheese; further inquiries necessary in connexion with the survey of markets are also proceeding.

Marketing Demonstrations.—Practical demonstrations of improved methods of marketing eggs, poultry, fruit, and pigs have been staged at the following Shows during the quarter: Oxfordshire, Bath and West, Suffolk, Three Counties, Royal Cornwall, and Lincoln. In addition to many verbal expressions of approval, written appreciation of these demonstrations has been expressed by, amongst others, the Imperial Economic Committee, by branches of the National Farmers' Union and by County Agricultural Organizers. Numerous requests have reached the Ministry for a repetition of the demonstrations at other Shows this year and next. A programme of demonstrations for the coming autumn and winter was published in this JOURNAL last month (page 496).

Displays of Empire Produce.—Adequate representation of home produce was arranged at the Exhibition of Empire Produce held at Belfast from May 23 to 28; a full account was given in this JOURNAL for June (page 193) and July (page 380).

Grants-in-Aid.—A grant of £100 has been offered to the *British Fruit Packing Company*, East Farleigh, Kent, on condition that the company supplies the Ministry with certain information in respect of the quantity of fruit and vegetables received at the company's packing stations, the costs of handling, the records of consignments to markets, gross and net returns, market charges, etc. The grant is to be used only in payment, or part payment, of the salary of an additional employee, whose primary duty will be to keep the records required.

A grant not to exceed £150 has been approved towards the expenses of a scheme for marketing black currants, initiated by the *Norfolk Fruit Growers, Ltd.* The grant is only in respect of the payment of marketing, secretarial and supervisory expenses, and no part is to be used for advertisement. Records showing the quantities consigned to, and the gross returns from, each market, and details of the net costs of consignment to, and sale in, each market are to be kept, and audited accounts are to be furnished.

A grant of £200 a year has been approved to the *School of Agriculture, Cambridge*, for an experimental trial of pig recording in conjunction with the St. Edmundsbury bacon factory.

A grant not exceeding £1,000 has been offered to and accepted by the *Pershore Co-operative Fruit Market* to enable that society to embark upon a scheme for marketing graded produce. Audited accounts, records of the produce handled and of the handling costs, together with records of expenses and receipts from sales, are to be kept and are to be available for inspection.

The Ministry has reserved the right in each instance to publish such of the above information as may be of general interest and utility.

Egg Marketing Poster.—The interest in the large poster calling attention to the points to be observed when marketing eggs has been sustained, and requests for copies are still being received. The issue of the poster has led to requests for large numbers of Marketing Leaflet No. 3, to which reference was made in a previous report.

Packages for Eggs and Dressed Poultry.—The Report of the Committee which was appointed to examine the various packages in use in the trade in this country in home-produced eggs and dressed poultry has been summarized in the form of a leaflet (No. 5 in the Marketing Series). Over 2,000 copies have already been distributed to the agricultural and trade Press, to the various organizations of producers and distributors connected with the industry and to education authorities likely to be interested. The recommendations of the Committee have received favourable comment from every quarter. An abridged edition of the leaflet has been prepared for general distribution on a large scale.

* * * * *

THE English Cheddar Cheesemakers' Federation has been formed with the object of placing on the market a standardized and trade-marked product. The Federation

Cheddar Cheese has appointed two graders, who will examine all Cheddar cheese submitted to them; and will affix the trade-mark of the Federation to such cheese as satisfies the standard laid down. This standard requires 88 per cent. of points to be obtained, points being awarded for flavour, texture, keeping qualities, colour and finish. The scheme was put into operation on August 1, when

the Duke of Somerset stamped the first cheese to be passed by the official grader. The trade-mark applied for consists of two "C's" with the word "Cheddaration" crossing them. It is understood that the farmers in the Cheddar district are joining the Federation in considerable numbers, and the trade-marked cheese is meeting with a good reception by traders.

This scheme, like that of the Cheshire Cheese Federation, is a great advance in marketing technique, and, in the belief that the experience gained will be of the highest value to all branches of the industry, the Ministry has sanctioned a grant to the Cheddar Federation of a sum not exceeding £700 for the first year of working, in order to assist them over the financial difficulties inherent in the inauguration of experimental schemes of this nature. The grant will be made from the fund placed at the Ministry's disposal by the Empire Marketing Board, and is to be used towards administrative expenses only. The Federation has undertaken to supply full information and accounts from time to time, which the Ministry will be at liberty to publish for the information and guidance of producers generally.

* * * * *

At the outset of the fourth manufacturing season since the passing of the British Sugar (Subsidy) Act, it is opportune to review briefly the progress that has been made in the industry in this country.

Beet Sugar

In 1924 there were only 22,637 acres under sugar beet, and in the ensuing manufacturing campaign only three beet sugar factories were at work—Cantley, Kelham and Colwick. These factories sliced in that season 183,713 tons of beet, giving a production of 23,915 tons of white sugar. Each succeeding campaign has seen the opening of new factories, until the number about to commence work on this year's crop is no fewer than 19, of which five will operate for the first time and five will have greatly enlarged their manufacturing capacity since the previous campaign. The total area under sugar beet in 1927 is returned at 229,200 acres—221,700 in England and Wales and 7,500 in Scotland. Should the yield per acre be approximately that of 1926, namely, 8.6 tons—though there is no reason why, with added experience, the British yields should not more closely correspond in the future to Continental and United States averages—it would be

reasonable to expect a total crop of about 2,000,000 tons of beet, and a production of white sugar of, say, 260,000 tons, or a little less than two months' supply of sugar for Great Britain. Should this forecast prove correct, the direct payments to farmers by the factories in respect of the 1927 crop will be nearly £6,000,000.

The following statement illustrates the development that has taken place:—

	MANUFACTURING SEASON			
	1924-5	1925-6	1926-7	1927-8 (Estimated)
Acreage under sugar beet	22,637	56,243	129,463	229,200
No. of factories	3	9	14	19
Sugar beet delivered to factories (tons) ..	183,713	431,185	1,117,072	2,000,000
Total production of sugar (cwt.)	478,308	1,035,672	3,069,739	5,200,000
Total production of molasses (cwt.)	114,015	270,910	750,000	1,300,000
	*	*	*	*

THE Ministry advocates the use of red squill poison in baits intended for the destruction of rats and mice, in preference to other stronger poisons sometimes used,

Red Squill as a such as strychnine, arsenic and phosphorus.

Rat Poison Red squill is particularly recommended for use on farms and in places where,

owing to the presence of poultry, live stock, domestic animals or stored food supplies, special care is necessary.

Red squill poison is extracted from the red squill bulb (*Urginea maritima*) which grows on the sandy shores of the countries bordering the Mediterranean Sea. It may be used in powdered or liquid form in baits consisting of bread (or oatmeal), fat, syrup and a few drops of aniseed, or in biscuit or other forms supplied by firms who deal in rat destruction preparations and appliances.

From experiments recently carried out on behalf of the Ministry, the following general conclusions were arrived at:—

- Female rats are killed by doses of red squill approximately only half as great as those generally needed to kill male rats.
- The finer the red squill powder is ground the more toxic it becomes.
- The best red squill baits for general use are those made from a finely ground and completely dried product of the bulb itself.
- The average lethal dose for male and female rats is, approximately, .50 and .27 grammes respectively.
- The white squill (used for medicinal purposes) is useless as a rat poison.

A series of experiments was also carried out with calves, sheep, pigs and rabbits, which were given red squill powder in their feed, and, in spite of the fact that they had been given no other food for the preceding 24 hours, it was found almost impossible to induce the animals to eat any appreciable quantity of the poisoned feed. It would appear, therefore, that on the grounds of palatability alone, there is little danger of such animals eating a sufficient quantity of red squill baits to cause ill effects. In those cases where the animals were induced to take the poison, it was found that unless a considerable quantity of the poison was consumed no ill effects were noticed. Experiments with fowls showed that they took the poison more readily, but even then it was found that to kill a fowl required a dose between 20 and 30 times as large as that necessary to kill a rat.

These experiments appear to show that, while fatal to rats, red squill poison is comparatively harmless to larger animals, and Rat Officers are urged to consider the desirability of using preparations containing this toxic agent, particularly in those cases where domestic animals and poultry are kept in the vicinity.

* * * * *

THE Royal Commission on Land Drainage, which was appointed earlier in the year under the chairmanship of Lord Bledisloe, to inquire into the present law relating to land drainage and report whether any amendment of the law is needed to secure an efficient system of arterial land drainage without any undue burdens being placed on any particular section of the community, has already heard evidence from most parties interested and has visited a few typical areas (such as the lowlands in Somersetshire and our Eastern Counties) where an efficient system of drainage is necessary to preserve the land from permanent waterlogging.

The Commissioners recently made arrangements, at the invitation of the Netherlands Government, to inspect the Dutch systems of drainage and reclamation and study their administration. They left for Holland on the night of Sunday, September 18, and were received next morning by the Minister of Waterstaat, who is responsible for the regulation of the level of the waters of Holland. Short lectures on drainage problems were given, followed by an inspection of the coast defence works south of the Hague. For this inspection and

for the whole of their tour, the Commissioners were under the guidance of Jonkheer van Panhuys, the Chief Engineer of the Dutch Ministry, Mr. J. Korthals-Altes (a Dutch expert on drainage problems in several European countries, who has, moreover, written a biography of Sir Cornelius Vermuyden, who came over to England from Holland in the seventeenth century and planned the huge schemes of artificial drainage which are still in existence in the Cambridgeshire fens and the Isle of Axholme), and Mr. Laming, the British Commercial Secretary at the Hague.

The second day was spent in inspecting the great national work of the Netherlands, the reclamation of the Zuiderzee. On that day members of the Royal Institution of Netherlands Engineers were visiting the Zuiderzee works with a number of French engineers, and they invited the British Royal Commissioners to join the party.

On the following day, the Commissioners were received by the Queen's Lieutenant of Overijssel, and under his guidance inspected various inland drainage areas and uplands, where, although no pumping is necessary as in the case of the coastal districts, water from the higher levels flows into the lower lands, thereby threatening them with serious deterioration. The last day of the visit was spent in inspecting the estuary of the River IJssel, which flows into the Zuiderzee between long training walls, similar to those which it is proposed to build into the Wash to improve the drainage of the area served by the River Ouse.

Throughout their tour, the Commissioners received every assistance from the Dutch authorities and the staff of the British Legation, the unfailing courtesy of both having afforded opportunities for the acquisition of very useful knowledge in the most pleasant manner possible.

* * * * *

FIELD EXPERIMENTS AT ROTHAMSTED DURING 1925-1926—I

Sir JOHN RUSSELL, D.Sc., F.R.S.,

Director of the Rothamsted Experimental Station, Harpenden.

As in previous years, many of the experiments have dealt with fertilizers, and have been designed to find out why fertilizers act well in some seasons and places and not in others. The variation in effectiveness is not the same for all; the nitrogenous manures give fairly steady increases each year, even though the seasons vary considerably, while both for phosphatic and potassic fertilizers the increases may be high in some seasons and low in others. Thus in recent years the increases in yield of potatoes in cwt., per acre at Rothamsted for one cwt. of manure supplied have been :—

Fertilizer	1922	1923	1924	1925	1926
Sulphate of ammonia	20	22-25	20	23	25
Sulphate of potash—					
No farmyard manure	58	25	10	40-46	—
Farmyard manure	20	10	0	—	20-23

Basal manure was given in addition.

Although there have been no experiments with phosphatic fertilizers on potatoes at Rothamsted (these are being started during the current season) there have been experiments on swedes, and these also show much variation in effect from year to year; the increase in cwt. per acre for the dressing of 600 lb. superphosphate per acre were :—

1913	1920	1922	1924
44	140	18	30

The variation in effect is not simply a matter of chance, it depends on the season; and it so happens that the phosphates and potash act best in a bad season when additional crop is a great advantage. This is well brought out in the further details given in the following table showing the yield of swedes in tons per acre :—

	Poor years		Good years	
	1913	1920	1922	1924
No artificials	3-2	3-3	25-2	17-3
No phosphate but only sulphate of potash and sulphate of ammonia	6-4	9-3	28-1	19-1
Phosphate in addition (slag 1922, or super. 1924)	8-6	16-3	29-0	20-6

Both phosphate and potash may, therefore, be regarded as insurance against loss; for in the bad season, when roots are scarce, the value of an extra 7 tons, or even of an extra 2½ tons, per acre is well worth an effort to secure.

Again, phosphatic and potassic fertilizers are important in keeping up the fertility of the soil. Wherever supplies of farmyard manure are restricted, the productiveness of the land falls off considerably unless phosphatic and potassic fertilizers are periodically added. This is shown in the following yields of barley grown in the same field (Little Hoos), part of which received no phosphate while other plots received periodical dressings of superphosphate :—

BARLEY : BUSHELS PER ACRE.

	Phosphate given	No phosphate given since 1904	Fall in yields
1909 ..	40-60	36-6	4 after 5 years
1914 ..	37-32	23-27	14 after 10 "
1922 ..	37-80	20-25	17½ after 18 "

The broad result is, therefore, that nitrogenous manures increase the growth of crops in almost any season, while phosphates and potash may not act in a good season, especially if farmyard manure is plentifully given; but they may act well in bad seasons or when farmyard manure is scarce, and in any case they are needed for keeping up the productiveness of the land.

Manuring of Potatoes.—The experiments on the manuring of potatoes bring out the important point that the fertilizers do not give their best action unless they are made up to give a complete manure. The effect on the potato crop of sulphate of ammonia, with and without sulphate of potash was tried both in 1925 and 1926. With no sulphate of potash the sulphate of ammonia had only little effect; 1 cwt. per acre produced no increase in crop, 2 cwt. gave 1½ tons of potatoes, and 4 cwt. gave no more. But as soon as sulphate of potash was added the yields rose with every additional quantity of sulphate of ammonia; the first cwt. gave one extra ton of potatoes; the second gave a further ton and a half; while two more cwt. gave up to two additional tons according to the amount of sulphate of potash supplied. The figures for 1926 are :—

Sulphate of ammonia ..	0	1	2	4 cwt. per acre
0 cwt. sulphate potash per acre	7-8	7-7	9-4	9-5 tons potatoes
1 " " "	7-8	9-0	10-6	11-2 " "
2 " " "	8-0	9-2	10-3	11-6 " "
4 " " "	7-8	9-1	10-4	12-3 " "

Standard error : 5-48 per cent.

Relation between Quantity of Fertilizer Supplied and Amount of Crop Yield.—The table set out above shows the relation between the amount of fertilizer and the crop yield. The

largest crop was given by the largest dressing of fertilizer, but it does not follow that still larger dressings would have given still larger crops. This point was tested in 1925 when the yields were :—

Sulphate of ammonia ..	0	2	4	6 cwt. per acre
0 cwt. sulphate potash per acre	5.54	5.22	6.44	— tons potatoes
2 " " "	7.25	9.18	10.18	— " "
4 " " "	7.92	10.54	10.96	— " "
6 " " "	—	—	10.95	10.47 " "

No farmyard manure was given.

Standard error : 4.27 per cent.

The highest yield the season permitted was about 11 tons per acre, and this was obtained by the use of 4 cwt. per acre each of sulphate of ammonia and sulphate of potash. Increasing these dressings to 6 cwt. each per acre gave no further advantage. One of the most important factors in successful manuring is to recognize that fertilizers added beyond a certain point do not increase the crop and may only involve the farmer in loss. It seems clear, however, that undermanuring is also likely to cause loss of profit. In the 1926 experiments (p. 601), for example, the additional crop obtained by the use of an extra cwt. of sulphate of ammonia per acre was as follows :—

Sulphate of ammonia ..	1	2	3 & 4 cwt. per acre
1 cwt. sulphate potash per acre	23.6	31.6	6.0 cwt. potatoes
2 " " "	23.2	22.6	13.2 " "
4 " " "	24.4	28.6	19.0 " "
Mean	23.7	27.6	12.7 " "

The first cwt. sulphate of ammonia gave an additional 23.7 cwt. of potatoes, the second cwt. gave an additional 27.6 cwt., a larger return than the first. The third and fourth cwt. gave less increase, however, varying from 6 to 19 cwt. according to the quantity of sulphate of potash, the heavier dressing having, as already pointed out, the greater need of potash. The falling off in effectiveness of the third and fourth cwt. is in accordance with the well-known Law of Diminishing Returns. The increased effectiveness of the second cwt., as compared with the first, is not, and shows that an increasing return precedes the diminishing return. Various other illustrations have now been accumulated at Rothamsted, and they indicate that the greatest profit is attained by pushing up the applications towards the point of Diminishing Returns rather than by keeping them too low.

The Balancing of Manures.—In recent years there has been considerable discussion as to the necessity or desirability of balancing manures for crops. Formerly a rather fine balance was thought desirable ; experiment has shown, however, that this is not so, the plant having considerable power of adjustment to its surroundings. This point has been carefully tested with the potato crop, where the fertilizer mixture is very important. The results for 1926 have already been given (p. 602) ; those for 1925 are as follows :—

YIELD OF POTATOES, 1925.
In tons per acre.

Fertilizers	No sulphate of potash	Additional for		Gain per cwt. sulphate of potash for	
		2 cwt. sulphate of potash per acre	4 cwt. sulphate of potash per acre	1st 2 cwt.	2nd 2 cwt.
No sulphate of ammonia given ..	5.54	1.71	2.39	0.86	0.31
2 cwt. sulphate of ammonia given ..	5.22	3.96	5.31	1.98	0.68
4 cwt. sulphate of ammonia given ..	6.44	3.74	4.51	1.87	0.39

Both in 1925 and 1926, there is a curious fall in yield when 1 or 2 cwt. sulphate of ammonia is used alone without sulphate of potash. Not only is there no gain : the experiment shows an actual loss of 0.32 tons per acre in 1925 and 0.07 tons per acre in 1926. If these figures stood alone the loss might be doubted ; we have, however, obtained the result before. The result is the same as that obtained in 1925, when the sulphate of ammonia was increased from 4 to 6 cwt. per acre, the sulphate of potash not being increased beyond 6 cwt. Here also there is no gain in yield but a loss of 0.48 tons per acre.

Within the safe amount of nitrogen there is no evidence of a rigidly defined "best" ratio of nitrogen to potassium for a potato fertilizer. In 1925, 2 cwt. sulphate of potash and 4 cwt. sulphate of ammonia are inferior to 4 cwt. sulphate of potash and 2 cwt. sulphate of ammonia, the difference being 0.35 tons per acre, i.e., 7 cwt. per acre. In 1926, the reverse happens : 2 cwt. sulphate of potash and 4 cwt. sulphate of ammonia give 1.2 tons per acre more potatoes than 4 cwt. sulphate of potash and 2 cwt. sulphate of ammonia. But although no rigid ratio can be prescribed, the general result emerges in both years that equal weights of sulphate of potash

and sulphate of ammonia in the mixture give, on the whole, better results than any other mixture. It should be noticed that this contains more potash than is usually present in potato manures.

Compensating Effects of Phosphates and Potash in Bad Seasons. The Maximum Crop obtainable by the use of Fertilizers.

—It is a commonplace that the effects of fertilizers vary with the different seasons; as we have seen the nitrogen is the most constant in action, but the phosphate and potash vary from year to year. The variation is of special interest because both fertilizers are better in a bad season than in a good one; they thus act as compensators, pushing up the yields when bad weather conditions would make them low, but not much increasing them when good weather conditions keep them high. This compensating action is well seen in our potato experiments, where on the properly fertilized plots the yield varies far less than might be expected from season to season; the results have been:—

MAXIMUM CROP, POTATOES, ROTHAMSTED.

In tons per acre.				
1922	1923	1924	1925	1926
9.5	10.6	13.3	11.0	12.3

The 1922 results are almost certainly low because the dressings of sulphate of ammonia then given did not exceed 2 cwt. per acre, a quantity now known to be insufficient. The figures show that, in any year, one may hope by the best scheme of manuring to arrive at about 11 to 13 tons of potatoes per acre, but the amount and composition of the manure required to attain this maximum vary from year to year. Several mixtures approach the maximum, but some more nearly than others, and for these the financial returns are better.

Both in 1925 and 1926, the best results are attained by 4 cwt. sulphate of potash and 4 cwt. sulphate of ammonia, and any reduction in amount of fertilizer leads to a reduction in crop. The man who wished to economize would, in 1925, have done better to begin with 4 cwt. sulphate of potash and add as much sulphate of ammonia as he felt disposed (up to 4 cwt.), but, in 1926, his best plan would have been to begin with 4 cwt. sulphate of ammonia and add as much sulphate of potash as he wished—again up to 4 cwt.

Experiments with Cereals.—In the manuring of cereals, it is not usually necessary to give a complete fertilizer because there should be sufficient potash and phosphates applied to

the roots, potatoes or seeds ley in the rotation to furnish all that is necessary. Exceptions occur on thin chalk soils, where potash may be required, or on the Norfolk soils and the Lincolnshire and Yorkshire Wolds, where phosphates are often given; but over large tracts of country a nitrogenous fertilizer is alone required for wheat, oats or barley. This is shown by the following results:—

AVERAGE INCREASE IN YIELD OF BARLEY IN BUSHELS PER ACRE, GIVEN BY 1 CWT. SULPHATE OF AMMONIA PER ACRE, 1925.

	With potash and phosphates	Without potash or phosphates	No of centres
Total grain ..	7.38	6.94	10
Dressed grain ..	7.12	7.09	8

The most suitable nitrogenous manures are nitrate of soda, nitrate of lime, sulphate of ammonia and cyanamide, and the proper time of application is in the spring. For spring-sown corn, the manure naturally goes in with the seed, but for winter corn it must be given as a top dressing, and then the difficult question arises, When should the manure be applied? Late application has led to larger crops and an increased proportion of nitrogen in the grain; it has also given dark green, unhealthy looking foliage. The latter is undesirable; the higher nitrogen content might be valuable in wheat, oats or feeding barley, but is not wanted in malting barley. Further information is wanted before general rules can be given, and the experiment is being carried on for a period of years.

For winter oats in 1925 the results were as follows:—

Treatments	Time	Yield of grain bushels per acre	Yield of straw cwt. per acre	Total produce lb.
Basal (2 cwt. superphosphate) +				
No nitrogen	—	49.6	23.5	4717
1 cwt. sulphate of ammonia ..	Early	59.4	31.8	6057
1 cwt. sulphate of ammonia ..	Late	64.2	30.8	6142
2 cwt. sulphate of ammonia ..	Early	66.4	36.7	6902
2 cwt. sulphate of ammonia ..	Late	69.3	34.6	6780

The early dressing was applied on March 5 and the late on May 5.

The effect of 1 cwt. sulphate of ammonia has, therefore, been to give the following increases:—

	1st cwt.	2nd cwt.	Increase for 2 cwt.
Applied early	9.8	7.0	16.8
Applied late	14.7	5.0	19.7

This is a general average of 9 bushels of oats per acre, which is not far from the figure obtained in 1923 (8.3 bushels) and

above the usual average for oats, 7 bushels; it shows the degrees of similarity of action of nitrogen in spite of the differences in season.

The experiment is very similar, so far as the treatments are concerned, to one made on the old lines in 1923, but the result differs in that the late dressing gave the larger yield for the second and not for the first cwt. of sulphate of ammonia. The gains were in that year in bushels per acre:—

		1st cwt.	2nd cwt.	2 cwt.
Applied early ..	..	8.1	9.2	17.3
Applied late ..	..	5.4	19.1	24.5

The experiment was repeated more fully in 1926 with both wheat and oats. The wheat behaved like the oats of 1925 and 1923 in producing more grain for the late dressings than the early ones. The oats, however, grew so well (yielding 75½ bushels per acre without added nitrogen) that the sulphate of ammonia had but little effect, 1 cwt. increasing the yield by only 2 bushels per acre, and 2 cwt. doing no better. But the 77½ bushels thus obtained was the highest we have ever had and probably the maximum obtainable on our land. The yields were:—

Sulphate of ammonia, per acre	Oats, 1925		Oats, 1926		Wheat, 1926	
	Grain bushels	Straw cwt.	Grain bushels	Straw cwt.	Grain bushels	Straw cwt.
None ..	49.6	23.5	75.4	44.1	27.0	41.0
1 cwt. early ..	59.4	31.8	77.2	50.0	24.5	43.7
1 cwt. late ..	64.2	30.8	77.0	50.0	32.8	44.9
2 cwt. early ..	66.4	36.7	77.4	58.9	30.8	46.2
2 cwt. late ..	69.3	34.6	77.3	50.3	32.1	46.7
Standard error per cent. ..			2.78	0.76		
			for total produce			
			1.45			

All plots received a basal dressing of superphosphate, except wheat in 1926.

We are not yet prepared to explain why the late dressing was more effective than the earlier ones.

Cyanamide on Cereals.—Another interesting effect which is being followed up was obtained this year with cyanamide. Usually, nitrogenous fertilizers, in increasing the yield of grain, also increase the length of the straw and so tend to "lay" the crop. In this season's experiments, cyanamide, while increasing the grain as much as sulphate of ammonia, did not cause the straw to grow so long. Further, it caused

more tillering, *i.e.*, it increased the number of heads per plant, though it produced no more grain than sulphate of ammonia. It is improbable that the cyanamide itself brings about these effects, as it quickly decomposes in the soil; some other substance associated with it is more likely to be the agent. We are now studying the possibility of combining this result with one mentioned later: an increased number of grains per head brought about by using chlorides or muriates. If we could do this, we could hope to obtain more heads per acre and more grains per head, and therefore more yield of corn at no great expense.

Malting Barley Experiments.—The consumption of barley for purposes of malting increases each year. The quantities of malt used and the amount of barley estimated to be required is as follows, assuming, as is generally true, that 4 cwt. of barley give 3 cwt. of malt.

Year ended September 30	Malt used in brewing cwt.	Malt used in distilling cwt.	Total malt cwt.	Estimated equivalent in barley of total malt cwt.
1923	10,742,000	3,242,502	13,984,502	18,647,000
1924	11,275,235	3,105,525	14,380,760	19,174,000
1925	11,453,591	3,056,601	14,510,192	19,347,000

About 75 per cent. of this barley is grown at home and the rest is imported, but there is no reason, in the nature of things, why a larger proportion should not be supplied by the British farmer. Over a run of seasons, the financial return is satisfactory, although there are sometimes marked differences between the price offered by buyers in different parts of the country for the same sample.

The purpose of the experiments has been to discover the effects of soil, climate and manure on the yield and quality of the grain. They have been carried out under the Research Scheme of the Institute of Brewing, of the Barley Committee of which the writer is chairman; the arrangement has the great advantage that the produce from each plot is examined in full detail by expert maltsters and brewers.

The first series of experiments, carried out not only at Rothamsted, but on some 15 good barley growing farms in different parts of the country, led to the following conclusions:—

- (1) Soil and season are the main factors determining yield and quality in barley. Conditions increasing the quantity per acre of non-nitrogenous material (presumably starch) in the grain, without correspondingly increasing the

amount of nitrogen, appear also to be conditions making for quality.

- (2) Sulphate of ammonia in small quantities (1 cwt. per acre) increased the total number of tillers and the number bearing grain; it also increased the yield of grain by about 5 bushels per acre in all the seasons 1922-26, the effect being but little influenced by season. On the average it slightly raised the percentage of nitrogen in the grain, but insufficiently to affect the buyers' valuation. At Rothamsted, however, it usually lowered the nitrogen percentage.

The Institute of Brewing is going further into the question whether the slight change is of any significance in malting, and for this purpose 30 quarter samples of each experimental lot are being obtained this year.

- (3) Larger quantities of nitrogenous manure may raise the percentage of nitrogen in the grain so much as to be perceptible by the buyer; in consequence the valuation falls.
- (4) Superphosphate also increased the number of tillers, but at most centres it had little effect on yield, except in 1926, and no recognizable effect on quality or on percentage of nitrogen in the grain. On loams in the Eastern Counties, however, it increased the yield and decreased the percentage of nitrogen in the grain.
- (5) Sulphate of potash caused little or no increase in yields indeed at one centre there was a depression. It slightly lowered the percentage of nitrogen in the grain but had no effect on the weight of 1,000 corns or on valuation.

The smallness of the effect of fertilizers on the barley grain as compared with the effects of season is shown by the figures at the top of p. 609, being the averages for all our results at Rothamsted and the outside centres. The figures for phosphatic and potassic fertilizers are very similar and show only slight differences.

Effect of Chlorides (also called Murates) in Fertilizers.—Previous experiments at Rothamsted have show that other substances besides the well-known nitrogen, phosphate, potassium and calcium (lime) have actions on the plant for good or for bad, and of these the chlorine in chlorides is important to farmers because two fertilizers, muriate of potash and muriate of ammonia, contain it in quantity.

NITROGENOUS FERTILIZER.

	1,000 corn weight grammes		Nitrogen in dry matter per cent.		Malt extract on 448 lb. barley		Colour of extract	
	No Nitrogen	Complete	No Nitrogen	Complete	No Nitrogen	Complete	No Nitrogen	Complete
1922 ..	41.8	41.4	1.702	1.767	97.1	97.1	5.5	5.5
1923 ..	40.4	40.4	1.617	1.629	99.8	100.5	5.1	5.2
1924 ..	39.5	39.1	1.434	1.414	97.0	97.5	6.2	6.1
1925 ..	40.0	40.0	1.567	1.649	95.9	95.2	9.7	9.7
Mean ..	40.3	40.1	1.580	1.614	97.5	97.6	6.6	6.6

This chlorine is not a plant food, but it influences some of the changes taking place in the plant. One of the most valuable effects is that of muriate of ammonia on the barley grain. This fertilizer, in some way not at present understood, seems to increase the number of grains per acre attaining the size of head corn. An estimate is obtained by comparing the weight of barley per acre with that of 1,000 corns, and the figures are :—

MILLIONS OF GRAINS PER ACRE.

	No nitrogen	Sulphate of ammonia	Muriate of ammonia	Excess of muriate over sulphate
1922	17.1	18.9	19.8	0.9
1923	10.5	17.3	18.9	1.6
1924	12.0	16.7	17.0	0.3
1925	12.3	15.1	16.5	1.4

The increased number is obtained even in 1922 and 1924, when there was little or no difference in the weight of the crop. There are two possible explanations. The muriate may cause more tillering and consequently a larger number of heads capable of bearing seed, or it may cause a larger number of the florets to become fertile and filled out with seed; in no head of barley are all the florets fertile. The indications are in favour of the latter explanation. The higher number of grains generally means a higher yield per acre, but not always: the grains may be lighter in weight, in which case the yield is not necessarily increased. The weights of 1,000 corns for the past four years have been, in grammes :—

	1922	1923	1924	1925	1926
No nitrogen	41.5	41.3	42.2	39.2	38.4
Sulphate of ammonia ..	41.7	43.2	42.4	39.6	38.8
Muriate of ammonia ..	40.3	41.8	42.4	40.7	36.8
Original seed ..	44.8				

The yields in bushels per acre have been :—

	1922	1923	1924	1925
No nitrogen	28.2	19.5	20.4	26.0
Sulphate of ammonia ..	32.6	32.8	27.7	32.25
Muriate of ammonia ..	32.5	35.7	28.0	35.0

Now this extra number of grains is obtained without corresponding increases in leaf or straw. The total produce per acre is almost exactly the same for sulphate as for muriate, as shown by the following results for 1925 :—

	Total produce: straw, chaff, cavings, etc., lb. per acre	Yield of grain		No. of grains, millions per acre	Nitrogen per cent. in grain
		lb.	Measured bushels		
No nitrogen	2775	1300	26.0	12.3	1.597
Sulphate of ammonia	3926	1813	32.35	15.1	1.585
Muriate of ammonia	3932	1829	35.0	16.5	1.552

At Rothamsted, muriate of ammonia has always given better money returns per acre for the barley crop than sulphate of ammonia, because when the yield was increased the valuation was not lowered, and when the yield was no higher the valuation was raised. The percentage of nitrogen in the grain is, in each of the five years, less than when sulphate of ammonia is used, and buyers commonly prefer a sample with low nitrogen content, other things being equal.

The percentages are shown by the following figures :—

PER CENT. OF NITROGEN IN GRAIN, DRY MATTER.						
	1922	1923	1924	1925	1926	
No nitrogen	1.58	1.648	1.611	1.597	1.599	
Sulphate of ammonia ..	1.647	1.544	1.517	1.585	1.711	
Muriate of ammonia ..	1.602	1.485	1.495	1.552	1.684	
In original seed ..	1.472					

It is rare in agricultural experiments to find a rule holding for five consecutive years without a break.

It will be observed that at Rothamsted both the sulphate and muriate of ammonia reduced the percentage of nitrogen in the grain in each of the three years 1923, 1924 and 1925 ; this is different from the mean result already recorded for the whole of the experiments, all of which, except at Rothamsted, are made on lighter soils, while the Rothamsted soil is heavy. The result suggests that, on our heavy soil, the nitrogen so much stimulates the growth of the young plant that it starts early on its career of leaf growth and assimilation, and this results in the making of much more starch.

Late dressings, both of sulphate and muriate of ammonia, had the opposite effect, and increased the amount of nitrogen in the grain. It is only when the nitrogen is applied with the seed that the above beneficial effects were obtained.

Effect of Chlorides (i.e., Murates) on Root Crops and Potatoes.

—Analysis showed that, under certain conditions, muriate of ammonia gave more dry matter per acre in the roots of mangolds and the tubers of potatoes, and more sugar in sugar beet, than did the sulphate. Further work is in hand to discover how far the result is general and to what it is due. Apparently these results are all linked up with the field observation that the leaves turn yellow more rapidly on the muriate plots than on the sulphate plots, all confirming the view that the chlorine hastens the transfer of material from the leaf to the seed, root or tuber, and so closes down vegetative growth. The first of these actions, the hastening of translocation, is an advantage to the plant ; the cessation of vegetative growth may not be. The net result is that the action of a chloride is advantageous wherever growth is in any case closed down by climate or other factors, as happens with cereals and with potatoes grown in cool climates, as at the Edinburgh farm in 1925. But it is disadvantageous if growth would otherwise have continued, as usually happens with potatoes and mangolds in England.

If this generalization turns out to be correct, it will indicate a useful field of fertilizer action for ammonium chloride. The chlorine ion is not a nutrient in the sense of being, like nitrogen, an ultimate constituent of the plant substance ; it exerts rather some special directive or controlling effects on the movement of substances in the plant. Three important applications are indicated. There is the possibility of improving the malting quality of barley, while the increased percentage of sugar in sugar beet and of dry matter in mangolds, if found to be general, would be of great agricultural value.

Muriate must, however, be carefully used ; when the ammonium chloride was applied late it injured the quality of the barley as already stated. while chlorides, applied to potatoes in quantities of more than 1 or 2 cwt. per acre, depressed the yields. Kainit is an example ; it is made up of chlorides and, in our experiments, always gives a lower yield than the sulphate or the muriate of potash. The results at Rothamsted were as given at the top of the next page.

POTATOES, TONS PER ACRE.

	Farmyard manure	No farmyard manure
No potash	8.36	4.95
Sulphate of potash	9.22	8.25
Muriate of potash	9.24	8.39
Low-grade potash salts	8.73	7.89

Even more marked depressions of yield occur when muriate of ammonia is used along with muriate of potash, and especially with kainit; this is shown by the following experiment made by Mr. R. W. Wheldon at three centres in Durham:—

Chlorine lb. per acre	Potassic salt	Ammonium salt	Yield of potatoes		
			Red House	Seaham Hall	Bunker Hill
None ..	Sulphate	Sulphate	100	100	100
80 ..	Sulphate	Muriate	96	98	93
120 ..	Muriate	Sulphate	91	92	87
200 ..	Muriate	Muriate	87	92	85
400 ..	Kainit	Sulphate	77	87	81
520 ..	Kainit	Muriate	77	85	69

Here the effect of the chlorine is consistently harmful; but at many centres the results are as obtained at Rothamsted, where the muriate of potash is practically as good in point of yield as the sulphate, no harmful effect being produced. The quality, however, sometimes suffers, and wherever this is important to the farmer he should use the sulphate rather than the muriate.

* * * * *

THE POPPLETON (YORKS) BEET SUGAR FACTORY: A DESCRIPTION OF THE FACTORY PROCESS.

At the close of the 1925-26 manufacturing campaign, the Anglo-Scottish Beet Sugar Corporation commenced the building of three further factories (Felstead, Cupar and Poppleton), two of which were constructed to deal with 500 tons of beet per day, whilst the third, *i.e.*, Poppleton, was erected for an initial daily capacity of 1,000 tons. The Poppleton Factory is some two miles from the City of York, and is conveniently situated in relation to the beet-growing districts in the area. It draws its water supply from the River Ouse. Interesting features have been embodied in its construction, the principal difference, compared with the older type of factory, being in the method employed for diffusion.

Erected in the summer of 1926, the Poppleton factory sliced its first beet on October 20, 1926. From that date until January 20, 1927, over 7,000 tons of white sugar had been extracted from 53,233 tons of beet.

The beets arrive by road and rail, are weighed and tested for sugar content and tare in the usual way. The beets are conveyed into the factory by water power, being picked up from the flume by a large beet wheel and dropped into a device known as the beet washer, where revolving paddles complete the removal of adhering dirt.

Washing of Beets.—The beets leave the washer practically free of dirt and heavy foreign substances, and then pass over an endless screen, known as the “picking table,” where a large percentage of the weeds, leaf-refuse and other small foreign substances fall through the mesh of the screen. At the same time employees watch the beets on their journey from the beet washer to the bucket elevator and pick out any remaining leaves and weeds as well as any beets which have been improperly topped or which are in such a condition as not to be fit for sugar manufacture.

Weighing.—Leaving the picking table, the beets fall into a chute, from which they are picked up by a bucket elevator which conveys them some 60 to 70 ft. to the top floor of the building, where they are discharged into an automatic scale. This scale is so constructed as to receive a definite weight—500 kg.—of roots, automatically fill and discharge, and, at the same time, record the weighings.

The heavy work to which the beet scale is subject in dealing with the large quantity of beets which passes through the factory daily renders it necessary to use a check scale in order that any inaccuracy in the working of the automatic scale may be detected and due allowance made therefor.

The object of weighing the beets at this stage is to enable the factory manager to ascertain at any hour of the day what quantity of raw material has entered the factory during any stated period, so that by taking into account the percentage of sugar in the raw material and the quantity of ultimate product obtained, it is possible to keep a strict watch on the efficient operation of the process.

Slicing.—As the beets are discharged from the weigher they fall by chutes into two slicing machines which produce the V-shaped shreds of beet known as “cossettes.” The cossettes are produced by the action of knives set on revolving discs,

each knife having a sharpened edge of the shape and size required to produce the type and thickness of cossettes which may be desired.

The beets have now been converted into a form suitable for the first stage of sugar extraction—that of separating from the other substances in the root the sugar which is contained in the beet cells.

Diffusion.—This separation or extraction is carried out at Poppleton by a modern method known as “continuous diffusion.” The diffusers, two in number, consist of long cylindrical metal tubes some $9\frac{1}{4}$ ft. in diameter and about 82 ft. in length, inclined at an angle of 4 degrees to the horizontal. Each diffuser is divided by partitions into 22 chambers, in each of which a star wheel or paddle is mounted, the object of these wheels being to convey the cossettes by stages from the lower part of the diffuser to the highest chamber, during which time a stream of water flowing in the opposite direction extracts sugar, as also other soluble substances, by a process of osmosis.

The paddles in the individual chambers are mounted on a longitudinal shaft which is geared to a drive shaft outside the apparatus. Fresh water enters the twenty-second chamber of the diffuser and, passing by gravity down the apparatus, gathers an ever-increasing proportion of sugar from the cossettes travelling in the opposite direction. The exhausted pulp is thrown out into a scroll conveyor, by which it eventually reaches the drying plant, and is converted into that convenient and very wholesome stock food known as “dried beet pulp.”

Before entering the drier, however, the exhausted cossettes are pressed to reduce the moisture content to about 80 per cent. The water pressed from these cossettes still contains a small amount of sugar in solution, and is therefore returned to the apparatus and re-enters the diffuser at one of the intermediate chambers, thus avoiding a certain loss of sugar.

From the first chamber of the diffuser there is a continuous draw of juice, varying in quantity according to the density and sugar content. In this juice there is in suspension a certain amount of fine pulp and sand, which must be removed before the juice is subjected to the clarifying process. The raw diffusion juice, therefore, passes through a system of pulp catchers and separators and then passes into the measuring tanks. This affords a further opportunity of maintaining a

check, not only on the quantity of sugar passing through the factory, but also on the quality of juice being obtained.

Carbonation.—From the measuring tank, the raw juice passes to the defecation or liming station, where a percentage of slaked lime, varying with the quality of beets being worked, is added to the liquor. The limed juice is then passed to the carbonation tanks, where the action of carbonic acid gas results in the purification of the juice, and the precipitation of the lime with the impurities entangled with it. This precipitate is then removed by passing the juice under pressure through filter presses of the plate and frame type. During the passage of the liquor through the mesh of the filter cloths, the lime mud is deposited in layers on the face of the cloths, whilst the filtered juice passes to the second stage of carbonation, where a second precipitation takes place and a further filtration results in the removal of more lime and impurities.

Sulphitation.—Clarifying the juice is completed by a third stage of purification, where the action of sulphur dioxide gas (SO_2) precipitates any remaining lime and impurities, and a final filtration gives what is known as “purified thin juice.” By this time there has been obtained a liquor consisting approximately of 13 parts of dry substance and 87 parts of water.

Evaporation.—The large percentage of water must now be removed by evaporation, and, for this purpose, quadruple-effect evaporators are employed. The thin juice enters the first body and is drawn from body to body by means of the high vacuum maintained in the fourth. The fall in pressure from one body to the next, which results from this process, permits boiling at a low temperature. Boiling of the juice in succeeding bodies is accomplished by means of the vapours given off from the boiling juice in the preceding body. So a gradual fall in the temperature takes place and the juice leaves the fourth body at a density of approximately 60 Brix., after having been concentrated with a comparatively small consumption of steam.

Saturation.—This thick juice is thereafter passed through the “blow-up tank,” where sulphur and steam precipitate additional lime compounds, these being finally removed by a last filtration through gravity filters.

Crystallization.—The juice is now ready for crystallization, and is accordingly pumped to the pan-floor and enters the

large tanks which supply the vacuum pans, of which there are five. Each of these pans is capable of boiling some 30,000 pounds of refined sugar, the operation of the pans being a matter of some considerable skill and judgment.

The demands of various markets call for crystals of different sizes, and, in the case of the Poppleton factory, a very fine crystal requires to be produced. During the process of boiling the attendants vary the conditions of temperature, vacuum, etc., according to the progress of the crystal formation and the ultimate results desired.

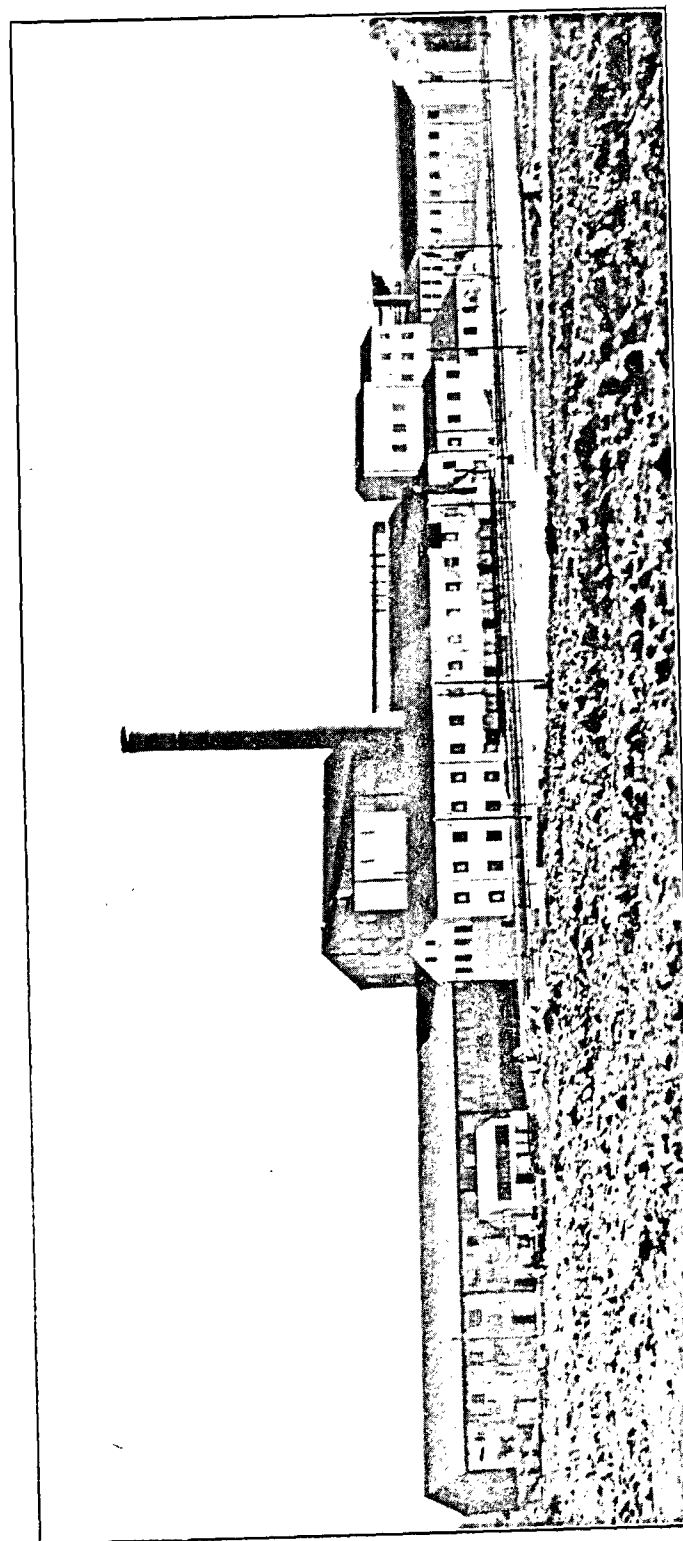
Centrifugation.—When the boiled mass of sugar and syrup has reached the desired stage, the “massecuite,” or “fillmass” as it is called, is dropped from the bottom of the pan into a large vessel known as the “strike mixer,” which feeds the centrifugal machines.

The centrifugal machine consists of a drum or basket revolving on a perpendicular shaft, having an outlet at the bottom, and a periphery of finely perforated brass screen. The action of centrifuging or spinning the sugar consists in admitting a certain quantity of “fillmass” from the strike mixer, and then increasing the speed until the centrifugal basket is spinning at some 900 to 1,000 revolutions per minute, each machine being driven by an independent motor.

As the mass of sugar and syrup falls into the middle of the basket, centrifugal action causes the product to be thrown to the sides of the container, where the syrup is able to pass through the minute holes of the brass screen. The sugar crystals are unable to pass through and therefore remain as a lining on the inside of the basket.

During the time that the sugar is revolving in the centrifugal machine it is washed, first with wash syrup and then with fresh water. When the machine is stopped, a thick lining of white sugar, in a more or less hot and moist condition, adheres to the inside of the basket. The syrup which has passed through the holes of the screen is run off into tanks, and, according to quality, is re-introduced into the process at appropriate stages.

A bell or outlet gate in the bottom of the centrifugal machine is then lifted and the “lining” of sugar is discharged by scraping it off the sides of the basket with wooden paddles. This moist white sugar is then conveyed by a travelling band underneath the machine to a hopper, where it is picked up



The Poppleton (Yorks) Beet Sugar Factory.

by a bucket elevator and conveyed to the drier, where it is subjected in a rotating drum to a draught of hot air. During this process the sugar naturally becomes hot. It is therefore passed from the drier or granulator to a drum of similar construction where the action of a draught of cold air reduces the temperature. The sugar then passes along "shakers" which remove the lumps. The lumps return to process for remelting, and the granulated sugar is deposited into the finished sugar bins.

Weighing and Sacking of Sugar.—The sugar is now ready for packing, and is weighed and sacked automatically, the filled sacks being sewn up by a rapidly operating sewing machine. The sacks then pass into store and are ready for dispatch to buyers.

During the whole time, from the entry of the beets into the factory to the final storage of the finished sugar, there is no interruption of the process, neither is the product at any stage touched by hand.

Further Details of the Factory Installation and Working.—

In addition to the machinery and equipment directly employed in the various processes, there is a considerable accessory plant for the production of steam, power, lighting, etc.

The steam requirements of the factory are furnished by four Babcock & Wilcox high-pressure boilers and ten Lancashire low-pressure boilers, whilst lighting and power are produced by a modern generating plant consisting of two Weir turbines connected with generators built by the English Electric Company and capable of a load of 1,200 KVA.

The lime and carbonic acid gas used for the purification of the extracted juice are furnished by two vertical lime kilns.

The pressed pulp is dried in two large drum driers manufactured by Messrs. Duncan Stewart & Co., Ltd., of Glasgow; 3,526 tons of this valuable material was produced by the Poppleton factory during the 1926-7 campaign.

In the production of sugar and pulp at this factory during the last campaign, nearly 14,000 tons of coal, 4,500 tons of limestone, over 560 tons of coke, and large quantities of sugar bags, pulp bags, filter cloth, sodium carbonate, sodium hydroxide, sulphur and many other supplies were used. There has thus been created a very considerable volume of new traffic on the lines of the railway companies concerned.

For the 1927-8 campaign, over 11,000 acres of beet are under cultivation for the Poppleton factory, and there is every prospect, in this area, that both tonnage per acre and sugar content will show a marked improvement on the results of last year.

HERBAGE SEED PRODUCTION IN NEW ZEALAND :

V.—SPECIES OF LESSER IMPORTANCE AND GENERAL CONCLUSIONS AS AFFECTING THE BRITISH FARMER

Professor R. G. STAPLEDON, M.A.,
Welsh Plant Breeding Station, Aberystwyth.

IN this concluding article it is proposed to give brief particulars about Chewing's fescue, brown top (*Agrostis vulgaris*) and the bird's-foot trefoils, and, finally, to draw certain broad conclusions from the evidence brought forward in the series as a whole, affecting the attitude which it might be desirable for the British farmer to cultivate in relation to the whole question of the production of herbage seeds.

Chewing's Fescue.—For a number of years this species has been fairly extensively harvested for seed in New Zealand. Since 1914, the area devoted to seed production has varied from about 3,000 to 6,000 acres. In 1924-25, the total output amounted to 560 tons—most of this being exported to the United States of America and Canada for lawn and golf-course purposes, the seed also being used to some extent for similar purposes in Europe. The great bulk of the seed is produced in the Mossburn district of Southland, the yield varying from about 200 to 350 lb. per acre.

Chewing's fescue has been classified by Bruce Levy* as a species proper to land of the lower and lowest fertility classes; on such habitats it grows in remarkably pure association, and consequently the seed crops are often practically free from weed seeds of all kinds.

The production of seed in the Mossburn district constitutes the primary feature of the farming practice. The soil is poor and excessively stony, and will not long carry rye-grass and clover. The usual procedure is to sow Chewing's fescue with perennial rye-grass and red clover, which provides a two-years' pasturage and then leaves the fescue in almost sole possession. A seed crop of fescue is taken in the third year, when the ley is alternately grazed and harvested for seed for two to four subsequent years.

At this stage the turf becomes sod-bound and unproductive. Rejuvenation is then frequently effected by ploughing in

* See Levy, E. Bruce: "The Grasslands of New Zealand: Preliminary Ecological Classification of Species," *New Zealand Journ. Agric.*, Vol. XXX, No. 6, June, 1925.

narrow furrows. The fescue makes surprisingly vigorous growth in the furrows, and after a harrowing the following spring gives a heavy crop of seed. A further seed crop may be taken the second year after this rejuvenation. The paddock will then be reploughed and sown with a crop of turnips; and this is followed again by sowing a simple mixture including about 4 lb. of Chewing's fescue. This constitutes the type of rotation practised in the Mossburn district, and affords an interesting example of a system of farming based on seed production. The crop is cut with the self-binder and thrashed out of stook, usually standing in the field for not less than two weeks.

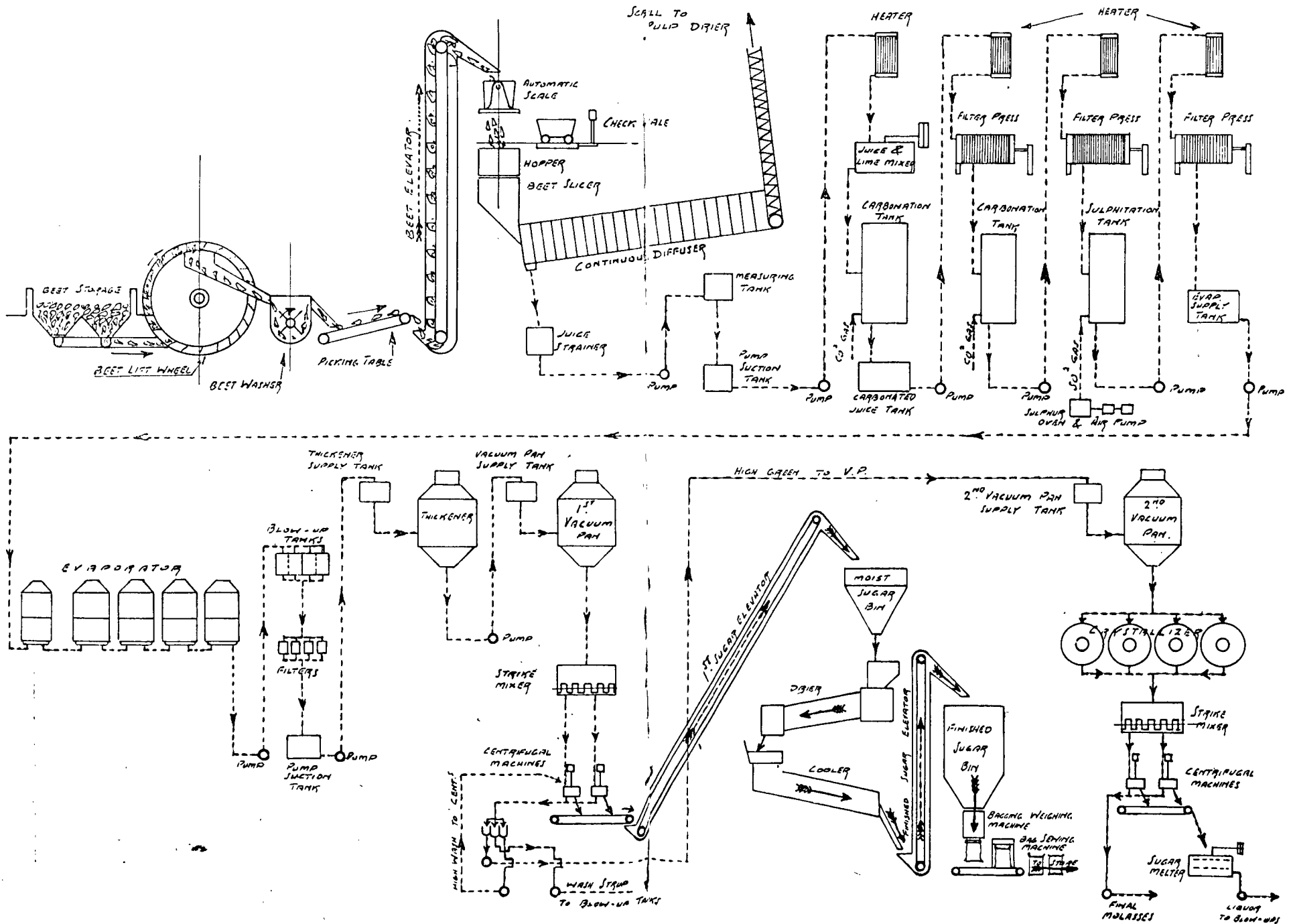
Chewing's fescue is one of those species of which the germination is prone to fall during ocean transit and prolonged storage. This characteristic is now under detailed study in New Zealand, with the result that it has been possible to make definite recommendations to the growers as to improved practices relative to the harvesting of the seed crop.*

Trials at Aberystwyth have shown that, from an agricultural point of view, Chewing's fescue is altogether more productive than the ordinary hard fescue of commerce, but it is not as winter green or as high-yielding as many of the indigenous (British) strains of red fescue under study. In common with the generality of fine-leaved fescues, Chewing's fescue in a mixed sward is not particularly palatable to stock, and only exceptionally can be regarded as a desirable ingredient in seeds mixtures for use in this country.

Brown Top (*Agrostis Vulgaris*).—Since the war there has been a ready demand for the seed of this species in the United States for lawn and putting-green purposes. The seed is chiefly harvested from the northern gum lands of Auckland, and the annual production now amounts to upwards of 30 tons. Bruce Levy has classified brown top as a species not proper to the lands of lowest fertility, but chiefly to those of moderately low and low fertility, and in connexion with his investigations on the formation of grassland in relation to habitat conditions, considers that a case can be made for the inclusion of brown top in mixtures for some of the low fertility conditions, so that this is a species for which there is likely to be a certain agricultural demand in the Dominion over and above the

* For more detailed particulars as to seed production of Chewing's fescue and as to conditions influencing the viability and vitality of the seed, see Foy, Nelson R.: "Chewing's Fescue," *New Zealand Journ. Agric.*, Vol. XXXI, No. 6, December, 1925.

POPPLETON FACTORY - FLOW SHEET.



normal export for lawn purposes. Seed production turns on the fact that land of the lowest fertility class, dominated by *Danthonia semiannularis*, has by top dressing with super-phosphate been improved up to the standard of brown top, which has now largely taken possession of such improved areas. The usual pre-treatment to obtaining a seed crop is either to disc heavily such grasslands or to plough into shallow furrows as is adopted with Chewing's fescue.

After such treatment, brown top makes rapid growth and throws up an abundance of flowering stalks. The paddocks are shut up in September and harvested in February. The stand is treated as if it were a normal hay crop, but is handled as little as possible; the produce is drawn by sweepers to the stack and later thrashed from the stack. A rejuvenated field may yield as much as 200 lb. of seed per acre.

The Bird's-Foot Trefoils (*Lotus* spp.).—In New Zealand, two species of bird's-foot trefoil are of very considerable value, particularly on the heavier lands. These are the annual *Lotus hispidus* and the perennial *Lotus major*, and there is now a considerable local demand for the seed of each species, both being harvested to an increasing extent on the northern gum lands.

The Agricultural Usefulness of Lotus Major.—It is not probable that *Lotus hispidus* has any potential usefulness in this country, but the evidence coming under the present writer's notice in both New Zealand and Tasmania leads him to believe that *Lotus major* has a very decided potential value as a herbage seed for special purposes in Britain. It has been used with great success on marsh land and on heavy land subjected to high annual rainfall in the two countries above mentioned, both when sown on existing vegetation and on marsh and swamp land that has been partially drained and ploughed. It has the ability of mingling well with rushes and other coarse herbs, and thus encourages stock in their eagerness for the *Lotus* to graze the former plants to some extent. By its straggling growth, the *Lotus* tends to prevent closely grazed marshy swards becoming too open, a condition very favourable to the spread of rushes, and is thus, under proper management, an important ingredient in the sward unfavourable to rush domination. When *Lotus major* is itself a dominant element in the herbage, it is freely grazed by stock, and they appear to thrive exceedingly well on a ration consisting predominantly of this species.

Experiments are now being initiated at Aberystwyth to test this species under very similar conditions to those in which it has proved so successful in the other hemisphere, and if at all comparable results are obtained it will be fortunate for the British farmer that stocks of seed are likely to become available. At present the seed is both expensive and difficult to obtain in quantity.

Seed Production.—The methods of seed production adopted are in effect the same for both *Lotus hispidus* and *L. major*, and are simplicity itself. Seed production follows after that of brown top on the same fields. Such a sward, when it has commenced to run out, will be heavily top-dressed and heavily disced, following which a great mat of self-established *Lotus* will come into evidence. Experience and local knowledge readily indicate the condition of swards most favourable to the production of *Lotus* seed.

Another method is to plough or to disc sufficiently heavily and to sow a crop of oats, when *Lotus* will appear in profusion in the stubble. The fields would be shut up in October and the harvest taken in January. As with brown top, the stand is treated rather as a hay than a seed crop. It is cut with the ordinary reaper, left to lie out for only a few days and then swept to the stack, and is thrashed after about six weeks in stack. An ordinary mill thrashes effectually, a clover huller not being necessary. The seed sheds freely and, consequently, the crop is handled as little as possible.

In the main, *Lotus major* dominates the heavier, wetter fields, and *L. hispidus* those of a relatively lighter nature; in practice, however, the seed as harvested generally represents both species, the one or other being very much the more abundant off any particular field.

Grassland Rejuvenation.—The methods adopted relative to the production of seed of the bird's-foot trefoils, brown top and Chewing's fescue are of interest as showing the effects that can be produced by drastic methods of mechanical treatment of grassland accompanied by top dressing. These treatments, of course, favour the abundant germination of such seed as is in the ground, while the cultivations also favour the more rapid growth of the plants left *in situ*. Drastic rejuvenation has been tested but little in this country, since the mechanical treatments adopted have seldom been drastic in the sense used in connexion with the methods of seed production described above. It would seem probable that white

clover seed production, no less than *Lotus* seed production, could be assisted by a well-conceived if drastic rejuvenation of swards by mechanical means. These New Zealand practices therefore deserve the attention equally of those concerned with the improvement of grassland and of those interested in the question of the production of herbage seeds in this country.

General Conclusions as Affecting the British Farmer.—The influence of seed production on the agricultural development of New Zealand is a matter which should not be overlooked by the farmers of this country at a time when any means of adding to the cash earning resources of the farm so emphatically need to be explored.

Seed production has had a definitely pioneering influence in New Zealand. It is probably not too much to say that the clearing of the bush in the Akaroa district has been effected almost entirely by the earning power of cocksfoot seed, and thus we now have in that district a thriving dairy industry on land where the production of cocksfoot seed was the original stimulus for clearing, and where consequently a cash commodity was produced almost immediately. Chewing's fescue, equally, has been responsible for making profitable farming possible on land that, but for the seed crop, would have the poorest prospect of earning power.

To-day, brown top and the bird's-foot trefoils appear likely to become very important factors in the successful opening up of the heavy northern gum lands—the profitable harvesting of the seed of these species making just all the difference to the balance sheet of those farmers who have taken the matter up, and constituting an important transitional stage towards the final improvement of these areas to the standard rather of white clover and of rye-grass than of brown top and the bird's-foot trefoils. In a similar manner, the large cheques received by Marlborough farmers for lucerne seed is reacting on the farming productivity of that district, has undoubtedly given a stimulus to the more abundant use of superphosphate, and has generally operated in the direction of higher and better farming.

The fat lamb industry in the South Island, moreover, owes not a little to the fact that it fits in admirably with the production of seed of rye-grass and red clover, these supplementary sources of revenue, like all supplementary production in farm practice, reacting decisively on the profitableness of the enterprise as a whole.

As emphasized in a previous article, it is perfectly true, speaking generally, that the climate of New Zealand is more favourable to seed production than that of this country. As a set-off to the effect of climate, it must, however, be realized that the agricultural usefulness of a particular parcel of seed is not only influenced by the quality of the seed as such, but to a very large extent also by the strain which that parcel represents. This is on all hands appreciated in the case of wild white clover, and is every day more fully realized in respect of red clover, and particularly of the late-flowering strains—the home-produced strains being far more productive and persistent than the foreign. The results recently obtained with perennial rye-grass, cleaned from wild white clover, and thus taken from old swards, are no less suggestive, while the experiments now in progress at Aberystwyth and elsewhere, with strains of indigenous cocksfoot, timothy and other grasses are equally informing. The whole trend of recent evidence should, therefore, serve as a stimulus to the British farmer to approach self support in the matter of his herbage seeds.

It is evident, however, that specialization is needed—that strain must be put in the forefront, and that methods of harvesting and handling must be closely studied in order to counteract, as far as may be possible, the effects of adverse weather conditions. Herbage seed production has the great merit that it is always supplementary; consequently if the crop fails the sward remains and has its independent use.

There would seem to be three main directions in which the British farmer could extend the scope of his activities in this direction: (1) Growing considerably more late-flowering red clover, each farmer always concentrating on a well-authenticated strain and never on any account "once growing" a foreign strain; (2) by growing "once-grown" wild white clover, care always being taken to sow the seed-producing leys with "old sward" white from a well-authenticated source; (3) by, to a greater extent, harvesting seed from the very best of the old swards in the country. It is possible that by the adoption of such a measure the farmer would, to some extent, be helped over the difficulties in which he now finds himself. There is no reason to suppose that the occasional "putting up" to seed of a fattening pasture, if followed by manuring and a long term of heavy grazing, would necessarily seriously harm that pasture; a modification in subsequent management can always be made to counterbalance an occasional departure

from normal practice. Such fields should not be put up for seed for too long a period—heavy crops of seed not being looked for. The proved value of wild white clover and of indigenous strains of rye-grass, cocksfoot and other species does seem to indicate, however, that the “stripping” of high-grade pastures on the basis of a long rotation carried over the whole of the grass farm does perhaps afford to our graziers a possible means of acquiring supplementary revenue from their holdings.

In this connexion it is much to be desired that arrangements should be made to hold a demonstration in this country of some of the leading makes of “strippers,” largely used in the Dominions; and that exhaustive experiments should be undertaken to estimate the influence of taking a periodic seed crop on the subsequent behaviour of the pasture, and the best means of counterbalancing any evil effects that may be shown to result.

In conclusion, it is perhaps appropriate to remark that the influence of the plant breeder will soon be felt—economically felt—in relation to herbage plants. It will be for the British farmer to ask himself whether he desires, despite the limitations of the climate under which he necessarily operates, to take any part in the “growing on” of these pedigree strains under proper supervision for the purpose of making available adequate supplies of such as eventually prove to be of the highest value and importance.

* * * * *

THE EFFECT OF IRRADIATION AND COD LIVER OIL UPON POULTRY

ERIC W. MERCER (Horticultural and Poultry Instructor),
F. H. W. P. TOZER, M.B., M.R.C.P. (Assistant Medical Officer),
Berks and Bucks Joint Sanatorium.

THE results of a large amount of research work have already been published concerning the value of cod-liver oil and of ultra-violet irradiation for poultry. Some of this work indicates that these factors have, under experimental conditions at least, a beneficial influence.* It seemed desirable, therefore, to carry out further tests to determine whether such treatment had any practical value for hens kept in the winter months with free access to open air, sunlight, green food and grass; and experiments were carried out at the Berks and Bucks Joint

*Hart, Steenbock and others. *Journal of Biological Chemistry*, 1925, 65, 579.

Sanatorium, Peppard Common, by permission of the Committee and Dr. Carling, the Medical Superintendent. A poultry farm is run at this sanatorium, producing some 36,000 eggs a year.

Arrangements of the Experiments.—The procedure adopted in these experiments was laid down by Prof. Leonard Hill and Mr. T. A. Webster, of the National Institute for Medical Research, who inspected the pens and all the arrangements that had been made before the experiments commenced, and also at intervals during their progress. Six pens were used, each containing six Rhode Island Red hens in their second laying season, together with a male bird. All these birds had been trap-nested in their pullet year and had yielded between 170 and 190 eggs each. The birds were carefully picked from the main flock, every effort being made to secure birds as much alike in every particular as possible. Each lot was separately housed, and had access by day to a grass run of about one-eighth of an acre, under fruit trees. The houses were 7 ft. × 6 ft. × 7 ft., and afforded each bird 6 sq. ft. of floor space and 42 cub. ft. of air space. There was a dropping board and perch at the back of each house, a foot of dry litter on the floor, and the nest boxes were raised in order to give full floor space for scratching. There was a window at each end of the house, and the front was boarded half-way up and the remainder wire-netted.

Feeding.—The food given was of good quality, but of a non-forcing character, and consisted of 2 oz. of mixed meal and 2 oz. of corn per bird per day. The soft food consisted of the following, all parts by weight:—

Toppings	5 parts
Sussex ground oats	1 part
Uveco poultry food	1 „
Maize meal	1 „
Fish meal	½ „

The fish meal was discontinued after the first fortnight in order to give a ration of less antirachitic vitamin content.

The corn consisted of equal parts wheat and crushed maize. Greenstuff, chiefly cabbage, was given *ad lib*. No house scraps of any kind were given.

Treatment.—The pens were treated as follows:—

- No. 1. Control pen.
- No. 2. Treatment as No. 1, but received 5 cc. fresh, untreated cod-liver oil mixed with the soft food. The oil was high-grade Newfoundland product, known to be actively antirachitic.
- No. 3. Treatment as No. 1, except that part of the toppings, before being mixed with remainder of meal, was exposed

to the rays of a mercury vapour lamp for 15 minutes at 9 in. distance.

No. 4 received 5 cc. of olive oil containing freshly irradiated cholesterol added to the soft food. The cholesterol was exposed in thin layer for half an hour at a distance of 1 ft. to the rays of a mercury vapour lamp. To each fowl was given 25 mgm. of irradiated cholesterol *per diem*. The irradiation and preparation of the cholesterol was carried out by Mr. T. A. Webster and the National Institute for Medical Research.

No. 5. The birds were exposed for 15 minutes each day to the rays of a mercury vapour lamp.

The lamp used for No. 5 pen and also that for treating the food of No. 3 pen was a 100 volt 5-ampere direct current type. This lamp, after three months' use, faded Webster and Hill's standard acetone-blue solution 5 units of the scale in 1 hour at 9 in. distance; one unit approximately equals twice an erythema-producing dose. It was suspended from the roof of the house in such a manner that it could be raised or lowered as desired.

As soon as the birds went on the perch in the evening, those in No. 5 pens were irradiated for 15 minutes at a distance of from 18 to 24 in. The birds took practically no notice of the light. The control of the lamp was in the hands of the Assistant Medical Officer of the Sanatorium, Dr. Paul Tozer.

Results and Conclusions.—The experiment was carried on for 11 weeks, from January 14 to March 31, 1926. The number of eggs laid by the various pens was as follows:—

No. 1.	Control	..	..	..	259
No. 2.	Cod-liver oil	..	..	..	237
No. 3.	Radiated food	..	..	..	232
No. 4.	Radiated cholesterol	..	..	..	221
No. 5.	Birds irradiated	..	..	..	211

All the eggs laid were up to the 2 oz. standard except six small eggs, containing no yolk, laid by pen No. 5.

A few hens became broody, one each from pens 1, 2 and 4, and two each from pens 3 and 5, but three days in the broody coop were sufficient to cure this. The health of the whole of the birds remained excellent throughout, and no ulceration of the combs or wattles occurred among the birds treated with the lamp. The average daily reading taken with the acetone-blue gauge out of doors at Peppard was $\frac{1}{2}$ for January, 1 for February and nearly 3 for March.

Conclusion.—Poultry farmers who keep their birds under proper healthy, open-air conditions with suitable rations and plenty of greenstuff, will not benefit by feeding cod-liver oil or by irradiating either their fowls or the feed.

STRAWBERRY INVESTIGATIONS AT LONG ASHTON—II*

E. BALL, M.A., Dip. Hort. (Cantab), *Research Pomologist*;
C. E. T. MANN, B.Sc., M.Sc. (London), *Research Plant Physiologist*; and

L. N. STANILAND, A.R.C.Sc., D.I.C., *Advisory Entomologist*;
University of Bristol Agricultural and Horticultural Research Station, Long Ashton.

Investigations on Varietal Strains in Relation to Vigour and Other Characters.—At the outset, it is essential that some explanation be given of the term "strain" in the sense in which it is used throughout this paper. The term has been adopted here advisedly since it is in general use among growers, but the writers wish to make it perfectly clear that the word is not employed in its true genetical significance. The importance of having a good strain or stock of plants has been recognized by many growers. They regard a good "strain" as a stock of plants which is vigorous, crops well and is true to name; conversely, a bad "strain" as a stock of weak plants which bears inferior crops. Notable differences of this sort clearly exist. Owing to the importance attached by the growers themselves to "strain," the real significance of such differences between one set of plants and another requires elucidation. Knowledge on this point may supply the answer to the question as to what extent and by what means, existing poor strains can be improved and maintained at the improved standard. To this end experiments are being carried out at Long Ashton (7, 13). Although the final stage has not yet been reached, reference to this section of the work is advisable here, since certain conclusions which can already be drawn have a direct bearing on some of the practical difficulties of the strawberry grower.

In these investigations, a number of "strains," exhibiting considerable variation in vigour and obtained from different sources, are being grown side by side under exactly the same conditions for a number of generations, in order to ascertain whether eventually the differences in vigour and other features will disappear. Should this happen it would appear probable that differences between one strain and another are due to environmental conditions, *e.g.*, soil, climate and cultivation, and not to genetical differences. At the commencement of the

* The first part of this paper appeared in this JOURNAL for September, 1927, pp. 497-510.

test the difference between the best and the poorest strain as revealed by crop weights was considerable. Interesting facts, referred to below, are the varying degrees to which these strains are affected with "red plant," and the maintenance of this difference over a number of generations.

The effect of the selection of parent and of runner on the yield obtained is being investigated experimentally. Runners have been selected (a) by grading and (b) by restricting the number made by the parent plant. So far the most outstanding result has been obtained by the restriction of the number of runners formed. In one case an unlimited number of runners were allowed to root, as is often the commercial practice, while in the other only the first three runners were allowed to root. The difference between the resulting crops was very marked.

In a further experiment some parent strawberry plants were selected as exhibiting (a) differences in vigour, (b) "blindness" or absence of blossom, and (c) differences in proportion of blossom to foliage. Runners were layered from these parents and the runners from each parent were kept separate, *i.e.*, pedigree plants were raised. In some cases only a restricted number of runners were allowed to root, whilst in others an unlimited number were taken. It was thus possible to determine whether the restriction of the number of runners formed had any effect, and whether a correlation could be found between the vigour, habit, etc., of the parent plant and its progeny. In this experiment it was found that vigorous parents gave more vigorous progeny than did weaker ones. It need not necessarily be concluded from this that there is any difference in genetical composition between the weak and vigorous parents. The restriction of the number of runners formed had a marked effect, the vigour of the progeny being considerably enhanced. On the other hand no correlation was found between the proportion of blossom to foliage in parent and progeny, or between "blindness" in parent and in progeny. In the latter case "blindness" due to "red plant" is not included. Further experiments are in hand; these are not yet sufficiently advanced to call for description here.

The points which have come out so far and which have a practical bearing are:—

- (1) The correlation between the vigour of parent and progeny.
- (2) The effect of the restriction of the number of runners formed.

These two facts point to the value of the selection of both parent and runner. In practice the parents can be selected by

the elimination of the weak and diseased plants, and the runners by grading or by the restriction of the number formed. The latter means has, of course, the greater effect. The number of weak and diseased plants in many commercial stocks is often large; here selection would be of great value in improving the strains by gradually increasing the proportion of vigorous and healthy plants. In some cases commercial stocks are so bad, the plants being mainly weak and diseased, that time would be saved by obtaining a fresh supply of more vigorous plants and commencing selection on this.

At the present very low prices often paid for strawberry runners it is useless to expect to obtain well selected material. The grower should be prepared to pay a considerably higher price for carefully selected material from which all diseased, weak and "rogue" plants have been eliminated: if he will do so, he will be more than compensated by the greater yield of fruit obtained.

It must be borne in mind, however, that selection by itself will not necessarily improve the yield in all cases. Other factors must be considered, such as the soil and cultural conditions. The best strain may fail under adverse conditions of soil or cultivation. It may, however, be confidently asserted that the selection of parent plants and runners is one of the most important means of increasing or maintaining the yield of fruit.

In conclusion, it is strongly emphasized that successful strawberry growing depends to a great extent on the quality of the "strain", and that efforts to control disease or to improve cultural conditions will not meet with full success unless the "strain" is maintained in a vigorous state.

Strawberry "Diseases."—It has already been shown* that waterlogging, improper cultural treatment and other causes can produce plants of a low order of vigour and abnormal in type. In extreme cases death may result, although no specific organism need necessarily be connected with the "diseased" condition. In the present section certain other forms of strawberry "disease" which have been investigated are considered, *i.e.*:—

- (a) "Red Plant."
- (b) Strawberry Aphis.
- (c) Other types of Abnormal Strawberry Plants.

(a) **"Red Plant."**—The disease affecting strawberry plants, known as "red plant," "red leg" or "red leaf," has been

* Part I of this article, this JOURNAL, Sept., 1927, p. 606.

known for a number of years. The symptoms were fully described in 1924 by Ballard and Peren. It was probably first reported in the Tamar Valley and Cheddar Valley districts, and at the present day it is in those districts that the disease still causes most concern. "Red plant" can, however, be found in most strawberry districts and a number of commercial varieties have been affected.

The Symptoms.—A brief description of the symptoms by which "red plant" may be recognized in the spring is given here, since it is at that period of the year that the symptoms are most pronounced. At the outset, it should be stated that an affected plant may bear both healthy and normal crowns, i.e., the whole plant is not always affected. The outstanding symptoms are the absence or extreme weakness of the blossom and the deformity of the young foliage (Figs. 17 and 18). In some cases reduced flower trusses are found, the inflorescence only bearing two or three flowers, parts of which may be abortive. Where there is apparently complete "blindness" the rudiments of an inflorescence can always be found in the axils of some of the leaves (Fig. 20).^{*} The characters of the malformed leaves are as follows: The petiole and lamina† are much reduced in size, the lamina or leaf blade being always small in proportion to the length of the leaf stalk. The leaf stalk tapers, or narrows in width, towards the leaf blade and is much less hairy than that of a healthy plant, sometimes being entirely devoid of hairs. The leaf blade in addition to being much reduced in size is very irregular in shape and often much crumpled. Some varieties, e.g., "Royal Sovereign," exhibit an intense red coloration of these deformed and reduced leaves, but others, e.g., "Sir J. Paxton," do not show this characteristic.

There is no evidence that the "disease" can be attributed to the condition of the root system. All "red plants" which have been examined have had apparently healthy and normal root systems which have been proportionate in size to the amount of shoot growth (Fig. 17).

"Cauliflower" Disease.—Ballard and Peren suggested that there is a correlation between "red plant" and "cauliflower disease," as they found a constant overlapping of symptoms. The symptoms of a typical "cauliflower" plant are as follows: The leaves and flowers are extremely deformed and fasciated,

^{*} In the same Plate the flower truss of a normal plant is figured for comparison Fig. 21.

†Petiole = leaf stalk. Lamina = the expanded part of the leaf.

the whole plant when flowers are present resembling a small cauliflower (Fig. 19). Hence the name. A detailed description of the symptoms can be found in the *Journal of Pomology*, vol. iii, p. 142.

The Relation of the Eelworm (Aphelenchus fragariae) to "Red Plant" and "Cauliflower Disease" of Strawberries.—*Aphelenchus fragariae* has for some years been accepted as the causal organism of "Cauliflower Disease" of strawberries, but no infection experiments have ever demonstrated this conclusively and the view is really based upon the presence of this eelworm in the affected parts of the plants. Ballard and Peren found confirmation of their suggestion of the correlation of "Cauliflower Disease" and "Red Plant" by their discovery of *Aphelenchus fragariae* at the growing points of crowns showing "red plant" symptoms, and put forward the view that both these abnormal forms were the result of attack by this eelworm (1).

Further work has confirmed the fact that *A. fragariae* is found in large numbers in "red" and "cauliflower" plants, but one of the present writers also found it in fair numbers in normal plants in the region of the leaf bases (3). An unsuccessful attempt was made to carry out an infection experiment (6). The principal difficulty experienced was in obtaining the plants required for the test free from *Aphelenchus* at the outset. The presence of *A. fragariae* in the soil was investigated at the same time, and the results showed that of the total number of eelworm collected from the soil, only 5 per cent. were *A. fragariae*.

It is therefore evident that *A. fragariae* can be present on the plants without causing disease symptoms. While it does not follow that this fact implies that this species is not the causal organism of these malformations, on the other hand it must not be overlooked that the evidence in support of the view that it is the causal organism is so far purely circumstantial and needs to be supported by positive results from infection experiments before it can be stated with certainty that *Aphelenchus fragariae* is the cause of either "cauliflower" or "red plant."

Propagation.—The question whether a runner taken from a "red plant" will also itself be a "red plant" is of considerable importance in practice. If this occurs, drastic roguing before attempting to propagate from a stock of plants is extremely desirable.

In one experiment the intensity with which the "disease" occurred in several "strains" for a number of generations was remarkably consistent. In other words, a strain which was most seriously affected in the first generation was also the most badly affected in the second and third. This view, that the disease is carried over from one generation to another when no attempt at roguing is made, is also confirmed by other observations in the field. Some growers at the present time successfully control "red plant" by means of careful roguing, affected plants always being removed as soon as they are recognized. The best time for this operation is during the months of April and May, since the symptoms are at that time most clearly observed, the "red plants," as stated above, being then recognizable by the absence of blossom and by the reduced and deformed leaves, the latter in the case of certain varieties being heavily suffused with a purplish red coloration.

At present it may be said that there is strong circumstantial evidence that the "disease" can be controlled by roguing (12). Some "strains" are more seriously affected than others.

(b) **Strawberry Aphis.**—Several species of aphids are found on the strawberry plant, but it is the species known as *Capitophorus fragariae*, Theob., which is found to be causing a definite type of "small leaf" plant.

The aphid was first described by Theobald, in 1912, from specimens sent in from strawberry plants in a greenhouse in Sussex. The insect is small and pale yellowish-green in colour, and is therefore difficult to distinguish on the under-surface of a strawberry leaf which has a similar colour. *C. fragariae* is distinguishable from other species of aphides found on the strawberry by the presence of small knobbed hairs,

Life History.—No egg stage has so far been found. The aphides may be seen all the year round, and reproduce entirely by means of living young. In winter the aphides feed very little, and then principally on the older leaves, reproduction being very slow. In spring the rate of reproduction increases very considerably, and the aphides feed on the young developing leaves (Fig. 25). Winged aphides, also giving rise to living asexual young, are produced throughout the year, but never in very large numbers. There is a tendency for winged forms to be produced more freely in late summer and early autumn.

The Effects of an Attack.—The typical aphid-infested plant has a very characteristic flattened appearance, with small crinkled and cupped leaves, yellowish-green in colour and with yellow edges. The leaf-stalks are short and fleshy. The number

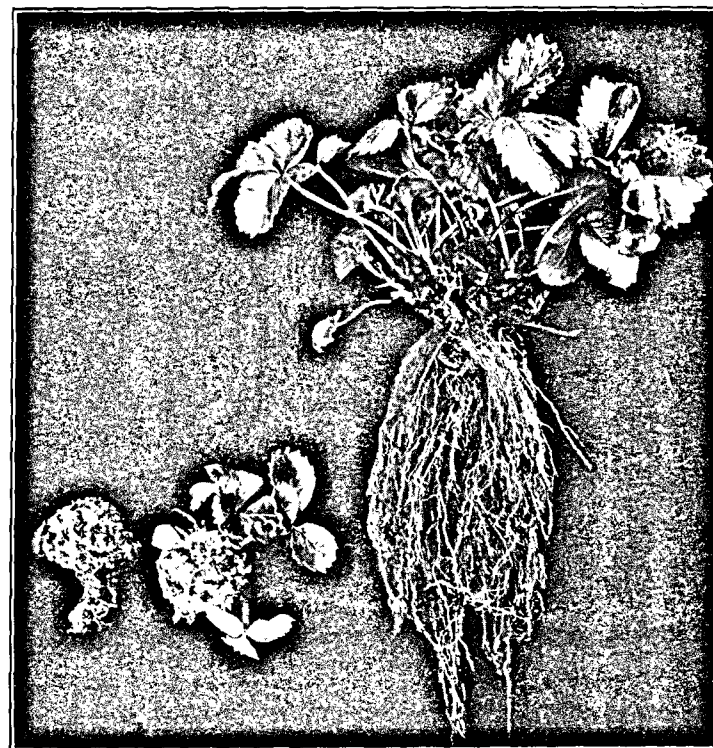


FIG. 18.

FIG. 17.

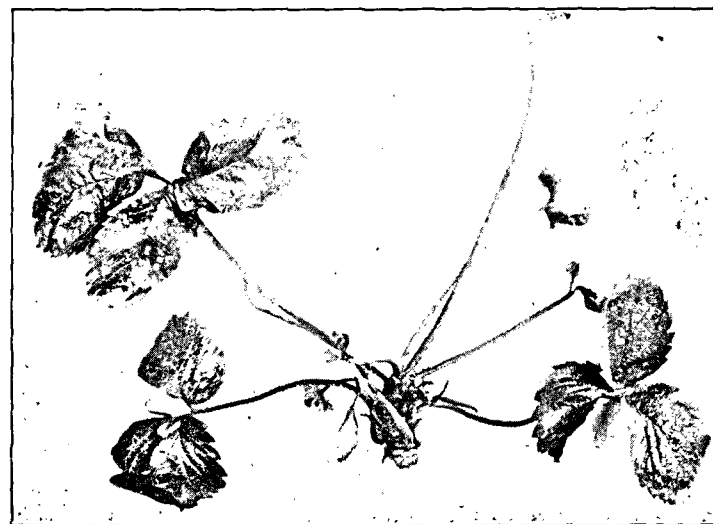


FIG. 19.

FIG. 17.—A typical "red plant" photographed in May, 1926. Note the absence of blossom, and the healthy appearance of the root system.

FIG. 18.—Typical specimens of the "cauliflower" (Type 3).

FIG. 19.—A "red plant" showing reduced and deformed leaves.

B

632-

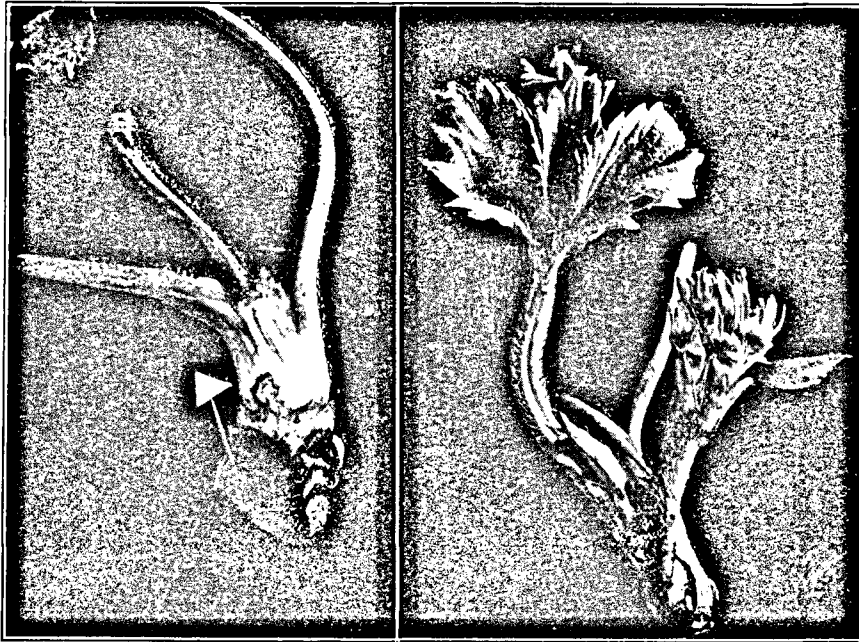


FIG. 20.

FIG. 21.

FIG. 20.—A "red plant" crown showing an abortive blossom truss. Some leaves have been removed to expose it to view.

FIG. 21.—A normally developed flower truss photographed at the same date for comparison with FIG. 20.



FIG. 23.—A later stage of an aphid-infected plant (Royal Sovereign) illustrating the results of aphid attack.

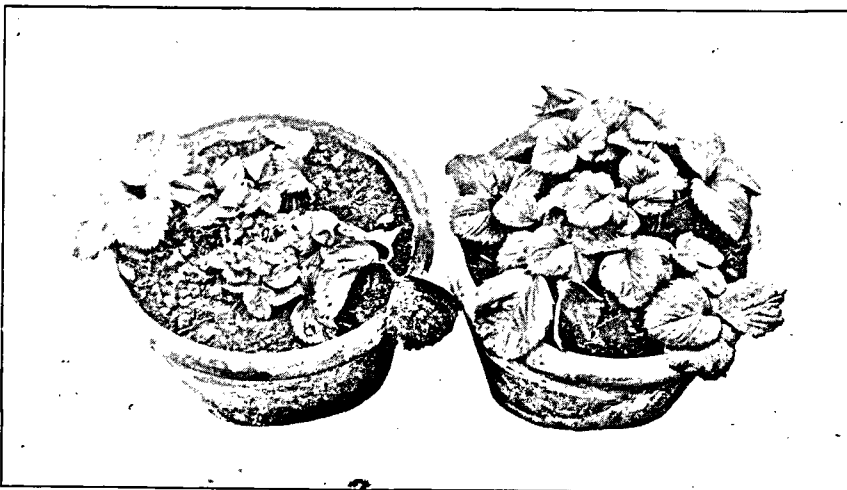


FIG. 22.—Two maiden plants of the variety "Royal Sovereign" potted August, 1925. The plant on the left was infected with Strawberry Aphis, the right-hand plant being kept free from Aphis. The photograph shows the result of three months' infestation under greenhouse conditions.

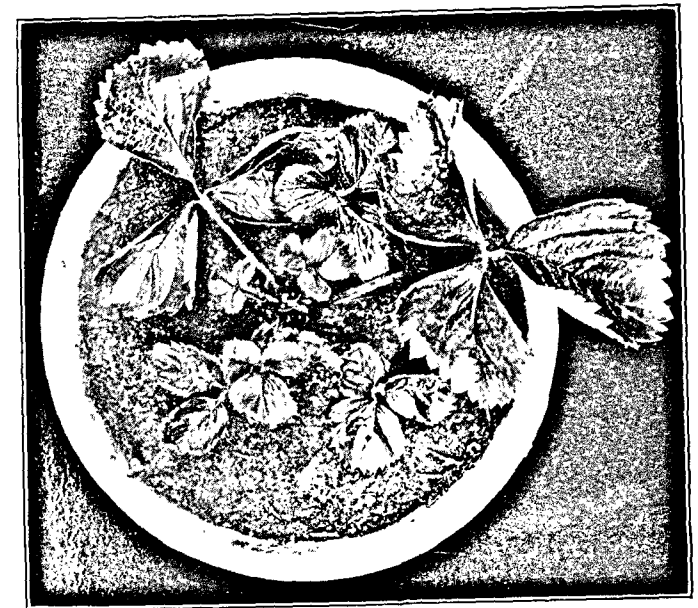


FIG. 24.—Showing the effect of dipping an aphid-infected runner in nicotine and soap solution. It will be seen that the foliage formed before dipping is small and deformed, and that foliage formed after dipping is normal in shape, but below normal in size (three youngest leaves).



FIG. 25.—This photograph shows the Strawberry Aphis (*Capitophorus fragariae*) feeding on the developing leaves and petioles of a young strawberry plant.

of crowns is greater than in a healthy plant of the same age (Figs. 22 and 23). The root system is normally in proportion to the shoot growth, and, as the latter is small, the root system is generally inferior. The root system is therefore, by reason of the excessive number of crowns, very inadequate. The size of the root system, as compared with the shoot growth, depends largely on the stage at which the plant becomes infested.

Runners from aphid-infested plants usually become themselves infested at an early stage of development. The aphides walk along the runner stolon and, reaching the runner plants, suck the sap of the young developing leaves. The leaf does not expand normally and a typical yellowish-green cupped and crinkled leaf is produced. Later, the leaf becomes yellow-edged. As soon as the leaf has expanded as much as possible, the aphides walk down the leaf-stalk and attack the next developing leaf. Owing to the continued sucking the successive leaves become smaller and smaller, more crinkled and cupped, with progressive shortening of the leaf-stalks. This severe check to the crown leads to an abnormally early production of lateral crowns by the plant.

In the spring of the second year in the life of the plant the process is repeated. Plants in their second year may have a very large number of crowns. Aphid-infested plants are seldom blind, and, in fact, usually have rather numerous weak blossoms. The fruit is small and frequently deformed.

Variety and Strain in Relation to Attacks of Strawberry Aphis.—From observations made at Long Ashton and in various strawberry districts, it is clear that different varieties vary greatly in their susceptibility to strawberry aphid. Considering varieties without reference to the question of strain in the respective cases, "Madame Kooi," "Laxtonian" and "Royal Sovereign" suffer most severely. "Stirling Castle," "Sir Joseph Paxton" and "President" are a little less susceptible, whilst "Bedford Champion," "MacMahon" and "Ruskin" show distinct resistance. "Marshal Foch," "Sturton Cross," "Lord Overton" and "Aberdeen Standard" exhibit a high degree of resistance. The French variety known as "Tardive de Leopold" has so far shown itself immune, although it was planted amongst "Royal Sovereign" heavily infested with aphid and showing the symptoms of the attack to a marked degree.

The importance of strain in relation to aphid attack cannot be over-estimated. Different strains of a susceptible variety exhibit varying degrees of susceptibility to aphid attack. A

plant of a resistant strain, even if fairly heavily infested with aphids, often remains free from symptoms until after the cropping period, when the symptoms often appear. The effects of aphids are seen sooner and more markedly after cropping when a large amount of fruit is borne. Strain in relation to strawberry aphids would seem to be largely a question of the vigour of the shoot growth. Where the shoot growth is vigorous the developing leaves expand before the aphides have damaged them sufficiently to cause marked deformity. During the fruiting period the shoot growth is slow and the plants "go off" rapidly.

The Control of Strawberry Aphids.—The work, so far as it has already proceeded, appears to justify the following recommendation for the control of the pest.

Only clean runners free from all symptoms of aphid attack should be planted, and such runners should be taken only from healthy plants. Before planting, all runners should be dipped in nicotine made up to the following formula:—

Nicotine (98 per cent.) $\frac{1}{2}$ oz.

Water 10 gal.

Soap Sufficient to produce a lather, so as to ensure that the solution will wet thoroughly.

The runners may be dipped entirely in the solution, or the "tops" only immersed, in which case any soil round the roots need not be disturbed. The runners need only remain in the solution sufficiently long to ensure thorough wetting. It will be found that dipped runners planted in the autumn will remain free from aphids until the following spring (Fig. 24).

It has already been pointed out that aphid-infested plants, showing the typical symptoms of the attack, do not become normal. Plants must therefore be kept free from aphids, and if the symptoms develop, affected plants should be removed and burned. The remaining plants should be sprayed, as a preventive, with nicotine and soap solution according to the formula recommended for the dipping of runners. As an alternative, plants might be dusted with a good insecticidal powder containing some form of nicotine. Whichever method is adopted, it is essential to ensure that the spray or dust reaches the crowns and the under-surfaces of the leaves. It is particularly important that plants should be free from aphids in the late summer and early autumn, when the new root system is being formed. Spraying or dusting should therefore be carried out immediately after cropping.

(c) *Other Types of Abnormal Strawberry Plants.*—So far, in this paper, five types of abnormal strawberry plants, viz.,

"miffy," "small-leaf," "red plant," "cauliflower" and small-leaf type of plant due to aphid attack, have been already described. In addition to these, two further types are sometimes found in the field. In the one case the name "sudden wilt" has been provisionally given and the other "patch" is the term commonly applied by growers. The latter is placed tentatively as Type 6 in the classification table given later in this paper.

"Sudden Wilt."—"Sudden wilt" is not of widespread occurrence, but at times quite serious cases have been noted in which a fairly high percentage of plants in a field were affected.

Plants affected in this way exhibit the following well-defined symptoms: The foliage wilts rapidly, the outer leaves lose their erect position and droop until they are lying on the surface of the soil. The younger leaves at the centre of the plant also become flaccid or limp. Plants may be affected at any time from the early summer onwards. When the plant is first affected, before the fruits have completely developed, the latter never reach maturity. In many cases the whole plant dies; in others all the foliage dies, but later a number of small weak lateral crowns are produced, giving rise to a small-leaf type of plant. Up to date certain fungi have been isolated from such plants but no proof has yet been obtained that any one of them causes the trouble. It is possible that certain adverse conditions for the strawberry plant are necessary before these fungi can be parasitic.

"Patch."—"Patch" occurs in most strawberry growing districts. So far it has been most extensively reported in the Tamar Valley and Southampton districts. The name "patch" has been given because, as a rule, affected plants are confined to well-defined areas in the strawberry beds. Such areas gradually enlarge. Isolated plants elsewhere in the fields can, however, be found with identical symptoms. Plants showing typical "patch" symptoms are never less than two years old. A "patch" plant can be recognized by the following characters:—

The crowns are very numerous, some of them always being dead. The surviving crowns are weak and produce leaves which are distinctly subnormal in size. These leaves are yellowish-green and usually cupped and distorted. The leaf stalks are short in proportion to the size of the leaf blade and are hence very short indeed, the leaf blade being itself much reduced in size. The plant as a whole has a much flattened appearance and consists of a large number of weak and dead crowns. The rootstock of the plant is very poor and any new roots which are formed are weak and few in number.

It will be seen from this description that a "patch" plant closely resembles the types produced by (a) an aphid attack (Type 5), or (b) some damage to the roots or some cause preventing free root development (Type 2). It has in addition a number of dead crowns. Hence, knowing the causes of Types 2 and 5, the view naturally suggests itself that a "patch" plant is a later stage of Types 2 or 5, the only additional symptom being that of dead crowns. Considering first of all the case in which a well-defined area containing a number of plants is affected, the most likely supposition is that the condition of the plants is primarily due to adverse soil conditions within that area, followed in many cases by a general attack of aphid over the whole field, which affects to a greater extent the weakened plants in the "patch" area. Considering next cases in which isolated plants exhibit typical "patch" symptoms, it seems again an advanced stage of Types 2 or 5, with the original cause of weakness of the plant as either root damage, failure to form roots owing to crown exposure, or aphid attack. The writers are of opinion that an investigation of the physical and chemical properties of the soil within "patch" areas is essential before the problem can be fully solved.

Summary.—In Part I of this article the present position of certain aspects of the strawberry growing industry was briefly reviewed. Though there are certain well-defined maladies which account in part for the deplorable decline in strawberry crops yet many causes of failure are still obscure. Some suggestions put forward by growers and by the writers are described, and a general scheme of experimental investigation of certain aspects of strawberry culture is summarized.

In the first instance a careful, detailed study of the life history of a normal plant, from the date of planting through three consecutive seasons, has been made. This study has revealed some important points. The bulk of the root growth has been found to take place mainly in the later summer and autumn. Roots formed during this period are strong main roots arising from between the lower leaf bases. On these roots large numbers of fine feeding roots arise during the spring and these form the essential absorbing organs of the plant during the flowering and cropping season.

The distribution in the soil of the roots of a normal plant has been ascertained and the essentially shallow rooting habit of the strawberry is clearly shown.

Concurrently with the work on the development of the normal plant the influence of such factors as time of planting,

methods of cultivation, and mechanical damage have also been studied.

Experiments at Long Ashton have shown the enormous advantage to be gained by early planting of the runners. The crop obtained in 1926 from "Royal Sovereign" "maidens" planted on August 8, 1925, was almost four times that obtained from a second batch of runners of the same strain planted on September 8, 1925.

Planting methods have been investigated and the deleterious effect of shallow planting is shown to be very marked. The poor vigour of shallow planted runners is due to the fact that normal root development is much restricted.

This same cause underlies the production of weak, small-leaved plants with their crowns in poor contact with the soil. Where hoeing is performed too close to the crowns of the plants, so that either (a) soil is scraped away and the young new main roots are unable to reach the soil level before death or damage occurs, or (b) roots already established are severed, then a small-leaved weak plant results. The greatest danger from (a) occurs immediately after cropping, when the most important phase of new root development commences. Danger from (b) is likely to occur in late autumn and spring cultivations. It has been further shown that a slight earthing up of the plants as soon as practicable after cropping increases the chances for root development with consequently an improved, more vigorous plant in the following cropping season.

Poor drainage with consequent water-logging causes death of a considerable portion of the root system, and this again is reflected in the "top" growth, small-leaved weak plants resulting.

Mechanical damage to the main crowns leads to the production of a definite type of abnormal plant frequently described as a "miffy" plant. Accidental or careless hoe damage may account for many such plants. Though the majority of these plants recover, at least one crop is lost as a result of the damage.

Experiments which are being carried out to investigate the causes of the difference between one so-called "strain" of plants and another are described. These experiments have so far revealed the importance of selecting parent plants and runners as a means of raising and maintaining the yield of fruit.

The symptoms by which "red plant," "red leg" or "red leaf" can be recognized in the spring are outlined, the most

useful characteristics being the absence or partial absence of flowers and the reduced and deformed leaves, the latter in the case of certain varieties, e.g., "Royal Sovereign," being intensely suffused with a purplish red pigment. The disease was found in all strawberry growing districts visited, and most commercial varieties have been seen to be affected. The possible importance of the strawberry eelworm as the casual organism of both "red plant" and "cauliflower" is discussed. Some evidence has been obtained that the "disease" is inherited from the parent plant by the runners, and careful "roguing" or elimination of affected parents from the runner bed in the late spring is suggested as a means of control.

A description and the life history of the strawberry aphid are given, and it is shown that an attack of strawberry aphid produces a flat, small-leaved plant, having yellowish-green, yellow-edged leaves with short leaf-stalks. Such a plant has an excessive number of crowns and the root system is often poor. Variety and strain are discussed in relation to the attacks of strawberry aphid. Some varieties and some "strains" have been seen to be more susceptible to attack by the aphid than are others. The dipping of runners, before planting, in nicotine and soap solution, and spraying or dusting the plants if they should subsequently be attacked, are suggested as means of control.

Two other maladies of the strawberry plant, viz., "sudden wilt" and "patch," are described. An explanation to account for the production of "patch" plants is put forward.

In this account of strawberry investigations six definite abnormal types of strawberry plant have been described, and, for the sake of the convenience, a full description of each of these types is appended in tabular form (pp. 640, 641). It has been found that these six types cover all the important strawberry troubles, apart from mildew, leaf spot, and certain minor insect pests with which the strawberry grower in England is concerned. Further, it should be mentioned that this classification after completion was fully discussed with advisory officers from the Southampton, Tamar Valley and Clyde strawberry growing districts, and complete agreement was reached.

Recommendations.—Some of the investigations described in Part I of this article have not yet reached completion, but the writers feel that a point has been reached when certain definite recommendations can be given to strawberry growers.

Some of these suggestions are not new, but since much of the existing unsatisfactory position of strawberry culture is due to not carrying out proved methods it is desirable to point them out here.

- (1) Planting should only be carried out on land that is well drained, for bad patches in a field are often due to poor drainage.
- (2) Planting should be carried out at the earliest possible date for the particular district, in order that the plants may be well established before the winter.
- (3) If the runners are bought it is essential that only the best possible material should be planted. In the course of propagation runners should be obtained only from selected parents, all weaklings, rogues, or diseased plants being removed in the spring at blossoming time. The runner bed should again be rogued carefully for diseased or abnormal plants at the time when the runners are layered. Restriction of the number of runners formed to first runners only is worth consideration. The parent plants should generally be de-blossomed.*
- (4) All runners before planting should be dipped in a solution of nicotine and soft soap. During the remainder of the life of the plant spraying or dusting should be carried out as occasion demands in order to keep the plants free from aphid, particular attention being given to this point during the period of new root formation (July to November).
- (5) The roots should be disturbed as little as possible at any time. The plantations should be cleaned and cultivated immediately after cropping and every encouragement should be given to root growth at this season, e.g., by maintaining close contact between soil and crown. Slight earthing up of the plants is decidedly advantageous, as it increases the chances of vigorous root production.
- (6) To minimize risks of waterlogging of established plants shallow furrows should be made between the rows before winter, especially on the heavier soils, care being taken not to damage the roots.

BIBLIOGRAPHY

- (1) E. Ballard and G. S. Peren: "Red Plant in Strawberries and Its Correlation with Cauliflower Disease." *Jour. of Pomol.*, Vol. III, p. 142, 1921.

* Some experiments to determine the effect of the age of parent on the quality of the runners produced are in progress at Long Ashton,

TYPES OF STRAWBERRY MALADIES
CHARACTERS

Type	Crown	Lamina							Petiole					New Root Development		
		Lobes	Size	Colour	Margin	Shape	Character		Rel. Length to Lamina	Thickness	Shape	Colour	Flower	Number	Vigour	Cause
I. "Miffy"	Weak, numerous spaced	Variable in number	Small ..	Tendency to red	Coarse	Normal usually	Normal		Long ..	Thin ..	Normal	Red in some varieties	Absent ..	Normal	Normal	Crown damage
II. Small Leaf	Weak, numerous dense	Normal	Small ..	Yellowish green	Normal yellowish edge	Normal	Normal		Short ..	Thick ..	Normal	Yellowish	Weak ..	Normal	Poor ..	Waterlogging. Desiccation, Cultivation damage
III. Cauliflower	Hypertrophied to extreme fasciation	3 to 0 ..	Reduced	Normal to yellow-green	Variable	Variable	Variable		Variable usually long	Thick ..	Tapered	Beetroot red to pale blue-green	Absent or cauliflower	Normal	Poor ..	Aphelenchus(?)
IV. Red Plant	Normal, few spaced	Variable 3 to 0	Reduced	Red ..	Coarse to no teeth	Abnormal variable	Normal to curled		Long ..	Normal	Tapered	Red ..	Reduced or dead and no visible	Normal	Normal	Aphelenchus(?)
V. Resulting from Aphis attack	Weak, numerous dense	Generally 3	Small ..	Yellowish	Coarse	Variable	Cupped-crinkled		Short ..	Thick ..	Normal	Yellowish green	Numerous weak some-time absent	Normal	Poor ..	Strawberry Aphis (<i>Capitophorus fragariae</i>)
VI. Patch	Weak, numerous some dead	3	Small ..	Normal to greenish yellow	Coarse	Variable	Crinkled to normal		Short ..	Thick ..	Normal	Greenish yellow	Numerous or absent	Poor	Poor ..	Probably a later stage of Nos. II or V

- (2) W. E. H. Hodson and A. Beaumont: "Strawberry Diseases in Devon and Cornwall." Seale Hayne Agricultural College, Dept. of Pathology, 1926.
- (3) A. H. Lees and L. N. Staniland: "Progress Report on Red Plant of Strawberries." Agricultural and Horticultural Research Station, Long Ashton. Annual Report, 1924.
- (4) C. E. T. Mann and E. Ball: "Studies in the Root and Shoot Growth of the Strawberry. I." *Jour. of Pomol. and Hort. Sci.*, Vol. V, 1926, p. 149.
- (5) E. Ball and C. E. T. Mann: "Studies in the Root and Shoot Growth of the Strawberry in Season 1924-25." Agricultural and Horticultural Research Station, Long Ashton. Annual Report, 1925.
- (6) L. N. Staniland: "Some Observations on Strawberry Eelworm." Agricultural and Horticultural Research Station, Long Ashton. Annual Report, 1925.
- (7) E. Ball: "A Note on Strawberry Strains." Agricultural and Horticultural Research Station, Long Ashton. Annual Report, 1925.

- (8) H. R. Briton-Jones and L. N. Staniland: "Economic Importance of the Strawberry Aphis (*Capitophorus fragariae*)." *Jour. of Pomol.*, Vol. VI, 1927.
- (9), (10), (11) E. Ball and C. E. T. Mann: "Studies in the Root and Shoot Growth of the Strawberry." II. "The Normal Development in the Second Year." III. "The Influence of the Time of Planting on the Development of the Strawberry." IV. "The Effect of Some Cultural Practices on the Normal Development." *Jour. of Pomol. and Hort. Sci.*, Vol. VI, Part II, 1927.
- (12) E. Ball: "Some Observations on 'Red Plant.'" Annual Report, 1926, Agric. and Hort. Res. Sta., Long Ashton, Bristol, 1927.
- (13) E. Ball: "The Correlation between Some Characters of Progeny and Parent in the Strawberry." *Ibid.* 1927.
- (14) C. E. T. Mann: "Studies in the Root and Shoot Growth of the Strawberry. V." (In the Press.)
- (15) C. E. T. Mann: "The Origin, Development and Function of the Cultivated Strawberry (*Fragaria vesca virginiana*)." (In the Press.)

FARM COST ACCOUNTS*

J. S. KING, B.Sc. (Econ.), B.Sc. (Agric.), N.D.A.,
University of Reading.

In a recent issue of *Punch* the following conversation between a smallholder and a labourer is reported, illustrated by one of Mr. Raven Hill's delightful sketches.

Smallholder : But if you don't keep books, how do you know where you are ?

Giles : Ain't got no patience, I ain't, wi' all this nonsense 'bout book-keepin' an' 'counts. If the hens be layin' there bain't nothin' to worry about, an' if they bain't layin' there bain't nothin' to put in the book.

A good deal of sympathy may be expressed for Giles's point of view, without admitting that he was entirely right. The broad fact is that farming presents, from the accounting standpoint, a problem of a rather peculiar kind, for the following reasons : (1) There are certain definite limits set by natural conditions to what can be produced on a farm ; for example, it is no use trying to grow wheat in regions where it will not ripen, or good malting barley on land that will, from its very nature, tend to produce a heavy crop of inferior quality. Again, sheep cannot be kept on land that will be spoiled for cultivation through their treading on it in all weathers. Hence the farmer's choice of alternatives is limited. (2) The yearly profits from farming are influenced to a great extent by yields and by current prices of produce, and these are, in great measure, outside the farmer's personal control. Crops must be sown and stock bought a considerable time before either can be ready for sale ; and it is only in the case of a few products, such as milk and, in more recent times, sugar beet, that a price basis may be fixed before the goods are produced. Even then the yield and the quality are matters of uncertainty and affect the ultimate return in money to the farmer. (3) Farming is, almost of necessity, conducted upon a relatively small scale ; and in saying this, I am thinking, not in terms of the amount of land occupied, but rather of the number of people employed, and of the fact that it is usually necessary to confine the business within such a size that the farmer can keep a personal control over detail. He knows each field, and decides, after thorough inspection and consideration, what ought to be done, having regard to weather

* This article is substantially the text of a recent broadcast address by Mr. King, who has since been appointed Advisory Economist to the Board of Agriculture for Scotland.

conditions and the state of the land and the crops. If he is a smallholder, or a dairy farmer, he may often milk many of the cows himself, and even on the larger holdings, farmers are often their own shepherds. (4) Perhaps the most important point is that it is generally true to say that agricultural products are what are termed "joint products," which means that they are linked together and are mutually dependent upon one another within the scheme of production. Crops must usually be grown in a rotation, and the arable crops and the livestock mutually support and help one another. To these four characteristics of the industry we must add that the farmer is, after all, a practical open-air man, and he is tired in the evening after a day's work and not very inclined to settle down to account keeping.

As a result of all these conditions, farmers are inclined to think that accounts, particularly those accounts which go into details of cost and return, will not help them very much to manage their affairs better. Experience in keeping detailed accounts for a number of farmers has, however, revealed two or three things which it may be important to note. One of these is that, although returns vary very much from year to year, the costs and expenses of the farm do not vary so much ; and, after a year or two's experience, it is possible to predict, with a comparatively small percentage of error, the costs of carrying out many of the processes of the farm. Another thing that has been observed is, that when farmers are absorbed, as they necessarily are, in the details of their work, they may not be able to detect those broader tendencies which are operating to make the business more or less profitable. It is, to use the old metaphor, quite easy to lose sight of the wood in looking at the trees. Again, experience of farm account keeping has shown that, if the keeping of cost accounts is approached from the point of view of the costs of the *processes* of farming, rather than from the point of view of the costs of the separate *products*, a good deal of light may be thrown upon the sources of profit and of loss.

Three Things Vital to Efficient Organization.—One may suggest that there are three things which are vital to the really efficient organization of the farm from the farmer's standpoint—from the farmer's standpoint because we are looking at farming through the eyes of the farmer who is doing the job in order to make a living. There are, of course, other viewpoints, but they are not under discussion here. What are, then, these three vital things for successful manage-

ment? (a) In the first place there must be a proper balance between the various activities of the farm, that is, the system must fit its environment. If the system is rightly conceived, then each element in the system, the various crops and the livestock, must be given their proper weight. (b) Each aspect of the farming should be developed to the maximum profitable limit that is consistent with occupying its proper place in the system. (c) There must be no avoidable waste of labour, power or material in any direction.

Putting the matter shortly, there must be the right kinds of crops and stock in the right proportions: the best use must be made of each; and neither time nor material should be wasted. These three things, of course, hang together, but I want to suggest that farm accounts can be organized suitably and simply to show the farmer how far he is achieving all these requirements of sound farming. Practical farmers will no doubt agree, however, that every farmer's problems are not the same. In some cases the question of the proper weight to give to various elements in the farm economy, in order to maintain a proper balance, may be the central problem. For example, on some of the downland farms in Hampshire, Dorset, and the Isle of Wight a really difficult problem, at the moment, is how to maintain a proper balance between sheep and corn, in order to make the farming as profitable as it can be at current prices. Downland farmers may sometimes have been able to make more money by increasing the number of sheep folded on their arable crops than by arranging for a maximum output of corn. To-day, the converse is the case, because the selling prices of sheep are low, and sheep have been bringing a very small return in comparison with corn crops. It is largely a question of the relative selling values of mutton and of wheat or barley, and it seems important for such farmers to know within what ranges of selling values it is better to put the emphasis on the one side or the other within the limits set by the conditions of their farms.

In other cases the conditions and surroundings of the farm may dictate, more or less definitely, the general policy to be followed at current price levels. For example, in areas in the eastern counties where corn will ripen well, but grass and forage crops tend to be poor, the inevitable policy will be to secure as much arable produce as possible for sale, and use cattle or sheep merely or mainly as agents for maintaining the fertility of the land. This is because the price of livestock, imported from abroad, or reared in the west country, is so

low that the eastern counties farmer's costs of growing forage put him out of court. If bullocks or sheep are used merely as machines for converting straw or root crops into fertility, and, in their absence, some other means of keeping the land in good heart would have to be employed, it seems to be important to know what is the cheapest and best way of maintaining the fertility of the land. The question is not what is the cost of fattening a bullock or a sheep in the process, but what is the cheapest way of producing manure.

In more westerly areas, where natural conditions make it easy to grow good grass and forage crops, but where only poor and uncertain yields of corn are obtainable, the main weight in the farming system will necessarily be upon cattle or sheep, and the corn crops will be subsidiary, because they do not ripen well and are grown mainly for feeding to stock. For the milk-producing farmer in the west country there can be no doubt that the keeping of cows on his land is better than trying to grow poor corn crops, and for him the problems are: how to feed his cows most economically; how far to push up his yields of milk in order to make the maximum profit under the conditions prevailing on his farm; how to maintain most economically the required number of cows. If he grows some corn, he will not expect that, in itself, to be a profitable venture, but it may pay him better to grow corn than to buy straw for the stock. That is a question of relative costs. These and other similar questions, accounts can help the farmer to answer. The first thing, however, for a farmer to decide is, What are the problems on my farm about which I feel uncertain? Having asked the question, the cost accountant may help him to find an answer.

Examples.—We may well consider one or two examples. On a certain downland farm, where soil, gradients, rainfall and other physical factors prescribe an arable-sheep policy, it has, in the past few years, been a question how far it pays to concentrate sheep on the land at the expense of corn. Whereas the sales of corn exceeded the outlays directly incurred on the corn crops on the average by about £4 10s. per acre in 1924 and 1925, the excess of sales over the costs of forage and other direct expenses on the sheep were £4 5s. per acre in 1924, and only £2 10s. per acre in 1925. Of course, out of these gross returns, rent, rates, and establishment charges had to be met, and without knowing what these overhead charges amount to you will not be able to calculate how much profit, if any, arises—though that is

scarcely the point. The point is that, whereas every sheep that could be carried was being kept, and more corn might have been grown, the returns, acre for acre, were coming down on sheep and coming down much less on corn. It was worth while for the farmer to measure those changes accurately, but his cost accounts told him still more. They told him that his outlays on corn and sheep had not varied appreciably in the two years, and how much they were, acre for acre; and it became possible to say at what prices, for his average yields of corn, lambs and wool, it would pay to alter a little the balance of cropping in favour of more corn or more forage for sheep, within the limits set by the needs and capacity of his land. Cost accounts cannot, of course, influence the prices of corn and sheep—farmers have got to take some risks—but farmers can rely more upon judgment, and less upon chance, if they are able to measure one side of the problem, the cost side, accurately, even if they are in doubt about the selling prices.

As another illustration, take the experience of a Lincolnshire arable farmer. Last year he had 180 acres under saleable crops—corn, sugar beet, and potatoes. His gross income in excess of direct outlays on these crops ranged from about £2 per acre on barley to over £12 per acre on potatoes, out of which he had to meet his overhead charges. His bullocks failed to meet the outlays directly incurred for forage crops and other expenditure by about £300, which represented the cost of carrying out their part in the farm economy, which was to turn his straw into manure for keeping up the yields of his arable land. He was rather surprised to learn this, and he is trying to reach the same end by other means—having a good water supply, he is experimenting with making manure artificially.

To take a last example. A west-country milk producer's cost accounts could throw some light upon the vexed question whether mangolds should be discarded in favour of concentrated food for milking cows. Some farmers have found this change profitable: in the case under notice the effect of the change was certainly to increase the output of milk, but unfortunately the costs were so far increased at the same time that the margin between costs and selling prices was not big enough to stand it. The right thing to do seems to depend upon the circumstances of the case, and these are reflected in the costs.

So far, my illustrations have been concerned with the

proper organization of the farm and the intensiveness of production. There is the further question of detecting waste. If men are not kept fully employed on jobs that bring a reasonable return from their work, waste is occurring. It is often found that a crop or a new process could be introduced that requires more labour and brings more money back to the farm, without adding to the number of men and horses required, or even increasing the total hours worked by the men. In that event, the extra return is mostly gain because the costs are not increased. If bigger crops could be grown for less than a proportional increase in cost, by giving more or different kinds of artificials, waste is occurring, waste of the productive powers of the soil. If too many horses are being kept; if an old-fashioned implement, expensive to work, is in use; if the cowman, who has not had the opportunity to study the principles of rationing, is giving more food than is necessary to produce the milk; or if the carter is taking each month a sack of oats more than the horses need, "just to make them look well," waste is occurring, and that kind of waste will often run into £100 or £200 a year without the farmer knowing it. None of these things mean dishonesty, they merely mean insufficient control of important detail. The cost accounts will find them out and save money. It is not possible to deal here with the methods of cost accounting, but I hope it has been made clear that it may be worth while to take some little trouble to find out more about the costs of working the farm. The costs are not really difficult to determine, and if based upon sound principles, and limited to what the individual farmer wants to know, they are within the reach of most farmers who can handle figures at all, and who think that a little trouble is worth while. Farmers who are interested to know more about methods, should communicate with their county Agricultural Organizer.

* * * * *

THE PRODUCTION AND MARKETING OF TABLE POULTRY: REPORT

A REPORT on the Southern Table Poultry Experiments just published deals with experimental work which has been carried out during 1925-6, on part of the South-Eastern Agricultural College Farm at Wye, Kent, under the National Poultry Institute Scheme. The experiments are under the control of a sub-committee which is constituted as follows: Principal R. M. Wilson, B.Sc. (*Chairman*), Messrs. H. Corrie, J. H. Dowden,

A. P. F. Grant, T. Neame and M. W. Slade (nominated by the National Poultry Council); Mr. N. Kenward (nominated by the Ministry of Agriculture and Fisheries); Mr. A. S. Juniper, Mr. E. Hardy and the Hon. W. E. C. James (co-opted by the sub-committee); Mr. P. Hedworth Foulkes, B.Sc. (nominated by the National Poultry Institute Advisory Committee); with Major C. H. Eden representing the Ministry, and Mr. C. T. Stock as Secretary.

Object of the Experiments.—The experiments are designed to furnish data for the information of the poultry industry 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 generally 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.

In order to obtain the data required, the Committee decided to attempt a comparison between the breeds most commonly kept by egg farmers and some of the better known table breeds and cross-breeds. They therefore commenced the investigation with breeding pens composed of the following breeds and cross-breeds:—

White Leghorn, White Wyandotte, Rhode Island Red, Light Sussex, Indian Game (male) × Light Sussex (female), Silver Grey Dorking (male) × Light Sussex (female).

The chickens from each breed and cross-breed were divided into four lots and marketed as follows:—

- (1) As petits poussins.
- (2) "Off the run" or green chickens.
- (3) Crate fed.
- (4) Crammed.

Records were kept of the amount of food consumed in each of the various pens and fattening crates used in the experiments; all the food fed was weighed and debited to the particular pen, breed or crate, so that a complete record of the food consumed by the birds in any pen was available at any time.

At each killing stage the following data were noted for each breed and cross-breed: (1) Average live weight of cockerels and of pullets (live weight being taken immediately before killing, crop empty); (2) Average dead weight of cockerels and of pullets (dead weight being taken as marketed—plucked, carcass cold, but not "roped" or "drawn"); (3) Total weight of food (dry) consumed by each breed and cross-breed.

From these records the following further data were worked out for each breed and cross-breed: (1) Average weight of food (dry) consumed per bird; (2) Average cost of food consumed per bird at each of the killing stages; (3) Average weight of food (dry) consumed per pound of carcass weight at each stage; (4) Average market value of carcass at each stage; (5) Average cost per carcass (food only) at each stage.

General Review.—Owing to fluctuations of market prices, which may vary considerably during consecutive days of the week, the actual prices realized cannot be relied upon to serve as an accurate index of the relative quality of table birds marketed on different days. The salesman appointed to receive the produce from the experiments therefore makes a special report on the relative quality of the various breeds and cross-breeds of chickens as received at the market. Relatively small numbers of birds were dealt with during the experiments under review owing to the incidence of disease (bacillary white diarrhoea and coccidiosis), shortage of eggs during the winter months, and insufficiency of broody hens. The sub-committee does not wish to make definite recommendations on the results obtained until the experiments have been concluded, when fuller data will be available; but the following general remarks on the breeds and cross-breeds used in the experiments may be of interest.

Indian Game (male) × Light Sussex (female).—This cross showed sex linkage as to down colour. The majority of the chickens of this cross had white skins and white legs, some showing a horn colour in the legs. A proportion, however, had yellow legs, and the skin of these yellow-legged birds varied from white to a very deep yellow. The broad, well-fleshed breast of this cross made it an ideal table chicken.

Silver Grey Dorking (male) × Light Sussex (female).—The chickens of this cross had five toes on each foot similar to the Dorking. This fifth toe is usually well developed, but occasionally chickens only showed this fifth toe as a rudimentary growth. The colour of the legs and flesh was white. The long breast and large size of this cross made it an excellent one for table purposes.

Light Sussex.—This breed has the white legs and flesh so much desired by buyers of table poultry. The chickens of this breed were ready growers and attained a large size. They produced a long, well-fleshed breast, and of the pure breeds were probably the most desirable of table fowls.

White Wyandottes.—This breed has the disadvantage for

table purposes of having yellow legs and to a more or less extent yellow-tinted skin. It would appear that this breed should be marketed young, not more than 18 weeks of age when brought into the fattening crates, to obtain the best results for table purposes.

Rhode Island Reds.—The young chickens in this breed were not in many cases well-fleshed on the breast, and in addition showed marked yellowness of skin. Chickens which had reached a greater age, 18 weeks and over, before they were brought to the fattening crates showed a great improvement and produced table birds having an almost white skin and well-fleshed breast. The Rhode Island Reds were never such ready feeders when first crate-fed as were other breeds in the experiments.

White Leghorns.—Up to the age of eight weeks this breed almost kept pace with the growth of the heavy breeds. This was particularly so in the case of cockerels. When placed in fattening crates they were wild and restless and never settled down as did the heavy breeds. They were seldom good feeders and might have shown better results if they had been put on to cram without any preliminary crate-feeding.

Market Stages.—The following remarks on each of the market stages may also be of interest.

Petits Poussins.—The petit poussin, which meets with the greatest demand, is one weighing about 16 oz. dead weight. The market requires these in $\frac{1}{2}$ doz. or 1 doz. lots, and the chickens in each lot should be as uniform as possible in size, appearance and condition. There is little demand for these birds after the end of June. Chickens hatched during the first four months of the year attain a size best suited for sale as petits poussins (16 oz. dead weight at about eight weeks of age), the chicken hatched late taking a little more time than this to reach a suitable size. The figures given below show the highest and lowest prices realized for petits poussins:—

Dates between which marketing took place	Lowest price obtained per poussin	Highest price obtained per poussin
March 3-April 6	2/3	3/-
April 19-May 28	1/9	2/3
June 10-July 6	1/3	1/8

“Off-the-Run” Chickens.—There appears to be little to choose either in the amount of live weight produced or in the cost of food per pound of live weight produced between the Indian Game × Light Sussex, Silver Grey Dorking × Light Sussex, Light Sussex and White Wyandotte. The Rhode

Island Reds did not reach the same weights as the foregoing and cost more in feeding to produce each pound of live weight. The White Leghorns, as might be expected, of the breeds under experiment, appeared to show the poorest results.

Crate-Fed Chickens.—Crate feeding extended over a period of 14 days, so that all breeds were comparable. In commercial practice the crate feeding would only be carried out so long as was deemed advisable for each individual bird, and to obtain the most profitable results some chickens would be put on to cram before the end of 14 days. In all cases the appearance and market qualities of the birds were improved by crate feeding, and as a rule the price returned per pound was higher in the case of crate-fed birds than in the case of the birds sold straight off the run.

Crammed Chickens.—The appearance and market qualities of the chicken marketed after cramming were superior to the crate-fed chicken, and the prices per pound returned for crammed chickens were usually in excess of the prices returned for crate-fed chickens. So far as the market returns were concerned, the highest prices per pound appeared to be obtained about the end of May and the lowest prices during October.

Feathers.—When disposing of feathers, 11½d. per pound was obtained for white body feathers and 4d. per pound for mixed colours. These prices were for body feathers from which the wing and tail feathers had been kept separate when plucking.

OCTOBER ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),

Agricultural Organizer for Derbyshire.

Seasonal Notes.—In the old Latin calendar the year began in March, hence the eighth month was called October; to the Anglo-Saxons it was known as wine month and as Winterfylleth, in allusion to the winter, which they regarded as beginning with full moon in this month. In Slavonic countries October is called the yellow month, because of the fading of tree leaves. Regarding the last phenomenon, it may be mentioned that there is an old idea both in this country and abroad that a severe winter may be expected when during October many leaves wither on the boughs and hang there. This observation, however, must be considered in relation to the kind of tree. There is a considerable difference in the

ordinary date of leaf-fall in the case of the horse-chestnut, sycamore and ash on the one hand, and young oaks and beeches on the other : the latter often retain their leaves until the approach of spring.

October bears much the same character in the fall of the year as April does in the spring. The commencement of the month is frequently distinguished by the lingering of summer warmth and the end by night frosts and sometimes a fall of snow. It is a month as various as April—clear skies and fogs, drought and rain, sunshine and storm, often in rapid succession. In almost every European country the expectation of a spell of fine weather in this month is proverbial : we speak of St. Luke's little summer ; and if ever there was a year when the twelve fine days (which the German proverb associates with October) were necessary, it is surely this year.

The similarity between the seasons of 1927 and 1918 recalls the ancient theory of astronomic periods and their influence on the weather. It was thought that at the end of a certain number of years the days succeeded each other with the same characteristics as in the preceding period. The difficulty, of course, was to find out where the one period ended and the next began. At one time it was widely believed that the weather period was nine years, and the adoption of nine-year leases in the letting of farms is thought to have been based on the belief that in so many years the tenant would have a proper share of the good and bad seasons. A semblance of scientific support was given to the nine-year period when it was pointed out that about every nine years (eight years and 10 months) the full moons and the new moons are to be found in the same conditions and distances from the earth. Another astronomic period is that of 18 years, based on the fact that every 18 years (18 years and 11 days) the sun, the moon and the earth occupy the same relative positions ; accordingly it is the period of eclipses. On comparing the seasons 1927 and 1909, considerable resemblance will certainly be noticed—a dry spring followed by a wet summer and autumn.

Field Operations.—In all parts of the country farm work is in a very backward state. How to occupy the men has taxed the resources of even the best managers. A few days ago I asked a farmer (who was spending the day with me visiting pedigree herds of cattle) what he had arranged for his men to do during his absence : it was a very wet day and the night had left pools of water in the fields. His reply was as follows :

“ Well, my head waggoner came to me this morning and said, ‘ What about it to-day, Master ? ’ I said, ‘ Grease your tackle.’ He replied, ‘ What, again, sir ? ’ I said, ‘ Well, first thing you can go and have a swim ; then you can sweep the barn floor again ; then you can go to the village and buy a bob's worth of marbles. I shall be away to-day.’ ”

Where wheat follows clover leas, the requisite manuring and ploughing will doubtless have been completed during the intervals when weather conditions interrupted the corn harvest. The lea furrow should, it is generally considered, be allowed to lie five or six weeks to become decayed before sowing. Where earlier ploughing was impossible, however, an opportunity should be taken to deal with this part of the arable land ; but instead of ploughing about 5 in. deep, as would be done in August or early September, the first operation in this case should be skim ploughing ; the turf should then be worked out with tine implements and afterwards buried under a fairly deep furrow, with the aid of a skim coulter. Wheat does not come well if sown on a late-ploughed lea furrow, unless the above procedure is adopted. Where little time can be allowed to elapse between the breaking up of the lea and the drilling of the wheat, it is desirable that the establishment of the wheat seedlings should be assisted by the application of a dressing of artificial manures, including a little nitrogen.

The breaking up of stubbles intended for wheat will be given precedence over the work of preparing for next season's root crops, although no opportunity should be lost which might properly be used for cleaning stubbles intended for sugar beet and mangolds, which are not very tolerant of spring cleaning operations. Unfortunately first-corn-crop stubbles this year are not so clean as usual and it will not be practicable to give them a thorough cleaning without causing delay in sowing, unless, of course, conditions are unusually good. What appears to be the best policy in the circumstances is to sow immediately after ploughing ; to be rather liberal in the allowance of seed ; and to make full use of artificial manures as a means of suppressing such weeds as may survive the deep ploughing with a skim coulter.

Beans.—Some farmers sow beans as their second grain crop, and there is something to be said in favour of the inclusion of an area of this crop where a fair acreage of arable land is cultivated. The winter varieties are not fastidious as to class

of soil; a good, fine tilth is not essential; the crop stands well and is not troubled by sparrows, while bad weather at harvest time does not injure the bean crop so much as it does white corn. Against the risk of bean aphids may be placed the fact that it is little troubled by other pests that affect wheat—smut, frit fly, wheat bulb fly, slugs and wireworm. In recent years, however, the possibility of serious loss from chocolate spot disease has been recognized. With the upward tendency in the price of protein-rich foods, the value of beans as a source of protein becomes more important. Where the land is not very dirty, the crop may be sown by drilling in the bottom of every second furrow, which will allow the beans to come up in rows about 20 to 22 in. apart according to the width of ploughing. The seedlings come quite well through a depth of 5 in. Where the subsequent horse-hoeing is likely to be more important, however, and the beans are expected to be a cleaning crop, it is advantageous to plough the land twice, then ridge up as for roots and drill the seed before splitting the ridges. This is an old practice, followed in East Lothian, for instance, before the replacement of the bean crop by potatoes in the rotation.

Root Harvest.—Potato tops died down, as a result of blight, early in September, and many queries have been received as to what is the best policy with regard to the harvesting and marketing of the crop. In the Midlands, at any rate, the effect of the disease has been to reduce the yield of the crop by at least 25 per cent., but as yet the tubers do not appear to have been browned to any great extent. As regards the lifting of the crop, apart from the quantities required for immediate sale, the best policy is that of leaving the tubers in the soil until the skin is quite firm. Lifting the crop early, because the tops have died down from disease, is likely to encourage the spread of the disease among the tubers rather than prevent it. Special care should be taken to have the tubers dry in the clamps. Visibly diseased potatoes should be sorted out at lifting time; the heaps should be not more than 4 ft. wide at the base, and the heavy soiling over should be delayed until there is risk of frost. A good method of ventilating the heap is that of drawing a pole along under the straw at the ridge when covering the heap. This makes a channel, which may for a time be left open at both ends.

Swedes are not ready for lifting until November, but mangolds—after last year's experience—will probably be

secured as early in October as conditions will allow. Sugar beets are less susceptible to frost injury than mangolds, and there is a certain amount of evidence that the percentage of sugar in the root increases if the crop is left in the ground till November, but further research on this subject is needed before it is possible to indicate the optimum time for lifting beet. Further information is also required on the matter of the loss in weight after clamping.

Live Stock.—October is a busy month for the shepherd on the arable farm, as it is the beginning of his winter season and the folding of roots has commenced. Skilled flock masters emphasize the desirability of giving an allowance of dry food, especially to ewes, and they regard dry food as even more important in seasons when green keep is abundant than when it is scarce. On grass farms this is the time of the year when moist meadows should be free of sheep, as at this season the sheep are liable to pick up the fluke embryo on such land. Cases of foot-rot call for special attention, in the endeavour to effect a cure before winter, and in the case of ewes before they are heavy in lamb.

Damp land is also dangerous for calves, but even on dry land calves under about nine months old are better kept indoors and rack fed as October comes in. Yearlings and older dry stock continue to thrive out of doors as long as keep allows, provided there is some shelter. This year there is abundance of grass to be cleared.

As regards the dairy herd, the duration of the grazing season is in some cases limited by the fact that the cows have to come up for milking twice a day; and under wet conditions the gateways may become almost impassable after the middle of October. Dirty gateways also increase the difficulties of producing really clean milk, for unless the cows' udders are washed before each milking there is risk of milk taints. Incidentally it may be mentioned that every case of so-called "turnip taint" that has come before my notice has responded to the simple treatment of washing the udders with an antiseptic fluid.

Apart from the above-mentioned difficulty, together with in some cases that of severely poaching the sward of the pasture—and on the heavy soils of the Midlands such poaching is certainly not beneficial—it is desirable to keep the cows out of doors as long as possible. A common mistake is that of keeping the cow-shed too warm at nights after the cows begin

to lie in, with the result that they become delicate and do not grow their proper length of winter coat. When they are turned out for exercise in winter such animals hang about the gateway bellowing to come in instead of grazing. In contrast with this there have come to notice several herds where the roots are fed on the grass in all weathers throughout the winter and the cows benefit from the longer time spent in the open.

* * * * *

NOTES ON MANURES FOR OCTOBER

H. V. GARNER, M.A.,

Rothamsted Experimental Station.

Management of Farmyard Manure.—In spite of the increased use of artificial fertilizers, farmyard manure is still the main source of fertility in mixed farming. It provides a complete plant food with a distinct residual effect, improves the physical conditions of the soil, and furnishes micro-organisms with a medium in which they can multiply to produce that live and mellow condition of the soil which is so favourable to crop growth. Against this must be put the fact that dung is heavy and bulky and is sometimes difficult to get out on the land when required, and that by careless handling a large proportion of its fertilizing value may be lost. Most of the farmyard manure made is enriched by feeding purchased concentrates: thus a recent estimate places the annual supply of oil cakes at about $1\frac{1}{2}$ million tons, and of wheat offals at about 2 million tons. Enormous quantities of oats, barley and maize are also fed to stock, but their manurial values per ton are considerably lower than in the case of oil cakes and wheat offals. The richer the feeding the greater the manurial value of the fresh farmyard manure, and the more need for care in making and storing it. A certain amount of rotting is desirable in farmyard manure to improve its manurial action, and, incidentally, to make it easier to handle; and this fermentation is bound up with unavoidable losses, which even under the best management amount to about 15 per cent. of the nitrogen fed.

On the other hand, Voelcker and Hall in their Compensation Tables (1914) estimated that under ordinary management 50 per cent. of the nitrogen and 75 per cent. of the phosphate and potash in the food found their way into the farmyard manure, while a recent committee which has reconsidered the question (*see this JOURNAL*, August, 1927, p. 401) suggests

that the estimate of the percentage of nitrogen to be recovered in the manure should be reduced to 40. There is therefore a considerable span between the best practice and ordinary attainment in the management of dung, and while it is recognized that conditions imposed by existing buildings and yards often render ideal treatment impracticable, a good deal can be done without incurring much expense. There are few branches of farming in which it is more necessary to hold a nice balance between what is scientifically desirable and what is commercially practicable than in the management of farmyard manure. With this in mind, the following points make for quality in the final product:—

(1) The absorption of the liquid manure, which is the most valuable part of the whole, by using sufficient litter. Failing this the liquid may be conducted to a tank, admixed with as little surface water as possible, and either carried out to grass land as convenient or else pumped over the dung before the yards are to be cleared.

(2) Small and deep yards with the surrounding buildings well guttered make better dung than extensive and shallow yards.

(3) Dung loses least when moved as little as possible, and if made up into heaps these should be compact.

(4) Promptness in spreading and ploughing in dung in the field avoids the loss of nitrogen which can be quite serious when manure is exposed in dry warm weather.

Green Manuring.—Green manuring has not up to the present found its way very generally into English farming. One practice, however, appears to be well established; namely, the ploughing in of mustard sown on a bare fallow for the benefit of the following wheat crop. Several benefits arise from this procedure:—

(a) The stems of the mustard open up the land and improve aeration and drainage, a very useful effect on the class of land on which bare fallows are usually taken.

(b) The decay of the plant residues ultimately adds to the supply of soil organic matter.

(c) The nitrates formed in the course of the following operations are taken up by the mustard plant and fixed in the organic form, and thus saved from loss by leaching in the winter. Nitrates are gradually released again for the wheat crop when the organic substances are broken down by soil micro-organisms.

From the point of view of the first two of these effects a large bulk of plant material is desirable, *i.e.*, a heavy crop of green stuff. Mustard fulfils this condition well as it is a rapid grower. The readiness with which a green crop hands on its nitrogen to the succeeding crop depends to some extent on its state of maturity. Young sappy growth is more active in this respect than mature, drier and more fibrous material. Thus in practice a compromise has to be drawn between bulk and ready decomposition and nitrification.

The higher the nitrogen content of the green manuring crop the more effective will it be, other things being equal, as a means of enriching the soil in nitrogen, and on this account leguminous crops such as tares and trifolium might be preferred for this purpose. Owing to their slower growth and the more expensive seeding these crops have not displaced mustard as a preparation for winter-sown crops. In certain circumstances, however, they may usefully be sown in autumn for ploughing down in the following spring.

Season and Fertilizer Action.—It is well recognized that the success of manurial treatment is largely decided by the nature of the season. The subject is important, and is only just beginning to receive quantitative study, owing, no doubt, to the difficulty of disentangling the effects of the individual factors which go to make up the season. Certain broad relations between season and fertilizer action are recognized, but they depend more on extended observation than on exact data, and most of them are connected with the most obvious seasonal characteristic, namely the rainfall. Excessive dressings of nitrogenous fertilizers give trouble in a wet season, tending to delay ripening and lodge the cereal crops. Under wet and late conditions phosphatic manures exert their best effect, which is the exact opposite of that of nitrogen. In the Rothamsted experiments on potatoes, in which a series of different fertilizer mixtures have been tested for a number of seasons under ordinary farming conditions, it appears that the potash effect is most marked in dry years, that is to say, in a droughty season the mixtures containing a relatively high proportion of potash will be the most successful. Also dependent on the winter rainfall is the return from autumn dressings of organic manures or of cyanamide, as the loss of nitrate from these sources may be considerable in wet periods, especially in open soils. The same thing can happen in the case of heavy falls of rain following a spring dressing of nitrate of soda.

Drought, on the other hand, hinders the action of fertilizers, and in extreme cases where a dry period follows a heavy dressing of soluble salts applied in the seed bed actual injury to the seedlings may result. Farmyard manure and potash fertilizers may do something to mitigate the effects of a dry year. The uncertain results of insoluble phosphates on grass land in dry seasons have frequently been observed, and experience tends to localize the use of these manures in those areas where ample rainfall can be expected. Low temperatures impair the action of organic manures and ammonium salts by delaying the rate of nitrification as indicated by the yellowing of the leaves of cereals in severe cold spells in spring. Under such conditions nitrates have the advantage.

Fertilizer Prices.—There is some inducement for farmers to maintain and in many cases to extend their use of fertilizers, in view of the fact that they have not on the whole suffered the same considerable rise above pre-war prices as have most of the commodities purchased for the farm. Below will be found figures showing for a few of the common fertilizers the level of prices of the three pre-war years, the average prices for 1926 and the early autumn prices of the present season.

	1911-13	1926	August 31, 1927
Nitrate of soda .. per ton	£10 13 0	£13 4 0	£12 7 0
Sulphate of ammonia ..	13 9 0	12 11 0	9 18 0
Superphosphate 30% ..	2 10 9	2 18 0	2 15 0
Slag 30% ..	1 14 6	2 8 0	2 15 0
Kainit 14% ..	2 10 0	2 17 0	2 16 0

NOTE.—Pre-war prices are ex works, the others are f.o.r. Sulphate of ammonia prices are f.o.r. in 1911-13 and delivered in the other years.

It will be seen that on the whole the increase above pre-war prices has been very moderate, basic slag showing the greatest difference. In the case of sulphate of ammonia the cost is considerably less now than it was either a year ago or in pre-war days. Artificial manures are therefore to be regarded as one of the relatively low-priced items in the cost of production of farm crops, and it would be ill advised to stint expenditure in this direction. Under good management the returns from fertilizers judiciously used should be quite satisfactory.

* * * * *

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 September 7				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	..	..	11 5	11 5	14 6
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	10 0*	10 0*	10 0*	10 0*	9 9
Calcium cyanamide (N. 19%) ..	8 8†	8 8†	8 8†	8 8†	8 10
Kainit (Pot. 14%) ..	3 2	2 17	2 17	2 16	4 0
Potash salts (Pot. 30%) ..	4 17	..	..	4 12	3 1
" (Pot. 20%) ..	3 12	3 2	3 7	3 4	3 2
Muriate of potash (Pot. 50·53½%) ..	9 10	8 5	8 13	9 5	3 5
Sulphate " (Pot. 48·51½%) ..	11 10	10 5	10 16	11 2	4 4
Basic Slag (T.P. 32%) ..	3 8§	3 3§	3 3§	..	..
" (T.P. 30%) ..	3 6§	3 1§	3 1§	2 15e	1 10
" (T.P. 28%) ..	..	2 12§	2 13§	..	..
" (T.P. 26%) ..	..	2 6§	2 7§	..	..
" (T.P. 24%) ..	2 10§	2 1§	2 2§	..	..
Ground rock phosphate (T.P. 58%)					
Very fine grade¶ ..	2 15	..	..	2 10d	0 10
Fine grade ..	2 10	..	..	2 7d	0 10
Superphosphate (S.P. 35%) ..	..	..	3 4	3 0	1 9
" (S.P. 33%) ..	..	..	3 2	..	..
" (S.P. 30%) ..	..	2 15	2 18	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 10	8 0	..
Steamed bone flour (N. ½%, T.P. 60·65%) ..	6 0†	6 2†	6 5	5 17	..

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 towns 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 Prices 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: 6d. per ton extra on Southern rails.

* * * * *

NOTES ON FEEDING STUFFS FOR OCTOBER

H. E. WOODMAN, PH.D., D.Sc.,

School of Agriculture, Cambridge.

The Feeding of Sugar Beet Tops.—In the notes for last month, it was shown, by means of data obtained in a recent feeding trial carried out at Cambridge, that sugar beet tops constitute a palatable feed of very satisfactory composition and nutritive value. By utilizing these crop residues, the farmer is enabled to continue the feeding of succulent green food to his animals well on towards the closing of the year, at a time when his pastures are lying inactive under the spell of winter dormancy. Thus the beneficial effects of both green fodder and root (*i.e.*, leaf and crown) are conferred on his animals in an essentially economical manner. Indeed, the yield of beet tops should prove a boon to those farmers who, as yet, have not found themselves in the position to take up ensilage as a regular feature of their farming practice. As with most other feeding stuffs, however, it is necessary, if the full benefits are to be secured, that certain precautions should be observed when utilizing the tops for feeding purposes. Some of these precautions, and the reasons for them, are considered below.

The presence of injurious or toxic substances in a feeding stuff may, obviously, seriously limit its value, even though it contains satisfactory amounts of digestible nutrients. Kellner describes the presence of considerable amounts of oxalic acid in unwilted beet leaves, the actual percentage displaying large seasonal and climatic variations. Other German investigators have demonstrated that this acid may form as much as 6 per cent. of the dry matter of the leaves. Small amounts of oxalic acid may be consumed by the farm animal without serious effects, beyond perhaps a tendency to cause slight "scouring." Larger amounts, on the other hand, may produce grave symptoms and even death, as will be appreciated by those readers who recall the efforts of certain ill-starred individuals during the war to enlarge their limited dietary by the use of cooked rhubarb leaves.

The writer hastens to state, however, that he has yet to come across a case of oxalic acid poisoning among animals which have been given access to sugar beet tops. The explanation of this clean record must be sought in the following considerations. When beet tops are wilted in the field, changes occur in the leaves which lead to a partial destruction of the oxalic acid constituent. The results of German experiments

have shown that a period of fourteen days' wilting is sufficient to halve the oxalic acid content of sugar beet tops. It would further appear that the major destruction of oxalic acid occurs during the first few days of wilting.

Fresh, unwilted tops should never, on any account, be fed to farm stock. A period of about a week's wilting should always be allowed. Fortunately, in actual practice, this is almost inevitable, since the animals usually follow on after the beets are cleared. In conversations with farmers, however, the writer has been told of cases where the animals have been permitted, apparently without serious results, to eat off the leaves from the still growing crop some short time before harvesting, the object being to reduce the amount of foliage to be handled. This is a practice which cannot be condemned too strongly. The stockowner who continues to adopt this "economical" method of topping will, in some unfortunate season of high oxalic acid content, find himself involved in disaster. The German scientists who have worked on this question have warned the farmer in the strongest possible terms against such a practice.

Artificial drying of the tops leads to an even greater destruction of oxalic acid than does wilting. This, then, is a circumstance which commends to the favourable consideration of those concerned in this country the German practice of drying down large masses of tops for winter use. Even after wilting or drying, however, the beet tops may still contain an unpleasantly high percentage of oxalic acid. A further safeguard now comes into play, since this toxic acid undergoes still further destruction as a result of fermentative activity in the first stomach of the ruminant. That so few cases of trouble have been reported as a result of feeding animals on beet tops is an indication, in all probability, that this preventive mechanism is very efficient. With pigs and horses, however, this safeguarding arrangement is absent, and it would follow that beet tops are a much safer food for sheep and cattle than for the first-named animals.

The farmer who wishes to avoid all possible risk of oxalic acid poisoning should give some precipitated chalk along with the beet tops. The effect of the chalk is to render the oxalic acid insoluble and therefore unavailable to the animal. Kellner recommends the addition of $\frac{1}{4}$ lb. of chalk to about 300 lb. of tops.

If, however, the addition of lime to tops renders the oxalic acid unavailable, then conversely it follows that the oxalic

acid in the tops must reciprocally render the lime in the animal's ration unavailable. Thus the feeding of beet tops to stock may be attended with a serious disadvantage, to which, so far as the writer is aware, attention has not previously been directed, namely, that such a fodder not only fails to supply the animal with available lime itself, but may also render unavailable the lime in such feeding stuffs as are fed along with the tops. The results for the lime balances in the Cambridge experiment certainly indicated that some such factor was operating. This form of lime starvation might have undesirable consequences when the tops are being fed to the ewe flock or the dairy herd, and it would appear desirable, in such circumstances, to allow the animals access to lime compounds (e.g., a mixture of precipitated chalk and steamed bone flour) in order to avoid a deficit of lime in the ration.

Beet tops may remain wilting in the fields for considerable periods without losing their wholesome character. With the first signs of decomposition, however, feeding should be discontinued, and the residual tops should be ploughed into the land. Putrefying tops may prove anything but an economical feed, as any thinking farmer can realize for himself.

The earth which adheres to the leaves may seriously impair the nutritive qualities of the beet tops, leading not only to irritation of the walls of the intestinal tract, but also to the introduction of harmful bacteria into the animal. A little extra care exercised in the field, however, enables this difficulty to be surmounted. After topping, the leaves should be shaken vigorously to remove adhering soil, and the tops should be gathered straightway into small, convenient heaps, to prevent their being trampled on and thus rendered earthy and unwholesome. Once the farmer is convinced of the good nutritive value of sugar beet tops, he will scarcely fail to insist that this little extra trouble be taken, in order that his animals may be able to secure the food under the best possible conditions.

It should finally be remembered that beet leaves, on account of their succulent nature, tend to have a loosening effect on the bowels of the animal. Beet tops should, therefore, be fed along with a more fibrous food, like hay. Kellner suggests that a third of the total ration of the dairy cow may suitably be composed of beet tops, while fattening bullocks may be given larger allowances.

In the notes for next month it is hoped to deal with some aspects of the problem of preserving sugar beet tops in the form of silage.

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.	Protein equiv. %
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	
Wheat, British..	—	—	11 15	0 13	11 2	72	3 1	1-65	9-6
Barley, Karachi ..	39 3	400	11 0	0 10	10 10	71	2 11	1-56	6-2
" Moroccan ..	39 0	"	10 18†	0 10	10 8	71	2 11	1-56	6-2
" Persian ..	40 0	"	11 3	0 10	10 13	71	3 0	1-61	6-2
Oats, English, white ..	—	—	10 0	0 11	9 9	60	3 2	1-70	7-6
" " black and grey ..	—	—	9 7	0 11	8 16	60	2 11	1-56	7-6
" Scotch white ..	—	—	11 10	0 11	10 19	61	3 8	1-96	7-6
" Canadian feed ..	23 6	320	10 0	0 11	9 9	60	3 2	1-70	7-6
" New Zealand ..	33 3	"	11 13	0 11	11 2	60	3 8	1-96	7-6
" American ..	27 6	"	9 12	0 11	9 1	60	3 0	1-61	7-6
" Argentine ..	28 0	"	9 17	0 11	9 6	60	3 1	1-65	7-6
" Chilean ..	28 3	"	9 18	0 11	9 7	60	3 1	1-65	7-6
Maize, Argentine ..	36 6	480	8 10	0 10	8 0	81	2 0	1-07	6-8
" South African ..	42 6	"	9 18	0 10	9 8	81	2 4	1-25	6-8
Peas, Japanese ..	—	—	21 15†	1 2	20 13	69	6 0	3-21	18
Dari, Egyptian ..	—	—	10 10	0 12	9 18	74	2 8	1-43	7-2
Millers' offals—									
Bran, British ..	—	—	8 0	1 3	6 17	42	3 3	1-74	10
" broad ..	—	—	9 0	1 3	7 17	42	3 9	2-01	10
Middlings, fine, imported ..	—	—	10 2	0 18	9 4	69	2 8	1-43	12
" coarse, British ..	—	—	9 12	0 18	8 14	58	3 0	1-61	11
Pollards, imported ..	—	—	8 5	1 3	7 2	61	2 4	1-25	11
Meal, barley ..	—	—	12 10	0 10	12 0	71	3 5	1-83	6-2
" maize ..	—	—	9 5	0 10	8 15	81	2 2	1-16	6-8
" " yellow, S. African ..	—	—	8 17	0 10	8 7	81	2 1	1-12	6-8
" " germ ..	—	—	9 5	0 16	8 9	85	2 0	1-07	10
" " gluten feed ..	—	—	9 0	1 1	7 19	78	2 1	1-12	19
" locust bean ..	—	—	8 17	0 8	8 9	71	2 5	1-29	3-6
" bean ..	—	—	12 0	1 6	10 14	66	3 3	1-74	20
" fish ..	—	—	21 0	3 10	17 10	53	6 7	3-53	48
Maize, cooked flaked ..	—	—	10 15	0 10	10 5	85	2 4	1-25	8-6
Linseed—									
" cake, English 12% oil ..	—	—	12 7	1 10	10 17	74	2 11	1-56	25
" " " 10% " ..	—	—	12 0	1 10	10 10	74	2 10	1-52	25
" " " 9% " ..	—	—	11 15	1 10	10 5	74	2 9	1-47	25
Soya bean " 6% " ..	—	—	11 10	2 3	9 7	69	2 9	1-47	36
Cottonseed cake " 5½% " ..	—	—	7 7	1 8	5 19	42	2 10	1-52	17
" " Egyptian 5¼% " ..	—	—	7 2	1 8	5 14	42	2 9	1-47	17
Decorticated cottonseed meal, 7% oil ..	—	—	11 2†	2 3	8 19	74	2 5	1-29	35
Coconut cake, 6% oil ..	—	—	9 10	1 5	8 5	79	2 1	1-12	16
Ground-nut cake, 7% oil ..	—	—	10 0†	1 8	8 12	57	3 0	1-61	27
Decorticated ground-nut cake, 7% oil ..	—	—	11 10*	2 3	9 7	73	2 7	1-38	41
Palm kernel cake, 6% oil ..	—	—	9 0	0 18	8 2	75	2 2	1-16	17
" " " meal, 6% oil ..	—	—	9 5*	0 18	8 7	75	2 3	1-20	17
" " " 2% " ..	—	—	8 2	0 19	7 3	71	2 0	1-07	17
Feeding treacle ..	—	—	6 10	0 8	6 2	51	2 5	1-29	2-7
Brewers' grains, Dried ale ..	—	—	7 5	0 19	6 6	49	2 7	1-38	13
" " " porter ..	—	—	6 15	0 19	5 16	49	2 4	1-25	13
" " " Wet ale ..	—	—	0 16	0 7	0 9	15	0 7	0-31	4-8
" " " porter ..	—	—	0 12	0 7	0 5	15	0 4	0-19	4-8
Malt culms ..	—	—	6 5†	1 8	4 17	43	2 3	1-20	16

* At Hull.

† At Bristol.

‡ 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 manual value is £1 2s. per ton. The food value per ton is therefore £8 18s. 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. 4d. Dividing this again by 22-4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1-25d. 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, 11s. 0d.; P, 0s. 3s. 8d.; K, 0s. 3s. 0d.

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

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported) ..	71	6-2	11 0
Maize ..	81	6-8	9 4
Decorticated ground nut cake ..	73	41-0	11 10
" cotton cake ..	71	34-0	10 0

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

The cost per unit starch equivalent works out at 2-72 shillings, and per unit protein equivalent, 0-77 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, 1926, 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 3
Oats ..	60	7-6	8 9
Barley ..	71	6-2	9 18
Potatoes ..	18	0-6	2 9
Swedes ..	7	0-7	1 0
Mangolds ..	7	0-4	0 19
Beans ..	66	20-0	9 15
Good meadow hay ..	31	4-6	4 8
Good oat straw ..	17	0-9	2 7
Good clover hay ..	32	7-0	4 12
Vetch and oat silage ..	13	1-6	1 17
Barley straw ..	19	0-7	2 12
Wheat straw ..	11	0-1	1 10
Bean straw ..	19	1-7	2 13

MISCELLANEOUS NOTES

TRIALS of new varieties of fruit trees were undertaken by the Royal Horticultural Society jointly with the Ministry in 1923

to aid the market fruit grower in the selection of new varieties for commercial purposes, and to provide growers with reliable information, not hitherto available, as to the characteristics of the newer varieties. This it is hoped will assist them in the selection of varieties for planting, and will, moreover, assure official recognition and wide publicity to really good varieties.

The conduct of the trials is in the hands of a Joint Committee of representatives of the Ministry and the Royal Horticultural Society. The gardens of the Society at Wisley, Surrey, serve as the Central Station, where all varieties entered for the scheme are grown and tested in the first instance. Those varieties which show sufficient merit at the Central Station are to be sent for further tests to sub-stations situated in fruit-growing districts throughout the country. Arrangements have already been made to establish sub-stations at Perdiswell (Worcestershire), Long Ashton (Somerset), Merton (Surrey), Osgodby (Yorkshire), Wisbech (Isle of Ely) (bush fruit only), Emneth (Norfolk), Saltash (Cornwall), East Malling (Kent), and Cambridge, and another is contemplated in the North of England.

The scheme embraces both top and bush fruits and nuts. Raisers whose varieties after inspection of the fruit promise to be useful for market purposes are asked to send sufficient plants, buds or grafts to allow the following number of trees, bushes or plants of each variety to be grown :—

Apples and Pears	20 half standards plus 20 bushes.
Plums, Cherries	20 half standards.
Nuts	20 bushes.
Currants, Gooseberries, Raspberries and other berries	20 bushes or canes.
Strawberries	100 plants.

The buds or grafts are "worked" on approved stocks before being planted. A nursery for the propagation of the stocks, trees and bushes is maintained at the Central Station. In no circumstances will the Central Station or any sub-station permit plants, buds or grafts to be taken off the stations. After consideration of the reports of the recording staff and of selected specialists, the Committee will issue reports in which re-

commendations of special varieties will be made. No report on a variety will, however, be issued until sufficient time has elapsed to enable a fair test to be carried out.

A collection of standard varieties of fruit is maintained at the Central Station and is available for comparison of the characteristics of the varieties under trial. This collection comprises the following number of varieties or supposed varieties :—

Apples	340	Raspberries	141
Pears	145	Strawberries	10
Plums and Damsons ..	65	Other berries	17
Red Currants	165	Quince	6
White Currants	39	Cherries	8
Black Currants	5	Nuts	9
Gooseberries	51		

In April last the trial and nursery grounds covered an area of over $17\frac{1}{2}$ acres, and the numbers of varieties under trial were as follows :—

Apples	72	White Currants	2
Pears	8	Gooseberries	14
Plums	13	Raspberries	30
Damsons	2	Strawberries	5
Cherries	6	Other berries	4
Red Currants	14	Nuts	1
Black Currants	37		

The trees and plants established in the trial grounds at the Central Station have made satisfactory growth, and those that have reached bearing age have cropped well. In particular certain Red and Black Currants and Raspberries are giving interesting results, their crops being well above commercial average in quality and apparently also in weight. Several varieties of Apples show promise of some commercial value.

Certain varieties have already shown sufficient merit at the Central Station to warrant further tests. In the autumn of 1925 the Committee selected the following varieties of Black Currants and Raspberries for distribution to sub-stations :—

Black Currants—

"Baldwin"	} Standard varieties for comparison ;
"Seabrook's Black"	
"Goliath"	
"Boskoop Giant"	

and the following new introductions :—

- "Westwick A" (Col. Petre, Westwick, Norwich);
- "Davison's Eight" (Col. Petre, Westwick, Norwich);
- "September Black" (Messrs. Daniels, Norwich);
- "Blacksmith" (Messrs. Laxton, Bedford);
- "Taylor 71/23" (G. Taylor, Portobello, Midlothian).

Raspberries—

"Baumforth's Seedling A"	} Standard varieties for comparison ;
"Baumforth's Seedling B"	
"Pyne's Royal"	
"Lloyd George"	
"Devon"	

and the following new introductions :—

"Bountiful" (Messrs. Laxton);
"Red Cross" (G. Pyne, Topsham, Devon).

Twenty bushes or canes of each variety were sent to the sub-stations at Osgodby, Perdiswell, Merton, and Long Ashton, and a year later to the more recently established sub-stations at Wisbech, Emneth, and Saltash. Reports received subsequently indicate that the stocks made satisfactory growth at the four first-named places during 1926.

In the following autumn two other varieties of Black Currants and four varieties of Red Currants were selected for further tests at the same sub-stations. The varieties in question were:—

Black Currants—

New introductions :—

"Westwick C" (Col. Petre);
"Mite Free" (Messrs. Laxton);

Red Currants—

"Perfection"	} Standard varieties for comparison ;
"Fay's Prolific"	
"Wilson's Long Bunch"	

and the following new introduction :—

"Laxton's No. 1" (Messrs. Laxton).

One Apple, "Laxton's Superb," is considered by the Committee to have reached the stage for further tests, and 40 trees of this variety will be sent next autumn to each sub-station.

The Committee also decided to test at sub-stations ten new varieties of Canadian Apples now growing at the Central Station, and one tree of each variety on each of three different root-stocks was sent last autumn to each of the sub-stations at Osgodby, Perdiswell, Merton, Long Ashton, Saltash, and Emneth. These trees will provide a preliminary test to secure early evidence of the suitability of varieties for extended trials with the full complement of forty trees of each.

No Gooseberries have yet been selected for distribution to sub-stations, but many varieties cropped well during 1926, and it is anticipated that some varieties will be selected for distribution this year. No Pear or Plum has yet commenced to crop sufficiently well to afford an indication of its true commercial value.

In addition to these trials, experiments are in progress to establish the number required in any given experiment to cover experimental error and other experimental risks. Arrangements are therefore being made to provide 100 bushes of each of four varieties of Black Currants by the Central Station to the three Horticultural Research Stations at Long Ashton, East Malling, and Cambridge, where crop records from individual bushes might be kept over a period of years.

* * * * *

DURING the winter session 1926-27 correspondence classes were held in seven counties in England. In Lincoln (Lindsey) and East Suffolk they were arranged for the third successive session, and in Lincoln (Kesteven) and Surrey the experiment was tried for a second time. In Gloucestershire and Wiltshire a course was held under the auspices of their respective county councils on the same lines as one which was conducted during 1925-26 independently of the county authorities by the Advisory Economist of Bristol University. In Hertfordshire a class arranged primarily for teachers desiring to prepare for the examinations of the Royal Horticultural Society, has been opened to gardeners in a modified form.

The high standard of work was maintained, but the proportion of students who completed the course was rather lower than in previous years; this was more noticeable in the second-year courses, but was partly accounted for by the pressure of work on the farms in the spring.

Gloucestershire and Wiltshire.—A course in farm book-keeping for students in the two counties was conducted by Mr. E. P. Weller, Advisory Economist, Bristol University, who prepared papers of instruction and sets of questions, which were sent to the students fortnightly. Model answers were supplied to the county staff, who corrected the papers. A fee of 10s. was paid by each student, half being returnable to students who completed the course, worked papers regularly and returned the set of instruction papers undamaged.

In Gloucestershire seven students entered, all of whom completed the course. The course was entirely satisfactory and was much appreciated by the students. The percentage of marks awarded ranged from 88.3 to 59.5. Another course will be arranged next year.

In *Wiltshire* 10 students enrolled, but only five completed the course. The standard of the work done was high, as was the case last year, the marks ranging from 97 per cent. to 62 per cent. Most of the students studied the papers effectively and obtained an intelligent grasp of the subject. It would, however, be of advantage for them to follow up the course with constant practice in book-keeping. Prizes were awarded to the best two students.

Hertfordshire.—A course, arranged for teachers in preparation for the Royal Horticultural Society's Teacher's Certificate, and their general examination, was thrown open in a modified form to gardeners, three of whom enrolled. The course included instruction on manuring, plant physiology, plant pests and diseases, and the growing of vegetables, fruit and flowers. Several inexpensive text-books, as well as the Ministry's leaflets dealing with the subjects studied, were prescribed for the students, who were also recommended to consult certain books of reference obtainable from the Rural Industries Headquarters Library at Hertford. The course, which extended from November 1, 1926 to February 28, 1927, consisted of eight fortnightly papers set on reading prescribed beforehand.

Lincolnshire (Kesteven).—Two courses were again held during the winter. The beginners studied Somerville's *Agriculture*, and the more advanced students Wood's *Chemistry of Crop Production*. Five students took the former course and four the latter; the course was completed by all with the exception of one advanced student. No fee was charged, but the pupils were required to buy their own text-books. Papers were set fortnightly for eight weeks, commencing October 18, 1926. Three prizes were given in the beginners' class and two in the advanced.

Lincolnshire (Lindsey).—Two courses were provided: one in crop husbandry for beginners, the other a continuation course for the previous year's students in animal husbandry. The first-year course began in November and ended in March, and the book studied was Somerville's *Agriculture*. As the book chosen for the second-year course, *The Stockfeeders' Companion*, by J. Porter, was temporarily out of print, it was not possible to begin that course till towards the end of December.

Twelve students enrolled for the former course, seven completing, while eight registered for the latter and three completed. A prize was awarded to the best student in each

class. The courses were designed for fortnightly lessons and sets of questions, but owing to the late start some of the lessons in crop husbandry were given weekly.

The answers of the students to the questions in crop husbandry showed that the text-book had been studied carefully and intelligently, but the class in animal husbandry appeared to find the subject difficult, and only two really grasped the principles underlying the scientific rationing of farm stock.

East Suffolk.—The book chosen for study, Porter's *Stockfeeders' Companion*, was out of print. The course was not started until February, when copies of the text book were available, and, as it was not possible to finish the work during the winter session, the class will be resumed this autumn with the same students.

Surrey.—Two courses were held, for beginners and for last year's students. Both began in December and ended in March.

The text-book adopted for the beginners' course on manures and manuring was the Ministry's Sectional Volume No. 8. Nine students began and six completed the course, while the remaining three worked three out of four papers of questions set. All did very well, the percentages of marks awarded on the papers ranging from 98 to 80 per cent.

The second-year students' work was based on the study of Mackintosh's *Feeding of Dairy Cows*. Only one student out of three finished the course, the remaining two relinquishing it owing to pressure of work on the farm, after answering the first series of questions

* * * * *

WHEN the National Federation of Women's Institutes held its last Handicraft Exhibition in 1924, even those within the movement were surprised by the high **Countrywomen's** standard of craftsmanship attained **Craftwork** generally by Women's Institute members, and the great beauty of some of the work shown. Visitors to that Exhibition were almost entirely members of Institutes, or persons in some way connected with the Women's Institute Movement, while all that the man in the street heard of the Exhibition was that it *had been* well worth seeing.

There are outside the Institute Movement many people keenly interested in handicraft work and many who (without being specialists) take a real interest in the country and in country life. It is hoped that these will take the opportunity

of visiting the Exhibition of Home Crafts which the National Federation of Women's Institutes has arranged this month at the Imperial Institute, South Kensington. The Exhibition will be open to the public on the afternoon of Wednesday, October 5, and throughout the day on Thursday and Friday, October 6 and 7. On Friday, October 7, at 12 noon, H.R.H. Princess Mary, Viscountess Lascelles, will visit the Exhibition.

This year's Exhibition will consist of a General Section, for which any Institute worker could enter, and a Co-operative Section, where the work shown will be the combined work of a group of Institute members, or of the members in a group of villages.

* * * * *

On the average the level of prices of agricultural produce was unchanged in August at 42 per cent. above 1911-13. For six months the general index number has remained almost stationary although there have been very appreciable changes in certain individual commodities. As compared with August last year prices are lower on the average by nearly 5 per cent.

The Agricultural Index Number

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

Month	Percentage Increase compared with the Average of the corresponding month in 1911-13					
	1922	1923	1924	1925	1926	1927
January	71	67	60	71	58	49
February	75	63	61	69	53	45
March	73	59	57	66	49	43
April	66	54	53	59	52	43
May	69	54	57	57	50	42
June	64	49	56	53	48	41
July	67	50	53	49	48	42
August	68	52	57	54	49	42
September	59	52	61	55	55	—
October	61	50	66	53	48	—
November	63	51	66	54	48	—
December	61	55	65	54	48	—

Grain.—There was a slight reduction in the price of wheat during August, but the decline of 1d. per cwt. to 12s. 6d. per cwt. left the index number unchanged at 56 per cent. above the base years. With some small quantities of new crop malting barley on the market, average prices of this grain showed a sharp advance from 11s. 11d. in the first week of August to 13s. 6d. in the last week, and the index number

rose by 7 points to 64 per cent. above 1911-13. Prices of oats declined as a result of new crop marketings, but the drop on the month was relatively much less than in August of the base years and the index number advanced by 10 points to 43 per cent. above pre-war.

Live Stock.—As is usual in August fat cattle declined in price, but the decrease was relatively smaller than in the base years and the index number rose by 4 points to 34 per cent. above 1911-13. Although fat sheep became rather dearer towards the end of July prices fell away somewhat during August, and the average was unchanged on the month at 45 per cent. above 1911-13. As compared with August, 1926, fat sheep were 4 to 5 per cent. cheaper. Fat pigs continued the decline in prices which has been in evidence for some time, although in the last two weeks of August there was a slight hardening. Bacon pigs averaged 36 per cent. and porkers 43 per cent. above the prices in the base years, but 7 and 6 points respectively lower than in July and over 20 per cent. lower than in August, 1926. Store pigs also sold at lower figures, but these were still relatively dear at 70 per cent. above August, 1911-13.

Dairy and Poultry Produce.—Egg prices rose sharply during August, and as has been the case for several years, the increase was relatively greater than in the base years, so that the index number rose by 13 points to 44 per cent. above pre-war, but was 5 points lower than in August, 1926. With smaller supplies on the market, butter prices advanced during August, but as the increase was relatively smaller than in 1911-13 the index number declined by 4 points to only 38 per cent. above the base years, which was 18 points lower than a year earlier. Cheese prices showed little change, but at 57 per cent. above pre-war were nearly 10 per cent. higher than in August, 1926.

Other Commodities.—There were heavy supplies of potatoes on the markets during August and the quality was in some cases rather inferior, so that prices of early potatoes declined sharply. On the average they realized only 30 per cent. above pre-war as compared with 61 per cent. in July, but made appreciably better prices than in August last year. For the first time for several years hay has been subject to fairly appreciable price changes and the index number rose by 10 points to 16 per cent. above pre-war, relatively the highest price recorded since 1923. As a result of the poor crop plums realized nearly 2½ times the pre-war prices, while apples sold during August at about 50 per cent. above 1911-13.

Index numbers of different commodities during recent months and in August, 1925 and 1926, are shown below :—

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

Commodity	1925	1926	1927			
	Aug.	Aug.	May	June	July	Aug.
Wheat	47	69	53	60	56	56
Barley	62	52	46	54	57	64
Oats	43	33	27	33	33	43
Fat cattle ..	54	43	24	25	30	34
Fat sheep ..	76	52	53	48	45	45
Bacon pigs ..	52	79	58	54	43	36
Pork pigs ..	56	83	66	60	49	43
Dairy cows ..	50	37	24	21	25	25
Store cattle ..	39	33	23	21	26	26
Store sheep ..	91	63	38	53	55	48
Store pigs ..	57	139	99	90	80	70
Eggs	67	49	28	30	31	44
Poultry	58	55	41	53	52	43
Milk	62	60	53	53	55	55
Butter	73	56	42	41	42	38
Cheese	78	43	46	54	58	57
Potatoes	67	11	74	61	61	30
Hay	3	11	2	3	6	16
Wool	38	24	31	33	40	742

* * * * *

By arrangement with the National Institute for Research in Dairying, a course of instruction in the production and handling of milk will be held at the University of Reading from November 1 to 12, 1927. The course is intended primarily for Dairy Instructors and Instructresses, but other applicants, especially those who are concerned with public health administration, will be admitted if accommodation allows.

Short Courses in Clean Milk Production

Application for admission to the course should be made in the first instance to the Dean, Faculty of Agriculture and Horticulture, The University, Reading, and intending students should travel to Reading on Monday, October 31, and be ready to commence work, if necessary, at 9 a.m. on Tuesday, November 1. The fee for tuition for the course will be £4, which must be paid to the University office.

Instruction will take the form of lectures, combined with demonstrations and laboratory work, and will deal with such matters as milk supply and production, legislation and

regulations regarding milk, applied bacteriology of milk and the chemical composition of milk. Excursions will be arranged to well-known dairy farms, factories and depots, but the travelling expenses in connexion with these are not included in the tuition fee.

The College cannot undertake to arrange residence for students, but will give all possible assistance and advice. Students are advised to take bicycles.

* * * * *

FARMERS and others interested in Agriculture are reminded that the field experiments on the manuring of root crops conducted at Rothamsted provide, at this time of the year, a very striking series of demonstration plots. The most important of these experiments are :—

1. Potatoes :—

- The effect of various potash manures (Sulphate of Potash, Muriate of Potash, Potash Salts).
- The effect of different proportions of potash and nitrogen (as Sulphate of Ammonia) in presence of constant dressings of dung and superphosphate.
- Comparison of the yields from seed potatoes fresh from Scotland with those from seed grown for various periods on the farm.

2. Swedes :—

- The Classical Mangold Field is this year in Swedes, the mangolds having failed owing to the spring drought. The effect on Swedes of the various schemes of manuring is well shown.
- Some of the newer forms of phosphate and nitrogen (Ammonium Phosphate and Urea) are being compared with Superphosphate and Sulphate of Ammonia.

3. Sugar Beet :—

- The effect of different widths of drilling: 14", 18" and 22" drills are being compared.
- A comparison of the effects of Muriate of Potash and 30 per cent. potash salts.
- Comparisons of Nitrate of Soda, Sulphate of Ammonia and Cyanamide in varying quantities.

In addition to the above experiments on root crops, the second crop of grass on the Park Hay Plots shows the effect of a number of different manurial treatments on old meadow land.

The Secretary will be glad to arrange for farmers' parties of any size to be conducted round the experimental plots at any time before lifting. In cases where it is difficult to fix a date in advance, farmers are invited to come at their own convenience, and the necessary arrangements will be made on arrival. At least three hours should be allowed for a tour

round the farm. Lunch and tea can readily be obtained in Harpenden. The Midland Railway station (Harpenden) is about half a mile from the Laboratory and the North-Eastern station about two miles. Farmers coming by road will find the Laboratory on the west side of Harpenden Common.

* * * * *

THE Agricultural Research Lectures Scheme, which was inaugurated in the winter season 1922-23, with the object of familiarizing farmers with the agricultural research work carried on at Research Institutes and at other centres in the country, will, with slight modification, be continued in the coming season. It is intended that the lectures to be delivered shall, while still furnishing information as to the present position of research in various branches of agricultural science, be rather more popular in character than hitherto: they will be in the nature of extension lectures on agricultural subjects. The lecturers will be drawn from the staffs of Research Institutes, Advisory Centres and Agricultural Colleges. A list of lecturers, and of the subjects on which they will be prepared to lecture, has been circulated to County Authorities for Agricultural Education, who have been asked to apply direct to lecturers for their services after preliminary consultation with the local branches of the National Farmers' Union.

* * * * *

THE sixth International Dairy Cow Judging Contest, for the Gold Challenge Cup presented by the *Daily Mail*, took place on July 14 at the Sussex Show at

Young Farmers' Clubs: Chichester, through the courtesy of the Council of the Sussex County Agricultural

International Dairy Cow Society. The competing teams were as follows:—

Judging Contest *United States of America*.—Gertrude

Kaiser, age 16, St. Olaf, Iowa; Kenneth Walter, aged 16, Luana, Iowa; Lloyd Kaiser, aged 17, McGregor, Iowa. This team was trained by Mr. Roy Combs, County Agricultural Agent, Clayton County, Iowa.

England.—Mabel Harriott, age 16; Leslie Cornford, age 18; John Harper, age 18; all of the Sussex Baby Beef Club, Haywards Heath. This team was trained by Mr. R. J. Noakes, the Club Leader.

The Judges were: Prof. A. C. McCandlish, West of Scotland Agricultural College, and Capt. Allan Skelton, Woodham

Ferrars, Chelmsford; the Umpire being Mr. E. A. Weir, of the Canadian National Railways.

The competitors judged three rings of Jersey, Friesian and Shorthorn cows. Twelve minutes were allowed to competitors for placing the animals and two minutes in which to give their reasons for the placing to the Judges. The animals judged were not selected from the stock on the show ground, but were brought specially in for the Contest under arrangements made by the Council of the Sussex Agricultural Society.

The contest began at 11 a.m. and lasted for two hours. The English team won by 12 points, having gained 842 points as against 830 points awarded to the American team. Mabel Harriott was placed first amongst the competitors with 283 points. Lloyd Kaiser and Gertrude Kaiser were equal last with 276 points, so that there was a difference of only 7 points between the top and bottom, showing the keen nature of the competition. The complete order of merit is as follows:—

	1.	Mabel Harriott	..	..	..	283	points
	2.	Leslie Cornford	..	..	..	282	"
	3.	Kenneth Walter	..	..	..	278	"
	4.	John Harper	..	..	..	277	"
equal {	5.	Lloyd Kaiser	..	..	..	276	"
	6.	Gertrude Kaiser	..	..	..	276	"

The English team scored 427 points against the American total of 407 for "placing," but the Americans gained 423 points as against the English 415 points for "stating the reasons." According to the rules governing the contest, competitors were permitted to take notes. The members of the English team availed themselves of the rule, but the Americans have been accustomed to work without notes, and their statement of reasons before the Judges was a striking feature of the contest which no one failed to appreciate.

H.R.H. Prince Henry specially visited the Show during the afternoon to present the gold cup and silver medals to the winning team and bronze medals to the American team. He also presented prizes to members of the Young Farmers' Club teams who had taken part in other judging competitions, and to individual club members who had been successful in showing their Sussex and Jersey calves on the first day of the Show.

It is desired to place on record the very high appreciation of the valuable support which the Council of the Sussex Agricultural Society has given to the Young Farmers' Club Movement in providing so many classes for the benefit of club members at the Show, and for making such admirable arrangements for the staging of the International Judging

Contest. Deep appreciation is also recorded for the help and encouragement given to all branches of club work in East and West Sussex by the Directors of Agriculture and their staffs, and to Major E. G. Sheppard, D.S.O., M.V.O., T.D., the Secretary of the West Sussex Rural Community Council.

* * * * *

THERE are fifteen farm institutes in England and Wales, and all except one have demonstration farms attached. The

main purpose of the teaching that is given
at farm institutes 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 instruction. The subjects dealt with and their
order of importance varies somewhat at the different institutes,
but a typical curriculum includes the following : Soils, manures,
crops, live stock, implements, machinery, veterinary hygiene,
surveying and mensuration, farm book-keeping, general
agricultural science (biology and chemistry), horticulture,
dairying, poultry 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, horti-
culture and poultry-keeping.

This information will perhaps be of greater service if coupled with the names of the fifteen counties in which the farm institutes are situated. They are : Cheshire, Farm Institute at Reaseheath ; Cumberland and Westmorland, at Newton Rigg ; Essex, at Chelmsford ; Hampshire, at Sparsholt ; Hertfordshire, at Oaklands, St. Albans ; Holland (Lincolnshire), at Kirton ; Northamptonshire, at Moulton ; Somerset, at Cannington ; Staffordshire, at Rodbaston ; East Sussex, at Plumpton ; West Suffolk, at Hartest (the Chadaere Agricultural Institute) ; Carnarvonshire, at Madryn ; Carmarthen-shire, at Carmarthen ; Denbighshire, at Ruthin ; and Monmouthshire, at Usk.

A certain number of scholarships are awarded at these institutes by the various County Councils to residents within their area, and the Ministry itself awards scholarships for the sons and daughters of agricultural workers.

Brief particulars of the courses for the sessions 1927-28 are given in the Ministry's Form No. 732/T.E., which can be had, post free, on application to the Ministry, and more detailed information can be obtained from the Principal of the institute concerned. Anyone desirous of attending one of these courses commencing in October, should make application immediately to the Principal, as accommodation at the institutes is limited.

* * * * *

IN the report on the Wart Disease Immunity Trials carried out at Ormskirk in 1926 (see this JOURNAL, March, 1927, p. 1156), it was stated that, in addition

to the varieties mentioned therein, the
Ministry was prepared to include other
varieties, which had successfully passed
the test, when the growers should give
notice of their intention to introduce them into commerce.

This intention has now been notified in regard to the three varieties, "The Baron," "Bounty" and "Boxer," and these have accordingly been added to the official list of approved immune varieties. Descriptions of these varieties are appended.

Second-Early Variety

"The Baron"

Sprout.—Pink.

Tuber.—Oval ; skin white ; flesh white ; eyes shallow.

Haulm and Foliage.—Upright to spreading, moderately vigorous ; leaflets long, fairly large, dull, wrinkled, waxy appearance ; stems general pink coloration ; wings straight.

Flowers.—White, not numerous.

Late or Maincrop Varieties

"Bounty"

Sprout.—Purple.

Tuber.—Round ; skin white ; flesh white, texture soft ; eyes medium.

Haulm and Foliage.—Strong, open, upright, moderately tall ; leaflets dark bronze-green, long, wrinkled, hard and glossy in appearance ; terminal leaflets drooping ; secondary leaflets large, numerous ; leaf closed ; stems purple coloration at base and in axils of leaves ; wings straight.

Flowers.—Light blue-violet, rare.

"Boxer"

Sprout.—Pink.

Tuber.—Round, flattish ; skin white ; flesh lemon ; eyes fleet and sub-terminal.

Haulm and Foliage.—Tall, upright, vigorous and open ; leaf erect ; leaflets Quaker-green, broad, long, hard and crinkled ; secondary leaflets large and numerous ; leaf closed ; stems green ; wings straight.

Flowers.—Light blue-violet tipped white.

AN interesting experiment has been going on in north Devon in the production of baby beef. For some years the age at killing has been steadily reduced. It used to be three years old; it is now a little over a year. That means that a calf of the right stock, that is, one having the hereditary quality of early maturity, can be fed to a stage when it produces good beef—and, incidentally, the smaller joints that are required by households to-day—at a little over a year old. The experiment was arranged by the North Devon District Agricultural Committee about 18 months ago, when one of its members undertook to put four young calves under the supervision of the District Lecturer to be fed systematically according to his prescription. They were North Devon calves, de-horned soon after birth. They were fed in the stall up to 17 months old, when they were sold for beef; they were about 8 cwt. each at slaughter, and realized a trifle over £24 apiece: 60s. per live cwt. In the same market in which they were sold, the best quality beef steers and heifers of about $2\frac{1}{4}$ - $2\frac{1}{2}$ years old, averaging $11\frac{1}{2}$ cwt., realized approximately 53s. per live cwt. The older animals, therefore, which had to be fed for a year longer, realized a good deal less per live cwt. and were not correspondingly heavier. It is not suggested that the actual profit on the sale of these 8-cwt. beasts is likely to be very high; indeed, it may merely be the value of the manure from the foods consumed. For the first fortnight the calves were fed on their mothers' milk, and each subsequently received a total of 116 gallons of new milk. The experiment aroused keen interest, and will be repeated on other farms in North Devon. Probably smaller quantities of new milk will be given, and the stock may be sold earlier if a favourable market presents itself. Had the four beasts been sold in June, they might have realized up to 70s. per live cwt. instead of 60s.

* * * * *

MANY experiments have shown that finely ground mineral or rock phosphates are useful fertilizers in suitable conditions.

The chief conditions in favour of the **Mineral Phosphates** action of ground rock phosphates are:

a moist climate and a soil which is strongly in need of phosphate, or rich in organic matter and not abundantly supplied with lime. Under opposite conditions, dry climate, or dry seasons and on chalky soils, they may

be expected generally to act more slowly than citric-soluble basic slags. It is to be noted, however, that Dr. Scott Robertson, in Essex, has obtained distinctly beneficial results from rock phosphates in this relatively dry area, results which only suffered by comparison with more soluble phosphates.

The proportion of phosphate of lime in ground mineral phosphate varies from 55 to 85 per cent. (some of the American phosphates contain less than 55 per cent. and those of Nauru and Ocean Island may contain slightly more than 85 per cent.), so that in practically all cases the amount of ground mineral phosphate required for the improvement of grassland would be from 5 to 6 cwt. per acre for a full application (equivalent to 10 cwt. per acre of high-grade basic slag), followed by, say, a dressing of 5 cwt. per acre every fourth year. Experience at Cockle Park, Northumberland, where a number of experiments with rock phosphates have been carried out, suggests that a suitable application of North African phosphates (containing 60 per cent. phosphate of lime) as a first dressing for the improvement of grassland, would be $6\frac{1}{2}$ cwt. per acre, which would be equivalent to 10 cwt. of basic slag containing 38 per cent. phosphates.

The mineral phosphate, however, must be finely ground.

The bulk of the ground rock phosphate available in this country was, until recently, of the same degree of fineness as that usually guaranteed with basic slag, that is that 80 per cent. will pass through a 100-mesh (linear) sieve, *i.e.*, a sieve having 10,000 meshes per square inch. Some grinders are now, however, producing an article of even greater fineness, 80 per cent. being guaranteed to pass through a 120-mesh (linear) sieve, *i.e.*, one having 14,400 meshes per square inch. Trials with North African phosphate (containing about 60 per cent. of phosphate of lime) of the latter degree of fineness carried out at Cockle Park, Northumberland, have given such satisfactorily increased yields of grass and of arable crops as to lead to the conclusion that it was comparable with high-grade basic slag. In a series of trials carried out by the Agricultural Education Association, the North African phosphate (which, however, was not so finely ground as that used in the Cockle Park experiments) proved inferior to low soluble slag on grassland but superior to it on arable land.* It would be valuable to have further comparative trials with mineral

* The results obtained showed that, in Northumberland, finely ground mineral phosphate acts well when applied to barley in which the seeds are sown. It improves the barley and the white clover.

phosphates of different degrees of fineness, but there is considerable indirect evidence to support the view that the finer grinding is an advantage. The difference in cost between the two grades is in most cases quite small.

At Cockle Park when dressings of lime have been applied in conjunction with these phosphates it has been found that the lime retards the action of the phosphates. Before applying lime, therefore, under such conditions, it would be advisable to ascertain by trial whether it is advantageous or otherwise to do so. When ground mineral phosphate is used on pasture it is advisable, as with basic slag, to remove the stock from the grazing land until rain has washed the phosphate from the herbage.

Tests with ground rock phosphates have now been carried out in a number of counties, and any who intend to give the material a trial should inquire of their County Agricultural Organizer* as to the results that may have been obtained under local conditions and as to the possibility of obtaining supplies in the district.

* * * * *

SMALLHOLDERS and cottagers who keep goats are reminded that the Scheme for improving the productive quality of their milch stock is again in operation.

The Stud Goat Scheme For the current breeding season, which ends on February 28, 1928, 110 stud goats have been registered, which are standing at

105 centres in various parts of the country, and their services are available for goats belonging to persons in the above-mentioned categories at a nominal fee, in no case exceeding 5s. Conditions of service and other information may be obtained from the County Agricultural Organizers at their respective County Education Offices, or from the Honorary Secretary of the British Goat Society, which is responsible for the administration of the Scheme, at 10 Lloyd's Avenue, London, E.C. 3.

* * * * *

Foot-and-Mouth Disease.— Fresh centres of disease were discovered during the month at Kempston, Bedford, on September 2, and at Llangeinor, Bridgend, Glamorgan, on September 5. A further case occurred in the Bedford area on September 6, and further outbreaks were also confirmed on September 15 and 16 in the Glamorgan area.

Thirty-two outbreaks in all have been confirmed since January 1 last, involving 11 counties and the slaughter of 1,294 cattle, 1,167 sheep, 422 pigs and 2 goats.

* See Leaflet No. 279 (*Technical Advice for Farmers*), obtainable from the Ministry.

Enforcement of Minimum Rates of Wages.—During the month ending September 15 legal proceedings were instituted against nine 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 ..	Chester ..	—	—	0	7 6	2	0 0	1
" ..	.. Broxton ..	1	0 0	—	—	10	7 0	4
Dorset ..	.. Beaminster ..	10	0 0	4	1 6	22	0 11	6
Kesteven & Lindsey	Barton-on-Humber ..	2	0 0	2	11 0	3	13 4	2
Dorset ..	.. Cranborne ..	10	0 0	1	2 6	28	17 0	3
Hereford ..	.. Kingston ..	*	—	—	—	—	—	1
" ..	.. Ledbury ..	15	0 0	6	5 0	44	18 0	8
Montgomery	Llanfyllin ..	1	0 0	3	0 0	28	18 2	1
Hants ..	.. Whitechurch ..	—	—	—	—	4	7 6	1
		£39	0 0	£17	7 6	£145	11 11	27

* Case dismissed.

Proceedings were also taken against two employers under Section 9 (3) (a) and (b) of the Act (refusing information and hindering an Officer in the course of his duty). In the first case, heard at Clun (Salop), the employer was fined 10s. and ordered to pay 10s. costs, and in the second case, heard at Talgarth (Brecon), the defendant was ordered to pay 4s. costs.

* * * * *

NOTICES OF BOOKS

All About Gardening. (London: Ward, Lock & Co., Ltd. Pp. 384. 8 colour plates, 32 photographic illustrations and 56 diagrams in the text. Price 6s. net.)

Gardening is, the publishers state, man's chief hobby, for all are at heart garden lovers, and it is only the lack of the knowledge of when, where, how and why that prevents one and all from becoming practical gardeners as well as mere garden lovers, and, believing this, the authors have designed this book, *All About Gardening*, to supply gardening knowledge in very simple, straightforward language. Gardening of to-day embraces flower gardens, lawns, rock gardens, water gardens, gardens covered with glass, vegetable gardens and fruit gardens, so it is not surprising that the mass of information—though very closely printed—extends through some 384 pages and makes a somewhat bulky book. In addition, there are eight coloured plates of typical flower gardens from paintings by Flora Pilkington and Beatrice Parsons, and of a Dutch garden from a painting by George S. Ellgood; 32 illustrations and 56 diagrams to interest the reader in gardening and to make the text easier to understand.

The book describes fully and accurately the way a garden should be made and managed to be beautiful and useful in supplying fruit, flowers and vegetables for the home.

A large number of people with gardens attached to their homes wish to acquire a sound working knowledge of gardening, and *All About Gardening* gives just the kind of information required. Lists of useful plants have been drawn up for guidance of readers, and the plants included are good. Plant lovers, however, would wish for something more, for they realize that each plant has its special features

which are not always brought out by the standardized methods of culture described in the book. To deal with the special treatment of each plant would have necessitated a considerable expansion of the book, and if done the simplicity which the authors desire to be a special feature would have been destroyed.

The information given in the book is accurate and generally up-to-date, and it is evident that some of the writers—though not all—have kept in touch with the research work of the Horticultural Research Stations. At the price of six shillings the book is very cheap.

Plant Products. By S. Hoare Collins, M.Sc., F.I.C., and George Redington, M.Sc. (London: Bailliere, Tindall & Cox, 1926. Second edition. pp. xiv + 262. Price 10s. 6d. net.)

Readers who are familiar with the war-time edition of this book will remember that it was divided into four main parts, dealing respectively with fertilizers, soils, crops and meat production, so that, to quote the words of Mr. Collins, it covered "the cycle from factory to fertilizer, from fertilizer to field, and from field to factory once more." In the preparation of this new edition, the authors have modified to a considerable extent the earlier treatment of the subject. It has been found advisable to curtail slightly the chapters dealing with the artificial fertilizers. The section on soils has been brought up to date, although considerations of space have prevented the authors from writing on this subject as fully as might have been desired. The third part, devoted to the subject of crops and the composition of feeding stuffs, has been considerably expanded and contains some of the most interesting chapters of the book. From the fourth part, dealing with meat and milk production, all features possessing a purely war-time interest have been omitted. The writers state that "in spite of these radical changes, which have resulted in a new book, the fundamental plan is unchanged, so that those readers who know the first edition will not feel any unfamiliarity."

It will be at once apparent that the authors, in a book comprising some 260 pages, have covered a very wide field. As a consequence, many matters of importance have perforce been dealt with in a manner which may prove slightly disappointing to the scientific reader in search of detailed information. The book, however, is avowedly not intended to supply "encyclopaedic completeness of information," and the reader engaged in specialistic studies will necessarily, as heretofore, have refuge in the scientific journals. This volume is one of a series of publications "giving a comprehensive survey of the chemical industries," and has obviously been compiled in an attempt to meet the special requirements of the applied chemist interested in the agricultural utilization of industrial products and by-products. To the chemist engaged in technical work in any way connected with agriculture, as well as to the reader in search of general information on questions concerning the relation of industry to agriculture, the book may therefore be recommended with every confidence.

A Bird Book for the Pocket.—By Edmund Sandars. (Oxford: The University Press, 1927. Pp. xix + 245. Over 200 coloured illustrations. Price 7s. 6d. net.)

The arrangement of this useful little handbook is admirable, the introduction well written and authoritative, and the descriptions of the various species are concise but ample. The field observations (always a criterion of value in a book on natural history) are numerous and accurate. The author is aware, for example, that the Lesser Whitethroat has a habit, when feeding its young, of hanging head downwards from a twig, although this fact has escaped the notice of many writers on ornithology. His statement, too, that all the pigeons

will drink salt water is of peculiar interest. The Rock Dove is known to do this, but that the habit extends to others of the genus is not so well-known, and such observations are valuable.

There are a few errors, though none of them serious. The breeding time of the Hobby is given as May and June, but it is doubtful whether the few British breeding Hobbies are ever engaged in nesting before the end of June or the beginning of July. It might have been made clear, also, that the Nightjar's habit of clapping its wings in flight is not confined to the courtship period, as the author's note might lead one to infer. The nomenclature is open to criticism in a few cases, as, for example, in the substitution of "Spotted Woodpecker" for "Greater Spotted Woodpecker," and "Barred Woodpecker" for "Lesser Spotted Woodpecker," although these substitutions are not very objectionable. In point of fact, the term "Barred Woodpecker" is more aptly descriptive, but "Lesser Spotted Woodpecker" remains, nevertheless, the accepted British name for this species. "Water Wagtail" is, however, misleading, as it might apply equally to both the Pied and Grey Wagtails.

The illustrations are presumably intended to be impressionist pictures rather than scientifically accurate drawings. Judged from that angle, they are good for the most part, although some are poor, and a few, such as those of the Nightingale, Spotted Flycatcher, White-throat, Dartford Warbler and Cuckoo, are definitely bad. It is doubtful whether the student would recognize these birds from the illustrations. Many of the drawings, too, are open to objection on anatomical grounds, or in the matter of scale. In the circumstances, the claim that the illustrations set a new standard of accuracy can hardly be upheld. The drawings of eggs, although somewhat crude, are good, but exception might be taken to the inclusion of the Nightingale's egg among those invariably uniform in colour. While it is true that the type is a uniform dun or olive brown, mottled examples are frequently found.

Apart from the illustrations, however, the book undoubtedly is a useful addition to ornithological literature at a very reasonable price, and may be commended to anyone desiring to study the habits of British birds.

Rural Industries in England and Wales. Vol. III, Decorative Crafts and Rural Potteries. By Helen E. FitzRandolph and M. Doriol Hayo; **Vol. IV, Wales.** By Anna M. Jones. (Oxford: The Clarendon Press. Price 5s. net each.)

These are the concluding volumes of the survey of rural industries, made on behalf of the Agricultural Economics Research Institute at Oxford and previously noticed in the May number of this JOURNAL. They complete successfully the survey itself, and fulfil the promise of thoroughness which was given in the first two volumes. It should be noted that the investigations were carried out under the direction of Mr. A. W. Ashby, formerly of the Oxford Research Institute, but now of the Aberystwyth University.

The Decorative Crafts and Rural Potteries dealt with in the first volume are specially interesting in these days when more attention is given than formerly to beautiful hand-made articles, especially as decorations for the home. The great selling stores in London and other of our chief towns would be incomplete without some products of such homely craftsmanship. It is quite true, as pointed out in the volume, that "the workman, shaping his material with his hands, or with tools directed by his hands, can adapt his work more exactly to the natural idiosyncrasies of the material than is possible with a machine." For that reason hand-made ironwork, cloth, lace and other

materials are usually much more beautiful and sometimes even better finished than goods turned out by machinery. The individual touch, the artistic touch, is of great importance in such articles, though it is perhaps insufficiently appraised by the public.

Apart from the purely business side of rural industries, what strikes one as being especially interesting on reading these books is the story of many of the industries themselves. The weaving industry in Kent, centred at Canterbury, appears to have been introduced in the Middle Ages by Flemish refugees and later reinforced by Huguenot weavers in the seventeenth century. The silk factories in Suffolk and Essex also come from Huguenot enterprise, and the woollen homespun industry in the Lake District was established by Flemings in the fourteenth century. Lace-making is also largely of Continental origin, although the names of the traditional patterns have become anglicized as appears in the well-known "Bedford," "Buckingham" and "Honiton" lace. The jet industry of Yorkshire goes back much further; the Phœnicians, it is said, were interested in Whitby jet, the mines which run inland from the face of the cliff having been worked by the early Britons as they are by the local people to-day, for the same purpose of getting the jet for carving into ornaments and making beads.

Volume IV, on Wales, will be especially interesting to rural workers in the Principality, and to those who, wisely, seek to develop the rural products of our numerous rural craftsmen. It is time that Rural Community Councils, with their helpful oversight of rural industries, became established in Wales. If, in some cases, the county is too small a division to support a Council, there may not be any great difficulty in getting a combination of counties, possibly with a centre in the provincial university, which could do much to assist the movement.

In a country like Wales, rural industries bulk more largely in the life of the people than they do in England; we would therefore expect them to be better developed. Already the woollen industry, with about 150 factories, has made its products widely known. Of these factories, nearly 100 still use water power only, showing how important the quick-flowing mountain currents are in the generation of power for these enterprises. In addition to the factories, there are a number of individual handloom weavers who work near the spinning and fulling mills.

In the industries connected with the Welsh woodlands, the making of clogs appears to be one of the most important. There is also cooperage, or the making of all kinds of barrels and vats, wood turnery for chairs, tool handles, etc., hurdles, packing shavings and charcoal burning. Osiers, willows and rushes are also used in the making of baskets, lobster pots, the ancient coracles, mats, etc. Tanning, pottery and small handicrafts such as toy making, leather purses and bags, complete the list outside the work of the larger craftsmen such as the blacksmith, wheelwright and carpenter. These skilled trades in Wales, as in England, are in need of revival, to accomplish which assistance by local farmers and others living in the country is chiefly necessary. No country dweller should think of buying from the factory an article which can be quickly made in the local smithy or carpenter's shop. This applies to all forms of wrought iron work, from the larger farm implements to latches, knockers, bolts for doors, and other forms of ornamental wrought-iron work. All of it is very much better and more lasting than the products of the factory; the local blacksmith can often make them, only he is not asked for them, but kept mainly to the job of shoeing horses. The same sort of thing often occurs in the case of the carpenter and the saddler.

Generally, and to sum up, the four volumes on *The Rural Industries*

of *England and Wales*, giving as they do the results of a new and up-to-date investigation into actual conditions in the country, are of very considerable value indeed to inquirers of all degree, whether for business purposes, social reform and rural improvement purposes, or for the mere student; and they can, therefore, be confidently recommended to them all.

Modern Denmark. By Hugh Jones. pp. xii + 83. (London: P. S. King & Son, Ltd. Price 2s. 6d. net.)

This is the short story, well written, of the rise of Denmark from a condition of extreme poverty to its present position as one of the best cultivated and best organized agricultural countries in the world.

The author makes the inevitable comparison between this country and Denmark, to the disadvantage of the former, but he admits the difference in conditions. Agriculture is practically the only industry in Denmark, and in making a living from the land the Danes are assisted by a consistent State policy, the object of which is to ensure the highest degree of productivity from the land, and by the fact that the industry is organized for an export market.

According to the writer, however, "It is absurd to say that agricultural co-operation is ineffective outside export countries." Yet he is constrained to admit in another part of the book that "The (Danish) co-operative societies in the towns have attacked the problem of the elimination of the middleman and have found the problem almost insoluble."

When Mr. Jones comes to deal with "Land Culture and Production" he is responsible for at least one serious mistake. He says, "The experiments of the scientists have resulted in the discovery that—weight for weight—roots are more than twice as valuable as hay for feeding purposes and more than seven times as valuable as green feed." This bears the stamp of obvious error. It may suffice to say that, according to the leading Scandinavian authority—Hansson—hay is five times as valuable as turnips, and that of the ordinary foodstuffs turnips occupy the lowest position in the table of feeding values.

The final chapter, dealing with deductions and suggestions, is not very helpful. "From time to time," it is stated, "suggestions, sometimes plausible, sometimes hopelessly impracticable, are made. Safeguarding and Protection are often urged as providing the only remedies, but the ramifications of the industry at home are often lost sight of. Protection of one side of the industry would open the door to legitimate claims from a hundred and one other branches," etc. Yet the one concrete proposal the author makes is for a tax on imported meat!

The Science of Farm Labour: (1) Scientific Management in German Agriculture, *International Labour Review*, March, 1927; (2) An Investigation of Certain Processes and Conditions on Farms, by W. R. Dunlop, *The National Institute of Industrial Psychology*.

In recent times a certain amount of attention has been given to the possibility of applying the principles of "scientific management" to agriculture, and some research in this direction has been carried out, including motion studies, the study of fatigue, and the investigations concerned with the efficiency of manual labour. The first of the above documents gives a useful summary of work done on this subject in Germany, particularly at the experimental station at Pommritz. Here an attempt has been made to study scientifically the elimination of unproductive labour in agriculture, and the investigations have been conducted on a somewhat wider basis than has often been the case. Farm lay-out; the position of buildings in relation to the fields; and the shape of fields, have been carefully studied, as well as a great number of manual operations. The following are some examples of

experiments carried out: Comparison of the efficiency of ploughing with the driver riding and walking; methods of plaiting bands for sheaves; methods of gathering the sheaf and binding it in its own straw; loading potatoes, etc. In addition to these motion studies, the examination of different kinds of tools by similar analytical methods has been undertaken.

One of the most interesting branches of inquiry is the experiments on payment by results which have been carried out by the Association of Employers in agriculture and forestry in Silesia. These experiments, conducted on 44 farms, cover all kinds of work throughout the year. Elsewhere this method has also been investigated and various forms of premium and bonus have been tried, *e.g.*, a bonus for quality of work, for economy of raw material, for good upkeep of machinery and tools. In some cases good results have been obtained by payment of a "premium task wage," *i.e.*, a payment in addition to the regular time wages for a definite task performed. The form of such a premium naturally varies with the kind of work undertaken. In addition to these, studies of team work, gang work and individual work have been made, particularly at Pommritz.

In this country very little investigation of this kind has been undertaken, and Mr. Dunlop's study is, on this account, all the more welcome. The investigation is concerned chiefly with motion studies conducted on certain farms in Kent, and in connexion with the South Eastern Agricultural College at Wye. They include the picking of bush fruit and hops; packing strawberries, loganberries, etc.; picking, grading and packing glasshouse produce; and a series of experiments on milking. Full experimental results are published and full description is given of how the experiments were actually carried out. The results go to emphasize not only the possibilities of economy in human effort in agriculture, but also the special difficulties which have to be confronted in agriculture as compared with manufacturing industry, where the application of manual effort is usually more a matter of steady routine. One might, perhaps, be tempted to criticize some of the experimental conditions in which the investigations were made, and to question some of the conclusions. However this may be, the broad results of the experiments show—as is nearly always the case in investigations of this kind—that in the simple elementary movements by which manual work on the farm is carried out, there lies hidden a steady, persistent waste of human effort which enlightened management might eliminate, or at least materially reduce.

Guide to an Exhibition of Manuscripts and Printed Books illustrating the History of Agriculture. With eight plates. (Printed for the Trustees of the British Museum. Price 1s. On sale at the Museum.)

The exhibition to which this is a Guide has been arranged in the King's Library, British Museum, on the occasion of the Imperial Agricultural Research Conference. It illustrates the history of agriculture by means of specimens of: (1) Papyri from Ancient Egypt, in which illustrations of agricultural occupations occur; (2) Greek papyrus illustrating agriculture in Egypt between 332 B.C. and A.D. 641; (3) mediæval and modern manuscripts of agricultural interest, ranging from the 12th to the 16th centuries; (4) printed books dealing with agriculture and husbandry, from the early part of the 16th century to the beginning of the 19th century.

Each item is exhaustively described (and, in the case of many of the manuscripts, transcribed) in the Guide, which is illustrated with four plates of reproductions of manuscripts and four of woodcuts and engravings in printed books.

Printed under the Authority of HIS MAJESTY'S STATIONERY OFFICE
by the London Caledonian Press Ltd., 74 Swinton Street, Gray's Inn Road, London, W.C.1
—W14326

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXIV. No. 8.

NOVEMBER, 1927.

NOTES FOR THE MONTH

At pp. 720 and 723 of this issue will be found two short articles by well-known experts on the winter feeding of dairy cows. One is written from the standpoint

Winter Feeding of Dairy Cows of the grassland farmer who, for the bulky part of the ration, depends almost entirely on hay; the other from the standpoint of the "mixed" farmer who, in the ordinary course, grows corn for sale and cultivates roots as one of his rotational crops.

Owing to the abnormal season hay, generally, is of inferior quality. Mr. Boutflour suggests that the best hay should be spun out with a greater quantity of the second-rate quality, and that really bad hay should not be fed at all: instead the farmer must "purchase (a) hay, or (b) straw, and sugar beet pulp or roots."

Both writers make the point that the heaviest milkers should have first call on the better qualities of hay available.

The "mixed" farmer has probably been able to secure a portion of his "seeds-hay" before the weather broke. In general he is well supplied with roots. He has also at hand considerable supplies of straw suitable, at least, for picking over, and, it may be, considerable quantities of damaged grain. Mr W. A. Stewart suggests how this can best be blended for milk production.

* * * * *

It will be remembered that about three years ago the Ministry took over the control of the Young Farmers' Clubs Movement in this country, and appointed

The Young Farmers' Clubs Movement an officer to foster the formation of clubs and, generally, to supervise and establish the Movement in rural districts. At that time, there existed 13 clubs with a total membership of about 260, distributed over eight counties.

During the intervening period, considerable progress has been made, and there are now 130 clubs, organized on progressive lines, with over 3,000 members in 23 counties.

Of these clubs, 72 specialize in poultry-rearing; 35 deal with "mixed" stock, i.e., any individual club may work with poultry and rabbits, with poultry and horticulture, with rabbits and calves, or may even combine all these interests; 16 are devoted to rearing calves; three are bee clubs; three tend rabbits; and one devotes its whole activities to horticulture.

Six calf clubs had entered for the annual dairy cattle judging competition, which was to have been held at the Dairy Show last month (October). Unfortunately the exclusion of cattle from the Show, on account of the outbreak of foot-and-mouth disease near London, rendered a postponement necessary. The clubs compete for a silver challenge cup, presented by the proprietors of *The Farmer and Stockbreeder and Agricultural Gazette*, and silver and bronze medals given by the British Dairy Farmers' Association. Last year the cup was won by the Sussex Baby Beef Club.

A brief summary of the development of the movement in the four northern counties, Northumberland, Cumberland, Westmorland and Lancashire, shows that it has progressed most rapidly in the first two counties, which now have five and seven clubs respectively. Of the Cumberland clubs, five are working with poultry (one or two with rabbits also), and two with calves, and it is worthy of note that most of these clubs have been promoted by schoolmasters in connexion with rural schools. A leader of one of these clubs, in sending an account of the first meeting, observes that the club is "moving slowly but surely, as funds are very difficult to accumulate," this being typical of the movement in the north. The clubs are receiving practical aid in Cumberland, the Governors of the Cumberland and Westmorland Farm School having agreed to allow short credit to club members in respect of sittings of eggs and of small live stock supplied.

Of the Northumberland clubs, three have held their annual show and sale of stock during recent months. A report concerning one of these clubs says: "The Slaley Club held its first Show and Sale during August last at the Annual Show of the Slaley and District Horticultural and Agricultural Society. Fifteen heifer calves, all about a year old, were exhibited, and the quality and condition of the animals fully merited the praise accorded by a large gathering of visitors. The calves were subsequently sold by auction, the average

price realized being £14 17s. 6d., the best animal bringing in £18. The club members profited to the extent of £3 to £4 on the sale." The members of this particular club also proved themselves, recently, to be good judges of dairy cattle, obtaining only twelve fewer points than the American Young Farmers' Clubs' International Team in a cattle-judging contest held in Northumberland. This is regarded as a most meritorious performance, and the Slaley Club is to be congratulated upon the result.

* * * * *

For the prevention of bunt or stinking smut in wheat, farmers are now being recommended to try dusting the grain

with copper carbonate instead of

Pickling Wheat moistening it with solutions of copper sulphate or formalin. (See Ministry's

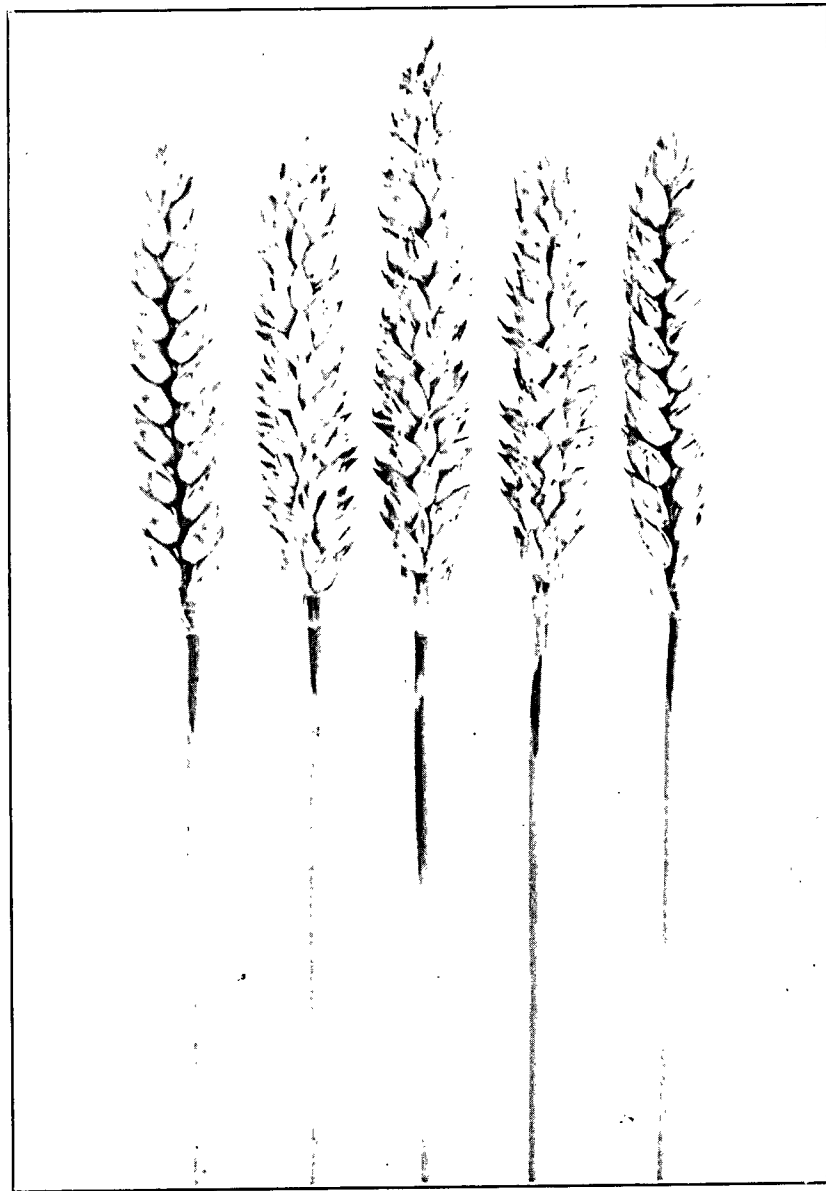
Leaflet No. 92, 1925 edition.)

Dusting with copper carbonate has certain advantages:—

- (1) It does not injure germination; in fact, there is some evidence to show that the braird from treated seed is better than that from untreated.
- (2) Treated seed may be stored, if necessary, without injury; wet methods do not permit this.
- (3) Dusted seed does not involve alteration of the seed drill to compensate for swelling, as is sometimes necessary with the wet methods.

The best control is given by samples of copper carbonate containing about 50 per cent. of copper, and of a fineness represented by about 90 per cent. passing through a 200-mesh sieve. The powder should be used at the rate of 2 oz. per bushel.

As to the method of applying the dust, it is essential that it should cover all parts of the grain, particularly the "crease" and the "brush," in which spores often lurk. Mixing, therefore, must be thorough. For this purpose machines of the rotary type are best. On the farm a suitable mixer may be made by fitting an axle and crank of, say, gas piping to a barrel supported on a stand. The barrel should not be more than half full of seed, and preferably only one-third full. One or two wooden baffle plates, fixed longitudinally inside the barrel, will help considerably to ensure that the grain becomes thoroughly and evenly coated with the powder. Other means of mixing will suggest themselves, but mixing on a floor is not satisfactory. For one thing, inhaled dust is most objectionable, and may cause severe nausea and irritation. It is advisable to mix in the open and to keep to the windward. A dust mask or a wet handkerchief should be worn over the nose and mouth while the grain is being treated.



"Brown Neck" in Wheat.

SEVERAL inquiries have been received, during the past summer, at the Ministry's Plant Pathological Laboratory, Harpenden, concerning a brown discoloration or stain which occurs at the top of the wheat haulm, usually just beneath the ear, as shown in the illustration opposite. The browning begins whilst the haulm is still green, and generally extends for about an inch or so below the ear. At first it is not particularly striking, but as the haulm ripens and becomes yellow, the contrast in colour becomes increased, so that "Brown Neck," as it may be called, is sometimes very evident. The discoloration is due mainly to the death of certain groups of cells containing the green colouring matter known as chlorophyll, which are towards the margins of the haulm: but the cause of death of these cells is not known. There appears, however, to be no interference whatever with the sap-conducting channels of the haulm, and the ears ripen normally. Moreover, the supporting tissues of the haulm do not become weakened and the straw does not break at the neck. "Brown Neck" was first observed many years ago, but it appears to have become increasingly prevalent during recent seasons. It is not confined to any one variety. In view of the fact that no apparent harm accrues to the crop from the presence of this discoloration, farmers need feel no great alarm about it.

* * * * *

THE following note has been communicated to the Ministry by Mr. A. M. Massee, of the East Malling Research Station:—

The Black Currant Gall Mite (*Eriophyes ribis* Westw.; Nal.) has been recorded on red currants for a number of years, but until recently it does not appear to have affected the cropping of the bushes to any marked extent, and in consequence has been overlooked by growers in many instances.

This pest, however, has become far more common during the past three years, and in many cases has been recorded as being a serious pest of red currants. At the present time it is very common in red currant plantations in many districts in Kent, including Canterbury, Brenchley, and Maidstone.

Description of the Disease.—The gall mite does not produce on red currants the "big-buds" which are so common on black

It is understood that copper carbonate of the grade and quality referred to costs about 75s. per cwt. Cheaper forms containing less copper are available, and these, if equally finely ground and used at a correspondingly higher rate, are likewise believed to be effective.

If more seed is treated than is used for sowing, the surplus should not be used for feeding purposes, as copper salts are poisonous. Further, such seed should not be allowed to stand in the seed drill under moist conditions, nor should dust be allowed to accumulate in the machinery on account of the risk of injuring the drill.

Where the seed grain is only slightly contaminated with bunt spores, pickling with copper carbonate dust may be expected to give as effective protection from the disease as that obtained with the wet formalin and bluestone (copper sulphate) pickles; but with severely contaminated grain the wet methods have proved to be more effective than the dry powder. Heavily smutted (blackened) seed, however, should not be sown.

* * * * *

FRESH ground has been broken during the last two months by the staging of the Ministry's Marketing Demonstrations at market towns in the West of England. At the end of September the marketing of eggs and poultry was demonstrated at the Market Hall, Shrewsbury, to an audience which was undoubtedly appreciative.

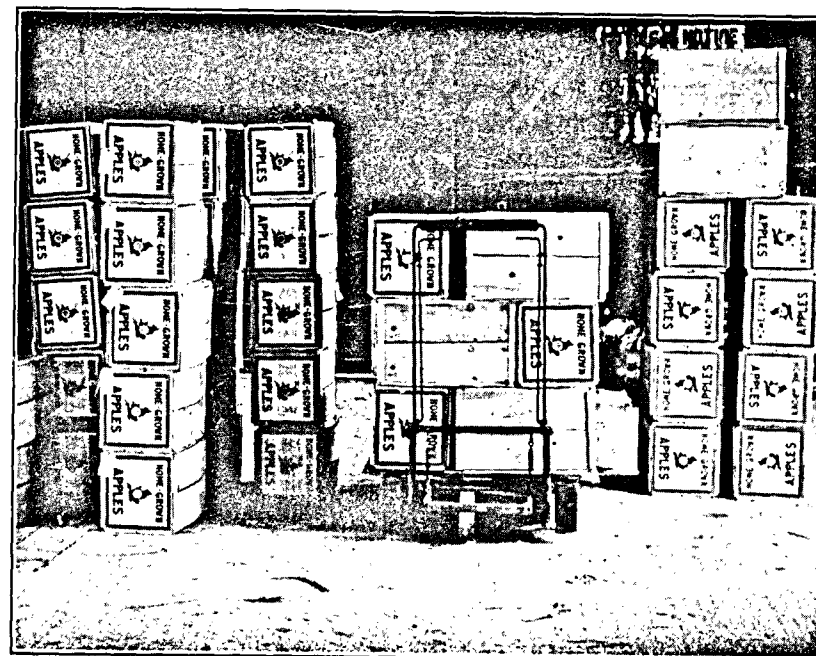
Demonstrations in Marketing Home Produce

Simultaneously, the fruit section began at Hereford a short tour which, by way of Pershore and Grange Court Markets, is finishing up at the Imperial Fruit Show. At each of the first three markets, the demonstrators were busy grading and packing apples supplied for the purpose by growers in the several localities, the best of the fruit being boxed and sent to distant markets, bearing on the boxes the national label suggested in the report on fruit marketing. It is not to be expected that a grower will benefit financially immediately he undertakes grading and box-packing, and therefore it was interesting to find that, as a matter of fact, fruit graded and packed at these demonstrations and sold at once on the auction floor did make a better price than similar ungraded fruit, even though most of the latter was also sold in non-returnables.

At the Imperial Fruit Show, the Cutler Grader has been operated with apples purchased "as picked," and growers and salesmen must have been interested to see how this fruit graded out.



Grading home-grown apples with the Cutler Grader.



Boxes of graded home-grown apples.

currants, but in instances of severe infestation the buds tend to swell out considerably, especially those at the base of the bush. The enlarged buds can be detected from November to March or April. About the middle of April the mites migrate from the buds and live freely on the leaves, and the infested buds eventually dry out. Probably the best time to detect the presence of the mites is in the spring as soon as the buds begin to open. At this season it will be noticed that the majority of the mite-infested buds remain dormant. These dormant buds are referred to frequently as "blind" buds, and are said to be the result of bird attack during the winter months.

Varieties Attacked.—Raby Castle undoubtedly suffers most from the attacks of the mite; other varieties, such as Fay's Prolific, are attacked in a lesser degree.

It might be as well to point out that white currants and gooseberries are attacked in a similar manner, and, as in the case of red currants, the disease is on the increase in many localities.

* * * * *

THE Institute has recently published the *International Year Book of Agricultural Statistics*, 1926-27. The general make-up of the volume is similar to that of earlier years, while the information has been amplified in some directions, *e.g.*, by the inclusion of statistics of international trade in wine, sugar and silk, and of tables

**International
Institute of
Agriculture**

relating to the approximate consumption of various descriptions of fertilizers in certain countries. The volume is divided into nine sections, the first dealing with total area and population, and the second with the apportionment of the area, the agricultural production and the numbers of live stock in each of a number of countries. Sections III and IV are devoted to the production of the principal crops, and the numbers of each of the principal descriptions of live stock throughout the world (as far as figures are available). The remaining five sections deal with international trade, prices, ocean rates of freight, fertilizers (production, trade, consumption and prices), and rates of exchange.

Copies of the Year Book, which contains a large amount of statistical data of great value to the student of international agricultural statistics, may be purchased from the Ministry (price £1 paper, £1 2s. 0d. cloth).

THE fifth Interim Report of the Permanent Committee on Basic Slag, just issued, covers experiments carried out on behalf of the Committee during 1925 and 1926, and gives the conclusions which the Committee feels justified in drawing from the results of their experiments so far as these have gone. The Report includes statistics of production, disposal, imports and exports of basic slag, and of the estimated quantities of superphosphate and phosphate rock used in agriculture in Great Britain. An account is also given of the Agricultural Education Association's phosphatic field trials, 1921-24.

**Permanent
Committee
on Basic Slag**

The article by Sir John Russell, detailing experiments carried out at Rothamsted with basic slag during these years (see page 727 of this issue) summarizes the results of the experiments and outlines the conclusions set out in the Report.

Copies of the Report can be obtained on application to the Ministry, 10 Whitehall Place, London, S.W. 1.

* * * * *

THE Sixth Annual Conference of County and College Poultry Instructors was held on October 18, at the offices of the Ministry of Health, the Poultry Commissioner occupying the chair. Seventy-six instructors, agricultural organizers, principals of colleges and others were

present, including fourteen representatives from Welsh counties. The proceedings were opened by Sir C. Howell Thomas, Secretary to the Ministry of Agriculture and Fisheries, who referred to the gratifying extension of the industry which had taken place in recent years. They had now in England and Wales some ten million more adult birds than in 1913, and the number was increasing at the rate of approximately 1½ millions per annum; but the fact that they still imported eggs and poultry to the annual value of over £20,000,000 revealed the need for further and fuller instruction in scientific methods of production and marketing. Miss M. P. Bally gave an account of the Egg-Laying Trials in Pembroke, which was followed by a paper from Mr. E. Rea on the vexed question of "Uniformity in County Egg-Laying Trials." As a result of the ensuing discussion, a committee was appointed, under the chairmanship of Major C. H. Eden, with a view to the formulation of a common system of scoring. Mr. T. W. Palmer gave an interesting address on "Goat-keeping in conjunction with Poultry," Mr. E. Russell described the non-subsidized Egg Distribution Scheme in Devon, and Mr. F. Bowers followed with an account

of the operation of the non-subsidized section of the Scheme in Essex. In view of the fact that grant-aided schemes are now to be discontinued, much interest was aroused by these papers. Mr. B. C. Brewer spoke on "Methods of Poultry Instruction in Somerset"; Mr. G. W. Goode on "Methods of Marketing Eggs and Poultry in Yorkshire"; Miss E. Kidd on "Small Live Stock Work in Surrey"; and Mr. L. G. Price on "Poultry-keeping on general farms."

THE Fourth Annual Conference of County and College Dairy Instructors and Instructresses in England and Wales, convened by the Ministry, was held on October 20, **Dairy Instructors' Conference, 1927** at the Offices of the Ministry of Labour, Montague House, Whitehall. The Conference met 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. Including the Ministry's officers, the attendance was, approximately, 130.

The Conference was opened by the Minister of Agriculture and Fisheries. Mr. Guinness referred to the efficient work which was being done in Dairy Education, and said that, partly as a result of this work, the dairy farming industry in this country had achieved a position which, he thought, was second to that of no other country. Remarkable co-operation existed between the Local Health and Educational Authorities and farmers, and the next step was to obtain the sympathy and support of the trade and of the public.

Addresses were given on the following subjects:—

"Milkers' Competitions in Conjunction with Clean Milk Competitions," by Mr. J. H. Mattinson, B.Sc., Agricultural Organizer for Surrey.

"The Milk Trade and Clean Milk Production," by Sir William Price, United Dairies, Limited. The paper was read by Mr. Tudor Price.

"Progress of Arrangements for the World's Dairy Congress," by Mr. V. E. Wilkins, Ministry of Agriculture and Fisheries.

"The Efficient Use of Milking Machines," by Mr. A. T. R. Mattick, B.Sc., National Institute for Research in Dairying, Reading.

"Some Economic Aspects of Milk Production," by Mr. James Wyllie, B.Sc., N.D.A. (Hons.), N.D.D., South-Eastern Agricultural College, Wye.

"Mammary Infections and their Bearing on Clean Milk Production," by Mr. A. W. Holtum, M.R.C.V.S., B.V.Sc., D.V.H., of the Ministry's Veterinary Laboratory. This was followed by an address by Mr. J. C. W. Simms, B.Sc., N.D.D., Instructor in Dairying for West Sussex, who gave a brief account of his experiences in connexion with mastitis.

All the addresses were followed by valuable open discussions.

THE NUTRITIVE VALUE OF SWEDES, MARROW STEM KALE AND SUGAR BEET TOPS

T. B. WOOD, C.B.E., LL.D., F.I.C., F.R.S.,

Draper's Professor of Agriculture and Director of the Animal Nutrition Research Institute, Cambridge University.

It is commonly asserted and widely believed that swedes grown in different districts vary greatly in nutritive value; that, for instance, swedes grown in certain districts in Norfolk and in the East of Scotland are very much more valuable than swedes of the same variety grown in the Cambridgeshire or Isle of Ely Fens. The point is one of considerable practical and scientific interest. It has been studied by the method of chemical analysis by Collins,* and by the writer and R. A. Berry, with results so indefinite that they were not published.

A series of sheep-feeding trials, carried out conjointly by the Cambridge Animal Nutrition Institute and the Norfolk Agricultural Station at Sidney Farm, Saxlingham, Holt, Norfolk, of which the writer has control, has fortunately provided material from which, by appropriate methods, can be worked out the real nutritive values not only of two widely different samples of swedes, but also of marrow stem kale and sugar beet tops.

Before proceeding further, it is obviously necessary to define what is understood by the term nutritive value. In the writer's opinion, which is backed by many years of experience in the conduct and interpretation of feeding trials, far the best measure of nutritive value is Kellner's starch equivalent, and the following calculations are accordingly concerned with the estimation of the starch equivalent of two samples of swedes, of marrow stem kale, and of sugar beet tops.

Estimating Starch Equivalent.—Kellner's original method of estimating the starch equivalent of a feeding stuff is well known and need not be described. It involves the use of a respiration chamber by means of which a complete carbon and nitrogen balance experiment can be carried out, and for this reason is beyond the scope of the ordinary experimenter. Kellner starch equivalents can, however, be estimated from an ordinary digestibility determination, provided a suitable

* *Jour. Agric. Sci.*, Vol. I, 1906, p. 89.

value number can be assumed, and this method has been frequently used. The ordinary experimenter, however, does not possess even the apparatus required for a digestibility determination, and this method, too, is therefore beyond his scope.

There is still a third method—to the writer's knowledge, unused heretofore—which is within the scope of any experimenter, and is capable of yielding accurate results of great practical value. This method and the results which it has given are described below.

The essence of this method is that when it is expressed in starch equivalent the average ration consumed by any lot of animals is equal to the average maintenance requirement plus the average gain in live weight multiplied by the weight of starch equivalent required to make 1 lb. gain in live weight. This is perhaps easier to follow if put in the form of a simple equation, thus:—

R = average ration per head per week in lb. starch equivalent.
 M = average maintenance requirement in lb. starch equivalent.
 G = average live weight increase per head per week in lb.
 K = weight in lb. of starch equivalent required to make 1 lb. of live weight increase.
 Then $R = M + G K$.

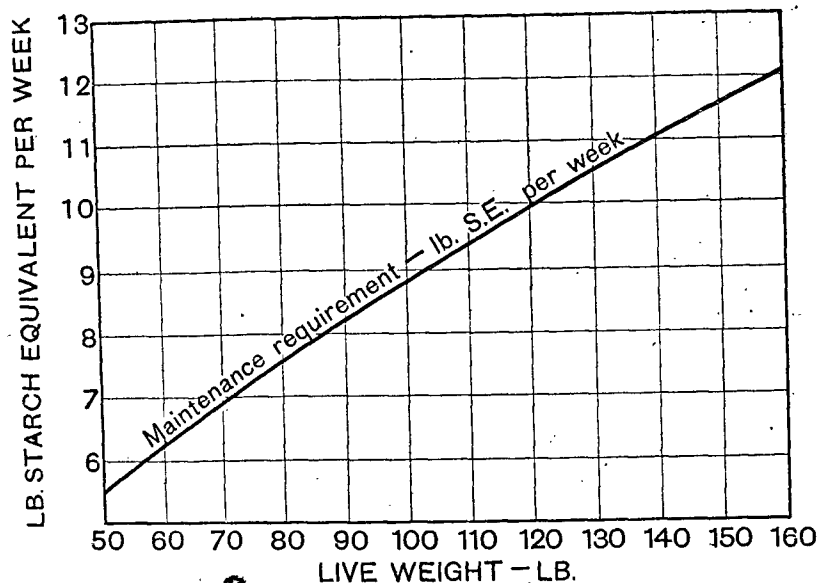


FIG. 1. Maintenance requirement of fattening Sheep.

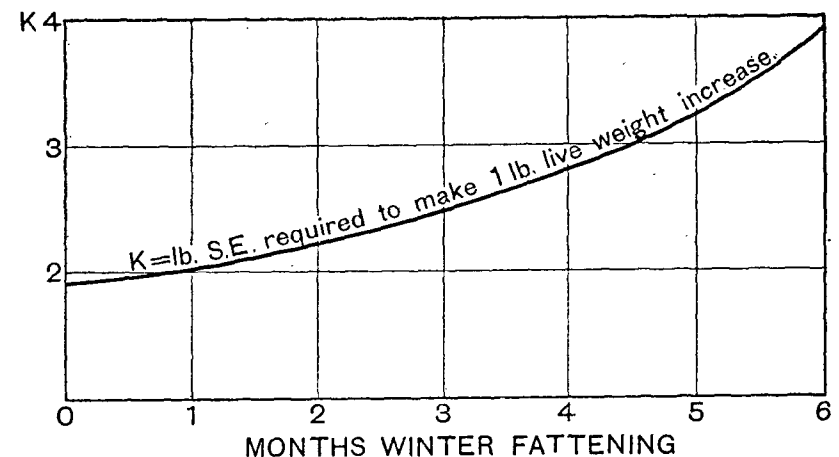


FIG. 2. Production requirement of fattening Sheep.

This equation has been found to be justified, provided the animals are quiet and contented so that they do not waste undue amounts of starch equivalent in movement.*

R can be readily calculated from the constituents of the ration.

M can be read off from the curve given in Fig. 1, which is based on the work of Capstick and Wood,† taking the average live weight of the animals during the experimental period.

G is calculated from the periodical weighings made during the course of the experiment.

K can be read off from the curve in Fig. 2 based on the work of the writer,‡ taking the value at the middle of the experimental period.

The experimental data required and the method of using them to calculate starch equivalents are shown below. The data are taken from the Saxlingham experiments already referred to,‡ which need no further description.

Starch Equivalent of Norfolk Swedes.—Experimental data:—

Average live weight of animals during experimental period = 102 lb., therefore $M = 8.9$ lb. S.E. per week.

Average ration per week during experimental period:—

Norfolk swedes 145 lb. = $1.45 \times x$ lb. S.E. if $x = \text{S.E. in 100 lb.}$

* "Production Requirement of Fattening Sheep." This JOURNAL, July, 1927, p. 295.

† *Jour. Agric. Sci.*, Vol. XVI, ii, 1926, p. 325.

‡ "Production Requirement of Fattening Sheep." This JOURNAL, July, 1927, p. 295.

Hay, good seeds 6.2 lb.=2.5 lb. S.E.
 Decorticated cotton cake .. 1.5 lb.=1.1 lb. S.E.
 Crushed barley 3.0 lb.=2.1 lb. S.E.

Therefore $R = 5.7 + 1.45 x$ lb. S.E. per week.

The experimental period covered the first $3\frac{1}{2}$ months of winter fattening. The middle point of this period is $1\frac{3}{4}$ months, at which date $K = 2.15$ lb. S.E. per lb. gain. Average gain in live weight per week, $G = 2.45 \pm .04$ lb.

Then, $R = M + G K$.

$$5.7 + 1.45 x = 8.9 + 2.45 \times 2.15$$

$$1.45 x = 8.47$$

$$x = 5.84 \text{ lb. S.E. per 100 lb. swedes}$$

Kellner's figure for starch equivalent per 100 lb. of swedes is 7.3 for average swedes containing 11.5 per cent. dry matter. These swedes contained 9.4 per cent. dry matter, which, if the dry matter bears a constant ratio to the starch equivalent, corresponds to $7.3 \times \frac{9.4}{11.5} = 5.95$ lb. S.E. per 100 lb.

swedes, showing a satisfactory agreement between the results of experiment and calculation.

Starch Equivalent of Fen Swedes.—For the purpose of this experiment, five acres of swedes of the same variety as those grown at Saxlingham were grown in Littleport Fen by Mr. Martin, the same delivery of seed being divided between the two places. They were sent by rail to Saxlingham, heaped on a barley stubble on which a similar number of sheep (50) were folded, their ration being the same weight of hay and concentrates as was given to the 50 sheep on Norfolk swedes, and all the cut Fen swedes they would eat. The actual weight of swedes consumed was 155 lb. per head per week.

Experimental data :—

Average live weight during experimental period, 98 lb.

Therefore $M = 8.7$ lb. S.E. per week.

Average ration per head per week during experimental period :—

Fen swedes, 155 lb.=1.55 x lb. S.E., if x =S.E. in 100 lb.

Hay, cake and barley as before=5.7 lb. S.E. per head per week.

Production requirement as before, 2.15 lb. S.E. per lb. gain.

Average gain in live weight per head per week,

$$G = 2.31 \pm .05 \text{ lb.}$$

Then, $R = M + G K$

$$5.7 + 1.55 x = 8.7 + 2.31 \times 2.15$$

$$1.55 x = 7.97$$

$$x = 5.15 \text{ lb. S.E. per 100 lb. swedes.}$$

Analyses of samples of these Fen swedes gave the average percentage of dry matter=8.1. Assuming, as before, that the starch equivalent is proportional to the dry matter, the

Kellner starch equivalent of these swedes should be $7.3 \times \frac{8.1}{11.5} =$

5.14 lb. S.E. per 100 lb. swedes. The agreement between the experimental figure and that calculated from the figure given by Kellner is almost too good.

The following table shows Kellner's figure, and the above two experimental figures for the starch equivalent of swedes as percentage of the dry matter :—

	Dry matter per cent.	Starch equivalent per cent.	Starch equivalent as percentage of dry matter
Kellner's figures ..	11.5	7.30	63.5
Norfolk swedes ..	9.4	5.84	62.1
Fen swedes ..	8.1	5.15	63.6

From these figures it is, in the writer's opinion, fair to conclude that the difference in the nutritive value of swedes grown in different districts is entirely accounted for by their variation in content of dry matter. The method of investigation proved very satisfactory, and might profitably be used to study the nutritive value of swedes grown in other districts, of varieties of swedes grown side by side and differing in dry matter content, and of other crops which are commonly used for folding sheep in the winter. The one considerable difficulty which it involves is the accurate estimation of the weight of roots or green fodder actually consumed.

It is, perhaps, noteworthy that the sheep under exactly similar conditions made rather smaller increases on Fen swedes than on Norfolk swedes, and one may well seek for an explanation of this. The Fen swedes had a considerable journey by rail and lorry, and had been out of the ground some time before they were sliced for the sheep. The Norfolk swedes were eaten quite fresh. Presumably for this reason the sheep found the Norfolk swedes rather more palatable, and consequently ate rather more in proportion to their dry matter content. The actual weights of dry matter consumed per head per week were : sheep on Norfolk swedes, 22.9 lb. (swedes 13.7) ; sheep on Fen swedes, 21.8 lb. (swedes 12.6). The writer has no doubt that this is the explanation of the lower rate of increase of the sheep fed on Fen swedes. The samples of Fen swedes for analysis were taken from the heaps which were being sliced for the sheep. Some evaporation

had probably taken place since the swedes were pulled. It is, therefore, likely that samples taken at Littleport would have contained even less than 8.1 per cent. of dry matter.

Starch Equivalent of Marrow Stem Kale.—It was suggested above that this method of estimating starch equivalent might be used for studying the nutritive value of other crops on which sheep are folded in the winter. Such a crop is marrow stem kale, which, on account of its great power of resisting drought on light land, is coming into continually increasing prominence. Kellner gives no figures for marrow stem kale, which was not known in his time. The figures given in *Rations for Live Stock*,* namely, 14.3 per cent. of dry matter and 8.9 per cent. of starch equivalent, were worked out, according to Kellner's formula, by the writer and Halnan from a small number of analyses and assumed digestibility co-efficients. For so important a crop they stand in urgent need of revision.

Accordingly, a third lot of 50 sheep were folded on marrow stem kale at Saxlingham in 1925-26, side by side with the two lots on Norfolk and Fen swedes. Numerous attempts were made to estimate the actual weight of kale consumed by the sheep. The methods tried were all based on weighing the crop on several small areas, averaging the weights, and calculating, from the average, the weight of kale on a fold of known area which the sheep cleared in a known time. The results, however, were entirely unsatisfactory. They indicated a rate of consumption far in excess of the possible appetite of the sheep, and at the same time it was noticeable that the sheep rejected considerable quantities of the harder parts of the stems and the older leaves. Attempts were also made to estimate the weight of the stems and leaves rejected, but with no success. Rejected leaves, especially, were so much contaminated with soil and water that their weight would have been meaningless. Such attempts as were made indicated a maximum figure of about 24 lb. of kale per day, from which an unknown but considerable weight of rejected leaves and stems must be subtracted.

The sheep evidently found the kale very palatable, and on this account it was decided that they would probably eat enough to supply them with the same weight of dry matter as was contained in the weight of Norfolk swedes eaten by the sheep folded alongside them. This was 145 lb. per head

* Ministry of Agriculture and Fisheries, Miscellaneous Publications, No. 32, Price 6d. net, post free.

per week of Norfolk swedes containing 9.4 per cent. of dry matter, i.e., 13.6 lb. of dry matter. Analyses of three samples of the kale, taken at intervals during the experiment, gave 88.81, 88.68, 88.64, average 88.7, per cent. of water, corresponding to 11.3 per cent. of dry matter. Consequently 120 lb. would be required to provide 13.6 lb. of dry matter, the weight of dry matter consumed per head per week in the form of Norfolk swedes.

This consumption of kale is $120 \div 7 = 17$ lb. per head per day. If this is correct something like $24 - 17 = 7$ lb. per head per day, or nearly 30 per cent. of the crop, must have been rejected, a figure which agrees as well as could be expected with the very rough estimates made of rejected leaves and stalks. It seems reasonable, therefore, to assume that the average consumption of kale was approximately 120 lb. per head per week. The following data are based on this figure.

Experimental data :—

Average live weight during experimental period, 103 lb.

Therefore, $M = 9.0$ lb. S.E. per head per week.

Average ration per head per week during experimental period :—

Marrow stem kale 120 lb. $= 1.20 x$ lb. S.E., if $x =$ S.E. in 100 lb.

Hay, cake and barley, as before $= 5.7$ lb. S.E. per head per week.

Production requirement as before 2.15 lb. S.E. per lb. gain

Average gain in live weight per head per week,

$G = 2.45 \pm .05$ lb.

Then, $R = M + G K$

$5.7 + 1.20 x = 9.0 + 2.45 \times 2.15$

$1.20 x = 8.57$

$x = 7.14$ lb. S.E. in 100 lb. kale

This corresponds to $7.14 \times 100 \div 11.3 = 63.2$ per cent. of starch equivalent in the dry matter. The figures given in *Rations for Live Stock* correspond to $8.9 \times 100 \div 14.3 = 62.2$ per cent., a sufficiently satisfactory agreement to confirm both figures. It also serves to suggest that, for swedes and other succulent crops grown for folding, the starch equivalent is approximately 62 to 63 per cent. of the dry matter.

The Starch Equivalent of Sugar Beet Tops and Crowns.—Sugar beet culture is extending rapidly, and its extension is likely to continue, at any rate whilst the home-grown sugar subsidy remains at anything like its present figure. Tops and crowns form so large a proportion—somewhere in the neighbourhood of one-third—of the total crop, that an estimate of their real nutritive value is very desirable. The writer, in *Rations for Live Stock*, gives the average percentage of dry matter in tops and crowns as 19.5 per cent., and the starch equivalent per 100 lb., estimated by Kellner's formula,

as 9.1. These figures were based on Kellner's digestibility co-efficients applied to a small number of analyses of English-grown produce before the War. Kellner, from his own investigations, gives 16.2 and 7.5 as the average percentages of dry matter and starch equivalent found. Recent, and as yet unpublished, analyses and digestibility determinations, carried out at Cambridge, confirm Kellner's figure for the average percentage of dry matter, but indicate that the percentage of starch equivalent is as high as 8.5.

In view of the importance of encouraging the proper use of sugar beet tops and crowns it was decided to attempt to estimate their starch equivalent by the sheep folding method. For this purpose 120 sheep were folded at Saxlingham during the autumn of 1926, half of them on swedes and half on sugar beet tops and crowns grown alongside. During the experimental period of 45 days, beginning on November 15, the sheep got per head per week 5 lb. of good seeds hay chaff, 1.64 lb. of crushed barley, and 0.82 lb. decorticated cotton cake meal. Those on the sugar beet tops and crowns were kept in their fold until they had cleared it up to the greatest extent which was possible. Many leaves were, however, trampled into the soil and rejected, and some of the crowns were also left, presumably those which through having gone to seed were hard and woody. If they had cleared up completely, their maximum consumption of tops and crowns estimated, as in the case of the kale, by weighing tops and crowns on several small areas, would have been 142 lb. per head per week. The large proportion rejected showed that actual consumption did not reach anything like this figure. Weighing the rejected portions was useless. They were too heavily contaminated with soil and water. It was, therefore, necessary to fall back on the unsatisfactory expedient of estimating the consumption by assuming that the sheep ate that quantity which would make the dry matter of their total ration up to 22 lb. per head per week, the average dry matter consumption of sheep of their live weight as recorded in preceding experiments at Saxlingham.

The Saxlingham tops and crowns contained on the average 16.2 per cent. of dry matter. The hay, barley and cake eaten by the sheep contained 6.5 lb. of dry matter per head per week. They should have eaten, therefore, $22 - 6.5 = 15.5$ of dry matter as tops and crowns, which corresponds to $15.5 \times 100 \div 16.2 = 93$ lb. of tops and crowns. If this is correct they must have rejected about one-third of the tops and crowns left on the

land, or much the same proportion as was estimated to have been rejected in the case of the marrow stem kale.

Experimental data :—

Average live weight during experimental period, 96 lb.

Therefore, $M = 8.6$ lb. S.E. per head per week.

Average ration per head per week during experimental period :—

Sugar beet tops and crowns . . . 93 lb. = .93 x if x = S.E. per 100 lb.

Seeds, hay, chaff 5 lb. = 2.00 lb. S.E.

Crushed barley 1.64 lb. = 1.10 lb. S.E.

Decorticated cotton cake meal .82 lb. = .56 lb. S.E.

Production requirement at middle day of first 1½ months,

$K = 2$ lb. S.E. per lb. live weight increase.

Average gain in live weight per head per week, $G = 1.63$ lb.

Then, $R = M + G K$

$.93 x + 2.00 + 1.10 + .56 = 8.6 + 2 \times 1.63$

$.93 x = 8.2$

$x = 8.8$ lb. S.E. per 100 lb. tops and crowns.

This figure is slightly higher than a recent estimate made at Cambridge on the basis of Kellner's formula applied to average composition and recently determined digestibility coefficients. It indicates that the starch equivalent is only 54 per cent. of the dry matter, a much lower proportion than that found in swedes and kale. The estimate of the actual consumption of tops and crowns was, however, so unsatisfactory that the writer has only described the experiment as an example of this method of estimating starch equivalent, showing the main difficulty in using the method in the case of green crops folded on the land, namely the difficulty of estimating the actual weight consumed.

Summary.—(1) A description is given of a method of estimating the starch equivalent of feeding stuffs. It can only be applied to such feeding stuffs as can make up the greater part of a ration.

(2) The method involves nothing more than a carefully conducted feeding trial which must be so arranged that the feeding stuff on trial forms the greater part of the ration.

(3) The starch equivalent of two samples of swedes have been estimated and shown to be in each case very nearly 63 per cent. of the dry matter, from which it is argued that swedes from different districts only differ in nutritive value in proportion to their dry matter content.

(4) The method has also been used to estimate the starch equivalent of marrow stem kale and sugar beet tops and crowns, but, on account of the great difficulty of estimating correctly the actual weight of these fodders consumed by the sheep, the results must be regarded as of a tentative character only.

ACCESSORY FOODSTUFFS FOR USE WITH CEREALS IN PIG FEEDING

CHARLES CROWTHER, M.A., PH.D.,

Principal, Harper Adams Agricultural College.

CEREAL meals (milling offals, barley and maize meals) have always figured largely in the feeding of the pig, and, even with the wealth of feeding stuffs open to our choice to-day, few rations are compounded which do not include a large proportion of this class of food. It has always been recognized, however, that a diet of cereal meals, alone, does not produce entirely satisfactory results, and that, in particular, an addition of separated milk or whey to the cereal diet effects a very marked improvement.

So marked indeed is the improvement that, in wide circles of farmers, the idea at one time became prevalent that profitable pig feeding could not be carried on as a regular part of farm routine except in immediate association with dairying. Only when bacon prices were high and the cost of feeding stuffs low, did the non-dairy farmer concern himself much with pig feeding, and the irregularity of his pig-feeding activities contributed, as it still does, to create the familiar instability of the pig market, with its regular cycles of high and low prices and supplies.

The deficiencies of the cereal meals presented a less serious problem in the days when the pig could be grown slowly as a "store," and finished off separately at a year old or more as a large fat bacon pig, than they do to-day when the main demand is for a comparatively small and lean bacon pig, and consequently all our effort needs to be directed towards growing and fattening the pig simultaneously in the shortest possible time.

These deficiencies show themselves mainly in the rate of growth of the pig, as distinct from fattening, and once the greater part of the growth has been secured, the subsequent fattening can be effected quite satisfactorily on a diet of cereal meals alone.

The question to be answered, therefore, is: What supplements to cereal meals are necessary in order to ensure a satisfactory rate of growth? We have already alluded to the great advantage derived from a supplement of separated milk and whey. This may be illustrated by the results of a comparison made with lots of 10 pigs each, in an experiment carried out at the Harper Adams College in 1923, as summarized below:—

	Average live weight gain per day lb.
Cereals alone (average of 3 lots)	0.75
Cereals + bean meal (25 per cent.)	0.83
Cereals + pea meal (25 per cent.)	1.03
Cereals + separated milk	1.53
Cereals + whey	1.46

The addition of bean meal or pea meal to the cereal diet produced a certain amount of improvement, but far short of that given by milk or whey. The value of other supplements will be discussed below, but it may be admitted at once that no meal supplement has yet been devised which produces results quite equal to those obtainable with separated milk, although the gap is being steadily reduced.

In examining the composition of separated milk to obtain guidance as to possible causes of the improvement it effects, three items may be noted from which possible advantage may accrue, *viz.*, its richness in proteins, soluble mineral matters, and vitamins.

The Protein Factor.—With regard to proteins, we have good reason to believe that the proteins of cereals and cereal meals are inadequate, from the point of view both of quantity and of quality, for the needs of the growing pig. Generally speaking, one would wish to have not less than 20 per cent. of protein (say 15 to 17 per cent. digestible protein) in the ration of the young growing pig; but the best milling offals will only contain about 17 per cent., whilst barley and maize meals contain much less. Separated milk, on the other hand, contains (in its dry matter) as much as 35 to 40 per cent. of protein, practically all digestible. An addition of separated milk to a cereal ration thus effects a very substantial increase in the amount of protein supplied.

With regard to the "quality" of cereal proteins, the research of recent years has revealed that they are in certain respects defective in their "make-up" for the purpose of manufacturing the proteins of the body, which constitute a great part of new growth (flesh, blood, etc.) American experiments with calves and pigs have demonstrated that the proteins of wheat or maize are by themselves ill-adapted for meeting the protein needs of the growing animal. The proteins of milk, on the other hand, provide all that is necessary in this respect and thus can remedy the defects of the cereals.

It seems probable that this "quality factor" in the proteins of milk may be more important than the influence of the increased quantity of protein, since the latter can hardly

furnish an explanation of the beneficial effects of whey, which contains (in its dry matter) only about 10 per cent. of protein. Whatever the precise nature of the effect may be, it would appear certain that some part of the explanation of the defects of the cereal diet must lie in the protein supply, since, with the exception of whey, all other foods which have been found to confer a sensible improvement on the cereal diet are rich in protein.

The Mineral Factor.—With regard to mineral matters the position is, perhaps, simpler. We need only recall the importance of sound bone development, in determining satisfactory growth, in order to emphasize the importance of a suitable supply of mineral matters in the diet of the growing animal. Generally speaking, fully one-half of the dry substance of the bone consists of mineral matters of various kinds, of which by far the most abundant is the combination of phosphoric acid and lime known variously as tricalcic phosphate, phosphate of lime or bone phosphate. Obviously, therefore, the supply of phosphoric acid and of lime must be of vital importance to the young, growing animal. With regard to these ingredients we find that cereals and the meals prepared from them, although well provided with phosphoric acid, are mostly very deficient in lime. Practical experience demonstrates that this shortage of lime is an important contributory cause of the defects of the cereal ration, and an addition of lime in some form usually effects a marked improvement. Some, indeed, are inclined to give the major part of the credit for the improvement effected by certain additions to the cereal ration, such as fish meal, to the improved supply of lime and possibly other mineral ingredients thereby provided, but such an extreme view is hardly warranted as yet by the experimental evidence available.

That the mineral factor alone is not sufficient to explain the inferiority is indicated by recent experiments at the Harper Adams College, in which a ration of cereals, plus minerals, gave results decidedly inferior to those obtained with the same rations to which a supplement rich in protein was added, as indicated in the following summary :—

Ration	Average gain per head in sixteen weeks lb.
Cereals + minerals	112.5
Cereals + minerals + bean meal	143.7
Cereals + minerals + soya meal	147.0
Cereals + minerals + groundnut meal	138.0
Cereals + fish meal	141.4

These results confirm the view, expressed above, that some supplement of protein to the cereal ration is essential for securing efficient utilization.

We referred above only to lime and phosphoric acid, but there are other mineral matters essential to normal growth, such as potash, soda, iron and iodine, and it may be that the cereal ration is, also, either deficient or badly balanced with regard to one or more of these, but evidence as to this is very scanty as yet. Here and there, practical rearing difficulties have been met with which seemed to be clearly due to deficiency of iron in some cases, and of iodine in others, but the only mineral shortage which can definitely be said to be widespread is that of calcium or lime.

The Vitamin Factor.—As to the vitamin factor in determining inferiority of plain cereal rations, whilst it is true that milk is normally well supplied with the growth-promoting vitamins (A and D), no great merit in this respect can be claimed for separated milk, since these particular vitamins will tend to accompany the fat into the cream. Moreover, some of the “accessory foods,” which produce a marked improvement in the cereal ration, are also not of much importance as sources of the vitamins A and D. Other vitamins are doubtless supplied by separated milk and the other “accessory foods,” but we have no reason to think that the cereals themselves are specially deficient in these items. On the whole, the evidence, obtained under the conditions of practical pig feeding, gives no indication of any widespread trouble due to vitamin deficiency ; and it seems likely that any part this factor may play in determining the inferiority of the cereal ration is of minor practical importance compared with the protein and mineral factors. The supply of green food, which is a usual feature of good pig management, will generally provide an adequate safeguard against vitamin deficiencies, and must certainly not be overlooked in the case of pigs reared entirely in confinement.

Of the various “accessory foods” which are now known to produce a marked improvement in the cereal ration the chief are the following : milk and milk products in both the liquid and the dried or partly dried form, dried blood, meat meal, fish meal, whale meat meal, dried yeast, bean meal, pea meal, soya meal and groundnut meal. Notes on each of these are appended.

Milk and Milk Products.—On the dairy farm, milk may be available for pig feeding in the four forms of whole milk,

separated (or skim) milk, buttermilk, and whey. The following figures give a general idea of the composition of these materials:—

	Whole milk	Separated milk	Skim milk	Butter- milk	Whey
	per cent.	per cent.	per cent.	per cent.	per cent.
Moisture ..	87.2	90.6	90.3	90.8	93.4
Protein ..	3.4	3.5	3.5	3.6	0.7
Fat ..	3.9	0.1	0.4	0.8	0.2
Sugar ..	4.8	5.0	5.0	4.1	5.0
Mineral matters ..	0.7	0.8	0.8	0.7	0.7
Starch equivalent	17.1	8.3	9.1	9.2	6.1

It will be noted that, apart from whey, the only marked difference is in the proportion of fat, though buttermilk is also a little down in milk-sugar. Whey is not only poor in fat, but also in protein, as compared with the other products.

The starch equivalents suggest that whole milk should have, roughly, twice the feeding value of separated milk, skim milk or buttermilk, and three times the feeding value of whey. Practical feeding tests with pigs, carried out on a very large scale in Denmark and Sweden, roughly confirm these relative values, so far as milk and separated milk are concerned, but give a slightly lower value to whey, namely one-half that of separated milk. These Scandinavian tests indicated that 3½ lb. of whole milk or 6 lb. of separated milk or 12 lb. of whey would replace 1 lb. of mixed cereal meal. Skim milk and buttermilk will vary considerably in value according to the degree of completeness with which the cream or butter has been removed, but, generally speaking, should have a slightly higher feeding value than separated milk. It is assumed, of course, that the buttermilk has not been diluted with water.

Apart from whey, the outstanding characteristic of all these dairy products is their richness in protein, which forms, in each case, roughly one-third of the total nutritive matters present. They possess also the advantage of easy digestibility with regard to all ingredients, and their mineral matters, whilst present in comparatively high proportion in relation to the mineral needs of the body, are also admirably balanced in nature for meeting the needs of growth. Thus, three-quarters of the mineral matter consists of lime, phosphoric acid, and potash in, roughly, equal proportions.

Whey, on the other hand, is no richer in protein than the cereals, the "dry matter" of whey containing only about 10 per cent. of protein, though this is probably of better "quality" for the purposes of growth than the cereal protein. It is probably desirable, however, to supplement whey with a little

food rich in protein. The mineral matters of whey are distinctly poorer in lime than those of separated milk, so that it is not as effective as the latter for remedying the lime-deficiency of the cereals. It would seem desirable, therefore, when using whey, to supplement it with a little food rich in protein and lime (*e.g.*, fish meal or medium grade meat meal).

In order to secure the maximum value from milk and liquid milk products, it is desirable to maintain a reasonable balance between the amount of milk and the amount of meals consumed. American and Danish experiments on this point suggest that the best ratio is about 5 lb. of milk to 1 lb. of meal for young animals, reduced to 3 lb. of milk to 1 lb. of meal for older animals, or say 1 gal. of milk to every 2-3 lb. of meal according to age.

In addition to milk, and the foregoing milk products, produced directly on the farm, the same materials can now be obtained in dried or semi-dried form as dried milk (whole or separated), condensed milk (whole or separated), dried buttermilk, semi-solid buttermilk, whey paste and dried whey. Broadly speaking, all these products retain the nutritive virtues of the raw materials from which they are produced, and consequently must be regarded as feeding-stuffs of the highest quality, although, in certain respects (such as digestibility, physical character of some of the ingredients, and vitaminic efficiency), they are not quite equal to the fresh, liquid, raw material. For practical purposes, however, they may be valued by comparison with the raw materials on the basis of equal dry matter content. Thus 1 lb. of dried separated milk may be regarded as roughly equivalent to 1 gal. of liquid separated milk, the latter containing approximately 1 lb. of dry matter. Similarly, 1 lb. of dried whey may be taken as roughly equivalent to 1½ gal. of liquid whey. A similar basis of valuation may be taken for the "condensed" or "semi-solid" products, although, in the case of whey, the value of the product may have been lowered somewhat by the removal of the albumin in the course of the concentration process.

Buttermilk also differs in one respect from the other products, in that, being produced normally from soured cream, it contains a certain percentage of lactic acid which may, conceivably, under certain conditions, exercise beneficial effects upon the digestive system of the animal. Certainly practical experience with condensed buttermilk appears to have been generally favourable, apart from the disadvantage which it suffers in common with most of these manufactured milk products of

being unobtainable at an economic price. The data in the following table will give an idea of the general composition of these milk products:—

	Dried whole milk	Dried separated milk	Con-densed whole milk (unsweet-ened)	Con-densed separated milk (unsweet-ened)	Dried butter-milk	Semi-solid butter-paste	Whey	Dried whey
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Water	4.2	10.2	61.4	68.6	10.0	70.4	44.4	7.2
Fat ..	26.5	0.3	11.4	.3	11.2	3.7	1.3	3.0
Lactose	37.4	48.8	14.0	15.7	*24.3	*8.0	*27.8	*68.4
Protein	25.5	32.8	11.2	12.4	42.3	13.9	17.2	13.6
Ash ..	6.4	7.9	2.0	3.0	12.2	4.0	9.3	7.8
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Containing lactic acid *? *4.3 *? *2.7

Bean and Pea Meals.—Before the War, these meals were probably the most widely used in association with cereals in pig feeding, where milk was not available. They are the most nitrogenous foods that can be grown successfully on our farms, and, for long, represented the only foods rich in protein and suitable for the pig that were generally available. Linseed cake was usually too dear and could, in any case, only be used to a very limited extent, whilst cotton cake was rightly condemned as unsuitable, and practically no other highly nitrogenous feeding stuffs were available in large quantities.

Both beans and peas contain usually about 23 to 25 per cent. of protein, and, when used in moderation, do not unfavourably affect the quality of the bacon, although, when more freely used, they tend to produce an undesirable hardness in the cured meat. Generally speaking the various types of beans in the market (field beans, Rangoon beans, etc.), if in good physical condition, seem to have pretty much the same nutritive value, but the soya bean must not be included with them, as it is an entirely different article.

Although the addition of beans or peas to the cereal ration usually produces a marked improvement, it still leaves much to be desired; and the results of recent experimental work suggest that the mineral constitution of the ration containing bean or pea meal is still defective. Thus in the Harper Adams experiments, quoted above (p. 708), the results obtained by adding bean meal *plus minerals* to the basal cereal ration were

practically equal to those obtained with any of the other supplements, and this experience has been confirmed elsewhere. In these experiments bean meal formed about 20 per cent. of the total food, and mineral mixture, rich in lime, was added to the extent of about 2 per cent. It is doubtful wisdom, however, to include bean or pea meal beyond about 25 per cent. of the total ration, as otherwise the above-mentioned detrimental influences upon the quality of the product are liable to become unduly prominent.

Dried Blood.—This material, as its name implies, consists of the solid matters of blood remaining after removal of the water by evaporation. The blood is usually heated until fully clotted, the clot being then removed and thoroughly dried by heat, and the resultant dark brown or black residue ground to a meal. When prepared from fresh blood and quickly dried, it is obtained in a tasteless, odourless form, and, if thoroughly dried, keeps well. Almost needless to say, only the blood of perfectly healthy animals is suitable for the manufacture of dried blood intended for use as food. The composition is usually somewhat as follows:—

Moisture	..	..	..	..	10 per cent.
Protein	..	..	..	..	85 "
Oil	..	..	..	..	1 "
Carbohydrates	..	..	..	..	1½ "
Ash	..	..	..	..	2½ "

It is thus extraordinarily rich in protein, and, moreover, this protein is of excellent quality for flesh formation. On the other hand, it is distinctly poor in mineral matters, and should in practice be supplemented by an addition of about 2 per cent. of a mineral mixture rich in lime. The proportion of dried blood that can safely and economically be introduced into feeding rations will usually be about 5 to 7 per cent., and when mixed in this proportion with cereal foods excellent results have been obtained. Unless great care is exercised, however, to avoid excess, it is liable to have an unduly laxative effect. Moreover, if used injudiciously, the quality of the carcass may be impaired. Excellent results have been obtained by its use in many cases with backward or unthrifty animals.

Meat Meal.—This is another product of the slaughter house, obtained by drying down the wholesome offal, scraps, blood, etc., that cannot be utilized for human consumption. Other meat waste may also be included in the raw material which is dried down. In the course of the drying a considerable proportion of the fat is melted and run off, but the final product is still liable to contain rather a large proportion of fat, which

detracts from its value in pig feeding, since such fat is not conducive to high quality of the bacon. This objection is overcome, in some of the modern meat meal manufacturing plants, by subjecting the material to extraction with benzine, which dissolves out the greater part of the fat.

A meal, made purely from meat, would contain 70 to 75 per cent. of protein, but this class of material is rarely obtainable, as the process of removing all bone from the carcasses, etc., would be too expensive. The material most commonly supplied contains a proportion of bone, which reduces the protein to the region of 50 to 60 per cent., but, at the same time, furnishes an appreciable proportion of phosphate of lime, in which the meat itself is deficient. The class of meat meal which is probably most generally useful contains about 60 per cent. protein with about 15 per cent. phosphate of lime and not more than 5 per cent. of fat. Some meat meals, however, contain as little as 45 per cent. protein and would be more correctly described as "bone and meat meals." In buying meat meal, therefore, it is important to obtain the proper guarantee of composition, and in view of the risk of infected materials having been used in the manufacture, it is also desirable to have some assurance that the material is wholesome and safe for use as food for live stock. The fact of the material having been thoroughly heated in its manufacture cannot by itself be regarded as an adequate safeguard. It is further desirable that the meal should be well-ground and free from sharp splinters of bone.

The proportion of meat meal which should be introduced into rations will vary with its richness in protein, but with meal of average quality a proportion of about 10 per cent. is usually ample and has produced excellent results both in experiments and in commercial practice. If the meat meal is rich in fat, it is probably best to restrict the proportion to 5 per cent. and make up the balance of protein required with some other food rich in protein and poor in oil, such as dried blood or extracted soya meal.

Fish Meal.—This product is similar in general character to meat meal, being produced by the drying of surplus fish and fish offal, including a varying amount of bone. In this case, however, there arises the important consideration that fish has a distinctive flavour, in some cases very pronounced, and unless special precautions are taken as to the class of raw material used, and in the use made of the fish meal, there is serious risk of a fishy taint being imparted to the bacon. The production of this taint is commonly associated with the fish oil, although

the experimental evidence on this point is not very conclusive, and it is generally agreed, therefore, that the proportion of oil in fish meal should be kept as low as possible. With this object in view, the more reputable manufacturers confine their raw material to the class of fish described in the trade as "white fish," excluding all strongly flavoured and oily material such as comes from herrings, etc. Further, in view of the sensitiveness of the pig to excess of salt, it is necessary that salted materials shall also be excluded.

Unfortunately, with the growth of the demand for fish meal, a good deal of material has been placed upon the feeding stuff market which does not comply with these requirements and is more fitly described as "fish manure." It is necessary, therefore, to use very great care in the purchase of fish meal, and in particular to regard with the gravest suspicion all meals containing a high proportion of oil or having an offensive smell. For the safeguarding of the purchaser in these respects, the leading manufacturers have adopted a standard warranty for fish meals intended for feeding purposes, in accordance with which the material is marketed under the definite name of "White Fish Meal," and guaranteed to contain not less than 55 per cent. of protein and 16 per cent. of phosphate of lime; and not more than 5 per cent. of oil and 4 per cent. of salt. The prospective buyer should, therefore, insist upon a warranty in these terms, and should reject any material for which such a warranty cannot be obtained. It may be noted that under the Fertilizers and Feeding Stuffs Act, 1926, it is an offence to sell as "White Fish Meal" an article containing more than 6 per cent. of oil or 4 per cent. of salt.

Such a meal, as described above, should be light-brownish in colour, well-ground and free from large pieces of bone, and should not have more than a stale fish smell, certainly nothing approaching the offensive smell associated with putrid fish. The moisture content is usually below 12 per cent., and, in this condition, the meal will keep in sound condition for many months in a dry store.

Of all the substitutes for milk used in pig-feeding fish meal has, in recent years, proved the most popular. After preliminary experiments at Seale-Hayne College (1913) and at Garforth (1915) had drawn attention to its outstanding merits the use of fish meal spread rapidly in practice, not only in pig-feeding, but also on poultry farms, until the demand soon exceeded the possible supply of legitimate "White Fish Meal," and led to the abuses referred to above, which unfortunately still

persist. Further experiments on a more extended scale have fully confirmed the earlier results and have established beyond question the high value of this feeding stuff as a supplement to cereal foods in the rations of the growing pig, the chicken, and the laying hen.

Much controversy has arisen, however, upon the question of the degree of risk of taint associated with the use of fish meal. On the one hand the bacon curers, having suffered great losses through undoubtedly tainted carcasses, are unsparing in their condemnation of the use of fish meal of any kind; whilst, on the other hand, experiments have repeatedly shown that where suitable material is used, under properly controlled conditions, no risk of taint need arise, especially if the use of fish meal is discontinued for a short time before slaughter. On a large number of farms, however, these necessary precautions are not observed, little care being exercised either to ensure that the fish meal purchased is the legitimate type of feeding meal described above, or to avoid excessive use. It is these feeders who create the taint problem and justify the refusal of fish-meal fed pigs by the curers, who can hardly be expected to be able to exercise a nice discrimination between the careful and careless users.

Experience has now quite definitely established the conditions necessary to avoid trouble, namely that the meal shall be a genuine "White Fish Meal," and that it shall not form more than 15 per cent. of the ration in the earliest stages, and 5 per cent. in the latest stages of feeding, up to the last week or two, when its use should be entirely discontinued. Incidentally, it may be said that, quite apart from the question of taint, the above proportions probably represent the limits of economy in the use of fish meal, so that there is no excuse for more lavish use. No feeder who is not prepared to adopt the above precautions and ensure that they are carried out in the piggery should use fish meal at all.

The special value of fish meal in pig feeding is not confined to the increased rate of growth secured by its use, but it is the common experience that it exercises a beneficial influence also upon the general health of the pigs. These combined advantages have been variously attributed to the proteins, vitamins, and the mineral salts (especially phosphate of lime) supplied by the meal, but there is some reason to think that the combined influence of these factors does not entirely account for the improvement effected. More recently, the suggestion has been made that the small quantity of iodine contained

in the meal may be a deciding factor, and experiments upon this point are now in progress.

Whale Meat Meal.—This product is closely allied to fish and meat meals, being, as its name implies, prepared from the residues of whale meat, after removal of the blubber. The difficulties of drying this material in sufficiently fresh condition appear to have been largely surmounted, and, as now marketed, it forms a wholesome meal with which very good feeding results have been obtained. It usually contains rather a high content of oil (10 to 12 per cent.), which must be regarded as a disadvantage from the point of view of the production of bacon of high quality. The protein content usually runs much the same as in fish and meat meals. Mineral matter inclines to be low in pure whale meat, but this deficiency is easily rectified.

Dried Yeast.—Although a vegetable product, dried yeast in many respects resembles the foregoing protein-rich foods of animal origin. It is made by drying the surplus yeast of the breweries, with or without special treatment to remove the ingredients which impart the bitter unpalatable taste to raw yeast. Generally speaking, the presence of these bitter principles is of no serious detriment in yeast intended for live stock, since there is usually little difficulty in inducing stock, especially pigs, to consume it. Yeasts may vary considerably in protein-content, so that the guarantee of this ingredient is essential, but the usual grades of dried yeast contain about 45 per cent. protein. Oil is very low, which must be accounted an advantage. The fresh yeast is rich in vitamin B, but the activity of this is probably very considerably reduced in the drying process. Usually the drying will destroy the vitality of the yeast cells, so that the dried yeast can be mixed with the other foods of the ration without risk of undue fermentation.

In pig-feeding tests with dried yeast, made at Garforth in 1916, using it to the extent of about 10 per cent. of the meal supply, good results were obtained, and these have been subsequently confirmed in practice, as also with poultry.

Soya Bean Meal.—This meal represents the residue after the removal of most of the oil from soya beans, and may be either soya cake meal or extracted soya meal. The essential difference between these two classes is the higher content of oil in the cake meal, and, since soya oil has rather pronounced laxative properties, preference is generally given to the extracted meal.

This extracted meal usually contains about 45 per cent. of protein and 1 to 2 per cent. of oil, but, in order to get the best

results, a supplement of mineral matter rich in lime is necessary. The quality of the soya proteins for the purposes of flesh formation seems to be excellent, and in recent experimental work with rations containing up to about 12 per cent. of soya meal, together with 2 per cent. of steamed bone flour or mineral mixtures, rates of growth equal to those obtainable with equivalent quantities of meat or fish meals have been obtained. Similarly good results have also been obtained by the use of soya meal in the feeding of poultry for egg production. It is probably desirable, however, both with pigs and poultry, to keep the proportion of soya meal within the limits above indicated, since in certain cases distinctly unfavourable effects have been produced with higher quantities.

Decorticated Groundnut Meal.—This product is similar in general character to soya meal, being the residue remaining after the removal of oil from groundnuts by commercial processes of pressure or extraction. In the case of groundnuts, however, it is necessary to bear in mind that the nuts are carried in a fibrous shell, more or less of which may be incorporated in the meal. Where no special effort is made to remove this shell, the product obtained is properly described as undecorticated groundnut cake or meal and is quite unsuitable for pig feeding. For this purpose the only class of meal that will serve is the decorticated meal prepared from nuts from which the shells and a good part of the actual skin of the nuts have been removed. This material is obtainable in the two forms of "cake meal" or "extracted meal," differing, as in the case of the corresponding soya meals, essentially only in their oil content, this being the higher in the "cake meal." As groundnut oil has no detrimental effect upon the general welfare of the pig, it is a matter of little consequence which of the two forms of meal is used, but considerations of the possible detrimental influence of the oil upon the quality of the bacon will usually incline the choice in favour of the extracted meal, which has the further merits of being the lower-priced and the richer in protein.

A good extracted groundnut meal will contain from 50 to 55 per cent. of protein, along with 1 to 2 per cent. of oil. As with soya meal, its mineral matters are defective in amount and kind for the purposes of growth and need to be supplemented, especially with respect to lime. Excellent results have been obtained in recent pig-feeding experiments with rations containing about 10 per cent. of groundnut meal, along with about 2 per cent. of mineral mixture, the rates of

growth obtained being practically equal to those obtained with equivalent quantities of fish or meat meals.

Summary.—(1) Attention has been directed above to the fact that rations consisting solely of cereal foods are incapable of giving satisfactory results with growing pigs. (This statement might be applied generally to all classes of young, rapidly growing live stock.)

(2) For the purposes of production of flesh and bone, the cereal foods are not only defective in the amount and "quality" of their proteins, but in the amount and "balance" of their mineral matters, being particularly poor in lime. Further, under certain conditions of feeding their poverty in the growth-promoting vitamins may be a factor of practical importance.

(3) The best supplement to the cereal ration is milk, either as such or in the form of the liquid dairy by-products, such as separated (or skim) milk, buttermilk and whey. Whole milk is probably the most efficient of all substitutes, but is closely followed by separated milk and buttermilk. Whey will generally have about one-half the value of separated milk. Probably, the next best substitute for the liquid milk-products will be the condensed and dried forms of these products, but their value is commonly more than neutralized by considerations of cost.

(4) For the pig feeder who is unable to command supplies of milk or milk-products, a choice of various feeding meals is available which when blended in quite small proportions, usually about 10 per cent., with cereal meals will produce results not far short of those obtainable with milk, the somewhat slower rate of growth being usually compensated by lower feeding costs. Certain of these materials, such as meat meal, dried blood, fish meal and whale meat meal, are, like milk, of animal origin; but equally good results are obtainable under proper conditions with various materials of vegetable origin such as dried yeast, bean meal, pea meal, soya meal and groundnut meal. In the last-named cases, however, as in the case of dried blood, it is essential that a small proportion (usually about 2 per cent.) of mineral matter rich in lime shall be fed with the meal.

The proportion of these special meals included in the ration is usually kept within the region of 10 per cent., or such proportion as supplies roughly the same amount of protein as 10 per cent. of fish meal, and it is doubtful economy to go far beyond these limits. These special supplements are most effective during the earlier stages of the life of the pig, when it

is growing quickly, and the proportions used may be reduced with advantage in the later stages.

The influence of these supplements upon the quality of the final product is less satisfactory than their influence upon the rate of growth, and in many cases special care is necessary to avoid the production of a distinctly inferior quality of bacon. The point is one upon which existing knowledge is very inadequate, and further investigation is urgently needed.

WINTER FEEDING OF DAIRY COWS

R. BOUTFLOUR, M.Sc.,

Director, Department of Dairy Husbandry, Harper Adams Agricultural College.

IN many parts of the country there are dairy farmers who have relied upon hay as the only home-grown feeding stuff for their cows, but owing to the bad weather conditions this year at hay-time, much of the hay has been damaged. The question asked in such cases is how to feed cows during the coming winter.

Where the farmer has good hay left over from the previous year, or has made sufficient good hay for his cows this season, no difficulty arises. On many farms, however, the position is that the hay can be grouped under three heads: (1) Good hay; (2) moderate hay; and (3) bad or ruined hay.

The first thing to be realized is that group 3 (bad hay) is of little value to the dairy farmer for his cows, for it has lost its value as a feeding stuff much as though it had been partly burnt. If such hay is fed to cows it may lead to indigestion and death. If the value of hay has been lost in the making it is poor consolation to lose good cows in the consuming of it. Where the hay on any farm is all of this type there is unfortunately no alternative but to purchase (a) hay, or (b) straw, plus sugar beet pulp or roots. Happily not many farmers are in this position, most of them having some hay that has not been ruined.

The good and the moderate hay should be fed concurrently, i.e., if the farmer has one-third good hay and two-thirds moderate hay, then the cows should receive one feed of good and two feeds of moderate hay per day, so as to keep the hay supply to the cows more or less uniform throughout the winter. It is a mistake to feed all the best quality hay at one time of the year and the poorer at another time.

The bulk of the hay fed must be strictly controlled, allowing not more than a total of 20 lb. per cow for cows giving three gallons of milk or less per day, and reducing this amount to the

higher-yielding cows in proportion to the increase in cake. The hay that should be reduced for the higher-yielding cows is the moderate hay, leaving them as far as possible the better hay on the farm.

Where most of the hay is moderate its feeding value will be low and consequently it will be necessary to supplement it with other foods to provide a maintenance ration. This can be done by supplementing the hay with 2 to 3 lb. of cereals or rice meal or maize meal, or of the ordinary ration, or by reducing the quantity of hay from 20 lb. to 14 lb., and feeding 6 lb. of sugar beet pulp per cow. It is preferable to do this rather than to increase the quantity of the hay, for if this is done it means that the bulk of the ration will be too great, and will not permit of the cows dealing efficiently with the production ration. If hay is poor but plentiful it may be fed in large quantities, the cows being allowed to pick out the better portions; it is, however, then necessary to put a time limit upon them, and remove the hay that is left 20 minutes after it has been given to them. The hay should be given in three small feeds—after milking in the morning, at noon, and as late as practicable in the evening. Great care should be taken that the evening feed is no greater than the other feeds, for if it is too bulky it leads to indigestion, which does not permit of the digestive organs resting in preparation for the next day's work. If the hay is properly controlled it is surprising how little is required, especially if the herd is a high-yielding one. The writer does not reckon to use more than one ton of hay per cow per winter.

The chief difficulty about this year's hay crop, however, lies not so much in its loss of feeding value, as in the fact that most of it is of a binding nature, and not sufficiently laxative when fed in the ordinary way with ordinary rations. The keeping down of the bulk will largely counteract this, and the difficulty can be overcome by feeding laxative production rations. In most cases a balanced ration low in fibre will give this result, such as the following:—

1 part decorticated ground nut cake	
2 parts rice meal	
2 parts palm kernel cake	
1 part linseed cake	
} 3½ lb. per gallon.	

Where, however, this is not sufficient, then one of the best recommendations is to feed all cows for the first gallon with 3½ lb. of coconut cake. The cake should be soaked overnight, thus allowing it to swell up into a thick porridge, and then fed to the cows as the first feed of the day. If coconut cake is not available, then 5½ lb. of bran, fed as a mash, or 16 lb. of wet

grains may be used for the first gallon of milk. In each case a laxative production ration should be fed for each gallon beyond the first.

Another alternative is to feed the heavier-yielding cows with a very laxative ration (e.g., $1\frac{1}{2}$ lb. raw linseed meal and $\frac{1}{2}$ lb. fish meal) for the last gallon, feeding only 2 lb. to the gallon, and for not more than one gallon per cow. These feeding stuffs may appear expensive, but it must be remembered that only 2 lb. are required, and consequently it is only about the same cost as $3\frac{1}{2}$ lb. of the ordinary balanced ration.

Finally it must be remembered that cows receiving indifferent hay should have an adequate supply of water, and that they cannot go long periods without a drink; it is, therefore, essential that they should have access to water three times a day, and that one of these times should be in the evening.

To sum up the recommendations :—

- (1) The good and the moderate hay should be fed concurrently.
- (2) The bulk should be controlled.
- (3) The hay should be given at three feeds.
- (4) All hay remaining 20 minutes after feeding should be removed.
- (5) The cows must be kept laxative, with a laxative production ration, and supplementary laxative rations.
- (6) Ample supply of water.
- (7) The deficiency in the hay to be made up either by beet pulp, or concentrates, or, perhaps the easier, feeding each cow for half a gallon of milk more than she is giving.
- (8) Don't kill good cows by giving really bad hay.

The writer is well aware that farmers are very hard hit financially and are not in a position to lay out a lot of money, but a farmer selling milk generally receives payment monthly, and it is out of this money that he must buy the feeding stuffs for his cows; the hay being poor it is all the more imperative that the feeding stuffs must not be stinted. The cows can only make milk from food, or from their own body tissues, and from the latter only for a limited time.

If the above recommendations are followed it will be found that cows can be kept to pay, but if on the other hand a farmer who has had a disastrous summer stints his cows with feeding stuffs, the bad summer is likely to be followed by an equally disastrous winter owing to a drop in the sales of milk, and loss of health in the cows.

DAIRY COWS AND WINTER FEEDING

W. A. STEWART, M.A., B.Sc. (Agric.),

Principal, Northamptonshire Farm Institute.

It has been stated that the most suitable maintenance ration, or bulky food, for a dairy cow is a strictly limited and controlled quantity of good quality hay. This view may, or may not, be correct, but so far as this article is concerned, it is necessary neither to agree nor to disagree with it. The object here is to show that perfectly satisfactory, and even high, yields of milk, can be secured with the use of roots and other home-grown feeding stuffs.

There are many farms throughout the country where milk production is but a subsidiary part of the general business of farming. On such farms it is not convenient to restrict the feeding of cows to the use of hay and concentrates. In advising farmers in connexion with feeding for milk production, it seems necessary to study the individual's circumstances, and to include the foods which he has available. In view of the general depression in farming, the shortage of money, and the difficulty of marketing certain home-grown produce at remunerative prices, particularly when the produce is slightly damaged, many farmers wish to buy as little as possible, and desire to utilize as fully as may be practicable the materials grown on the farm. In most districts the root crop is good, and farmers can be assured that roots in limited quantities form suitable food for dairy cows, including those giving high yields of milk. In this connexion it may be of interest to recall the results secured in Mr. F. B. May's herd of Friesians in Essex, as recorded by Dr. Scott Robertson in this JOURNAL (May, 1919). The average yields of these cows and heifers were as follows :—

Year.	Number in the herd.		Average quantity of milk (gallons).	
1915	..	13	..	1,044
1916	..	13	..	1,112
1917	..	12	..	1,334

During the first two of those three years, the winter ration contained 56 lb. of roots, *viz.*, kohlrabi before Christmas, and mangolds from Christmas to April, together with a quantity, up to 10 lb., of oats' "glumes" per cow, per day. In the last winter the ration was altered to the following :—

Mid-October to Christmas.		Christmas to May 1.	
66 lb. kohlrabi.		84 lb. mangolds.	
$1\frac{1}{2}$ lb. oats.	} Per gal. of milk {	$1\frac{1}{2}$ lb. oats.	}
2 lb. bean meal.		2 lb. bean meal.	

With regard to this ration, Dr. Scott Robertson says that it "is somewhat exceptional, inasmuch as it does not include any straw or hay. Previous experience showed that the cows were not able properly to digest such a strong bean meal mixture as the above, but by increasing the quantity of roots and eliminating the chaff this difficulty was overcome, and the above winter ration was fed with excellent results, as the average of 1,334 gal. per cow for the 1917 lactation period testifies." It should be understood that these yields were obtained with twice a day milking, and if we are to compare them with those obtained in other cases, where three times a day milking has been practised, it will be necessary, in order to secure a fair comparison, to deduct some 20 or 25 per cent. from figures obtained by milking three times daily. Jesse has given in this JOURNAL (August, 1925) an account of his extensive experience in the feeding of dairy cows in East Sussex. From the results he obtained it would appear that roots, up to 45 lb. per cow per day, have an effect in increasing the yield of milk. It also would appear that a suitable amount of fodder to feed with this quantity of roots is about 17 lb. per head per day. In Northamptonshire herd averages of upwards of 1,100 gallons (three times a day milking) and over 900 gallons (twice a day milking) have been secured with rations containing 35 to 40 lb. of roots, together with a limited quantity of fodder. In some cases this fodder has contained a proportion of straw along with the hay.

Maintenance and Production Standards.—A Shorthorn cow of 1,250 lb. live weight requires a *maintenance ration* supplying about 7 lb. starch equivalent, and containing 0.74 lb. protein equivalent, per day. For *production* purposes the cow requires a further ration supplying 2.5 lb. starch equivalent, containing 0.6 lb. protein equivalent, per gallon of milk. The standards for maintenance vary with the breed and weight of cow, and for production according to the quality of the milk. Detailed information regarding the standards for the various breeds will be found in the Ministry's Report on the Rationing of Dairy Cows, page 36. The total dry matter, which a Shorthorn cow can deal with daily, is in the neighbourhood of 30 to 33 lb.; in the case of a heifer it is from 27 to 30 lb.

Production Rations.—Building on the basis of the foregoing information, it is possible to devise maintenance rations for dairy cows in a variety of ways.

Most farmers should have at least some medium quality hay this year. Their poorest hay will not be suitable for dairy

Example 1.	Dry matter.	Starch equivalent.	Protein equivalent.
40 lb. swedes	4.60	2.8	.28
10 lb. medium hay ..	8.57	3.10	.46
7 lb. oat straw	6.02	1.19	.06
	<u>19.19</u>	<u>7.09</u>	<u>.80</u>

cows, and every effort should be made to give the rather better quality stuff to the milking cows. On arable farms it should be possible in many cases to make up such a ration as in Example 1 above. Using this ration it would be possible to feed concentrates for cows giving up to 4 gallons of milk ($3\frac{1}{2}$ lb. per gallon, i.e., 14 lb. cake or meal, supplying about 12 lb. dry matter) without exceeding the limit for total dry matter per day. With cows giving 5 gallons and upwards it will be necessary to reduce the fodder to the extent of $3\frac{1}{2}$ lb. for each additional $3\frac{1}{2}$ lb. of concentrates fed, in order to keep the total dry matter fed daily down to 30 to 33 lb.

Example 2.	Dry matter.	Starch equivalent.	Protein equivalent.
40 lb. mangolds	5.28	2.80	.16
17 lb. oat straw	14.62	2.89	.15
1 lb. decorticated ground nut cake	.90	.73	.41
	<u>20.80</u>	<u>6.42</u>	<u>.72</u>

This maintenance ration would be suitable on an arable farm where there is no good hay available. In feeding a ration like this it is exceedingly important to bear in mind the rules which should apply to the feeding of all fodder, namely, that concentrates should be fed first, before roots and fodder, that it is preferable to give three feeds daily, and that fodder should be fed long—not chaffed. It is advisable to give the cows just enough time to pick over the straw and eat the best of it, then to clear the remainder out of the rack or manger. Racks and mangers should be completely emptied every evening to prevent the cows eating second-rate quality, or fibrous indigestible material, if hungry overnight.

Example 3.	Dry matter.	Starch equivalent.	Protein equivalent.
40 lb. mangolds	5.28	2.8	.16
10 lb. (medium) hay ..	8.57	3.10	.46
7 lb. wheat straw	6.02	.77	.007
1 lb. crushed wheat ..	.87	.72	.1
	<u>20.74</u>	<u>7.39</u>	<u>.727</u>

One pound of crushed wheat could be used to supplement medium quality hay and wheat straw, in order to raise the starch equivalent and protein equivalent to the required standard. With better quality hay, the pound of wheat, or other cereal, would not be necessary.

In special circumstances potatoes may be used in conjunction with medium hay, as follows :—

<i>Example 4. (In special circumstances.)</i>	<i>Dry matter.</i>	<i>Starch equivalent.</i>	<i>Protein equivalent.</i>
40 lb. potatoes ..	9.52	7.20	.24
10 lb. (medium) hay ..	8.57	3.10	.46
	18.09	10.30	.70

It will be seen from these figures (starch equivalent 10.30 lb.) that potatoes supply an excess of starch. In order to balance this starchy excess, it is advisable to feed a food very rich in albuminoids (protein) to supply the required protein for the first 1 or 2 gallons of milk. Decorticated cotton seed cake or meal, at the rate of $1\frac{1}{2}$ lb. for each of the first 2 gallons would be suitable. As potatoes have a laxative tendency, the concentrated food should be selected to counteract this. Any ordinary balanced mixture, at the rate of $3\frac{1}{2}$ lb. per gallon, could be fed for the third and subsequent gallons. As this maintenance ration is comparatively low in dry matter, it is possible to feed for 5 gallons of milk without it becoming necessary to reduce the amount of hay fed.

With regard, generally, to feeding potatoes, it is advisable to start with a very small quantity per day, say 3 or 4 lb. Unless this is done cows are liable to become blown or hoven, or to suffer from other digestive troubles. Provided that increases are made very gradually, it has been found possible to go to 40 lb. per head per day with good results. A herd fed in this way last winter averaged over 3 gallons per day. Potatoes should be fed whole. After cows become used to potatoes they appear to relish them, even when the tubers are not of first-class quality.

Production Rations.—In the case of low-yielding cows, *i.e.* those giving only 1 or 2 gallons of milk per day, it is possible to utilize some bulky foods for production purposes. For example :—

12 to 14 lb. kale and $1\frac{1}{2}$ lb. decorticated cotton seed meal may be used to supply the nutriment required for 1 gallon of milk.

7 lb. of good hay, or 7 lb. moderate hay, and $\frac{1}{4}$ lb. to 1 lb. decorticated cotton seed cake or meal, or decorticated earth nut cake or linseed cake, form a suitable ration for the production of 1 gallon of milk.

The following foods are sufficient for 2 gallons of milk: 12 to 14 lb. roots, 7 lb. hay, 2 to $2\frac{1}{2}$ lb. decorticated cotton seed meal.

In the case of cows giving 3 gallons and upwards, it is better to use concentrated foods only, for production purposes. Home-grown feeding stuffs, such as beans and oats, may be utilized in the same proportions as were employed in

Mr. F. B. May's herd, referred to above. It is not suggested, however, that fodder should be eliminated when beans and oats are fed with roots. It is only in exceptional cases with very high-yielding cows that this would be advisable.

The following is a production ration to utilize slightly damaged or discoloured cereals :—

- 1 lb. decorticated ground nut cake.
- $1\frac{1}{2}$ lb. oats (crushed).
- 1 lb. barley (crushed).
- $3\frac{1}{2}$ lb. per gallon of milk.

Many other mixtures, quite suitable for milk production, can be made up. Farmers requiring assistance in this connexion should apply to their County Agricultural Organizer.

* * * * *

FIELD EXPERIMENTS AT ROTHAMSTED DURING 1925-1926

II—EXPERIMENTS WITH BASIC SLAG

Sir JOHN RUSSELL, D.Sc., F.R.S.,

Director of the Rothamsted Experimental Station, Harpenden.

The Value of Basic Slag as a Fertilizer.—Two important problems connected with the use of basic slag have been studied: the crops on which it is best used and the value of knowing its solubility in the official 1 per cent. citric acid solution. Judging from our correspondence, and the questions asked at farmers' lectures given by our staff, these two problems are exercising the minds of agriculturists considerably.

The older experiments dealt mainly with the use of basic slag on poor grassland, and they showed the extent of the improvement that could be effected. In recent times, the position has altered considerably, because slag is no longer the same substance as it was; it now includes at least three different kinds of material :—

(1) Bessemer slags, and those of similar type, containing phosphoric acid equivalent to about 40 per cent., tricalcic phosphate, 80 per cent. or more of which is soluble in citric acid.

(2) Open hearth slags, made without fluorspar, containing phosphoric acid equivalent to about 20 per cent. tricalcic phosphate, 80 per cent. of which is soluble in citric acid.

(3) Open hearth slags, in making which fluorspar has been used, containing phosphoric acid equivalent to about 20 per cent. tricalcic phosphate, 20-25 per cent. of which is soluble in citric acid.

All of these can, quite correctly, be sold as basic slag, but they have different agricultural properties and values.

The slags of the Bessemer type, formerly largely produced in England, now come in the main from Belgium, though some are still made in this country. They have high value as fertilizers.

The open hearth slags of the soluble and insoluble types are made in Britain; some are of considerable value, others are not.

These slags have been tested on swedes, meadow hay and permanent grazing land, and the tests have been made, not only at Rothamsted, but at other centres, as part of the work of the Permanent Basic Slag Committee of the Ministry of Agriculture.

Testing Basic Slag on Swedes.—These experiments were made at two centres: Andoversford in Gloucestershire and Stalybridge in Cheshire. The results were as follows:—

Phosphate	Analysis percentage		Yield per acre, tons	
	Total phosphate	Solubility	Andoversford	Stalybridge
None	—	—	8.3	18.5
<i>Slag:</i>				
Low soluble ..	22.41	37.3	9.6	18.6
Medium soluble ..	20.51	60.9	10.8	19.6
High soluble ..	20.56	86.8	11.1	20.8
<i>Superphosphate</i> ..	—	—	11.7	—
Standard error %	—	—	2.5	2.8

The experiment at Andoversford was made with the efficient help of Mr. Comely, and, at Stalybridge, of Mr. Reeves.

The experiment was carried out on the modern lines now adopted at Rothamsted, each treatment being repeated four or five times and the plots being "randomized" in proper statistical fashion. The extent to which the figures can be trusted is therefore known and, in point of fact, the figures are very trustworthy. The experiment shows that the low-soluble slag has no value at Stalybridge and only little value at Andoversford, while, at both centres, the medium-soluble slag is better and the high-soluble best. Superphosphate was tested only at Andoversford and it exceeded even the best of the slags in effectiveness.

Testing Basic Slag on Meadow Hay.—An experiment on new meadow hay was made at Brooke, Norfolk, and on old meadow hay at Enmore, Somerset. In neither case was it possible to obtain so accurate a result as with swedes, owing

to the circumstance that the crop is a mixture and not a single one. The new hay, however, being from newly-sown seed, was more uniform than the old and therefore gave less variable results; the standard error for the new hay was 5.4 per cent., while for the old hay it was 7.1 per cent.

The results were as follows:—

Treatment	Hay, yield per acre			
	Brooke (Temporary grass)		Enmore (Permanent grass)	
	Tons	Per cent.	Tons	Per cent.
Control	2.28	100	1.37	100
Slag: Low soluble ..	2.28	100	1.49	109
Medium soluble ..	2.31	101	1.59	116
High soluble ..	2.65	116	1.53	112
Standard error percent.	5.4		7.1	

As with swedes, the low-soluble slag had no effect in the drier Norfolk conditions, but it was somewhat effective at the moister Somerset centre.

These results show how greatly climatic conditions influence the effectiveness of slag; this is seen better when the percentage increases in crop are collected.

SUMMARY OF ARABLE RESULTS
PERCENTAGE INCREASE IN CROP GIVEN BY DIFFERENT SLAGS

	Moist Conditions		Drier Conditions		Mean of all
	Andoversford	Enmore	Stalybridge	Brooke	
Low soluble ..	16	9	Nil	Nil	6
Medium soluble ..	29	16	5	1	14
High soluble ..	34	12	12	16	20
Standard error ..	2.5	7.1	2.8	5.4	

It appears, therefore, that farmers in the Eastern Counties, under low rainfall, should use only high-soluble slags, while farmers in the West, under high rainfall and moister conditions, generally, may use low-soluble slags provided they can obtain them at sufficiently low prices. Even here, however, high soluble slags are more effective.

Bringing together the whole of the results on basic slag, it appears that the slag of low solubility is different in its nature from that of high solubility, and can never be made to give quite the same results, however much is applied. This important

fact has only recently been realized, and it explains many apparent discrepancies of earlier work. It had always been assumed that the low and high soluble slags were similar in their essential fertilizer action, but differed only in that the low-soluble slag contained less of the fertilizing material and need only be applied, therefore, in proportionately larger amounts to give the same effect as the high soluble slag. This point was tested on old meadow hay at West Tower Field, Cockle Park, by the staff of that farm: the mean results for the three years 1923, 1924 and 1925 were (in cwt. of hay per acre):—

		Gain from the extra 5 cwt. slag
Control	14.1	—
Low soluble slag (22%), 5 cwt. per acre ..	17.3	3.2
" " " " 10 " " " ..	18.7	1.4
High " " (42%), 5 " " " ..	21.1	7.0
" " " " 10 " " " ..	28.1	7.0
" " " " 5 " " " ..	25.6	—
+ ground lime, 10 " " " ..		

This result is very interesting. For the low soluble slag, the first 5 cwt. increase the yield by 3.2 cwt. of hay; the second 5 cwt. give only an additional 1.4 cwt. For the high-soluble slag, the first 5 cwt. give an additional 7 cwt. of hay, while the second give a further 7 cwt.

The conclusion is that the low-soluble slag differs not only in the amount but also in the kind of its action from high-soluble slag, and, however much were used, it would not come equal to the high soluble slag.

Recognizing the difference, we can now proceed to find what purposes the low-soluble slags can best serve. As far as experiments have gone they have these properties:—

(1) Under moist conditions they increase the yield of crops, but not as much as high-soluble slags would do.

(2) There is some indication that their effect lasts longer than that of high-soluble slags, so that in the second and subsequent seasons there is less difference between them and the high soluble slags than in the first season: this point, however, requires further testing.

(3) They seem to differ not only in the amount of their action, but in the kind of action, and it would be interesting to see how a mixture of low and high grade slags, or a mixture of low-grade slag and superphosphate, would behave.

Fine Grinding of Slag.—One obvious suggestion for improving the value of a low-grade slag is to grind it more finely. This

was tried, with the assistance of Mr. Comely, at Brockhampton, where the soil is a light limestone on the Oolite; the basal dressing was 1 cwt. each sulphate of ammonia and muriate of potash, applied early in June, but no dung was given; phosphates were given at the rate of 14 lb. phosphoric acid (P_2O_5) per acre on May 13. Swedes were drilled on June 5 and lifted on December 29. The yields were:—

	Swedes Tons per acre	Per cent.
No phosphate	2.5	100
Slag, low soluble, normal grinding (100 mesh) ..	7.8	335
" " " " extra fine " (180 mesh) ..	6.7	289
High soluble	13.5	590
Superphosphate	15.3	658

The figures show that the extra fine grinding has not improved the low-grade slag; on the contrary, it has rather spoiled it. The experiment was also tried on mangolds at Leadon Court, and a similar result was obtained. The simplest explanation is that some constituent of the low-grade slag is harmful to plant growth, and its effect is intensified (as would be expected) by fine grinding.

General Conclusion.—The general conclusion of all the experiments with slag on arable land and hay land, and of those made in pots, is that solubility is a useful guide to the farmer in selecting basic slag. A high soluble is almost always more effective than a low-soluble slag.

Among the high-soluble slags (above 70 per cent.), however, the solubility is not a complete guide, for a slag of 75 per cent. solubility may prove better than one of 85 per cent. solubility. Presumably, the other constituents play a part in determining the fertilizer action.

For slags of less than 60 per cent. solubility, the solubility is a fairly safe guide to effectiveness. In moist conditions the low-soluble slags have more value than in drier conditions.

Basic Slag and Grazing Experiments with Sheep.—These experiments were carried out at Rothamsted, Thruxington in Leicestershire, and Fiddington in Somerset, as part of the work of the Permanent Basic Slag Committee of the Ministry of Agriculture. Both at Rothamsted and Thruxington the high-soluble slag usually acted well, though the relation between solubility and effectiveness was not as sharp as for the arable crops, one or other of the slags always coming out of its order. It is not possible to say whether the apparent exceptions result from some other property of the slag or from inequalities in the herbage or in the sheep. The Gafsa phosphate was

ineffective, as, also, was the slag of 28 per cent. solubility ; a 35 per cent. soluble slag at Leicester also gave a good result out of place in its series, suggesting the possibility of accident, error, or some unknown factor. The results have been :—

ROTHAMSTED
Series I.

Total Phosphate Per cent.	Solubility Per cent.	Live weight increase in sheep			
		Total, lb. per acre		Per cent.	
		1st 4 years 1921-24	5th & 6th years 1925-26	1st 4 years 1921-24	5th & 6th years 1925-26
Control		427	271	100	100
18.0	81.3	423	276	99	102
42.5	77.2	479	299	113	110
19.8	70.9	583	293	139	108

Series II.

Control		496	298	100	100
19.8	70.9	635	360	128	121
21.1	27.7	510	291	103	97
Gafsa		492	303	99	102

THRUSSINGTON

Particulars of slag		Live weight increase in sheep lb. per acre			Hay removed cwt. per acre
Total phosphate Per cent.	Solubility Per cent.	1925 4 sheep per acre	1926 6 sheep per acre	Sum	
Control		133.8	217.0	350.8	3.0
19.31	82.7	164.6	267.0	431.6	6.0
20.98	63.3	166.9	207.7	374.6	5.5
26.61	49.9	145.3	216.1	361.4	5.25
20.51	35.0	158.4	260.7	419.1	3.5
Gafsa (55.7 total)		157.5	212.3	369.8	5.5

At Fiddington, Somerset, the slags did not increase the output of mutton from the land ; on the contrary they lowered it, so that the unmanured land came out best. This remarkable result was obtained because the land was not sufficiently closely grazed ; in consequence the grass grew away from the sheep and became coarse and innutritious. The old saying, common among the Leicestershire graziers, that " grass grown

in May must be eaten in May" is very wise, and embodies the profound truth that young herbage is more nutritious than old. It seems clear that farmers should not slag more land than they can properly graze or hay.

The grazing results, taken together, have brought out the interesting fact that land, capable of yielding in its unmanured state about 200 lb. live weight increase per acre in sheep, is difficult to improve by slag, while land, which without manure gives only 50 lb. or less, may be considerably improved so as to give 100 or 120 lb. Farmers who have seen these poor lands changed completely by slag must not think that better grassland will respond equally well. Other means must be sought for improving this.

The results for all centres are as follows :—

Centre	Live weight increase lb. per acre				Number of sheep carried per acre			
	1925		1926		1925		1926	
	No manure	High soluble slag	No manure	High soluble slag	No manure	High soluble slag	No manure	High soluble slag
Fiddington ..	242	212	187	93	6.5	6.5	6.3	6.3
Thrussington ..	134	165	156	225	3.8	3.8	6	6
Rothamsted ..	81	103	190	196	6.6	6.6	6.1	6.1
Hebron ..	53	123	18	71	2	4	2	4
Cockle Park ..	22	113	—	—	1.3	3.6	—	—

Degree of Trustworthiness of the New Field Experiments.—

The new method of making field experiments used throughout at Rothamsted in 1925 and 1926 is not only more accurate than the older ones, but it allows an estimate of the magnitude of the error. Some of the experiments recorded in Parts I and II of this article had the following standard error.

STANDARD ERROR, PER CENT., 1926

Oats, total produce ..	..	..	..	1.4
straw ..	..	..	..	0.76
grain ..	..	..	..	2.78
Malting barley ..	..	..	..	4.5
Potatoes, quantitative set ..	..	..	..	1.92
quantitative set ..	..	..	..	5.5
Swedes ..	..	..	..	2.5
Meadow hay, new sown ..	..	..	..	5.4
old ..	..	..	..	7.1

* * * * *

FURTHER OBSERVATIONS AND EXPERIMENTS ON THE CONTROL OF LIVER FLUKE

C. L. WALTON, M.Sc., Ph.D.,

Adviser in Agricultural Zoology for North Wales,

AND

W. REES WRIGHT, M.Sc.,

Department of Agriculture, University College of North Wales, Bangor.

FOLLOWING severe outbreaks of liver rot in Mid and North Wales, the senior writer and his collaborators have given considerable attention to the life history, bionomics, and control of the small fresh-water snail, *Limnaea truncatula*, which act as the chief intermediate-host of the liver-fluke in this country.*

As regards control in the field it has been found that copper sulphate applied as a spray, as a dust, or broadcast when mixed with sand, proved effective in killing the snails, and this method has been used in a considerable number of cases.

One point, however, remained obscure in this connexion, and has been the subject of query by numerous sheep owners and others, namely: Are the eggs of these snails destroyed by such applications of copper sulphate? Experiments just concluded now enable this point to be cleared up and answered in the affirmative. The senior writer has also been asked on very many occasions such questions as: "Does drought kill the eggs?" "What is the effect of frost on the snails and on their eggs?" and so forth. Whilst able to answer such queries in a partial manner, the actual experimental evidence was either not available or was incomplete. These points also have been cleared up to a large extent, and are now dealt with.

The Eggs of *Limnaea truncatula*.—This species is self-fertile and consequently a solitary individual can repopulate a ditch or similar piece of water. Oviposition commences early in the spring, usually in March, and under suitable conditions continues throughout the summer. Each snail would appear

* 1 Walton, C. L., *Parasitology*, x, 2, 1917.

2 " " U.C.N.W. Dept. of Agriculture, 1922.

3 " " this JOURNAL, May, 1922.

4 " " this JOURNAL, August, 1923.

5 " " U.C.N.W. Dept. of Agriculture, Advisory Leaflet, 1922 and 1926.

6 Walton, C. L., and Jones, N. W., this JOURNAL, November, 1925.

7 " " *Parasitology*, xviii, 2, 1926.

8 Walton, C. L., and Rees Wright, W., *Parasitology*, xviii, 4, 1926.

to deposit several masses of ova, the number of eggs in each mass varying considerably, ranging in our experience from 1 to 28. Details of a hundred masses recently tabulated gave a mean number of 15.7 ova per mass; these masses were deposited by snails to an average height of 10mm. A previous count of 20 masses from smaller snails averaged 9.75 ova. The mean size of masses from the large snails was 5.6mm. × 3.9mm., the smallest being 4mm. × 3mm., and the largest 8.5mm. × 4.0mm. (It may be noted that this unusually large mass contained only 14 eggs.) The masses are usually roughly ellipsoidal in shape when deposited on mud, but when placed on dead leaves, etc., the surface of attachment is markedly flattened. When deposited they are clear and gelatinous, but rapidly become coated with mud, etc. The average hatching period is about three weeks, but naturally varies with temperature and other conditions. The eggs being thus embedded in a gelatinous mass, it has been argued that they would not of necessity be reached and destroyed by more or less dilute solutions of copper sulphate.

Effects of Copper Sulphate on the Eggs.—Experiments were therefore conducted to determine this point. Egg masses in all stages of development, both free and attached to leaves, were placed in dishes. Some were treated with copper sulphate solutions of various strengths, whilst a number were left as controls. The details of the experiments were as follows:—

Copper sulphate solution, 1 per cent.: 18 masses in various stages were placed in each of three dishes, A, B and C. A and B were treated with the solutions for periods of 24 and 48 hours respectively, C remaining untreated. In A and B all the eggs became opaque in varying degrees, and failed to hatch, whereas in C the hatching rate was normal. Further experiments were then carried out on these lines, using solutions of $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{10}$ per cent. respectively, with similar and equally successful results; the controls in each case hatched normally.

Desiccation of Eggs.—Drought has proved to be the chief natural controlling factor both for the adult snails and for their eggs. The senior writer had previously carried out some experiments (Walton, 1917); the ova masses, when removed from water, or allowed to desiccate naturally, were found speedily to dry up and then resemble a hard and inconspicuous scale. On re-immersion they speedily resumed their former size and shape, and in some cases hatched after periods of desiccation ranging from 36 to 100 hours. This matter,

however, was left in an unsatisfactory state, and has now been re-examined.

Egg masses attached to leaves were placed in dishes, some being allowed to dry, whilst others were kept as controls. It was found that whether the masses were dried in the laboratory or in the open air (protected from rain) that eggs of all stages of development could resist desiccation up to twelve hours, whilst eggs about to hatch withstood 24 hours' drying. These results are not strictly concordant with those obtained in 1917, but it is obviously impossible, with experiments of this nature, to ensure that all factors are exactly consistent on different occasions.

Freezing of Eggs.—Several trials were made to determine the effect of freezing on egg-masses. The eggs were placed in vessels containing water, which were surrounded by a freezing mixture of ice and salt. The water was allowed to freeze to a solid mass, and to remain in this condition for about three hours, and then melt gradually. In no case was the death rate found to be other than normal, a majority of the eggs hatching in due course.

Experiments and Observations on Snails: *Desiccation of Snails.*—The seasonal fall of water level (which usually occurs during spring and summer) exposes the Molluscan inhabitants of shallow waters to numerous enemies and adverse conditions. The senior writer has already discussed this matter as follows: "Direct observation in the field, and laboratory experiment, have both amply proved that the snails can resist drought for a relatively short time, though the time necessary to cause death depends upon both physical and meteorological factors which are very variable." (Walton,¹ p. 251.) "If the land was bare and level, death speedily took place, but where there was long, dense vegetation, or shade of any kind, up to 30 per cent. of the snail population survived right through the drought. . . . The most favourable conditions for the snails prevailed on heavy soils, which had been trodden into deep holes by horses and cattle during the winter and spring, so that holes were left which were frequently from four to six inches in depth and retained the form of the hoof, thus forming more or less overhanging and cavern-like pits." (Walton,² 1922.)

During October, 1925, a considerable number of farms in North Wales, in all types of country were examined for *Limnaea truncatula*. As a result it became evident that an

enormous reduction in the snail population had taken place since the spring; and, as after the drought of 1921, the reduction was most notable in those situations where the snails had been previously most abundant, that is to say, in shallow waters on heavy or clayey soils. On many of these—including some on which sheep were infected in a wholesale manner, and where sheep actually remained heavily infested with fluke and under treatment—*L. truncatula* had almost disappeared. It nevertheless remained apparent that a few individual snails always survive to continue the species; for if careful and prolonged search be made, isolated snails could almost invariably be discovered, preserved by some exceptional circumstance. Recent research (Walton and Jones⁶), has shown how these few survivors may perpetuate the species. It is also notable that more survivors could be found in the normally less favourable environments (such as certain peaty lands or clays overlaid by, or adjacent to, peat, and especially at higher elevations), than in those which were actually optimum earlier in the season.

A series of experiments bearing on these points has recently been carried out by the Agricultural Department at Bangor, using a wooden trough 3 ft. 7 in. long, 2 ft. 7 in. wide and 4 in. deep (inside measurements), which was placed on the flat roof of the buildings and supplied with mud, water, vegetation, and snails brought direct from a natural field environment. This proved very suitable for the snails, which lived there for several months in a healthy condition. Drought conditions commenced on April 15, 1927, and all water had disappeared by April 18, although the hollows in the mud were still damp. The species utilized were *Limnaea truncatula*, *L. pereger*, *L. palustris*, *Aplexa hypnorum*, and *Planorbis spirorbis*. Samples of snails were collected daily and placed in water for 48 hours, two counts being made, one after 24 hours and the second after 48 hours. The results are given in the table appended, and indicate the relatively greater resistance of *L. truncatula* as compared with the other species employed.

Freezing of Snails.—Repeated trials were made to test the effect of frost upon snails, both under natural and under artificial conditions. In these trials, in addition to *L. truncatula*, the species already listed were included, all of them being locally abundant, and frequently inhabiting the same or nearly adjacent environments. All were exposed to frost,

NATURAL DESICCATION EXPERIMENTS WITH *Limnaea truncatula* AND OTHER SPECIES.

Date 1927	No. of snails examined	Weather conditions	Result
April 18-19	A. 20 (various) from dampest hollows B. 20 from driest areas.	Hot sun; calm. Temp. Max. 77°F Min. 51°F	A. 6 <i>truncatula</i> , all alive. 7 <i>pereger</i> , 4 alive, 3 dead. 5 <i>palustris</i> , all alive. 2 <i>Aplexa</i> , dead. B. 16 <i>truncatula</i> , 1 alive, 15 dead. 2 <i>palustris</i> , 1 alive, 1 dead. 2 <i>Aplexa</i> , dead.
20-21	A. 30, dampest hollows. B. 25, driest areas.	Dull, cloudy, cold dry west wind. Temp. Max. 52°F Min. 52°F	A. 18 <i>truncatula</i> alive. 3 <i>pereger</i> 1 <i>palustris</i> 5 <i>Aplexa</i> 3 <i>Planorbis</i> } all dead. B. 16 <i>truncatula</i> 7 <i>pereger</i> 2 <i>Planorbis</i> } all dead.
21-22	A. 50, dampest hollows. B. 50, driest areas.	Bright sun, strong west wind. Temp. Max. 69°F Min. 59°F	A. 22 <i>truncatula</i> alive, 15 dead. 2 <i>palustris</i> , 1 alive, 1 dead. 1 <i>Aplexa</i> , dead. B. 28 <i>truncatula</i> alive, 10 dead. 7 <i>pereger</i> 1 <i>palustris</i> 2 <i>Aplexa</i> 2 <i>Planorbis</i> } all dead.
22-23	A. 50 dampest hollows. B. 30, driest areas.	Very strong dry west wind, sun intermittent. Temp. Max. 79°F Min. 56.5°F	A. 12 <i>truncatula</i> alive, 34 dead. 2 <i>pereger</i> 2 <i>Aplexa</i> } dead. B. 8 <i>truncatula</i> alive, 14 dead. 2 <i>pereger</i> 3 <i>palustris</i> 1 <i>Aplexa</i> 2 <i>Planorbis</i> } all dead.

After April 23 showery weather set in, and the experiment was abandoned. The relative resistance of *L. truncatula* is evident.

mixed together in the same vessels. In some cases they were in shallow water only, in others they were placed on mud under water. The results obtained were by no means uniform. In the case of *L. truncatula*, for example, two identical experiments, carried out on the same day, gave recovery rates of 50 and 100 per cent. respectively. As regards the other species, the results were equally vague, except in the case of *Planorbis*, which invariably succumbed.

These results met the expectation of the writers, since previous observations in Mid and North Wales on ditches

inhabited by numerous *L. truncatula* showed no appreciable difference in population after severe frosts lasting several days. *L. truncatula* is of frequent occurrence in waters so shallow that it cannot fail to become frozen on numerous occasions during any normal winter. It may be remarked, however, that artificial freezing experiments with newly hatched snails of *L. pereger* and *Aplexa* gave 100 per cent. death rate.

Summary.—(1) Egg-masses of *Limnaea truncatula* are killed by very dilute solutions of copper sulphate.

(2) Under laboratory conditions, desiccation for more than twelve hours was fatal to egg-masses in all stages of development.

(3) Under laboratory conditions, freezing appeared to have no effect on egg-masses.

(4) *L. truncatula* show very considerable natural resistance to freezing, : evidently frost cannot be relied upon as an aid to the clearance of ditches or pastures.

(5) *L. truncatula*, although killed by direct desiccation, resisted drought longer than other species living with it, and under certain circumstances survived for considerable periods.

* * * * *

MARKETING OF EGGS AND POULTRY

STANDARDIZATION: PRINCIPLES AND POSSIBILITIES *

Standardization has been described as the first principle of modern commerce, the movement from the indefinite to the definite. The spirit of order that standardization implies is already spreading over many of the industries that together make up the great industry of agriculture, and, in a number of countries, there are examples of the successful application of a standardization policy that reaches back to production, and forward—through classification, grading, packing, packages and methods of selling—to what is known in America as “orderly marketing,” with its attendant advantages in the sphere of distribution.

Hitherto, standardization has largely, though not wholly, achieved its most notable successes when applied to agricultural products that are the subject of international trade, but there

* Paper contributed by Mr. A. W. Street, C.I.E., M.C., Ministry of Agriculture and Fisheries, to the World's Poultry Congress, Ottawa, July, 1927.

is evidence of a gradual movement towards the standardization of commodities that meet a wholly domestic demand and have no market abroad. This trend is indisputable, though it varies in degree with different countries and with different commodities. Indeed, if a little crystal-gazing may be permitted, it seems safe to predict that, under the pressure of competition, the deliberate standardization of agricultural products, in the mass, is inevitable over the whole marketing field. The reason lies mainly in the superior economy of standardization; it saves time and effort and, therefore, money.

(1) Relation of Production to Economical Marketing.—In the market place, the product of one farm mingles with that of another—this breed with that breed, this variety with that variety, this type with that type, this cross with that cross, this nondescript with that nondescript, the large with the small. If a uniform product is to be distributed, someone, somewhere, must sort these diverse supplies; but it is obvious that if producers would agree to standardize their production types they could, to some extent, diminish this service and reduce its cost. This is an obvious and first step towards better and cheaper marketing. It involves the planning of production in terms of areas rather than of individuals; it simplifies marketing.

There are examples which show the advantages to be obtained when a large proportion of producers over a wide area concentrate on the type best suited to local conditions of soil and climate—the Heathfield district of Sussex in England (where the fowls known in the trade as “Surreys” are mostly produced), the Malines district of Belgium (“Poulets de Bruxelles”) and the Vendée and Bresse regions of France (“Poulets Nantais” and “Poulets de Bresse”). Mention might also be made of the district of Barneveld in Holland and of parts of Deux Sèvres in France, where the production of brown eggs is the main objective.

The importance from a marketing standpoint of this group or community production of more or less uniform types is gradually gaining recognition among producers of all farm commodities. Standardization begins on the farm.

(2) Standardization of Classes, Grades and Packages.—Although, by the concerted action suggested above, it is possible for poultry keepers over wide areas to approach uniformity in their product, grading to varying degrees of refinement will always be desirable, since there will always be

differences arising from natural causes and from differences in farm practice. In fact, the specific uniformity that is desired by the trade can only be obtained first by classification, according to some fixed characteristic such as weight, and then by quality grading, according to such attributes as freshness for eggs, or condition, colour of skin, conformation and so on for table poultry. The importance of this arrangement of products into groups with common characteristics is manifest. It is not, however, sufficient that produce should be efficiently graded according to the systems favoured by this producer or that producer, by this merchant or that merchant; it is essential that one schedule of classes and grades should be operative over the whole country, and one only, and that this should be designed explicitly to meet the demands of the market. In short, classification and grading, though always in themselves important, only assume their real significance when the classes and grades are standardized.

Standardized grading provides a basis for a national system of selling in which inspection need not invariably precede purchase; it furnishes a common language for buyers and sellers, makes possible the accurate determination of values and the quotation of comparable market prices, minimizes disputes, encourages long-period contracts, and, in general, facilitates direct sale at assembling points in producing areas to distributors in distant consuming centres. This means increased efficiency and a corresponding reduction in costs. It also facilitates the financing of such operations as storage.

The standardization of methods of packing is, perhaps, of less importance for poultry produce than for some other commodities, such as fruit. The standardization of containers, whether cartons, boxes, hampers, crates or baskets, is, however, of considerable importance to the poultry industry. It is obvious that if one or two types of packages be selected as best adapted to trade requirements (in such matters as attractiveness—where this is a consideration—size, convenience of handling, prevention of damage to contents, storing and economical transportation), and these types alone are manufactured, not only are cheaper packages possible, but the quantity element is standardized.

Thus standardization reduces the marketing costs of the producer. It also opens the way to fundamental marketing reforms; it is a step towards organized marketing, the pooling of supplies and the adoption of mass selling methods—which

include advertising and the control of the daily flow of supplies to market.

(3) **Organization.**—Experience the world over shows that, for various reasons, some form of organized marketing is desirable if the continuous supply of a standard product is to be provided and maintained. This applies particularly to table poultry; only in exceptional cases can the table-poultry producer, as an individual, supply a standard product continuously and in bulk; the systematic conditioning of birds for market can rarely be conveniently and economically carried out by individual farmers. It is also true of eggs, in the sense that the pooled contributions of a large number of suppliers can be more cheaply and effectively tested, graded, packed and sold than the limited output of a single farm. This is not necessarily a plea for producers' co-operation as the term is generally understood. It is, however, a plea for the establishment, in the areas of surplus production, of efficient assembling organizations which can undertake the standardization of bulk supplies for market. How this organized assembling finds expression, whether through country dealers working on their own account, through independent undertakings operating in an agency capacity on behalf of producers, or through producers' co-operative organizations, depends on circumstances, and is not of such immediate importance as the realization by producers that the lack of organized assembling means, for their industry, excessive internal competition and a wasteful marketing system generally.

(4) **Constructive Possibilities.**—In the poultry industry, as in other agricultural industries, standardization leads naturally, therefore, to the establishment of large business units in the assembly field. There are already interesting examples of this in a number of countries. If, for any reason, producers are not disposed to capitalize the tendency, others will do so. These combinations, however constituted, when brought gradually into relationship and agreement one with another, will be in a position so to work together that, through them; the poultry industry *as a whole* will be able to undertake the collective study of the market, to choose and carry out a marketing policy, and, what is of paramount importance, to bring production into harmony with it; this is impossible while marketing remains unorganized.

Ordinary commercial vision will reveal the directions in which the co-ordinated industry can then best move. One direction

will, doubtless, be towards central selling to distributors, which may take the form of collective bargaining or the conduct of agency sales. Other directions may be towards the mitigation of internal competition by the allocation of markets, and towards the balancing of supply and demand—both by the studied diversion of produce according to the types and qualities desired by particular markets and by the determination of the time and rate of marketing supplies. This presumes also a correlated programme of cold storage and other methods of conservation. Finally, when sales are slow or supplies are heavy, an industry that has standardized products to sell will be able to advertise to advantage; modern advertising is expensive and frequently can only be worth while when applied to standardized products.

(5) **The Distributor's Position.**—The standardization of products increases the speed with which business can be conducted—a merit of particular importance for perishable produce. It means less risk for the distributive trade. For these and other reasons that are apparent, it costs less to buy and sell a standardized than an unstandardized product. Further, the growing preference of the consumer for standard products, coupled with the ease with which demand can be influenced and established in their favour by means of trade names, brands and marks, promotes increased turnover, which, again, means cheaper selling. Viewed in this light, the organized assembling of produce in the areas of surplus production for the purpose of standardization becomes an aid and not a rival to the distributive trade; it may lead to the consolidation of buying interests and, in some instances, to the integration of assembling and distribution; it would certainly attract capital into agricultural marketing.

(6) **Consumer-demand.**—The force which has helped many standardization programmes to success is the imperiousness of consumer-demand. The consumer increasingly expects dependable quality with little or no waste; the convenience of "repeat orders" is valued. On these counts, standard products give unchallenged satisfaction to which the consumer promptly reacts; further, and this is of importance from the standpoint of the consumer, the prices of standard products can be easily and reliably compared.

There is no doubt that in the table-poultry industry, a standardization policy, by instilling confidence, would work

wonders in the stimulation of consumer-demand. In the egg industry, Canada, appropriately enough, affords an interesting example. Grading to recognized standards improved the export trade and led to the adoption of the system for the domestic market. What has been the result? Consumers have so reacted to better value that the estimated consumption of eggs per head in Canada is said to have increased by nearly 50 per cent. in the few years since the reform was introduced. After all, the object of production is consumption.

(7) **Conclusion.**—Standardization all along the line is one of the most promising and constructive ways of reducing the spread between producers' and consumers' prices, and of diminishing the fluctuations which at present characterize both. It is even probable that savings greater than those possible in any other direction are to be obtained by *the production and marketing of standardized products*. The marketing reforms that have been introduced in some countries, and that are being urged in others, are important elements of a standardization policy; they show the way in which the poultry industry is already moving in some countries and will eventually move in all. The responsibility of recognizing the inevitability of standardization rests with the leaders of the industry. It is their duty so to guide the impulse towards it that the industry may move smoothly and securely forward to this end.

* * * * *

POULTRY KEEPING IN FRUIT PLANTATIONS

G. H. GARRAD, N.D.A.,

Agricultural Organizer for Kent.

In the July, 1920 (Vol. XXVII, No. 4), issue of this JOURNAL the writer gave an account of the financial results obtained by a successful Kent small-holder and his son—Messrs. W. Hall & Son, of Grover Hill, West Peckham—during the war years, 1914-19. Careful accounts have been kept, year by year, since the termination of the war, and it may now be of interest to set out the results during the past seven years.

Mr. Hall's holding of 17½ acres is situated about nine miles on the Sevenoaks side of Maidstone and lies on the slope of a steep hill facing south, on the Lower Greensand formation, an ideal site for poultry. Of the 17½ acres, 4½ acres are under grass,

of which 2 acres are usually hayed to provide winter food for a horse and two cows. The remaining 13 acres are under fruit, 10 acres of cobnuts, with standard apples as top fruit, 2 acres of cobnuts alone, and 1 acre of young nuts with man-golds and potatoes grown between the bushes. No fowls are kept on the acre growing the young nuts. The poultry are confined in permanent runs on the other 12 acres devoted to fruit. The number of birds on the holding on November 1 of each year has averaged 750 during the past seven years, i.e., approximately 60 birds per acre, latterly 70 birds per acre. Practically the whole of the work on the holding is done by Mr. Hall and his married son, so that two livings have to be earned from the poultry and from the fruit, the accounts for which are kept separate. Mrs. Hall (senior) and Mrs. Hall (junior) help with the gathering of the fruit and nuts, and a young man is employed for three weeks in the year to help with the pruning of the nuts. A married daughter also helped to gather the nuts in 1925. With these exceptions, nobody else has been employed on the holding. In the poultry account, no charge is made for rent, because the ground is fully cropped with fruit and the value of the birds' manure is estimated to be more than equal to any sum due as rent. Excluding any charge for rent, the accounts for the past twelve years have shown that a considerable sum of money has been available at the end of each season to pay for the labour of Mr. Hall and his son.

Year ending Oct. 31	No. of birds on holding at beginning of season		No. of eggs produced	Eggs per bird	Balance to pay for labour		
	Total birds	Hens and pullets			£	s.	d.
1915	152	138	15,111	109	104	1	8
1916	408*	140*	22,859	163*	141	6	7
1917	542	312	31,416	101	112	1	5
1918	224	205	22,052	107	237	11	5
1919	285	189	27,611	146	419	19	1
1920	518	394	42,605	108	697	18	5
1921	655	404	52,725	130	547	9	2
1922	716	458	62,171	136	487	10	7
1923	638	593	68,894	116	407	15	11
1924	875	795	82,607	104	410	4	3
1925	890	817	101,367	124	522	6	8
1926	954	823	93,383	113	605	13	10

* The total number of birds (408) includes 256 autumn-hatched chickens. Half of them were pullets (127) and several of them began to lay in the middle of January.

The number of eggs laid per bird is estimated by dividing the total number of eggs laid during the year by the number of hens and pullets on the holding at the beginning of the year.

Seven years ago several breeds of poultry were kept—White Wyandottes, White Leghorns, Buff Orpingtons, Light Sussex, and Rhode Island Reds—but now there are only two breeds, Rhode Island Reds and Light Sussex, many of the hens being first-cross.

Mr. Hall took up poultry keeping on a commercial scale for the first time in 1911, as the result of attending a course of lectures given by the County Council Instructor in Poultry-keeping, and he ascribes his success very largely to the instruction and advice he has received from time to time from the same source. On the average of the past seven years, there has been a balance of £525 a year to pay for labour. Mr. Hall and his son do practically the whole of the work on the holding themselves, and only a portion of their time—though much the greater portion, because the fruit trees receive very little attention—should be charged against the poultry. It is evident, therefore, that the poultry show a good profit.

Full particulars of the accounts up to October 31, 1919, were published in the July, 1920, issue of this JOURNAL, so that it is only necessary to deal here with the past seven years. In the valuations, cocks are valued every year at 4s. per head, cockerels at 5s., hens at 3s., and pullets at 5s. Houses and appliances are valued at the end of each year by taking the valuation figure at the beginning of the year, adding on any purchases made during the year, and deducting 12½ per cent. for the year's depreciation.

Sales of Eggs for Consumption.—The number of eggs sold for domestic purposes each year, with the average price per dozen, has been as follows:—

Season	No. of eggs sold	Average price per dozen	Total receipts	
			£	s. d.
1919-20	26,283	4 1½	451	4 10
1920-21	42,830	3 0½	541	7 9
1921-22	55,081	2 3	527	18 5
1922-23	60,991	1 11	484	17 11
1923-24	77,269	1 11	618	12 6
1924-25	96,649	2 0	794	3 3
1925-26	89,223	1 11½	724	15 6
Total for seven years	448,326		£4,143	0 2
Average per annum	64,046	2 2½	591	17 2

Commissions and tolls have been deducted in the case of those eggs sold in Maidstone and Tonbridge markets. The prices realized have, of course, varied considerably from month

to month and from year to year. In 1925-26, first quality eggs averaged 3s. 4½d. per dozen in November, and 1s. 4d. per dozen in March and April. Second-grade and pullets' eggs averaged 2s. 8d. per dozen in December, and 1s. 2d. per dozen in March and April. The first pullets started laying on June 21 in 1926, and on July 24 in 1925.

Sales of Eggs for Setting.—Eggs were also sold for setting as follows:—

Season	No. of eggs	Average price per dozen	Total receipts	
			£	s. d.
1919-20	10,600	6 10½	303	19 10
1920-21	6,225	6 11	179	12 7
1921-22	4,138	6 5	110	7 8
1922-23	3,314	5 5	74	11 5
1923-24	1,987	4 11	41	0 1
1924-25	1,345	5 2	28	19 11
1925-26	699	5 6	15	19 5
Total for seven years	28,308		£754	10 11
Average per annum	4,044	6 5	107	15 10

Sittings are sold each year at a definite price each, a sitting consisting of 12 eggs if they have to be despatched or 13 eggs if they are called for. The cost of carriage and packing has been deducted in the above table.

Sales of Eggs under Ministry's Distribution Scheme.—Messrs. Hall & Son have acted as a Station Holder under the Egg Distribution Scheme ever since its inception and, in addition to the eggs already mentioned, have sold the following number of sittings under the scheme:—

Season	No. of eggs sold	Average price per dozen including Government grant	Total receipts	
			£	s. d.
1919-20	2,652	8 0	88	10 0
1920-21	1,334	9 0	50	0 6
1921-22	833	8 0	27	15 4
1922-23	876	7 0	25	11 0
1923-24	1,057	7 0	30	16 5
1924-25	1,173	7 0	34	4 3
1925-26	1,038	7 0	30	5 6
Total for seven years	8,963		£287	3 0
Average per annum	1,280	7 8	41	0 5

Hatching Results.—Infertile eggs were used at home and valued at 1d. each. The hatching results, each season, have been as shown in the next table:—

(a) *Incubator Results :*

Season	No. of eggs set	No. of eggs infertile	Chicks hatched	Percentage fertile eggs hatched
1919-20	600	70	373	70.3
1920-21		Figures not available		
1921-22	194	32	111	68.9
1922-23	2,661	360	1,607	69.8
1923-24	1,818	214	1,171	73.0
1924-25	2,189	252	1,545	79.7
1925-26	1,872	127	1,448	83.0
Total for six years	9,334	1,055	6,255	—
Average per annum	1,556	175	1,043	75.5

Three incubators are used, each incubator having a capacity of 160 eggs.

(b) *Hatching Results under Hens :*

Season	No. of hens set	No. of eggs set	No. of eggs infertile	Chicks hatched	Percentage fertile eggs hatched
1919-20	211	2,470	182	1,707	74.6
1920-21	173	2,016	168	1,463	79.0
1921-22	170	1,925	201	1,310	75.9
1922-23	89	1,052	116	742	79.2
1923-24	41	476	50	345	80.9
1924-25	1	11	0	9	81.8
1925-26	49	551	29	437	83.7
Total for seven years	734	8,501	746	6,013	—
Average per annum	105	1,214	107	859	77.5

In comparing the hatching results under hens with the incubator results it must be borne in mind that the incubators were started in January each year, whilst the hens were not set until about a month later.

The total number of eggs hatched during 1925-26, in incubators and under hens, was 1,885, of which 838 were sold as day-old chicks and 6 at six weeks' old, leaving 1,041 to be reared. Of this number 949 were in fact reared as follows : 347 sold as table birds, 49 sold as pullets, 27 cockerels, 2 table birds, and 524 pullets on the holding at the end of the year. The chicks were all reared in hovers, except about 120 reared with hens, and the losses were 92, *i.e.*, 9 per cent. Of the 1,041 to be reared, 638 (53 per cent.) were cockerels and 573 (47 per cent.) were pullets.

Birds of various ages have been sold at various prices or killed for home use, and a valuation price entered in the accounts.

Sales of Chicks under Ministry's Distribution Scheme.—

In 1925-26, Messrs. Hall & Son sold 408 day-old chicks under the Egg and Day-old Chick Distribution Scheme at 14s. per dozen, including the subsidy, bringing in £23 16s. 0d. Every year they have sold a number of day-old chicks in the ordinary way at commercial prices as follows :—

Season	No. of day-old chicks	Average price s. d.	Total receipts £ s. d.
1919-20	1,088	1 7	85 6 4
1920-21	693	1 5½	51 17 4
1921-22	708	1 1½	38 17 0
1922-23	1,092	0 10	44 13 11
1923-24	480	1 0	24 4 8
1924-25	134	1 2	7 14 9
1925-26	430	0 10	18 13 0
Total for seven years	4,625	—	£271 7 0
Average per annum	641	1 2	38 15 3

Expenses.—The chief expenses, apart from labour, have been food and appliances ; as many of the appliances are home-made or home-repaired they have not cost very much. The cost of the food, including cockle-shell, consumed each year is shown in the following table. The cost of appliances, including depreciation at the rate of 12½ per cent. per annum on both the appliances in stock at the beginning of the year and the appliances purchased during the year, is also shown.

Season	Quantity of food consumed Cwt.	Cost of food £ s. d.	Cost of houses and appliances £ s. d.
1919-20	401½	383 8 0	7 4 2
1920-21	555½	411 10 6	6 12 10
1921-22	506½	286 16 3	11 16 0
1922-23	717½	322 11 5	34 4 4
1923-24	665	342 10 6	47 8 4
1924-25	797	409 1 7	48 13 0
1925-26	845	360 14 8	41 16 6
Total for seven years	4,489	£2,516 12 11	£197 15 2
Average per annum	641	359 10 5	28 5 0

The houses and appliances do not include consumable stores such as paraffin, creosote, straw, non-returnable chick and egg boxes, &c. The feeding is rather unusual. As an illustration of the kinds and quantities of foods used, the following table shows the purchases during the past year.

Cwt.		£	s.	d.
250	Cracked maize at 9s. 3d. (approx.)	116	0	10
127	Wheat points at 8s. 11d.	56	13	11
5½	Kibbled wheat at 13s. 6d.	3	14	3
2½	Maize grits at 10s.	1	7	6
297½	Middlings at 7s. 2d.	106	13	8
36½	Meat meal at 15s. 9d.	28	9	6
36	Maize germ meal at 9s. 8d.	17	8	0
32	Bran at 5s. 11d.	9	9	9
9½	Stale bread at 10s. 8d.	4	15	11
14½	Malt culms at 6s. 5d.	4	15	10
12	Steamed bone flour at 6s. 3d.	3	15	0
15	Cockle shell at 5s. 3d.	2	8	6
9	Flint grit at 3s. 6d.	1	11	9
1	Sussex ground cats at 13s. 3d.	0	13	3
½	Damaged rolled oats at 10s.	0	2	6
½	Wheat germ meal.	0	6	7
½	Wheat meal	0	2	6
849½ cwt.		£358	9	3

An analysis of the accounts for the past seven years gives the following interesting figures:—

Season	Balance to pay for labour	Appreciation or depreciation in valuation	Cash surplus	Sales of produce	Capital invested
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1919-20	697 18 5	+ 15 6 4	682 12 1	1,094 4 11	189 4 9
1920-21	547 9 2	+ 157 2 3	390 6 11	977 3 3	204 11 1
1921-22	487 10 6	- 92 9 2	579 19 8	830 4 7	361 13 4
1922-23	407 15 11	+ 203 15 2	204 0 9	747 1 0	269 4 2
1923-24	410 4 3	+ 32 10 0	377 14 3	831 2 0	472 19 4
1924-25	522 6 8	- 1 0 10	523 7 6	1,002 10 8	505 9 4
1925-26	605 13 10	- 10 6 6	616 0 4	1,002 7 2	504 8 6

Messrs. Hall & Son avoid all extravagances in poultry houses and appliances. Most of the houses have been built to their own design, the favourite type for adult stock on free range being 20 ft. by 10 ft. with wooden floor, movable perches, and nest boxes to open from the outside. These houses have hopper windows and ridge ventilation, and will hold 120 birds easily on free range.

The 1925-26 accounts show that the poultry consumed 845 cwt. of food costing £360 14s. 8d., and the total number of eggs produced—either sold or used for setting at home—was 93,383. This works out at 0.93 pence, *i.e.*, less than a penny per egg for food, without making any allowance for the food that was used for rearing young stock. In the previous season 797 cwt. of food costing £409 1s. 7d. produced 101,367 eggs or 0.97 pence per egg for food. The number of eggs laid per bird was 113 in 1926, and 124 in 1925.

PROFIT AND LOSS ACCOUNT
November 1, 1925, to October 31, 1926

DEBIT		CREDIT	
£	s. d.	£	s. d.
Value of 51 cwt. of food in stock, November 1, 1925	26 7 3	89,223 Eggs sold for domestic purposes at 1s. 11½d. per doz. (approx.)	724 15 6
Value of 954 birds in stock, November 1, 1925:—		699 Eggs sold for setting purposes at 5s. 6d. per doz.	15 19 5
18 Cockerels (1925) at 5s.	4 10 0	1,038 Eggs sold under Ministry of Agriculture's Scheme at 5s. per doz.	21 12 6
2 Cocks (1924) at 3s.	6 0 0	Ministry of Agriculture's grant at 2s. per doz.	8 13 0
421 Hens (1924) at 3s.	63 3 0	430 Day-old chicks sold at 10s. 5d. per doz.	18 13 0
51 Hens at 2s.	5 2 0	408 Day-old chicks sold under the Ministry of Agriculture's Scheme at 10s. per doz.	17 0 0
233 Pullets (1925) at 5s.	58 5 0	Ministry of Agriculture's grant at 4s. per doz.	6 16 0
118 Younger pullets at 3s.	17 14 0	Received for the loan of two hens for rearing chicks	2 6
79 Young cockerels at 2s.	7 18 0	Received for rearing chicks for two weeks after they were sold	4 0 0
32 Late-hatched chickens at 1s.	1 12 0	156 Infertile eggs at 1d.	13 0 0
Value of houses, appliances, etc., November 1, 1925	158 10 0	6 Cockerels, six weeks old, sold in May	9 0 0
Appliances purchased during the year	319 11 3	2 Hens sold with some chicks	15 0 0
Paraffin, creosote, etc.	10 2 6	347 Young cockerels at 4s. 2d.	71 16 3
Stationery, subscriptions, stamps, etc.	9 15 6	50 1926-hatched stock birds at 8s. 4d.	20 16 1
Advertisements	2 16 1	85 Young birds (autumn-hatched, 1925) sold for table, mostly in November and December, at 5s. 6d.	23 10 0
Purchase of 2 stock cockerels	1 5 11	331 Old birds sold for table at 3s. 2d.	53 1 9
Purchase of 849½ cwt. food	3 17 8	39 Stock birds sold at 6s. 9d.	13 4 6
Balance to pay for labour	358 9 2	31 Birds killed for own use at 2s. 3d.	3 11 8
	605 13 10	4 Hen coops sold	14 0 0
		55 Cwt. of food in stock, October 31, 1926	24 1 9
		Value of houses, appliances, etc., October 31, 1926	287 17 3
		Value of 928 birds in stock, October 31, 1926	182 3 0
			£1,496 9 2

NOTE.—No rent is charged in this account, the ground being fully cropped with fruit and nut bushes, and the value of the manure is estimated to be more than equal to any sum due as rent. The cost of attendance has not been included, as no actual figure can be given. Mr. Hall and his son do all the work themselves.

Summary.—It must not be expected that every poultry keeper could be as successful as Messrs. Hall & Son. Their case is undoubtedly exceptional. There are, however, many orchard and fruit plantations throughout the country which would produce larger crops of fruit, and better quality fruit, too, if poultry were allowed to have a free run under the trees. Poultry consume innumerable caterpillars and other fruit tree pests, and thus save the fruit grower much expense that would otherwise have to be entailed in grease-banding, spraying, etc. Moreover, if the land is first dug over, or if it has previously been kept under cultivation, the birds will, by their continual scratching, keep it free from weeds and will reduce the cost of cultivation, while their droppings will assist considerably in the manuring of the trees. There are also considerable advantages in the combination of poultry keeping and fruit growing from the point of view of the fowls. The cost of feeding the fowls is reduced appreciably during certain times of the year by the number of insects, usually regarded as pests, that they consume. Amongst the insects readily devoured by poultry may be included the caterpillars and wingless females of the winter moth, the larvae of the codling moth, pug moth and pear midge, slugworms, wireworms, leather jackets, surface caterpillars, the raspberry and many other weevils, aphides, etc. Unfortunately they are useless for the control of fungus diseases.

Space prohibits the publication of the complete Profit and Loss Account for each season, but a summary of the 1925-26 Profit and Loss Account is given on the preceding page.

* * * * *

NOVEMBER ON THE FARM

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

Seasonal Notes.—November is in the autumn quarter of the astronomer's year, the beginning of winter being reckoned from December 21. In the farmer's calendar, however, this month belongs to the dead season, and the countryside in November wears an aspect more like winter than summer. The trees are nearly bare; the hedgerows are now leafless and display their red berries; the flowers have gone, and all that remains of the flowering herbs is their dead and shrivelled stalks. The pastures now begin to look grey—an appearance which will this year be emphasized by the quantity of long growth that has been

left unconsumed by the stock. Such few cattle as are still out of doors now carry long shaggy coats, which add to the wintry appearance of the fields.

There is often a gloomy silence in the November day, yet its reputation for windiness is well founded. Our Saxon ancestors called November the Wind-monath, owing to its storms, for fear of which they drew their boats ashore at this period and ceased fishing till next April. Fog-month is another appellation that has been aptly used, if only because of the misty evenings at this time of the year. On the average of long periods the rainfall of November is high, being exceeded only by October and December. For six years preceding 1926, however, the November rainfall in the Midlands had been light, and favourable to the completion of wheat sowing operations.

The chief farm date in November is the eleventh, St. Martin's Day or Martinmas. This is still a term day in Scotland and certain northern districts of England, and an indication of its former place as an important rural feast survives in the custom, still fairly common, of holding the estate rent audit and tenants' dinner on Martinmas Day. This custom probably dates from that of feudal times, when smaller land-holders paid Wroth-money to the Lord of the Hundred, who in return undertook their protection. The payment was made on this day and was followed by a substantial meal provided at the expense of the Lord of the Hundred.

Before farmers had root crops and concentrated foods for winter feeding it was necessary to slaughter cattle and swine at Martinmas; and, as only salt meat was available from then till next summer, the secular reason for feasting on this occasion is not far to seek. The association of St. Martin with conviviality, however, was probably derived from the fact that this day happened to coincide with the Roman Vinalia or Feast of Bacchus, an occasion when the new wines of the year were tasted.

Wheat Seeding.—Wheat may follow any crop in the rotation that allows of the land being prepared and sown at the proper season for wheat seeding. During the last few years, while oats have been relatively lower in price than wheat, the tendency has been to drill winter wheat at the expense of the acreage of winter oats. This tendency has been accentuated somewhat by the recognition of the fact that, whereas it is risky to delay the sowing of wheat till after the New Year, winter oats and

especially white winters are if anything favoured by not being sown until after the middle of January.

It is not easy to analyse the divergent views held as regards the best date for wheat sowing. Formerly one heard much of the risks of early sown wheat becoming winter-proud, but this trouble is not often met with, and indeed there is little likelihood of its occurring in ordinary practice, unless early sowing has been accompanied by too heavy seeding. There is, however, a belief that on the lighter classes of land the proportion of grain to straw is reduced by sowing too early. The difficulty is to know what date is not early enough to incur this risk without running the risks attaching to late sowing. November is a favourite month for wheat sowing on light land in the Midlands, but this contrasts with Continental practice, where September is preferred when conditions will allow of sowing so early. Differences in climatic conditions and varieties grown may account for these divergences in views, and usually local experience is the safest guide.

Certain sorts of wheat are better than others when sown late in the season. Early ripening varieties, "Little Joss" and "Squarehead's Master" or "Red Standard," are undoubtedly safer than late-growing kinds such as "Iron," "Iduna" and "Rivett's"; and this preference is not induced by considerations of the time at which they will be ready to harvest next season, but by the experience that they are less liable to die away in the winter than are those of later habit.

In drilling wheat it is generally best to draw the rows from north to south, as this allows of the sun's rays reaching the bottom of the plants. Three bushels per acre is the standard quantity of seed for November sowing, but the actual quantity required will vary with the size and viability of the sample of seed and the nature of the land. This rate of seeding, if every seed germinated, would give two to three seedlings per inch in six-inch rows. That the seedlings do not come up so thickly is due not only to the depredations of birds and soil pests, but also to drilling too deeply, dressing with injurious preparations, and excess of soil moisture.

The possibility of poor germination after a bad harvest was mentioned in the September notes. Many farmers, however, impair the germinative energy of their seed wheat by pickling it in too strong solutions of copper sulphate: the old dressing of $\frac{1}{2}$ to 1 lb. per gallon of water has been found to destroy 25 to 30 per cent. of the seed and to delay the germination of that which survives by one to two weeks. Formalin has been preferred

for dressing. The most recent proposal is that of using finely-powdered copper carbonate in its dry state. This has been found to be non-injurious to germination and, if thoroughly mixed with the seed, satisfactory as a preventive of stinking smut at any rate, when the seed grain is not heavily contaminated with spores. The quantity required is $\frac{1}{2}$ lb. per sack of wheat.

Winter Barley.—With the improvement in the price of barley, some farmers have inquired as to the wisdom of drilling "Archer" or other hardy variety of two-rowed barley in this month. It is well known that barley of the malting types, as distinct from the six-rowed winter sorts, can be sown with success in autumn; but there is little practical evidence that it is better to sow in autumn than in spring. Indeed, the results of the following experiment conducted in Devonshire on light loam, where winter sowing might have been expected to succeed if anywhere, do not favour autumn sowing.

	<i>Sown October 13, 1923.</i>		<i>Sown March 14, 1924.</i>	
	<i>Yield per acre.</i>		<i>Yield per acre.</i>	
	<i>Bushels.</i>		<i>Bushels.</i>	
Plumage Archer	30		42	
Spratt Archer	28 $\frac{1}{2}$		39 $\frac{1}{2}$	
Plumage	26 $\frac{1}{2}$		36	
Archer	26		38	
Maltster	20		37	

In the annual report of the Botanist to the R.A.S.E. for 1926 are recorded a number of observations on the results of sowing barley in the autumn months of 1925. Not only were there frequent failures to secure a plant, even on light soils, but the ears of the plants were badly affected with blindness.

Live Stock.—One cannot converse long with dairy farmers without being asked for suggestions regarding the use of weathered hay during the coming winter. Few farmers have been so fortunate or so skilful as to secure the whole of their hay early and in really good condition, and many have a large proportion of unsatisfactory fodder to consume. It is possible, although not generally advisable, to induce cows to eat otherwise unpalatable hay by chaffing and mixing it with pulped roots, meals, or treacle water; and probably the use of about a quarter of an ounce of ground aniseed per cwt. of chaff would be advantageous in the absence of roots. The fundamental problem, however, is that of compensating the animal for the difference in nutritive value between good and bad hay. This difference in an ordinary daily allowance of 15 lb. of hay may require an increase

* For fuller particulars as to pickling seed wheat, see the Ministry's Leaflet, No. 92, 1925 Edition.

of about 3 lb. in the ration of concentrates ; and this addition will cost about £3 per cow during the winter. The heaviest yielders, however, should receive a reduced quantity of the inferior hay, and if necessary a further allowance of corn ; lower yielders may be required to utilize a greater proportion of hay.

Liver Fluke.—Past experience of wet summers warns the grassland flock master of the possibility of a severe outbreak of liver rot during the coming winter. The sheep losses after the wet season of 1879 are still remembered by the older generation of farmers ; and recently in the Bangor area, where the agricultural advisory officers have this problem under special observation, the number of sheep affected has been found to vary in close relation with the rainfall of the preceding summer. The reason for this relationship lies in the fact that the fluke passes its early stages in the body of certain small water snails ; and when these spread on to grass fields and multiply, as they do in wet summers, they distribute the parasites which, when consumed with herbage, ultimately become flukes in the liver, bile duct and gall bladder of sheep and cattle.

Both prevention and treatment of liver fluke are being investigated with successful results, the first being based on the eradication of the snail, without which the fluke cannot be reproduced. At this date, however, the remedial treatment of sheep that have grazed on suspected land is of more interest. Early recognition of the symptoms of the disease is essential, and if there is reason to suspect infestation, one of the suspected sheep should be killed, opened and thoroughly examined. If flukes are found in this, the whole flock should be treated by a veterinary surgeon.

* * * * *

NOTES ON MANURES FOR NOVEMBER

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

Rothamsted Experimental Station.

Autumn Manuring.—*Phosphates.*—At this time of year, interest centres chiefly round the use of phosphatic fertilizers. Two cases commonly arise on the arable land :—

- (1) Autumn-sown corn crops, wheat, oats, beans and forage mixtures.
- (2) Seed leys after the nurse crop has been harvested.

It will be recognized that the actual amount of phosphate needed by these crops will be determined chiefly by the nature

of the particular soil, the general response of which to phosphatic treatment is likely to have been observed in the course of cropping. The climate will also have some bearing on the matter, since, other things being equal, wet districts need more phosphate than dry ones. Finally, the amounts of dung or of phosphatic fertilizers used for the preceding crop will affect the case.

A common dressing for the autumn-sown crops would be about 2 cwt. of superphosphate per acre, or its equivalent of other phosphatic fertilizers, but the dressing would vary from nothing up to 4 cwt., according to the above considerations. It is desirable that the phosphate should be mixed with the surface soil of the seed bed before drilling rather than broadcast afterwards, as the roots of the seedling plants should have some phosphate in their immediate neighbourhood, and this is the more important when insoluble phosphates are used.

Similar dressings might go to the young seeds in their first autumn, but, in this case, the quantity of phosphate given to the cereal crop under which the seeds were sown would be the main guide. When it is thought that phosphates are required for young seeds, the earlier the dressing is given the better.

As far as the source of phosphate is concerned, autumn dressings tend to smooth out the differences in activity between the various types. Superphosphate, high-grade basic slag, and steamed bone flour may each be used with confidence, the relative prices being the main point of consideration. Finely ground North African phosphate has given good results in certain districts, especially on soils strongly in need of phosphatic treatment. Further experiments on this subject are needed in many areas. Another possibility of reducing costs would be to supply part of the phosphate in water-soluble form and the remainder as ground phosphate.

Potash.—Autumn dressing of potash salts in the arable will be less general. On the lighter soils, and where dung is scarce, such autumn corn as may be grown would probably benefit from a light dressing of muriate of potash, say $\frac{1}{2}$ cwt. per acre, in addition to the phosphate. Especially would this be the case for leguminous crops, *e.g.*, beans and clover, which have been observed to respond well to potash even on medium soils.

Insoluble Phosphates.—Until recent years, the standard phosphatic manures for arable purposes were superphosphate and high-grade, 40 per cent., basic slag, each of these being readily available to plants after mixture with the soil. Lately,

owing to changes in the grade and composition of some of the basic slags, attention has been turned to the possibility of using the finely ground rock phosphates for agricultural purposes, especially as these forms provide phosphate at a relatively cheap price per unit. It was on grassland, however, that the possibilities of rock phosphates were most extensively tried at the outset; and the value of finely ground North African phosphate for pasture improvement has been brought out by many experiments, with the result that, in many places, it is used with confidence, for this purpose, as an alternative to basic slag or superphosphate. It appears to have made most headway in districts with good rainfall, although experiments are on record in which it has given quite good results in drier areas. The possibilities of rock phosphate for arable purposes have been less explored. An interesting report of his experiments on this subject, conducted in Northern Ireland over the period 1921-26, is given by Prof. Scott Robertson in a new journal.* On comparing the effects of superphosphate, high-grade basic slag, and Gafsa phosphate, under arable conditions, on a number of soils, all of which were more or less acid, it is shown that the nature of the crop makes a considerable difference to the relative performance of the manures. In the case of turnips, all the phosphates tried were about as effective as the water-soluble form, while in the case of potatoes superphosphate showed a marked superiority. All forms showed similar large residual effect in oats, taken after turnips treated with phosphate, and here basic slag was probably the best. Hay as the third crop without further phosphate did quite well in the control areas—plots which had been a complete failure in turnips three years before through lack of phosphate; and a slight, and approximately equal, residue for all forms was observable in the hay. It is concluded from the experiments that, in the district covered, Gafsa can replace superphosphate for turnips, but not for potatoes, and the Gafsa and high-grade slag can be regarded as alternatives. It was found that on the whole superphosphate did better than Gafsa phosphate on the peaty soils, and that in the very wet year 1924 the superphosphate again showed to advantage over the rock phosphate. It was noted in the field that water-soluble phosphate was more effective than Gafsa in helping the turnip plant in the earlier stages, and also caused the potatoes to start earlier and ripen quicker.

**Journal of Ministry of Agriculture for Northern Ireland*, Vol. I, 1927.

Farmers' Experiments.—A great many trials are conducted with fertilizers in various parts of the country and are the most direct way of ascertaining the manurial requirements of soils. The value of these trials increases when the results can be interpreted with due regard to the magnitude of the experimental error, thus estimating whether observed differences are actually due to treatments or are merely accidental. It must also be borne in mind that the results of a single experiment may not be confirmed under the conditions of the following seasons, a fact which makes it desirable to repeat experiments over a series of years.

Moreover it is not permissible to apply the results of a trial carried out under one set of conditions to cases where the circumstances are different, though this often occurs on a single farm. The more the soil and climatic conditions in two districts approximate, the more likely is it that indications obtained by experiments in the one will be borne out in the other.

Such methods are complicated, demanding considerable work in the field, and are more within the scope of experimental institutions than of individual farmers. When experiments of this type cannot be undertaken, as would be the case on the ordinary farm, and tests are conducted with manures or varieties on large plots with no repetition, one has to be content with a much lower degree of precision, and nothing but very broad differences, which easily meet the eye, can be accepted with certainty. It appears, therefore, that experiments conducted by the farmer on his arable land are only useful as a general guide and will not serve to bring out small differences. Difficulties in applying manures and weighing produce also occur, to say nothing of uncertainty in interpreting the results. The chief advantage is that the soil in question is the actual one which concerns the farm. On grassland the case is somewhat different. The crop remains unchanged for a long period, differences due to treatment with fertilizers being, frequently, very striking and easily recognized by inspection. Such matters as the need of the permanent grass for phosphate, potash, and lime, and the effect of nitrogenous manures, can quite readily be decided by farmers themselves by direct trial and observation over a period of years.

* * * * *

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 October 5				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	..	..	11 5	11 5	14 6
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	10 2*	10 2*	10 2*	10 2*	9 10
Calcium cyanamide (N. 19%) ..	8 10†	8 10†	8 10†	8 10†	8 11
Kainit (Pot. 14%) ..	3 2	2 17	2 17	2 17	4 1
Potash salts (Pot. 30%) ..	4 17	..	..	4 14	3 2
" (Pot. 20%) ..	3 12	3 2	3 7	3 6	3 4
Muriate of potash (Pot. 50·53½%) ..	9 10	8 5	8 13	9 8	3 6
Sulphate " (Pot. 48·51½%) ..	11 10	10 5	10 16	11 6	4 5
Basic Slag (T.P. 32%) ..	3 8§	3 3§	3 3§	..	..
" (T.P. 30%) ..	3 6§	3 1§	3 1§	2 15e	1 10
" (T.P. 28%) ..	..	2 12§	2 13§	..	..
" (T.P. 26%) ..	..	2 6§	2 7§	..	..
" (T.P. 24%) ..	2 10§	2 1§	2 2§	..	..
Ground rock phosphate (T.P. 58%)					
Very fine grade¶	2 15	..	..	2 10d	0 10
Fine grade¶	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 15	2 18	2 15	1 10
Bone meal (N. 3½%, T.P. 45%) ..	8 15	8 10	8 10	8 0	..
Steamed bone flour (N. 2½%, T.P. 60·65%)	5 17†	6 2†	6 5	5 17	..
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 towns 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.

NOTES ON FEEDING STUFFS FOR NOVEMBER

H. E. WOODMAN, PH.D., D.Sc.,

School of Agriculture, Cambridge.

The Ensilage of Sugar Beet Tops.—It is of importance to continue to discuss the subject of sugar beet tops, already dealt with in some of its phases in recent issues of this JOURNAL. The beet crop is one of the few bright spots which can be discerned in the somewhat drab agricultural outlook of to-day, and therefore our thoughts turn hopefully in that direction. What the future may hold for the beet sugar industry in this country cannot at the moment be predicted with any confidence. It is certain, however, that the industry will only be able to flourish as an independent factor in national life when we have learnt to make the fullest possible use of all the manifold by-products which arise in connexion with the beet crop both in the field and in the factory. It is of the highest importance that the agriculturist should be in possession of all the information which patient investigation in field and laboratory has been able to accumulate in respect of the cultivation and utilization of the crop.

It has already been indicated that the most economical and satisfactory utilization of sugar beet tops consists in allowing stock to eat them directly off the land. Where large areas of sugar beet are grown, however, it may not be possible to secure consumption of the whole of the tops before decomposition of the material sets in. What is the farmer to do in such a case?

Two courses are open to him. He may, on the one hand, plough the surplus tops into the land as manure. The question of the manurial value of sugar beet tops will be dealt with in a concluding article on this subject in the notes for next month. He may, on the other hand, decide to preserve a certain proportion of the tops for use in winter feeding.

The preservation of sugar beet tops can be effected in two ways, either by artificial drying (as practised on the Continent) or by ensilage. The drying down of such sappy material as beet tops is essentially a factory process and can hardly under any circumstances be contemplated by the farmer. He can only look forward to the time when the beet sugar factories may be in a position to regard this method of preservation as a commercial proposition. It follows, therefore, that the

farmer who wishes to preserve these residues must inquire into the possibility of achieving his purpose by a resort to ensilage.

The ensilage of sugar beet tops, however, is not unattended with difficulty. There is firstly the trouble and expense of carting the tops, especially on heavy land. There is the additional difficulty of filling the wet, heavy tops into a tower silo, a difficulty which would not wholly be removed if a convenient method of cutting up the tops were available. Moreover, at the season when the sugar beet crop is lifted, the silo is frequently full, and the contents are ready for being fed to stock. The results of our silage investigations at Cambridge have also shown that when a mass of wet material like beet tops is superimposed in the silo on a crop which has been ensiled at a suitable moisture content, then the losses of nutrient matter in the lower layers may be augmented very considerably.

It might be suggested that a way out of these difficulties would be to adopt the alternative method of ensiling the tops in a pit or clamp. The losses of nutrient matter in these processes would, however, be excessive, in consequence of the wetness of the crop, and the resulting silage would almost inevitably be of an objectionable "sour" quality. Further, the presence of small amounts of a nitrogenous substance called betaine in these beet residues might lead to the silage acquiring the obnoxious odour of trimethylamine, should partial spoiling occur. It need only be added that the smell of this substance is that of putrid fish. By no means is it asserted that the production of a good type of silage from beet tops is not possible by this method; it would, however, call for the exercise of considerable skill and careful management.

Why, however, when we think of ensilage, should we necessarily have visions of the tall and roomy towers which are usually erected for this purpose? For many years now we have employed at Cambridge, for experimental purposes, small, inexpensive, cylindrical wooden silos, measuring 6 ft. in height and 4 ft. in diameter. These small silos, which could be made portable if desired, are simply constructed of 1 in. boards, tongued and grooved and kept tightly pressed together by three circular iron hoops, which can be kept tightened by suitable screws. The wood is of plain deal, tarred externally for purposes of preservation. The floor of each silo simply consists of puddled gault clay. At the time of filling,

metal extensions 2 ft. high are fitted to the top of the silos. After completion of filling, the crop is covered with a layer of soil and the metal extensions are used as covers to protect the contents of the silos from the effects of the weather. Silage equal in quality in every respect to that made in a tall tower silo can be produced in these smaller containers, and it was in such diminutive silos that our experiments on the ensilage of sugar beet tops were carried out.

The following account summarizes our experiences in one typical experiment. The crop of sugar beet was topped on or about October 30, 1924. The tops were allowed to wilt in the field until November 14, during which time they were subjected to the adverse influences of variable weather conditions. For that reason the conditions for ensiling the tops were probably unfavourable to the best possible results being obtained. *The wilted tops were ensiled whole*, care being taken to ensure tight packing. The silo was opened on March 3, 1925. Considerable settlement of the crop had occurred during storage. A maximum thermometer, which had been buried in the material, recorded only a slight rise of temperature.

In spite of the somewhat unfavourable conditions of the trial, the resulting silage was of unexpectedly good quality. It possessed a pleasant, fragrant smell. It was cold and wet to the touch, sourish to the taste, and had retained the faded green colour of the crop as ensiled. There was an entire absence of the unpleasant pungent odour associated with butyric acid. The beet crowns appeared, to the eye, to have suffered very little change. Chemical investigation showed that the changes which had been suffered by the beet tops during storage were of the type usually associated with the production of good silage. The dry matter content of the material had risen from 17.5 to 19.3 per cent. during the period of preservation, mainly as a result of copious losses of juice. As would therefore be anticipated, the losses of nutrient matter were excessive, amounting to 28 per cent. of the total organic matter in the ensiled crop.

In another trial, a common Continental practice was followed in filling a small silo with alternate layers (each layer weighing about $\frac{1}{2}$ cwt.) of wet sugar beet pulp and *whole*, wilted sugar beet tops. In spite of the fact that the tops were slightly rotted in parts at the time of filling, the silage, obtained when the silo was opened after a month's interval, was of very good quality and possessed the fragrant smell associated with silage from sugar beet tops alone. The pungent odour of

butyric acid was entirely absent. The silage was eaten eagerly by both heifers and sheep. It may be observed, further, that in no similar trial in the small silos had so little wastage by spoiling been noted, the silage being of good quality right up to the soil covering. The losses of nutrients during preservation were again considerable, 20 per cent. of the organic matter of the crop being lost as a result of fermentation and juice drainage.

Digestion trials with sheep carried out on this "pulp plus tops" silage yielded eminently satisfactory results, no less than 81 per cent. of the organic matter being digested and utilized by the animals. The high digestion coefficients of the carbohydrate (85 per cent.) and of the fibre (82 per cent.) were especially noteworthy. It was found that every 100 lb. of the dry matter of the silage contained as much as 65 lb. of starch equivalent. Obviously, the production in small, inexpensive silos of such palatable and highly nutritious silage from mixtures of beet tops and wet sugar beet pulp offers distinctly attractive possibilities on farms *situated in the vicinity of beet sugar factories*. The cylindrical silos referred to above, 6 ft. high, with a diameter of 4 ft., might be expected to contain when opened for use, 10 cwt. or more of good, utilizable silage.

It can scarcely be claimed, however, that the use of such small containers affords a satisfactory solution to the difficulties of the farmer who wishes to ensile large areas of beet tops. In such a case, it will be necessary to devise means whereby the tops can be filled into a large tower silo, and the writer would be glad to hear from any farmer who has experience of this operation. Under present conditions, however, where even large areas of sugar beet are grown, it is probable that the farmer will only ensile that fraction of tops which he decides cannot be eaten directly before putrefaction begins; and it is doubtful whether such fractions will be even of such magnitude as to fill a silo of, say, 50 ton capacity.

* * * * *

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

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	10 9
Maize	81	6.8	8 3
Decorticated ground nut cake	73	41.0	12 15
" cotton cake	71	34.0	10 15

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

The cost per unit starch equivalent works out at 2.42 shillings, and per unit protein equivalent, 1.89 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 18
Potatoes	18	0.6	2 5
Swedes	7	0.7	0 18
Turnips	5	0.4	0 13
Green foods—			
Cabbage, drumhead	7	0.9	0 19
" 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 11
Lucerne hay	24	7.9	3 13
Meadow hay, poor	19	2.9	2 11
" " medium	31	4.6	4 4
" " very good	40	7.8	5 11
Seeds hay	24	4.9	3 7
Straws—			
Barley straw	19	0.7	2 7
Bean straw	19	1.7	2 9
Oat straw	17	0.9	2 3
Wheat straw	11	0.1	1 7
Grains and seeds—			
Barley	71	6.2	9 3
Beans	66	20.0	9 17
Oats	60	7.6	8 0
Peas	69	18.0	10 1
Wheat	72	9.6	9 12

*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		Price per lb.	Pro- tein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.	100 lb.	s. d.	starch equiv. d.		%
Wheat, British..	—	—	10 17	0 13	10 4	72	2 10	1-52	9-6	
Barley, British feeding	—	—	11 5	0 10	10 15	71	3 0	1-61	6-2	
„ Canadian No. 3 Western	40 6	400	11 7	0 10	10 17	71	3 1	1-65	6-2	
„ American ..	36 6	—	10 5†	0 10	9 15	71	2 9	1-47	6-2	
„ Danubian ..	38 0	—	10 13	0 10	10 3	71	2 10	1-52	6-2	
„ Karachi ..	38 0	—	10 12*	0 10	10 2	71	2 10	1-52	6-2	
„ Persian ..	37 0	—	10 7	0 10	9 17	71	2 9	1-47	6-2	
Oats, English, white ..	—	—	9 13	0 11	9 2	60	3 0	1-61	7-6	
„ „ black and grey ..	—	—	9 15	0 11	9 4	60	3 1	1-65	7-6	
„ Irish, black ..	—	—	9 8	0 11	8 17	60	2 11	1-56	7-6	
„ Canadian feed ..	29 6	320	10 7*	0 11	9 16	60	3 3	1-74	7-6	
„ New Zealand ..	33 3	—	11 13*	0 11	11 2	60	3 8	1-96	7-6	
„ Argentine ..	28 9	—	10 2	0 11	9 11	60	3 2	1-70	7-6	
Maize, Argentine ..	35 0	480	8 3	0 10	7 13	81	1 11	1-03	6-8	
Peas, Indian, white ..	—	—	12 0*	1 2	10 18	69	3 2	1-70	18	
Dari, Egyptian ..	—	—	10 10	0 12	9 18	74	2 8	1-43	7-2	
Rye, homegrown ..	—	—	10 5	0 13	9 12	72	2 8	1-43	9-1	
Millers' offals—										
Bran, British ..	—	—	8 0	1 3	6 17	42	3 3	1-74	10	
„ broad ..	—	—	9 0	1 3	7 17	42	3 9	2-01	10	
Middlings, fine, imported ..	—	—	10 2	0 18	9 4	69	2 8	1-43	12	
„ coarse, British ..	—	—	8 15	0 18	7 17	58	2 8	1-43	11	
Pollards, imported ..	—	—	8 0	1 3	6 17	60	2 3	1-20	11	
Meal, barley ..	—	—	12 10	0 10	12 0	71	3 5	1-83	6-2	
„ maize ..	—	—	9 5	0 10	8 15	81	2 2	1-16	6-8	
„ „ S. African ..	—	—	8 15	0 10	8 5	81	2 0	1-07	6-8	
„ „ germ ..	—	—	9 0	0 16	8 4	85	1 11	1-03	10	
„ „ gluten feed ..	—	—	9 0	1 1	7 19	76	2 1	1-12	19	
„ locust bean ..	—	—	8 17	0 8	8 9	71	2 5	1-29	3-6	
„ bean ..	—	—	12 0	1 6	10 14	66	3 3	1-74	20	
„ fish ..	—	—	21 0	3 10	17 10	53	6 7	3-53	48	
Maize, cooked flaked ..	—	—	10 12	0 10	10 2	85	2 5	1-29	8-6	
Linseed—										
„ cake, English 12% oil	—	—	12 10	1 10	11 0	74	3 0	1-61	25	
„ „ „ 10% „	—	—	12 0	1 10	10 10	74	2 10	1-52	25	
„ „ „ 9% „	—	—	11 15	1 10	10 5	74	2 9	1-47	25	
„ „ „ 6% „	—	—	11 10	2 3	9 7	69	2 9	1-47	36	
Soya bean „ „ 5½% „	—	—	7 7	1 8	5 19	42	2 10	1-52	17	
Cottonseed cake „ „ 5½% „	—	—	7 2	1 8	5 14	42	2 9	1-47	17	
Decorticated cottonseed meal, 7% oil	—	—	11 15†	2 3	9 12	74	2 7	1-38	35	
Coconut cake, 6% oil ..	—	—	10 0	1 5	8 15	79	2 3	1-20	16	
Ground-nut cake, 7% oil ..	—	—	10 5†	1 8	8 17	57	3 1	1-65	27	
Decorticated ground-nut cake, 7% oil	—	—	12 15†	2 3	10 12	73	2 11	1-56	41	
Palm kernel cake, 6% oil ..	—	—	9 7	0 18	8 9	75	2 3	1-20	17	
„ „ „ meal, 6% oil ..	—	—	9 5*	0 18	8 7	75	2 3	1-20	17	
„ „ „ meal 2% „	—	—	8 7	0 19	7 8	71	2 1	1-12	17	
Feeding treacle ..	—	—	6 10	0 8	6 2	51	2 5	1-29	2-7	
Brewers' grains, Dried ale ..	—	—	7 10	0 19	6 11	49	2 8	1-43	13	
„ „ „ porter ..	—	—	7 0	0 19	6 1	49	2 6	1-34	13	
„ „ „ Wet ale ..	—	—	0 16	0 7	0 9	15	0 7	0-31	4-8	
„ „ „ „ porter ..	—	—	0 12	0 7	0 5	15	0 4	0-19	4-8	
Malt culms ..	—	—	7 10	1 8	6 2	43	2 10	1-52	16	

* At Hull.

† At Bristol.

|| 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 18s. per ton. The food value per ton is therefore £9 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. 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. 7d.; P₂O₅, 3s. 10d.; K₂O, 3s. 0d.

1927.]

MISCELLANEOUS NOTES.

767

MISCELLANEOUS NOTES

THE members of this club, which affords a striking example of the value of the Young Farmers' Club Movement in connexion with agricultural education, are drawn from a wide area in the county, some of the boys and girls travelling as much as 16 to 20 miles to attend the club meetings. This keenness and the high standard of work maintained are due, in great measure, to the untiring efforts of the President, Mr. T. Bannister, by whom the club was promoted at Haywards Heath in 1922, and of Mr. Noakes, the Club Leader; and their enthusiasm has also evoked the interest of the members' parents, who follow the activities of the club with close attention and not a little pride.

During the past three seasons, the members have put up a very creditable record, providing, from their number, the County Champion Team for Dairy Cattle Judging in 1925 and 1926, although the objects of the club centre mainly in beef cattle. The club also provided two of the three members of the English team selected, in open competition at the Dairy Show in 1925, to compete against the National American Champion team for the International Championship in Dairy Cattle Judging. This English team, comprising two Sussex boys from the club and one Sussex girl (from the Heathfield Friesian Calf Club) thus won the Gold Challenge Cup for the first time in the history of the English Young Farmers' Club Movement. The club further had the honour of supplying all the members of the English team which successfully defended the cup against the Americans last summer.

Very careful records are kept of the work done by the members; and the calves in their possession are regularly weighed each month by the Club Leader, either on an ordinary weighbridge or on sack scales specially adapted to meet local conditions. From these records detailed statistical information is prepared, showing the age and type of calves, the quantities and varieties of food used, with particulars of costs and profits. The results provide much interesting material which might form the basis of useful lectures to members of similar clubs. As an example of these records, one may take the case of a heifer calf, born in April, 1925, which, at the request of some of the South African farmers visiting England in that year, was, as an experiment, fed on a ration which included crushed maize. On September 1, 1925, it weighed

256 lb., and had cost, with insurance, £11 3s. 0d. During the ensuing year it consumed 1,175 lb. of roots, 1,045 lb. of hay, 2,337 lb. of green food, 1,603 lb. of crushed oats, 60 lb. of linseed cake and 964 lb. of crushed maize, the total cost of which amounted to £14 15s. 3d. On August 26, 1926, on which date it was sold, it weighed 886 lb., having gained 630 lb. during the year, the food cost working out at 5.62d. per lb. gain in live weight. The price realized was £27 6s. 0d.

* * * * *

DISPLAYS of Empire Produce have recently been staged under the ægis of the Empire Marketing Board at the following exhibitions :—

Displays of Home Produce	Exhibition	Place	Date
	International Grocers' Exhibition.	Agricultural Hall	Sept. 17-23.
	Commercial and Industries Exhibition.	Liverpool.	Sept. 23-Oct. 1.
	Norwich Grocers' Exhibition.	Norwich	Oct. 5-15.

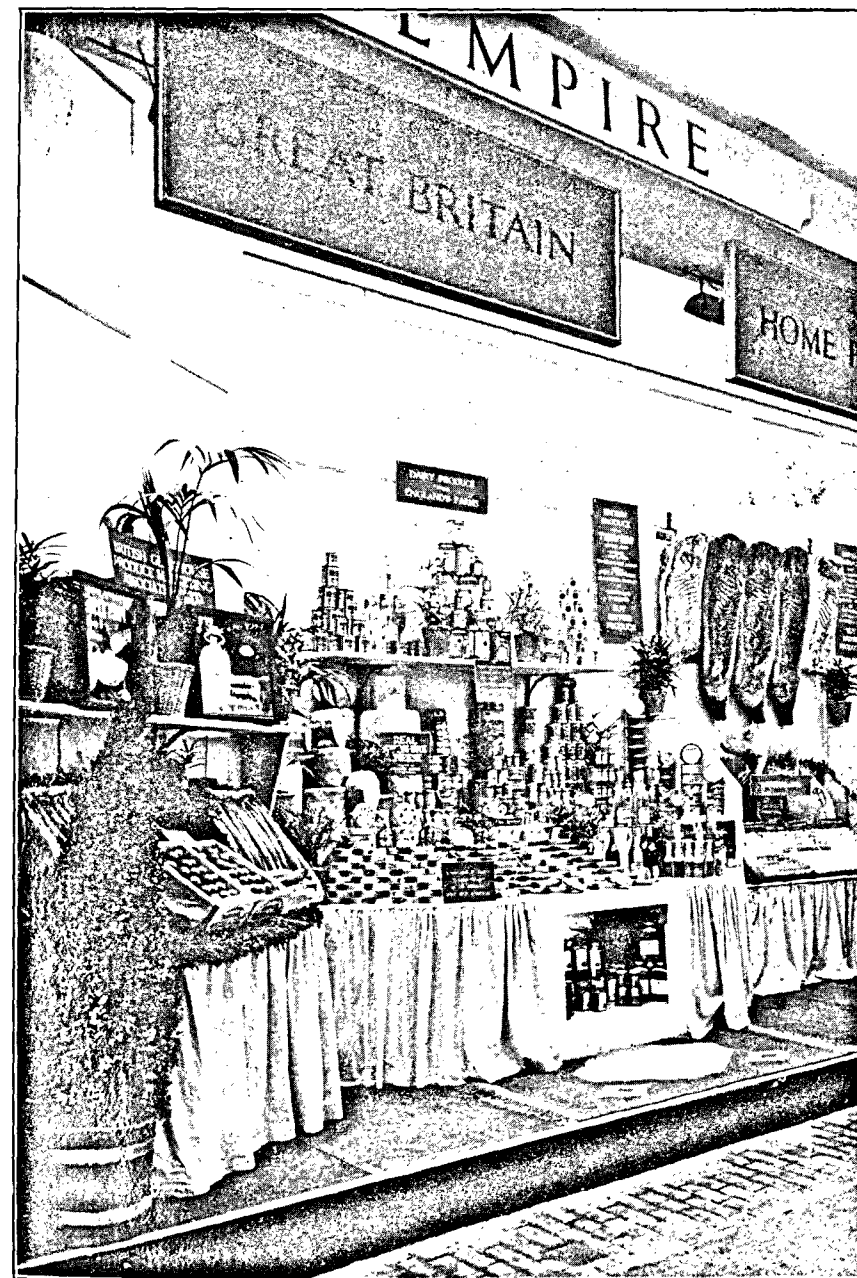
These exhibitions have been well attended, over 200,000 people passing through the hall at Liverpool, and the Empire Marketing Board displays have been widely appreciated.

In pursuance of the Board's declared policy to encourage the purchase of home produce where available, the Ministry was requested to assume responsibility for a Great Britain stand in each case. An attractive display of home-produced foodstuffs was accordingly arranged through the good offices of the National Farmers' Union, Food Manufacturers' Federation, National Food Canning Council, National Association of Cider Makers, British Glasshouse Produce Marketing Association, Western Curers' Association, Cheshire Cheese Federation, and the English Cheddar Cheese Makers' Federation.

Great interest was shown in the variety and quality of home products; and, in particular, dessert apples, glasshouse produce and crustless cheese evoked much favourable comment. Photographs of the stand at the International Grocers' Exhibition are reproduced opposite.

At the Imperial Fruit Show, to be held at Belle Vue Gardens, Manchester, from October 28 to November 5, the Empire Marketing Board is taking the whole of one pavilion, and arrangements are being made for a striking display of home-grown fruits, potatoes, fruit products and glasshouse produce.

Empire Marketing Board's Advertising Campaign.—The claims of home produce are being kept well to the front in the



Display of Home Produce at the International Grocers' Exhibition, London.
Left side of the Stand.

To face page 768.



WHAT THE EMPIRE MARKETING BOARD ASKS YOU TO DO

THE BOARD'S appeal to you is simple. It invites you, in your daily shopping, to demand first the produce of your own country. The fields and farms of home are none the less a part of Empire because they are near and familiar; and "Empire buying begins at home."

The Board invites you next to ask for the produce of the Empire beyond the seas. In so far as you can find Empire produce, whether it be from home or overseas, that is satisfactory in price and quality, the E.M.B. asks you to give it your first choice.



ISSUED BY THE EMPIRE MARKETING BOARD

The Empire Marketing Board's Advertising Campaign:
A specimen Press advertisement.

Press advertisements and posters now being issued by the Board. A specimen advertisement and poster released recently are reproduced here.

* * * * *

ARRANGEMENTS have been made, as in previous years, to enable members of the Rothamsted Experimental Station Staff, during the coming winter, to give a few lectures upon the Station experiments to Chambers of Agriculture and Horticulture, Farmers' Clubs, Farm Workers' Associations, Agricultural Societies, etc. No fee will be charged for the lecturers' services, but any association desiring to engage them will be expected to defray travelling and hotel expenses, also 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 sufficiently long notice is given. It will not be practicable to deal with more than one subject 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., AND OTHER MEMBERS OF THE FARM AND EXPERIMENTAL FIELDS STAFF

- (1) Artificial Fertilizers and their Use in Practice.
- (2) The Management of Farmyard Manure.
- (3) The Use of Lime in Agriculture.
- (4) Recent Work on the Manuring of Potatoes and Sugar Beet.
- (5) Some Points in Manuring a Rotation of Crops.
- (6) Manuring as a Factor in Grassland Improvement.
- (7) The Rothamsted Field Experiments, 1843-1926.
- (8) Recent Additions to the List of Artificial Manures.
- (9) The Growing of Sugar Beet.
- (10) The Growing of Lucerne.
- (11) Fallow and Fodder Crops.
- (12) Malting Barley.

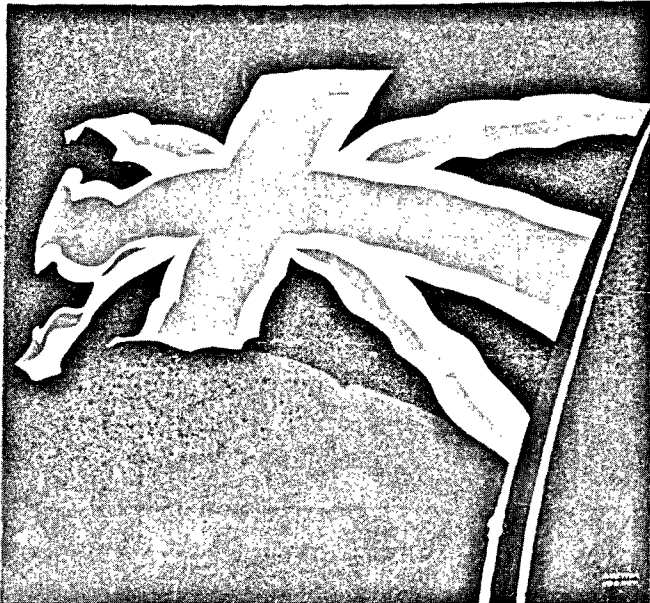
OTHER LECTURES

- (1) *Soil Micro-Organisms (Bacteria, Protozoa, etc.)*

Lucerne Inoculation.	} Mr. H. G. Thornton, B.A.
Life in the Soil.	
Biological Aspects of Partial Sterilization.	
- (2) *Agricultural Botany*

Weeds of Arable and Grass Land.	} Dr. Winifred E. Brenchley, F.L.S.

A black and white photograph of a large exhibition stand for 'GREAT BRITAIN' products. The stand is covered with a white cloth and features a large, tiered display of various goods, including canned fruits and bottled products. A sign at the top reads 'GREAT BRITAIN'. To the left, there are more displays, including a large cake or loaf on a table. The background shows other exhibition stands and a large window.



**FOLLOW THE FLAG
IN ALL YOUR
PURCHASES**

**BUY NOW APPLES, PEARS AND PLUMS
HOME GROWN HOME GROWN**

ISSUED BY THE EMPIRE MARINE LTD, LONDON

Empire Marketing Board's Advertising Campaign: the "Flag" poster.

(3) *Agricultural Chemistry*

Liming and Chalking of Soils.

Green Manuring; its place in British Agriculture.

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*

The Principles of Soil Cultivation.

The Place of the Tractor in Soil Cultivation.

Soil Moisture and Temperature, and their control.

Dr. B. A. Keen, F. Inst. P.

(5) *Insecticides and Fungicides*Mr. F. Tattersfield, B.Sc.
Mr. C. T. Gimingham, F.I.C.(6) *Entomology*

Insect Pests.

Horticultural, Market Garden and Orchard Pests.

Bee Keeping.

Dr. A. D. Imms, M.A.

Dr. J. Davidson, F.L.S.
Mr. D. M. T. Morland, M.A.(7) *Mycology*

Potato Disease (Wart, Virus, etc.)

Plant Diseases: their causes and control.

Soil Fungi and Plant Growth.

Fungus Pests of Crops.

Dr. W. B. Brierley, F.L.S.

* * * * *

THE following further additions have been made to the official list of approved immune varieties (see this JOURNAL, October, 1927, page 679) as a result of

**Varieties of
Potato Immune
from Wart
Disease**

the introduction into commerce of "Sunrise" and "Arran Banner." These varieties successfully passed the test in the Wart Disease Immunity Trials carried out at Ormskirk in 1925 and 1926,

respectively. Descriptions of the varieties are appended:—

Second-Early Variety**"Sunrise"***Sprout*.—Pink.*Tuber*.—Kidney; skin white mottled pink; flesh pale lemon; eyes shallow.*Haulm and Foliage*.—Fairly vigorous, spreading; leaflets grey-green, long, narrow, corrugated, glossy, harsh appearance; secondary leaflets small, few; stem faint coloration at base only; wings straight.*Flowers*.—Pale heliotrope.**Late or Maincrop Variety****"Arran Banner"***Sprout*.—Pink.*Tuber*.—Round, slightly flattish; skin white; flesh white; eyes medium, deeper at the rose end.*Haulm and Foliage*.—Tall, open, upright; leaflets medium grey-green, soft, wrinkled and dull appearance, medium size, roundish; leaf open; stems green with slight bronzing in the axils; wings straight; secondary leaflets large.*Flowers*.—None observed; flower buds pink.

* * * * *

IN an article in the *Tuinderij*, an account is given of the methods of harvesting and storing onions practised in North Holland. Horticultural holdings in that

Onion Storage region are usually of limited extent, and
in North Holland the growers are able to give the crop special attention which probably would be

too costly if larger quantities were handled.

Immediately on lifting the ripened crop, the small onions are separated out and are usually sold for pickling. Only the larger onions are stored, and these are set up in piles in the open field. The piles are made with the aid of a "piler," which consists of a circular iron band supported on four legs.

The band, which has a certain amount of flexibility, is perforated at intervals with holes, into which a knob at one end will fit, being kept in place by a slip ring passed over the point of junction. By this means, the diameter of the circle can be varied, within limits, as desired, very much as a body belt can be drawn in or relaxed. A layer of straw having been spread upon the ground, the "piler" (Fig. 1) is stood upright upon it. A walling of reeds, set vertically, is then placed round the "piler," being secured in position against it by encircling two bands of strong iron wire at the top and bottom.

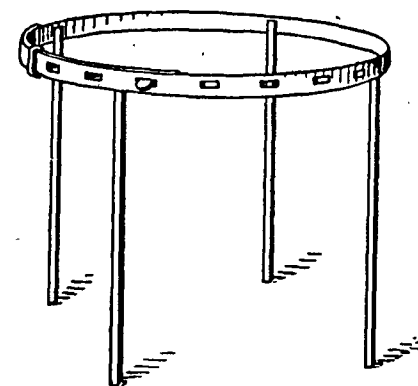


FIG. 1.—The onion "piler."

The onions are then filled in, care being taken to secure an even pack, and as the compartment is gradually filled, the "piler" is raised and a third wire band is fixed to keep the reeds in position higher up, onions being put in on the top of those already deposited. Once again, the "piler" is raised for fixing a fourth wire band and bringing in more onions, care being taken that the wires are placed at equal distances. The "piler" is then withdrawn. Before finishing a pile, the onions have to subside, and the pile is, accordingly, left for a few days, being covered over temporarily with old sacks to exclude rain. After the final filling up, a conical and projecting cap of straw thatch is then put on the top and securely fastened down to the wire bands.

It will be realized that the stability of a pile centres mainly in the weight of the onions, any tendency to side-slip being checked by the walling of reeds held in place by the outer wire bands; but it is necessary to add that satisfactory piling of the onions calls for a regular method in packing and a certain amount of practice.

Piles thus constructed are left undisturbed until the contents are wanted, receiving, meanwhile, the beneficial effects of sun and wind in the open field. It is not advisable to construct the piles where they would be shut out from these influences by trees or buildings. No attention is required by the piles beyond an occasional inspection, especially after storms, to see that the caps have not been damaged or dislodged. This method of storing does not give protection against frost, certainly not against severe frost, but the onions can sustain a sharp night frost without danger. Should they become frozen, they must not, in any circumstances, be handled until the frost has thawed out.

The "pilars" are 70 centimetres high (approximately 2 ft. 3 in.) and are usually set to a diameter of 90 centimetres (approximately 3 ft.), these being the normal dimensions of a pile, the contents of which average 600 kilograms (approximately 11.8 cwt.). By continuing to raise the "piler" and construct the reed walls with encircling wire bands, as previously described, the piles are often built up to a height of 1.6 metres (approximately 5 ft. 3 in.) as seen in the illustration (Fig. 2). In the case of the more slender piles, additional stability may be given by attaching vertical and horizontal stakes as stays against wind pressure.

Many North Holland growers grade their onions before sale into three classes, and higher prices are said to be realized for graded samples than for ungraded lots.

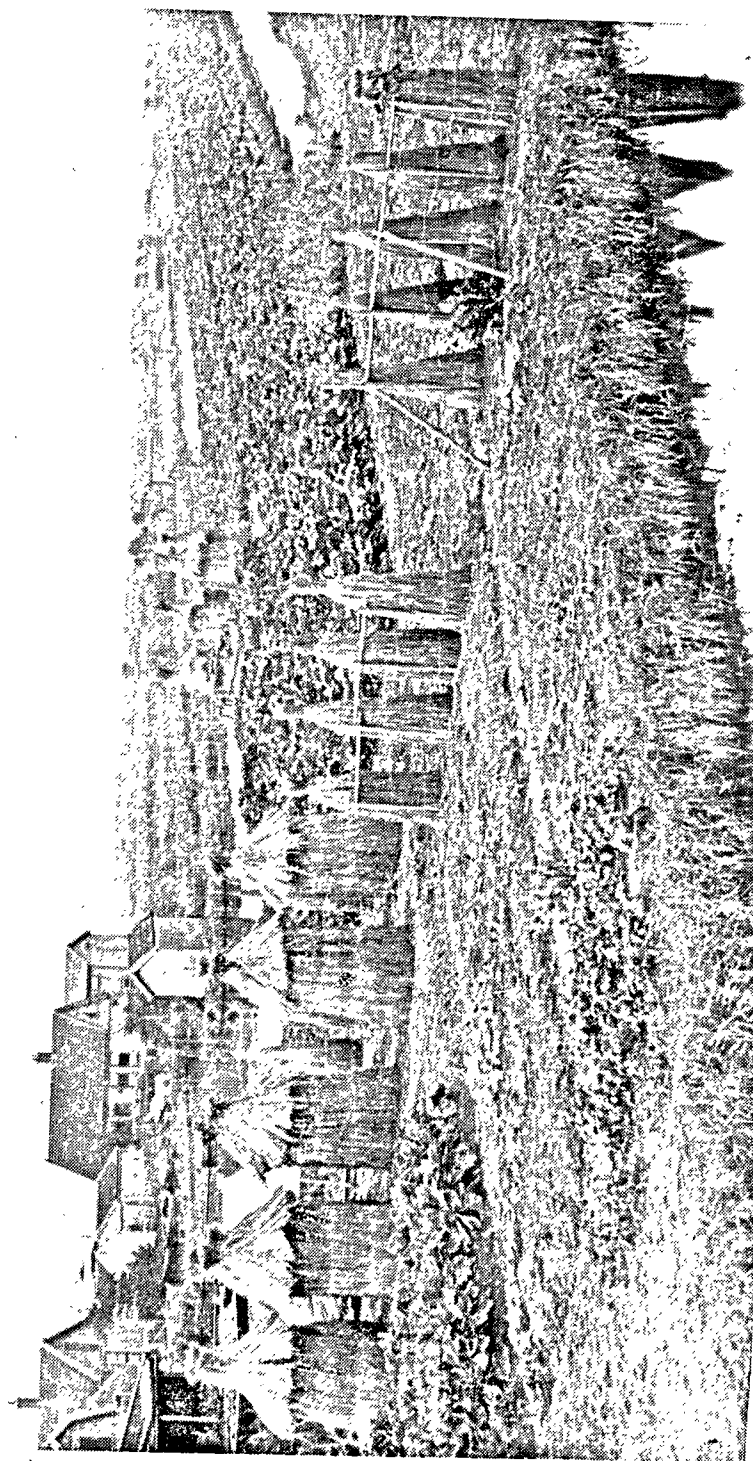


FIG. 2.— Onion Storage in North Holland: Examples of piles formed with the "piler."

B

In the South Holland Islands and in Zeeland, the onions are stored in clamps of more elaborate construction, having strong uprights supporting open batten walls and thatched roofs. Examples of these are shown in Fig. 3.

Acknowledgments are due to Mr. B. Gerritzen, Horticultural Adviser to the Netherland Legation in London, and to the Editor of *Tuinderij* for assistance in preparing this note and for the loan of illustrations.

* * * * *

THE prices of agricultural produce as a whole have not varied considerably from those ruling in August, alterations as a rule having followed the usual

The Agricultural Index Number seasonal fluctuations, and the general index figure is only one point higher on the month at 43 per cent. above the base

years 1911-13. The index figure in September, 1926, was 55 per cent. above pre-war as compared with 49 per cent. in the previous month, but this increase was abnormal and due to the fact that whereas the contract price of milk in September is as a rule the same as in August, the price in September, 1926, was 4d. per gallon higher.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

				Percentage Increase compared with the Average of the corresponding month in 1911-13					
Month	1922	1923	1924	1925	1926	1927			
January	71	67	60	71	58	49			
February	75	63	61	69	53	45			
March	73	59	57	66	49	43			
April	66	54	53	59	52	43			
May	69	54	57	57	50	42			
June	64	49	56	53	48	41			
July	67	50	53	49	48	42			
August	68	52	57	54	49	42			
September	59	52	61	55	55	43			
October	61	50	66	53	48	—			
November	63	51	66	54	48	—			
December	61	55	65	54	46	—			

There was the customary decline in wheat prices, the average falling from 12s. 6d. per cwt. in August to 11s. 1d. for the month under review, with a fall of 8 points in the index figure to 48 per cent. above 1911-13. In the corresponding period of 1926 wheat fell from 13s. 6d. to 11s. 3d. per cwt., and the index figure declined by 19 points to 50 per cent. above pre-war. Barley rose by 1s. 1d. per cwt. this September to an average of 13s. 6d. as compared with a rise

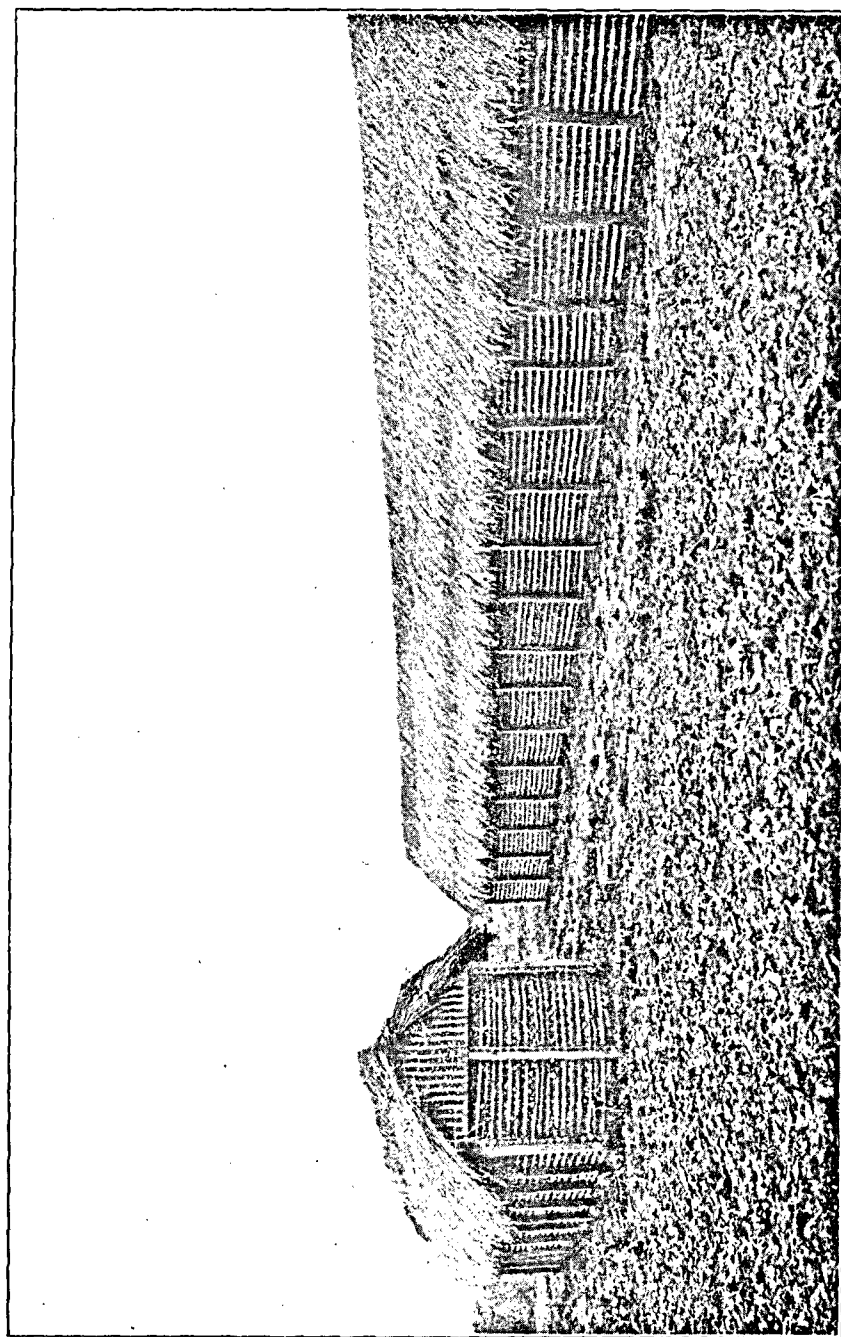


FIG. 3.—Examples of the Clamps used for storing Onions in the South Holland Islands and in Zeeland.

of 1s. to 12s. 6d. in September, 1926, the index figures declining 2 points in each period to 62 and 50 per cent. respectively above the pre-war level. A fall of 11d. per cwt. was recorded for oats in September to an average of 9s. 1d. per cwt., but this marks an increase of 8d. per cwt. on the price ruling a year ago, and oats are now 35 per cent. above pre-war as compared with 25 per cent. in September, 1926.

Live Stock.—With the plentiful supply of fat cattle on offer during September and the continuance of a slow demand, average prices were lower, second quality cattle being nearly 2s. per live cwt. cheaper than in August, and the index figure was 4 points lower at 30 per cent. above the base years. Fat sheep, however, remained unaltered in price and the index figure stood at 45 per cent. above pre-war as in the two preceding months. The price of bacon pigs declined slightly, while porkers failed to show much improvement on August values, and a decline of 2 points is recorded in the index figures to 34 and 41 per cent. above pre-war respectively. A year ago baconers were 79 per cent. and porkers 81 per cent. above the level of 1911-13.

The usual seasonal demand for dairy cattle occurred during September, and prices advanced about 20s. per head, the index number rising from 25 per cent. to 28 per cent. above the base years. A year ago prices advanced by about 15s. per head and the index figure rose 2 points to 39 per cent. dearer than pre-war. Store cattle, sheep and pigs, however, made lower prices than in August, and the index numbers for cattle and pigs fell by 2 and 6 points respectively to 24 and 64 per cent. above the level of 1911-13, while the index figure for sheep rose 1 point owing to a relatively greater fall in the base price in September, 1911-13.

Dairy and Poultry Produce.—During September butter and eggs continued their customary advance in price, the former being about 1d. per lb. and the latter 3d. per dozen dearer than in August, and the respective index figures advanced by 3 and 10 points to 41 and 54 per cent. above pre-war. Cheese prices also were higher during September and the index figure moved upwards from 57 to 59 per cent. above the base years. In September, 1926, butter was 56 per cent. and eggs were 52 per cent. dearer than in 1911-13, while cheese was only 34 per cent. dearer. Poultry was a little cheaper on the month at 37 per cent. above the prices ruling in the base years and cheaper also than a year ago, when the index figure stood at 46 per cent. above the pre-war level. Milk prices in most

districts in September were the same as in August, but higher prices ruled in the Manchester area, and the index number shows a rise from 55 per cent. to 65 per cent. above the pre-war level. At the corresponding period last year the September price for most areas, as fixed under the agreement negotiated by the Permanent Joint Milk Committee representing producers and distributors, was 4d. per gallon more than for August.

Other Commodities.—Potatoes averaged 46 per cent. above pre-war during September as compared with 40 per cent. a year ago. The prices of hay advanced a little on account of the difficulty in securing supplies this season, and at 18 per cent. above 1911-13 the index number was 2 points higher on the month and 9 points higher than in September, 1926. Apples in September were about 30 per cent. and pears about 15 per cent. above pre-war prices, but the increase in the case of plums was about 150 per cent. A year ago plums sold at almost pre-war prices. Vegetables commanded very similar prices to those ruling in August and averaged about 40 per cent. above 1911-13. Wool remained firm at 43 per cent. above pre-war.

Index numbers of different commodities during recent months and in September, 1925 and 1926, are shown below:—

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

Commodity	1925	1926	1927			
	Sept.	Sept.	June	July	Aug.	Sept.
Wheat	53	50	60	56	56	48
Barley	69	50	54	57	64	62
Oats	43	25	33	33	43	35
Fat cattle ..	53	39	25	30	34	30
Fat sheep ..	69	52	48	45	45	45
Bacon pigs ..	66	79	54	43	36	34
Pork pigs ..	65	81	60	49	43	41
Dairy cows ..	46	39	21	25	25	28
Store cattle ..	37	28	21	26	26	24
Store sheep ..	90	63	53	55	48	49
Store pigs ..	75	142	90	80	70	64
Eggs	75	52	30	31	44	54
Poultry	58	46	53	52	43	37
Milk	63	100	53	55	55	65
Butter	70	56	41	42	38	41
Cheese	77	34	54	58	57	59
Potatoes	53	40	61	61	30	46
Hay	4	9	3	6	16	18
Wool	40	31	33	40	42	43

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on September 20 and 29, at 7 Whitehall Place, S.W. 1, Mr. W. B. Yates, C.B.E., presiding.

The Board considered notifications from Agricultural Wages Committees of resolutions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying out the Committees' decisions:—

Berkshire.—An Order to come into operation on October 12, continuing the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until further notice. 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 8½d. per hour, and in the case of female workers of 19 years of age and over, 5d. per hour for all time worked.

Gloucestershire.—An Order to come into operation on October 9, continuing the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until October 6, 1928. The minimum rates in question are, in the case of male workers of 21 years of age and over, head carters 34s. 6d. per week of 58 hours in summer and 36s. per week of 60 hours in winter; head shepherds or head stockmen, 36s. per week of 60 hours; under-carters 32s. 6d. per week of 54 hours in summer and 34s. 6d. per week of 57 hours in winter; under-shepherds or under-stockmen 34s. 6d. per week of 57 hours; and other classes of male workers 30s. per week of 50 hours in summer and 48 hours in winter. Overtime is payable to all male workers at the rate of 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.

Hampshire and Isle of Wight.—An Order to come into operation on October 12 continuing the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until varied by the Committee. 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 connexion with duties performed by carters, cowmen, shepherds or milkers in connexion with the care of stock, when the overtime rate is 7½d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

Lincolnshire (Holland).—An Order to come into operation on October 30 continuing the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until October 27, 1928. The minimum rate in question in the case of male workers of 21 years of age and over is 35s. per week of 50 hours in summer and 48 hours in winter, with, in addition, in the case of cattlemen and shepherds 6s. per week, and in the case of horsemen 10s. per week to cover employment in excess of those hours on employment other than overtime employment. In the case of shepherds additional payments are to be made in respect of the lambing season. The overtime rate of wages for all classes of male workers of 21 years of age and over is 9d. per hour except on Saturdays, when it is 10½d. per hour, and on Sundays, when it 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.

Somersetshire.—An Order to come into operation on October 1 fixing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers, to continue in

operation until September 30, 1928. 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 respect of employment on the hay and corn harvests, when the rate is 10d. per hour. In the case of female workers of 21 years of age and over the minimum rate is 6d. per hour for all time worked.

Wiltshire.—An Order to come into operation on October 12 continuing the existing 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. per week of 50 hours throughout the year, 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.

Pembrokeshire and Cardiganshire.—An Order to come into operation on October 1 continuing the existing minimum and overtime rates of wages for male and female workers until September 30, 1928. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 50 hours in winter and 54 hours in summer, with overtime at 8½d. per hour on weekdays, 9½d. per hour for the first three hours of employment on Sundays and 11d. per hour for subsequent hours. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for a day of eight hours, with overtime at 6d. per hour on weekdays, 6½d. per hour for the first three hours of employment on Sundays and 7½d. per hour for subsequent hours.

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

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending October 15, legal proceedings were instituted against seven employers for failure to pay the 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.	
Kesteven ..	Lincoln ..	1	0	0	3	0	0	22	0	0	2
Hereford ..	Ross ..	6	4	0	—	—	—	22	10	3	1
„ ..	Wigmore ..	4	0	0	5	18	0	52	0	0	2
Pembroke ..	Mathry ..	2	0	0	—	—	—	31	3	3	2
Derby ..	Bakewell ..	2	0	0	0	2	0	10	10	0	1
Cheshire ..	Stockport ..	*	*	*	0	8	0	9	12	0	1
Suffolk ..	Bungay ..	*	*	*	3	3	0	7	0	0	2
		£15 4 0			£12 11 0			£154 15 6			11

* Dismissed under the Probation of Offenders Act.

* * * * *

Foot-and-Mouth Disease.—Ten outbreaks of foot-and-mouth disease have been confirmed since the report in last month's (October) issue of the JOURNAL, including a further outbreak in the Glamorgan area already referred to.

A fresh centre of disease was discovered on October 5 at Allerford, Selworthy, Somerset, and, since that date, seven other cases of disease have been confirmed in that neighbourhood. A fresh centre was also

discovered on October 5, at Enfield, Middlesex, but no further case has occurred in that area.

Forty-two outbreaks in all have been confirmed since January 1 last, involving 12 counties and the slaughter of 1,472 cattle, 1,560 sheep, 496 pigs and 2 goats.

* * * * *

United Dairies Scholarships.—The third annual award of scholarships from the United Dairies Scholarship Fund has just been made. The scholarships are open to the sons and daughters of farmers and smallholders in Somerset, Cornwall, Devon, and Dorset, and are tenable at Reading University, the Somerset Farm Institute, Cannington, Bridgwater, and the Seale-Hayne Agricultural College, Newton Abbot, Devon. The successful candidates for this year are as follows:—

Two Years' Course at Reading University: R. J. Brine, R. Coleman, A. B. James, Miss M. E. Vowles.

Four Terms at Reading University: W. J. Badcock.

One Year's Course at the Somerset Farm Institute, Cannington: Miss M. Osborn.

One Year's Course at Seale-Hayne Agricultural College: J. W. T. Derges.

The fund, amounting to £30,000, which was created in 1924 by United Dairies, Ltd., for the purpose of promoting and encouraging practical and scientific education in dairying and dairy farming, also provides for one or more Travelling and Research Scholarships to enable advanced students to study these subjects at home or abroad. The terms and conditions of both ordinary and research scholarships for next year will be issued in the spring.

* * * * *

National Diploma in Dairying.—The 32nd Annual Examination for the National Diploma in Dairying was held by the National Agricultural Examination Board at the University and British Dairy Institute, Reading, for English students, from September 2 to 10, 1927, and at the Dairy School, Kilmarnock, for Scottish students, from September 16 to 24, 1927. One hundred and twenty-three candidates presented themselves (76 at Reading and 47 at Kilmarnock), and 78 candidates (51 in England and 27 in Scotland) gained the Diploma. No candidate this year reached "Honours" standard. Following are the names of the successful candidates:—

English Centre.—Irene D. Beston, Phoebe F. Bond, G. S. Briggs, Dorothy A. Brunning, Ellen G. Butler, A. C. Castle, Edna M. Crossley, Gertrude M. Davies, William Evans, Mary L. Evelyn, Norah M. Fisher, Leslie F. Gregory, Hilda M. Hatchwell, Herbert Hodgson, Owena Jenkins, Muriel M. Johnston, Margaret M. Jones, W. A. Jones, Mildred P. Knowles, Doris S. Lindsay, Frances M. McDougall, Phyllis Madders, A. J. Marval, E. G. Owen, Dorothy A. Peake, Elizabeth G. Pritchard, Sarah D. J. Probert, J. B. B. Robertshaw, R. N. Sadler, Marjorie S. Sellers, J. N. Sharrock, K. Singh, M. H. Sumners, G. E. Taylor, Eleanor M. Thomas, Sylvia L. Udell, Margaret A. V. Griffiths, W. F. Heathfield, J. C. Mauger, Phyllis H. S. Read, Rose Ward, Kate Cragg, Winifred Davies, Sarah E. Gillson, Margaret F. Griffiths, Kathleen R. C. Hodgson, Millicent A. Hunt, Ruth M. Saxelby, H. C. Smith, W. A. G. Turbutt, Kathleen L. Wigglesworth.

Scottish Centre.—W. R. Alexander, N. S. Ayyangar, S. A. Child, Florence M. Clouston, Mary Cowell, George Dunlop, John Glen, Catherine H. M. Grant, Eric Knowles, Mary McArthur, Mary M. MacCaskill, Catherine McColl, Maggie MacDougall, Alice M. McMillan,

Christina Matheson, Ishobel McL. Millar, Clifford Pringle, Nance M. Reid, Thomas Robinson, David Strathie, J. H. Ward, Ruth H. Taylor, Molly A. Thomson, H. E. Wells, Agnes White, Mary R. Wilson, Norah S. Milne.

* * * * *

Leaflets Issued by the Ministry.—Since the date of the list given in the May (1927) number of this JOURNAL, p. 185, the following leaflets have been issued:—

ADDENDUM to Leaflet No. 394 (Phosphatic Fertilizers), *Mineral Phosphates*.

New:—

No. 183. Cultivation of Raspberries.

No. 181. The Culture of Green Peas and Beans.

No. 196. Small Holdings, Cottage Holdings and Allotments.

No. 191. Asparagus Cultivation.

No. 209. Practical Soil Sterilization by Heat for Glasshouse Crops.

Rewritten:—

No. 352. Control of Pests in Fruit Trees.

No. 177. Precautions against Accidents caused by Farm Machinery.

No. 293. Soil Analysis.

No. 98. Grading and Packing of Apples.

Revised:—

No. 26. Farmers and the Income Tax.

No. 368. The Cultivation of Flax for Fibre.

No. 180. Dodder.

No. 244. The Destruction of Rats.

No. 400. List of Publications.

Amended:—

No. 265. Rabbit Keeping.

No. 193. Dry Rot of Potatoes.

* * * * *

NOTICES OF BOOKS

The Economics of Small Holdings. By Edgar Thomas, with Preface by C. S. Orwin. (Cambridge University Press, 1927. Pp. ix + 132. Price 4s. 6d. net.)

This little book is a study of the economic position of the small cultivator as contrasted with that of the wage labourer, based on a survey of 262 small holdings in Carmarthenshire and an examination of financial records kept by 93 of them, at the instance of the author, for a period of one year. The method of investigation was to forward a schedule of questions to the selected small holders and to follow this up with a personal visit, when the information supplied was supplemented by oral inquiry.

The author found that the Carmarthen small holders in general practise the same methods as their larger neighbours, and fail to specialize in those branches of farming that they might be expected to conduct not merely as well as, but even better than, the larger farmer. This fact must not be lost sight of when considering the conclusions to which the author's investigations led him, since it is on specialization that the small holder must commonly depend for real success.

Mr. Thomas's inquiries confirm the generally accepted opinion with regard to the superior stock-carrying capacity of the smaller holding (especially in regard to cattle, pigs and poultry), the greater employment of labour and the handicap suffered by the small holder in

consequence of proportionately heavier capitalization. Mr. Thomas remarks, however, that although the smaller holdings afford more employment than the larger, they supply no criterion of relative efficiency. Most of the small holdings are carried on without hired labour, and this exploitation of family labour is, in the author's opinion, not without serious social disadvantages.

From his analysis of the records of sales and purchases Mr. Thomas found that the balance of receipts per acre diminished as the size of the holding increased, but after allowing on the one hand for produce consumed, and on the other hand for interest on working capital and remuneration of the small holder and his family at ordinary wage rates, the general result showed an excess of expenses over income which, per acre, was greatest on the smaller holdings. Estimates of this kind are, of course, rather arbitrary, and seldom if ever enter into the calculations of the small holder himself. Nevertheless they have their value in helping to elucidate the question as to the most economic size of holdings of different types.

Appendices contain a bibliography, and comparative data for Denmark, Norway, Sweden and Switzerland drawn from official sources.

The Genetics of Sexuality in Animals. By F. A. E. Crew, M.D., D.Sc., Ph.D. Cambridge Comparative Physiology Series. (Cambridge: The University Press. 1927. Pp. 188, illustrated. Price 10s. 6d. net.)

The mantle of the prophet is not one which should be carelessly assumed, but one feels reasonably safe in saying that, in the future, Genetics will be the most important of all the sciences which have been called to the aid of agriculture. The basic aim of agriculture is not merely to produce food and other raw materials; it is rather to produce and maintain a stock or race of plants or animals which can be carried on from generation to generation, and which will yield their valuable products the while. Working only by experience and rule of thumb, husbandmen have achieved really remarkable success in breeding animals and plants, but there is a limit to the possibilities of these methods, and yet further improvement can be attained, as has been shown, for example, by the work of Luther Burbank, the "Plant Wizard."

Genetics, as a science, is only a quarter of a century old, and therefore one cannot expect it to revolutionize the practice of agriculture as yet, for research workers are still learning the grammar of this new knowledge. Very considerable progress has been made, however, and the implications of recent discoveries are far-reaching, and of the greatest importance. In his new book Dr. Crew treats of one side of the modern science of breeding, namely, the factors which underlie the determination and differentiation of sex, and brings out very clearly the new outlook which results from recent genetic discovery, and the hints of what it holds out for us in the future.

This volume is not one for the layman, or for those unversed in the technical terms of genetics and physiology, but it will prove most illuminating to those biologists, veterinarians or other specialists who already possess the necessary technical equipment, and to such it can thoroughly be recommended. The determination of sex and the subsequent sex-differentiation of organs are of fundamental importance to the economy of the animal, and the hitherto little understood mechanisms of these processes must be taken into consideration by the biologist who has to deal with the problems of modern agricultural practice.

It is now well established that sex is determined at the time of fertilization by the nature of the chromosomes of the egg and of the sperm which fertilizes it. This impress of sex is not limited to the

eggs or sperm which the animal will later produce, but is found in all the cells of the body. At a later stage in development a point is reached when the embryonic tissues begin to develop definitely the male or female characters, which up to this time have been indistinguishable. According to Dr. Crew this is dependent upon the already determined sex nature of the body cells acting in conjunction with the hormones produced by the reproductive glands. This hypothesis is substantiated by the consideration of a large number of very diverse cases of abnormality of development throughout the animal kingdom, and the interpretation is both economical and reasonable. Moreover, it is put forward in Dr. Crew's now well-known style of clear exposition and compact lucidity, which enhance the value of this monograph on a somewhat difficult subject in no small degree.

Animal Nutrition. By T. B. Wood, C.B.E., LL.D., F.R.S. Second Edition: pp. viii + 226. (London: University Tutorial Press, Ltd. Price 3s. 6d. net.)

This is a companion volume of another well-known text-book by the same author—*The Chemistry of Crop Production*. Just as the latter describes the scientific principles of cultivation, so the volume under notice deals with the utilization of the products of the soil for the feeding of animals. Primarily intended for students, the book will also prove invaluable to farmers who take an intelligent interest in the computation of rations for the various classes of stock. In this connexion, the author has adopted a system based on the results which the feeder desires to produce. For example, if the desire, with fattening cattle, is to produce a steady average gain in weight of about 2 lb. per head per day, the chapter on beef production shows how this object is to be attained. The rations are worked out in this way, not only for fattening cattle and for dairy cows, but also for sheep, and should appeal strongly to farmers at the present time, as they will be found to differ materially from those in general use in that they contain far less cake and meal.

The reference to the feeding of dairy cows on pasture is likewise of general interest. The author shows that a deep-milking cow on good, well-managed pasture will find all the nutriment she requires without the aid of concentrated feeding stuffs.

It is necessary to draw attention to certain arithmetical errors, as on pp. 159 and 191.

Baillière's Atlas of the Ox: Its Anatomy and Physiology. By T. G. Browne, M.R.C.V.S. Original plates by Georges Dupuy, M.D. (London: Baillière, Tindall & Cox. Price, 7s. 6d. net.)

Professor T. G. Browne has prepared this atlas of the ox with great care and has succeeded in presenting much information in a comparatively small compass. That part of the atlas which deals with anatomy is the best section. The author states that the work is intended primarily for veterinary and agricultural students as well as stockbreeders and those interested in meat inspection. Undoubtedly the agricultural student will find in the atlas all the information on anatomy and physiology that he is likely to require, but the needs of the veterinary student, who must be well informed in these subjects, are not likely to be met by the work, nor indeed by any other work of this nature.

* * * * *

ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Buechel, F. A.—The Commerce of Agriculture: A Survey of Agricultural Resources. (439 pp.) New York: John Wiley. London: Chapman & Hall, 1926, 18s. 6d. [338-9; 63.]

- Agriculture and Food Supply in France during the War: Agriculture, *Michel Augé-Laribé*; Food Supply, *Pierre Pinot*. Carnegie Endowment for International Peace. New Haven: Yale University Press, 1927, \$4. [63 (44); 338.1 (44); 338.9.]
- Commission Internationale d'Agriculture*.—XII^{me} Congrès International d'Agriculture, Varsovie 21 au 24 Juin, 1925. Vol. I (191 pp.), Organisation, etc., 1926; Vol. II (611 pp.), Économie Rurale, Production Végétale et Animale, 1927; Vol. III (427 pp.), Industries Agricoles, Experimentation et Enseignement Agricole, 1927. Varsovie. [63 (063).]
- Jones, Anna M.*—The Rural Industries of England and Wales. A Survey made on behalf of the Agricultural Economics Research Institute, Oxford. IV: Wales (xi + 123 pp.). Oxford: Clarendon Press, 1927, 5s. [63.193.]
- Rural Industries Bureau*.—Leaflet No. 28: Oxy-Acetylene Welding and Cutting Apparatus. (31 pp.) London: The Bureau, 3d. [63.193.]
- National Institute of Industrial Psychology*.—Report No. 2. An Investigation of Certain Processes and Conditions on Farms. By *W. R. Dunlop*. London: 329 High Holborn, W.C. 1, 1927, 2s. [331; 371.]
- Ministry of Agriculture and Fisheries*.—Report of Central Committee on Scheme for Establishing Scholarships and Maintenance Grants for the Sons and Daughters of Agricultural Workmen and others. (62 pp.) London: H.M. Stationery Office, 1927, 1s. 3d. [37 (42); 378.]
- Wakeman, Selman A.*—Principles of Soil Microbiology. (897 pp.) London: Baillière, Tindall & Cox, 1927, 45s. [63.115.]
- Corrie, F. E.*—Lime in Agriculture: I, In Plant Nutrition; II, In Animal Nutrition. (100 pp.) London: Chapman & Hall, 1926, 3s. 6d. [63.15; 612.394.]
- Canada, National Research Council. (Nitrogen Fixation Committee.)*—Bulletin, No. 12: Nitrogen in Industry. (Nitrogen, Fertilizers, Urea.) (55 pp.) Ottawa, 1927. [63.1671; 668.6.]
- Geological Survey of England and Wales*.—Memoirs. The Geology of the Southern Part of the South Staffordshire Coalfield (South of the Bentley Faults). By *T. H. Whitehead* and *T. Eastwood*. (218 pp.) London: H.M. Stationery Office, 1927, 6s. 6d. [55: 912.]
- Department of Scientific and Industrial Research*.—Geological Survey of Great Britain. The Geology of the Country Around Wrexham. Part I (179 pp. + 4 pl.). London: H.M. Stationery Office, 1927, 4s. 6d. [55: 912.]
- Department of Scientific and Industrial Research*.—Geological Survey of Great Britain. The Geology of the Country Around Ipswich. (121 pp. + 4 pl.) London: H.M. Stationery Office, 1927, 3s. 6d. [55: 912.]
- Empire Marketing Board*.—Irrigation in the Empire: Memorandum and Questionnaire. By *Dr. B. A. Keen*. (8 pp.) London: 1927. [63.13.]
- Empire Marketing Board*.—Note on the Work of the Board and Statement of Research Grants approved by the Secretary of State from July, 1926, to May, 1927. [Cmd. 2898.] (13 pp.) London: H.M. Stationery Office, 1927, 3d. [37 (42); 381.]
- Empire Marketing Board*.—A Year's Progress. (40 pp.) 1927. [37 (42); 381.]
- Seale-Hayne Agricultural College*.—Pamphlet No. 23: An Economic Investigation of Devon and Cornish Farms, 1923-24, 1924-25,

- 1925-26. By *W. H. Long*. (35 pp.) Newton Abbot, 1927, 1s. [338.1 (42).]
- Crew, F. A. E.*—The Genetics of Sexuality in Animals. (188 pp.) Cambridge University Press, 1927, 10s. 6d. [575.1; 612.]
- Bose, Sir Jagadis Chunder*.—Plant Autographs and their Revelations. (231 pp.) London: Longmans Green, 1927, 7s. 6d. [58.11.]
- Sanders, E.*—A Bird Book for the Pocket. (xix + 246 pp. including about 200 coloured illustrations.) London: Oxford University Press, 1927, 7s. 6d. [59.82.]
- North of Scotland College of Agriculture*.—Bulletin No. 33: Acarine Disease in Hive Bees: Its Cause, Nature and Control. By *John Rennie*. (34 pp.) Aberdeen, 1927, 1s. [63.81:09.]

Field Crops

- University College of Wales, Aberystwyth, and the University College of North Wales, Bangor*.—Report on a Joint Test of Five Types of Mangel, 1922-26. (10 pp.) Bangor. [63.332.]
- Bristol University: Department of Agriculture and Horticulture*.—Bulletin No. 1: Sugar Beet Trials, 1926. (In the West of England.) (16 pp.) Bristol, 1927. [63.3433-16.]
- Leeds University and Yorkshire Council for Agricultural Education*.—No. 150: The Improvement of Poor Pasture in Yorkshire. (28 pp.) Leeds, 1927. [63.33-15; 63.33-16.]
- University College of Wales, Aberystwyth, Welsh Plant Breeding Station*.—Series H, No. 5, Seasons 1925-1926. The Animal Complex and the Pasture Complex. [I, Italian Rye-Grass for Winter and Early Spring Keep; II, The Sheep as a Grazing Animal and for Estimating Productivity of Pastures.] (54 pp.) 1927, 3s. 6d. [63.60433; 63.33; 63.631:043.]
- University College of Wales, Aberystwyth, Welsh Plant Breeding Station*.—Series H, No. 6, Seasons 1923-1926. Seeds Mixture Problems. (70 pp.) 1927, 3s. 6d. [63.1951; 63.33.]
- Seale-Hayne Agricultural College*.—Pamphlet No. 22: Purity of Strain in Red Clover. By *E. Wyllie Fenton*. (11 pp.) Newton Abbot, 1927. [63.33.]

Horticulture

- Chandler, W. H.*—Fruit Growing. (xv + 714 pp. + bibliography 63 pp.) Boston, etc.: Houghton, Mifflin Co. London: Constable. 1925, 21s. [63.41.]
- New Jersey Agricultural Experiment Station*.—Extension Bulletin No. 60: Pruning Young and Bearing Apple Trees. (48 pp.) New Brunswick, 1927. [63.41-195.]
- Missouri Agricultural Experiment Station*.—Bulletin No. 245: Transplanting Fruit Trees. (16 pp.) Columbia, 1927. [63.41-195.]
- Chilean Nitrate Committee*.—The Manuring of Orchards and Fruit Trees. (38 pp.) London, 1927. [63.41-16.]
- Livingston, A. E.*—The Management of Greenhouses and Frames. (127 pp.) London: Crosby, Lockwood, 1927, 2s. 6d. [63.5; 63.5-19.]

Plant Pests and Remedies

- Midland Agricultural and Dairy College*.—Bulletin No. 14: Report on Celery Blight and Its Prevention. By *H. H. Stirrup* and *J. W. Ewan*. (12 pp.) Sutton Bonington, 1927. [63.24-51.]
- Leeds University and Yorkshire Council for Agricultural Education*.—No. 151: Blindness in Barley. (19 pp.) Leeds, 1927. [63.21; 63.24.]

Wisconsin Agricultural Experiment Station.—Research Bulletin No. 73: Studies of the Epidemiology and Control of Apple Scab. (104 pp.) Madison, 1926. [63.24.]

Oregon Agricultural Experiment Station.—Station Bulletin No. 226. A Progress Report on the Removal of Spray Residue from Apples and Pears. (46 pp.) Corvallis, 1927. [63.295.]

Washington Agricultural Experiment Station.—Bulletin No. 213: Arsenical Spray Residue and Its Removal from Apples. (56 pp.) Pullman, 1927. [63.295.]

Live Stock and Feeding

Horlacher, L. J.—Sheep Production. (x + 418 pp.) New York and London: McGraw-Hill Book Co., 1927, 20s. [63.631.]

Corrie, F. E.—The Feeding of Farm Animals (with particular reference to the use of Fish Meal) (48 pp.) London: British Feeding Meals Manufacturing Co., Ltd., Adelaide House, King William Street, E.C. 4, 1s. [63.6043; 63.60432.]

Montana Agricultural Experiment Station.—Bulletin No. 192: Fattening Pigs with Rye. (19 pp.) Bozeman, 1926. [63.64: 043.]

Dairying

East Anglian Institute of Agriculture.—Bulletin No. 1: The Systematic Feeding and Management of Dairy Cows. (6 pp.) Chelmsford, 1927. [63.711: 043.]

Midland Agricultural and Dairy College.—Bulletin No. 11: Variation in the Solids not Fat Content of the Milk of a Herd of Cows in Leicestershire during 1923–26. By *H. T. Cranfield*. (15 pp.) Sutton Bonington, 1927. [63.712.]

Midland Agricultural and Dairy College.—Bulletin No. 15: Variation in the Composition of Milk and its Control by the Dairy Farmer. By *H. T. Cranfield*. (14 pp.) Sutton Bonington, 1927. [63.712.]

Tennessee Agricultural Experiment Station.—Circular No. 14: Removal of Onion or Garlic Flavor and Odor from Milk. (2 pp.) Knoxville, 1927. [63.719.]

University College of North Wales, Bangor.—I. Eradication of Tuberculosis (6 pp.); II, Clean Milk. (16 pp.) Bangor, 1927, 6d. [614.32; 614.54.]

South Africa Department of Agriculture.—Science Bulletin No. 58: The Manufacture of Loaf and Blended Varieties of Cheese. (20 pp.) Pretoria, 1927. [63.736.]

Poultry

Kaupp, B. F.—Poultry Diseases, including Diseases of Other Domesticated Birds. With a Chapter on the Anatomy of the Fowl (4th edition). (393 pp.) London: Baillière, Tindall & Cox, 1927, 15s. [619.5.]

California Agricultural Experiment Station.—Bulletin No. 417: Poultry Feeding: Principles and Practice. (48 pp.) Berkeley, 1927. [63.65: 043.]

Washington Agricultural Experiment Station.—Bulletin No. 210: Feeding Experiments with Leghorns. (32 pp.) Pullman, 1927. [63.651: 043.]

New Jersey Agricultural Experiment Station.—Circular No. 199: Care and Management of Baby Chicks. (32 pp.) New Brunswick, 1927. [63.651.]

Missouri Agricultural Experiment Station.—Research Bulletin No. 88: The Relation of the Date of Sexual Maturity to Egg Production. (12 pp.) Columbia, 1926. [63.651.]

786'

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXIV. No. 9.

DECEMBER, 1927.

NOTES FOR THE MONTH

THIS Report describes and analyzes the chief economic conditions which affect the marketing of fluid milk in this country. The author is Mr. R. B.

The Fluid Milk Market* Forrester, M.A., M.Com., Cassel Reader in Commerce in the University of London, who was invited by the Ministry to

undertake the investigation and prepare an independent report.

The earlier chapters form an appropriate background to the general subject, and deal with the magnitude, localization, and variation of supplies, the various markets which utilize these supplies, and the problems connected with their assembly and transport from the farm. It is shown that there are six main centres of consumption in England and Wales, namely, Tyneside, Lancashire, the West Riding of Yorkshire, Birmingham and the Midlands, South Wales, and London. With the exception of the last-mentioned, they are, more or less, all local markets, obtaining their requirements, on the whole, from within a 50-miles radius. London, on the other hand, "pulls into its market area supplies from all over England south of a line from the Wash to the Mersey and east of the Gloucester, Birmingham and Warrington line."

Then follows an examination in detail of the methods, organization and facilities provided by the two chief forms of transport used in this country—road and rail. In recent years, road vehicles have played an increasingly important part in the transport of milk, the latest development in this form of transport being glass or enamel-lined tanks having a capacity of from 1,000 to 2,500 gallons. Two of the railway companies now contemplate the provision of a number of

* *Report on the Fluid Milk Market in England and Wales*, Ministry of Agriculture and Fisheries, Economic Series No. 16 : H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 6d. net, or 9d. post free.

waggon under-frames for carrying tanks of 3,000 gallons capacity.

The central theme of the Report is woven round the low consumption of milk in this country. With the majority of foodstuffs, it is generally conceded that demand largely depends upon quality taken in relation to price, and while it is shown that the quality of the bulk of the milk in this country is relatively good, there are certain aspects of the quality question which require special attention at the present time if the confidence of the community is to be gained. These are discussed very fully in Chapter IV, dealing with quality and the graded milk movement.

With regard to ordinary market milk, the Report contains a short résumé of the two forms of control which, in their present use, date back to 1875, when the Public Health Act and the Sale of Food and Drugs Act were passed. The former deals with the health and sanitary controls relating to milk, and, from it, has been elaborated the present milk code, the principal landmarks in which include the Milk and Dairies (Consolidation) Act, 1915, the Milk and Dairies (Amendment) Act, 1922, the Tuberculosis Order, 1925, and the Milk and Dairies Order, 1926. Special attention has, however, been devoted to the second form of control—that by chemical analysis—because of the difficulties inherent in the present law, relating to the chemical quality of milk, which embodies minimum limits of 3·0 and 8·5 per cent. of milk-fat and non-fatty solids respectively. If the percentage falls below either of these limits, it is presumed, until the contrary is proved, that the seller has been guilty of a wrongful act, and that such milk is not genuine; no distinction is made between the person who deliberately adulterates milk and one who sells genuine milk below the presumptive limits prescribed. The Report recognizes that this is a real difficulty to surmount, but it is emphasized that it is not in accordance with ordinary commercial procedure to prosecute in a criminal court for offences which are, in reality, of a civil nature.

In view of this defect of the present situation, three alternative suggestions are put forward by Mr. Forrester as directions in which change might take place. These are:—

- (a) towards a legal minimum quality standard enforced by criminal procedure, together with special provisions against adulteration, if deemed necessary;
- (b) towards a legal minimum quality standard enforced by purely civil procedure except in cases of adulteration, where criminal procedure would remain;

possibility of this, although certain of the hypotheses put forward to explain the changes to which the beet is subjected would, in the light of his investigations, appear to be mistaken. The conclusion reached by previous investigators that the albuminoids present in beet are coagulated on drying was confirmed.

The desiccation process produces raw juices with a greater viscosity and greater relative concentration of impurities than the diffusion process. Means, therefore, have to be devised for overcoming the difficulties arising. Various methods were tried and two were found to be successful. The method finally adopted consisted of mechanically clarifying the juices either before or after liming, whichever is the more convenient. By this method, a good-class white sugar, was obtained. The other method, which also produced a white sugar, consisted in using, after liming, an activated carbon. Both methods of purification gave good results. The latter, though more expensive, gave a better yield of white sugar, as it was found that the green syrup obtained from the first strike of white sugar could be re-boiled to produce a second strike of white sugar. The syrup from the second strike produced a final molasses of low purity and a second product sugar which was available for re-melting into the raw juice.

* * * * *

THIS Report,* issued by the Ministry in the now familiar Economic Series, follows the general commentary on markets and market conditions in this country presented in Part I (Economic Series, No. 13). The Report now issued covers **Markets and Fairs in England and Wales** the 414 agricultural markets and auction marts and 250 agricultural fairs in the Midland Counties, and contains detailed information of a kind which the Ministry is frequently asked to supply. It will be recalled that the Linlithgow Committee recommended that detailed information regarding markets and fairs should be collected and published.

The Report is divided into three main sections. The first of these surveys in general terms the Midland markets, as a whole, from the standpoint of the commodities sold; thus live stock markets, corn markets, wholesale fruit and vegetable

* Economic Series No. 14, *Report on Markets and Fairs in England and Wales: Part II, Midland Markets*. H.M. Stationery Office, price 6d. net (post free, 9d.). To be obtained from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2, or through any bookseller.

markets, egg and poultry markets, meat markets, fish markets, cheese and butter markets, wool auctions, hide and skin markets and the numerous retail markets all receive a share of attention. A note as to the rents, stallages and tolls charged in the Midland markets follows, and the section ends with a review of the agricultural fairs which are held annually or at shorter intervals in the area covered by the Report. The agricultural fairs are gradually disappearing, although many linger on, chiefly as pleasure fairs. For reasons of sentiment, the disappearance from English country life of these pleasant, if boisterous, anniversaries may give cause for regret, but, from the point of view of the producer, there is no question that the properly equipped weekly markets which have taken their place offer greater convenience and efficiency.

Section 2 of the Report gives a series of brief sketches of the agricultural conditions of each county in relation to the markets within its administrative area. In all, 18 counties are reviewed, ranging from Bedfordshire and Gloucestershire in the south, to Lincolnshire and Cheshire in the north. Notes on a few markets of general or particular interest are included.

The third section will probably be regarded as the most informative part of the Report, as, in this section, a number of live stock, egg and poultry, and fruit and vegetable markets have been selected for description in some detail. This will enable those directly concerned with markets, either as owners, managers or users, to appreciate the special features of a number of important markets in various parts of the country. Taken as a whole, and read in conjunction with Part I (Economic Series No. 13), the Report may be said to provide a useful background for the investigation of a number of problems connected with markets, such as why one method of sale is practised in one place and a different method in another; whether, in some parts, the markets—more especially the live stock markets—are not so numerous that concentration would be an advantage; and whether, notably in the large centres of the population, the market accommodation is sufficient to meet the needs of the wholesale trade in agricultural produce. This section of the Report has been well illustrated with photographs and diagrams.

Printed as an Appendix to the Report is a complete list of the markets in the Midland area arranged alphabetically by counties. This appendix contains, for each market, information as to the market days, the market occupier, the covered and uncovered area of the market, the commodities sold, the

method of sale and other relevant data. The live stock markets are, further, classified according to turnover of stock. This appendix is a veritable "Bradshaw" of the Midland markets.

Other appendices contain a list of agricultural fairs, by counties, showing the dates when they are held and the commodities sold, and a list of cattle markets showing the total numbers of each class of stock handled in a recent typical year. Such comprehensive information has not previously been published on the subject of markets and fairs, and there is no doubt that the appendices give the Report distinct value as a permanent book of reference, essential alike for local authorities and their market committees, for auctioneers and other market owners, and for the larger public represented by farmers and buyers of every sort of agricultural produce and stock. The Report enables the farmer to see, at a glance, not only the status of nearby markets with which he is familiar, but also to ascertain information regarding markets at a distance which may offer alternative channels for disposing of his produce.

* * * * *

THE Report on Eggs of the Standing Committee under the Merchandise Marks Act, 1926,* leaves the reader in no doubt

that the Committee were satisfied that a substantial amount of misrepresentation as to the origin of eggs does, in fact, take place. The Committee, however, see two dangers in a marking Order.

First and foremost, they fear that, in the present unorganized state of marketing in this country, the balance of advantage would rest with the best classes of imported eggs. Secondly, they think that a requirement of marking would interfere with the imports of "cheap" eggs and so affect the cost of living of the poorer classes in the United Kingdom.

The Committee express the view that, before an Order is made, steps should be taken to improve home methods of marketing, and also to remove, or at least to reduce, the second of the dangers which they foresee. They recommend that, in the meantime, experiments should be continued with marking inks suitable for use upon eggs, and that the problem presented by preserved eggs should receive attention. It is

* Cmd. 2969, price 3d.: H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2.

clear, therefore, that the Committee, while reporting adversely to an Order in existing circumstances, feel that as soon as means can be found to overcome the two main obstacles, the question of marking might again come up for consideration.

* * * * *

THE following Report of Proceedings under Section 2 of the Agricultural Credits Act, 1923,* from January 1, 1926, to March 31, 1927, was recently published :—

Proceedings under the Agricultural Credits Act A Report of Proceedings under the above Act up to December 31, 1925, was presented to both Houses of Parliament on March 24, 1926.

As stated in that report, a total of nine Credit Societies had been formed under the Act up to the end of December, 1925. Of these Societies only two have materially extended their operations during the period under review. One Society is in an unsatisfactory financial position, and, notwithstanding the efforts of its committee, has had to face a number of bad debts. It has arrears of interest payments due to the Ministry. One other Society is also in an unsatisfactory position, but has maintained its interest payments throughout the period.

Only two Societies have been established since January 1, 1926, one of which has received no advances from the Ministry. Apart from these, very little interest has been taken in the facilities afforded under this Section of the Act; in fact, the 15 months' experience from the beginning of 1926 has only confirmed the statement contained in the previous report as to the lack of interest shown by agriculturists generally.

The initial period of three years fixed by Section 2 (2) of the Act during which the Ministry was authorized to make advances to Credit Societies formed under the Act, expired on July 31, 1926. In view of the small extent to which advantage was being taken of the Act, and after full consideration by the Ministry, it was decided by the Treasury to extend the above period to March 31, 1927, but to bring the powers conferred by this Section to an end on that date. The existing Societies were accordingly notified of this decision.

Of the total sum of £440,000 transferred to the Agricultural Credits Account in 1923-24, £400,000 was surrendered on March 30, 1926. Of the remainder, £5,461 6s. 2d. had by March 31, 1927, been disbursed as " Expenses of the Ministry,"

* A summary of the provisions of the Act appeared in this JOURNAL, October, 1923, p. 649.

mainly as grants to the Agricultural Organization Society as described in the previous report, and £11,763 17s. 3d. represented the total advances to Societies, less refunds and repayments of interest. The balance of £22,774 16s. 7d. was accounted for by the surrender to the Exchequer of £15,414 9s. 1d. on November 20, 1926, and £7,360 7s. 6d. on June 1, 1927.

The following statement gives particulars of the Credit Societies formed since the passing of the Act :—

Name of Society	Date of registration	Amount of total advances under Sect. 2 (2) of the Act	Amount of repayment	Remarks
Bedfordshire Agricultural Credit Society, Ltd., 18 Bunyan Rd., Kempston, Beds.	29.1.24	£ —	£ —	Wound up. Has never operated.
Cornwall Agricultural Credit Society, Ltd., Restormel, Lostwithiel, Cornwall.	22.2.24	—	—	Has never operated.
East Hill Agricultural Credit Society, Ltd., East Hill Poultry Farm, Kemsing, Kent.	3.5.24	1,732 0	—	
East Sussex Agricultural Credit Society, Ltd., 197 High Street, Lewes, Sussex.	8.7.24	430 0	350	
Pillaton and District Agricultural Credit Society, Ltd., St. Odulph Cottage, Pillaton, St. Mellion, Cornwall.	11.8.24	—	—	Has never operated.
Furness and Cartmel District Agricultural Credit Society, Ltd., 3 Theatre Street, Ulverston, Lancs.	18.12.24	3,230 10	—	
Arlesey and District Agricultural Credit Society, Ltd., Arlesey, Beds.	11.2.25	2,105 10	45	
Addington Agricultural Credit Society, Ltd., Eldon House, Wellesley Road, Croydon.	5.2.26	—	—	
The Fur Board, Ltd., Bucklebury, Reading.	*2.2.26	5,000 0	—	

* Constituted a Credit Society by amendment of rules.

ACCOUNTS have been given in this JOURNAL from time to time of the various activities undertaken by the Ministry with the aid of a grant of £40,000 a year for five years made by the Empire Marketing Board. The grant is for the purpose of carrying out further investigations into the marketing of home-grown agricultural produce and for demonstrating improved methods. A further brief report of progress for the quarter ended September 30, 1927, may prove of interest.

Marketing of Home Produce *Publications.*—No report was issued during the quarter, but considerable progress was made with Part II of the *Survey of Markets* (Midland Markets—Economic Series No. 14) and the *Report on the Fluid Milk Market* (Economic Series No. 16), both of which have since been published and are reviewed in these pages. A draft report on the pork and bacon trades (Economic Series No. 17) and a draft report on the marketing of wheat, barley and oats (Economic Series No. 18) are now under consideration. Part III of the *Survey of Markets* (Northern Markets—Economic Series No. 19) and a detailed report on the marketing of apples, pears and plums are in course of preparation.

During the quarter under review, over 2,500 copies of the Economic Series were sold, bringing the total sales of the Series up to September 30, 1927, to nearly 40,000.

Marketing Investigations.—Field work in connexion with the marketing of cattle, vegetables and cheese continues; inquiries are also being made in the eastern and southern counties in connexion with the Survey of Markets, the object being to prepare a report on the markets and fairs of that area.

Marketing Demonstrations and Displays of Empire Produce.—A considerable amount of work in both these directions was undertaken during the quarter and detailed accounts of this have already been given in this JOURNAL. Numerous applications have reached the Ministry for permission to use the experimental national mark. These have been noted pending further developments.

Grants-in-Aid.—A grant not exceeding £700 for the first year was sanctioned to assist the English Cheddar Cheese-makers' Federation in launching a scheme for the standardization and marking of farmhouse cheddar cheese; details of this scheme were given in this JOURNAL for October, 1927 (p. 595). It is satisfactory to record that both the Cheshire and the Cheddar Federations are making satisfactory progress.

Farmers are joining the Federations in considerable numbers; the trade-marked cheese is gradually establishing its market and commands a higher price than the best ungraded products.

A considerable amount of preliminary work on the experimental trial of pig recording mentioned in this JOURNAL for October, 1927 (p. 595), has been done during the summer by the School of Agriculture, Cambridge; the scheme commenced officially on October 1.

The Pershore Co-operative Fruit Market's scheme for marketing graded produce (see this JOURNAL for October, 1927, p. 595) has commenced, and reports indicate satisfactory progress.

The Cottenham Growers, Limited, have decided not to open their apple grading and packing station this year on account of the poor crop. The grant of £100, mentioned in this JOURNAL for July, 1927 (p. 292), will not therefore be made this year, but the Society has been informed that the offer will be renewed next year on the same conditions.

* * * * *

In previous years it has always been interesting to note the difference in prices obtained at the Imperial Fruit Show for apples in non-returnable boxes

Auction Prices for Apples in and for the same quality fruit in returnable wickers.

returnable and non-returnable packages The auction at the recent Imperial Fruit Show held at Manchester again demonstrates the buyer's readiness to pay more for high quality apples in non-returnables. Below are a few of the prices obtained for apples in (non-returnable) boxes and (returnable) wicker sieves.

		Boxes :			Bushel Sieves :		
		<i>Bramley Seedling</i>			<i>Bramley Seedling</i>		
		£	s.	d.	s.	d.	
Grower	(a) ..	..	0	11	6	7	0
	(b) ..	..	0	13	3	10	3
	(c) ..	..	1	1	6 (1st prize)	6	0
	(d) ..	..	0	10	6	16	0 (1st prize)
	(e) ..	..	0	15	0	6	0
	(f) ..	..	0	15	6	8	0
	(g) ..	..	1	1	0 (1st prize)	7	0
	(h) ..	..	0	10	9	12	3 (1st prize)
	(i) ..	..	0	13	0	8	0
	(j) ..	..	0	11	9	9	3
	(k) ..	..	0	13	0	8	6
	(l) ..	..	0	12	6	7	0

Average per box, 14 1 Average per bushel, 8 9

In addition, the buyer is charged 2s. for the returnable sieve.

The boxes and bushels contained apples of identical quality, size and net weights, and in most cases were from the same grower and from the same trees.

Prices for "Newton Wonder" apples show exactly the same comparison as the above.

The old controversy as to the advisability of packing English cooking apples in the standard box should surely now be at an end, seeing that the comparison of prices for boxes and bushels has been on a similar level at the Manchester, Holland Park and Birmingham Shows.

* * * * *

THE distribution of awards to the winners of the Inter-County Clean Milk Competition for England and Wales, 1926-27, held under the auspices of the British Inter-County Clean Dairy Farmers' Association, took place at Milk Competition, the Dairy Show on Wednesday, October 19, 1926-27 1927. The prizes were presented by the Rt. Hon. Walter Guinness, Minister of Agriculture and Fisheries. It will be remembered that this Competition was instituted by the British Dairy Farmers' Association with the object of encouraging improved methods of milk production.* Eighteen counties entered the competition, of which 11 finally competed, and over 400 dairy herds were included; with one exception, these counties also held clean milk demonstrations and/or milkers' competitions.

Mr. Whitley (British Dairy Farmers' Association) in opening the proceedings commented on the great strides which were being made in the production of cleaner milk, largely due to the educational facilities offered by Local Education Authorities under the guidance of the Ministry. He observed that the winning county, Cornwall, had obtained nearly full marks in regard to the absence of bacterial contamination of the milk examined, and the high standard they had maintained throughout the competition made them very deserving winners.

The Minister, in presenting the prizes, congratulated the British Dairy Farmers' Association on their enterprise in having instituted this Inter-County Competition, and the committees of the Local Education Authorities on the work which had been carried out. He complimented Miss Nicholas (County Dairying Instructress for Cornwall) on the very high standard achieved by her county, which was largely due to her efforts. Commenting generally on clean milk production, the

* A Note on the Competition appeared in this JOURNAL for January, 1927, p. 881.

THE ANTIQUITIES OF AGRICULTURE: A NOTE ON THE BRITISH MUSEUM EXHIBITION

H. G. RICHARDSON, M.A., B.Sc.,

Ministry of Agriculture and Fisheries.

ON the occasion of the Imperial Agricultural Research Conference the British Museum arranged an exhibition, chiefly of printed books and manuscripts, illustrating the history of agriculture. This exhibition will remain on view until the New Year. The purpose of this article is to direct the attention of those who are interested in the history of agriculture, but who have not already seen the British Museum exhibits, to a collection which they are not likely to be able to view as a whole on any later occasion.

Ancient Egypt.—The range of exhibits actually covers about 5,000 years; but the extreme limit is represented by a single object, an archaic sickle of wood fitted with flint blades from the Fayum. This implement (Fig. 1A) obviously belongs to a world different from our own, a world without metal. A bronze sickle (of about 1000 B.C.) shown next to it (Fig. 1C), belongs to an age preceding our own, but in form it is the counterpart of implements in use to-day. The implements of tillage in Ancient Egypt were apparently evolved along lines rather different from those which determined the development of the plough in Western Europe. The primitive hoe-like implement, of which a specimen is shown (Fig. 1B), was developed into the plough, by a simple enlargement of its parts and the extension of the handle into a beam. The plough is shown in a vignette (Fig. 2) from the Funerary Papyrus of a royal scribe, Ani (fifteenth century B.C.), which also shows the harvesting of corn with the sickle and threshing by the treading of oxen on a circular threshing floor.

Fruit-culture played an important part in Egyptian agriculture. A vignette (Fig. 3) from the Funerary Papyrus of a military scribe, Nakht, shows the cultivation of the date, the fig and the grape. These are grown in a garden surrounding a tank. In such gardens, the soil of which was almost pure sand, pits were dug and filled with Nile-mud: Nile-mud provided also the material for rimming these pits with a low bank, which enabled them to be flooded from time to time.

The work of cultivation was performed by the fellaheen. Their lot is illustrated by a papyrus containing part of the

teaching of Duauf and by several "Shauabti" figures¹ (Fig. 4). Duauf, some 2,000 years or more B.C., wrote a book of advice for his son Pepi, in which he extolled the virtues of learning and the superiority of the scribe's profession. He describes the endless toil of the peasant, which is followed by the interminable settling of accounts with the steward.² We are reminded of the picture of the ploughman in the Colloquies of Ælfric—also a work of instruction—in the eleventh century of our era. "Mighty hard work is it," says the English ploughman, "for I am not free." He had to contend with bitter cold and frozen fields, the Egyptian fellah with burning sun and parched sand: their lot in this world was one.

Greek Agriculture.—We know only the broad lines of primitive Egyptian agriculture. Before the end of the fourth century before Christ, Greek influence became strong in consequence of the Macedonian conquest, and Egypt entered fully into the common Mediterranean civilization which we call classical. Greek thought and Greek science dominated classical civilization; and it survived for many centuries until, firstly, the barbarian invasions and, secondly, the Mohammedan conquests reduced it to the ruin which Europe had slowly and painfully to reconstruct. Of Greek agriculture and of agricultural administration under the Ptolemies and the Romans many witnesses remain in the documents written upon papyrus and preserved in ruins, rubbish heaps, and cemeteries in the dry soil of Egypt.

When we try to reconstruct that past life, as papyri such as those in the present exhibition enable us to do, we cannot fail to be struck by the modern air it wears. Irrigation has, of course, always been essential to Egyptian agriculture, and it is but to be expected that there should be many references to the ways and means of getting Nile water on to the arid land. For the work of constructing and repairing dykes personal labour appears to have been demanded, just as personal labour was demanded in mediæval England for the maintenance of dykes constructed for draining fens: but, by the third century A.D., money payments were beginning to be substituted, just as a rate or cess was substituted for personal

¹ These, representing fellaheen, were buried with the dead, their purpose being to perform tasks demanded of the dead men in the nether world. They hold in their hands agricultural implements: one here shown has a basket slung over his left shoulder.

² *Guide to Exhibition Illustrating the History of Agriculture*, p. 8.

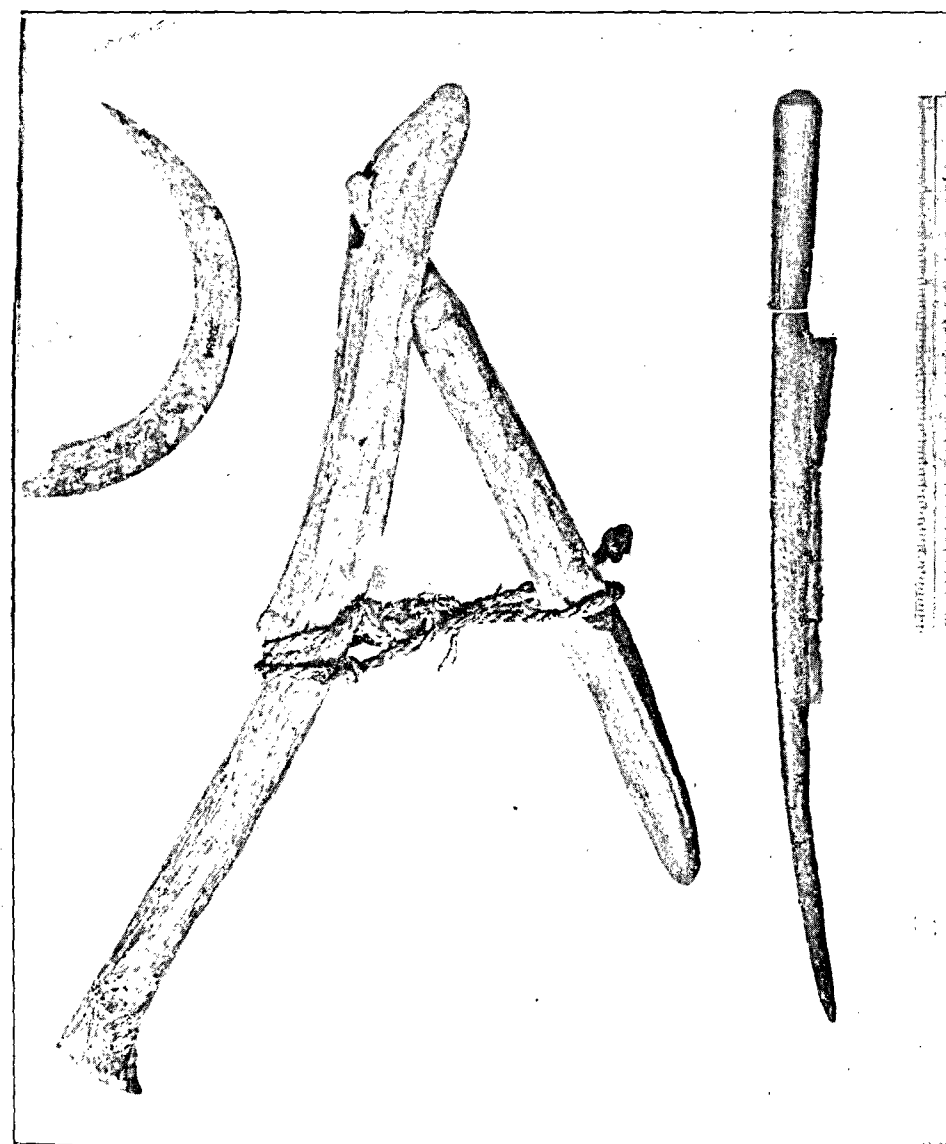


FIG. 1.—Primitive Agricultural Implements from Egypt: (a) Sickle, before 3000 B.C.; (b) Hoe or Digging Implement, c. 1500 B.C.; (c) Bronze Sickle, c. 1000 B.C.



FIG. 2.—Part of Vignette from Funerary Papyrus, XVth century B.C., showing harvesting, threshing and ploughing.

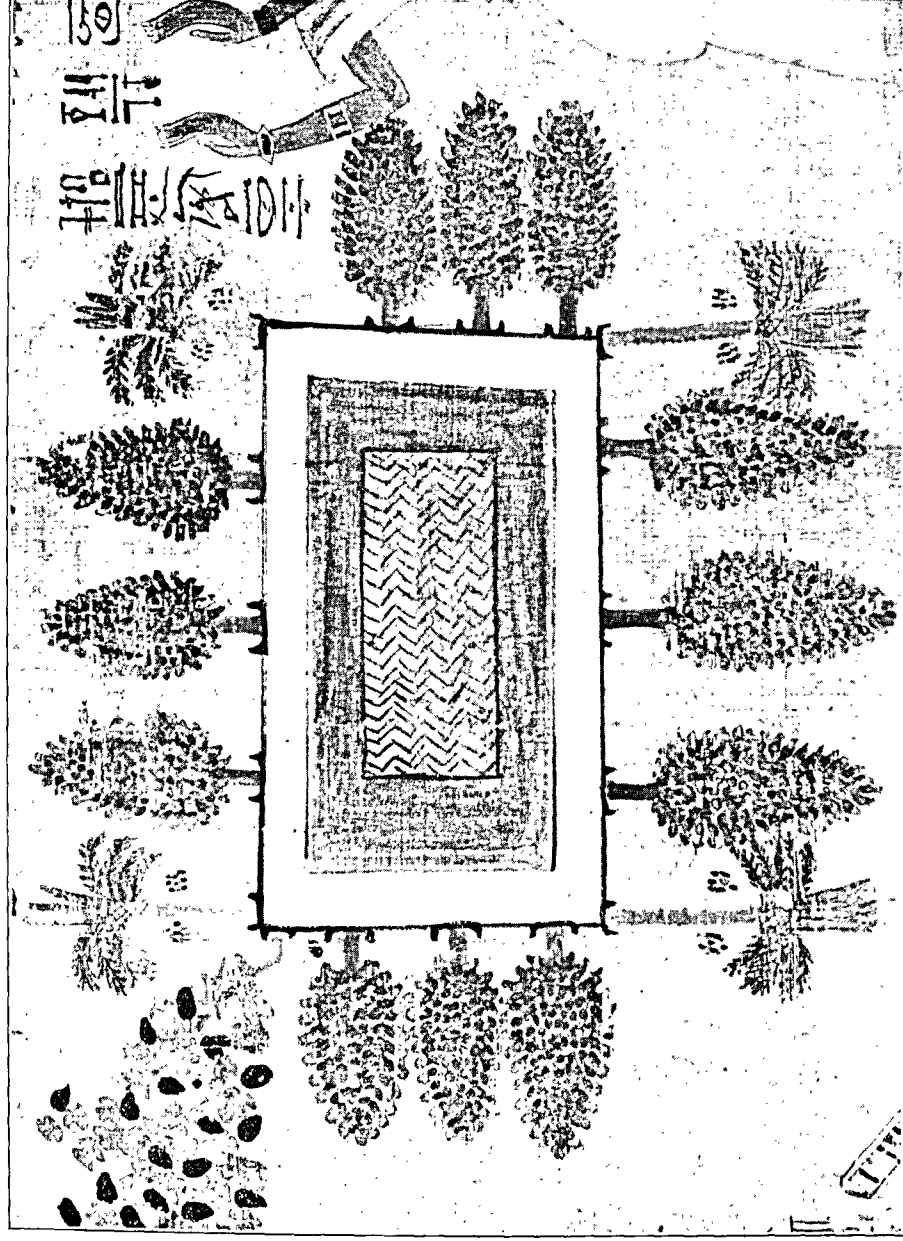


FIG. 3.—Part of Vignette from Funerary Papyrus, XIVth century B.C., showing fruit-cultivation.

800. C

D

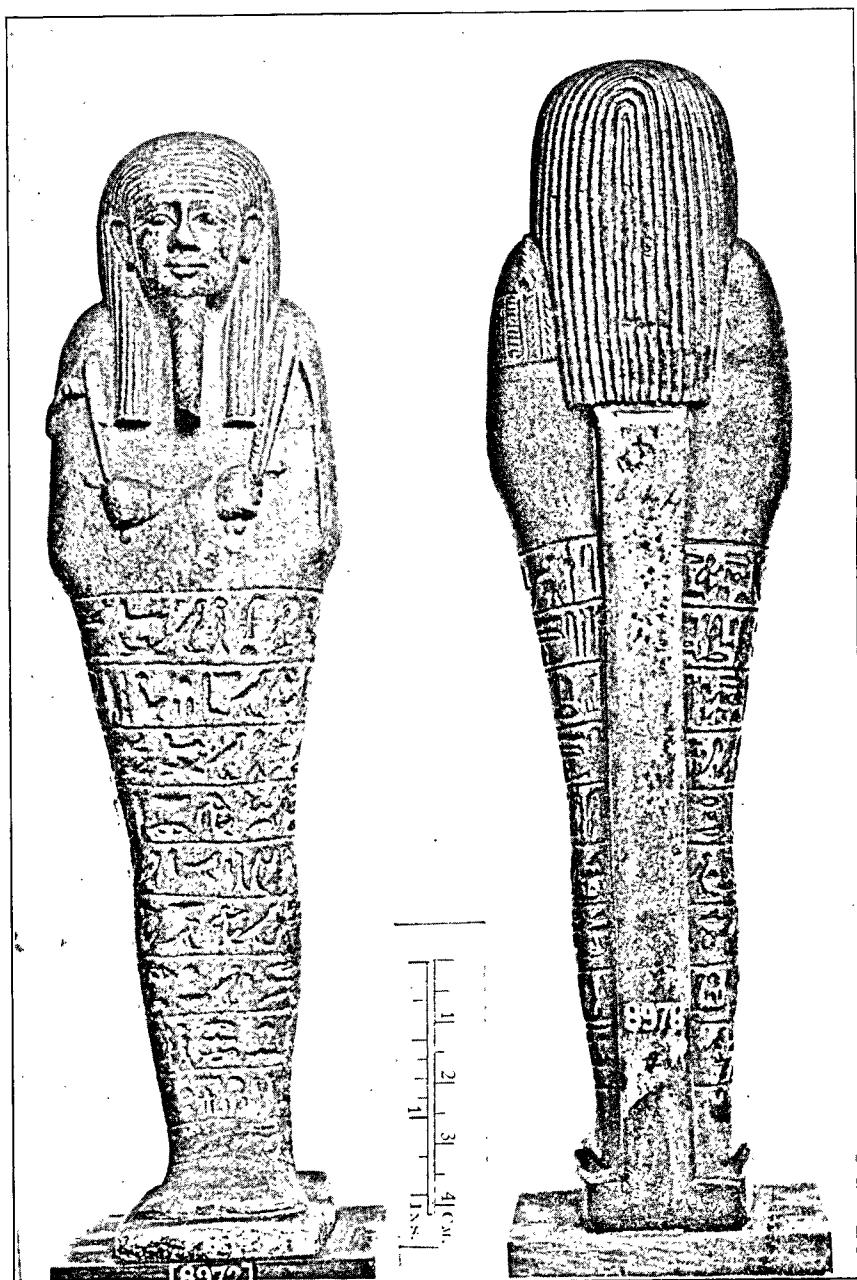


FIG. 4.—Shabti figures holding agricultural implements.



FIG. 5.—Four miniatures from the Luttrell Psalter, c. 1340 A.D., showing (bottom to top) ploughing, clod-breaking, weeding, harvesting.

services in England. An interesting letter³ of the year 278 requires the overseers to compel everyone to "perform his proper work by personal service . . . so that the dykes are raised to the ordained height and breadth and the breaches are filled up, in order that they may be able to withstand the flood of the most sacred Nile auspiciously approaching, and that the canals are cleansed up to the so-called standards and the usual width, in order that they may easily contain the coming influx of water for the irrigation of the fields, this being for the common weal, and that absolutely no money is exacted from any one in place of work."

Other parallels, but to a later England, are provided by leases from about the year A.D. 200. In one,⁴ allowance is made in the rent in the event of the failure of the annual inundation of the Nile: in two others⁵ there are restrictive covenants—one prohibiting woad and coriander, and another safflower. Proposals for an annual tenancy of a fruit farm in A.D. 280⁶ provide for a rent in kind and also for payments to the tenant in money, wheat and wine for certain work to be carried out: this arrangement is similar to *métayage* which became not infrequent in Byzantine times. A lease providing for what is unmistakably *métayage* comes from the sixth century A.D.⁷: by then the economic position, particularly of the peasant, had worsened in the Roman world, but it is well to remember that the system still prevails in some parts of the Mediterranean region.

References to live-stock returns from the first and second century of our era⁸ remind us that Government regulation is no new thing: another reference to an agricultural expert—from the third century B.C.⁹—reminds us that scientific agriculture has its roots deep buried in the past. And then farm accounts,¹⁰ and documents concerning labour disputes¹¹ and destructive pests,¹² remind us that to-day we are confronting the same problems as this vanished civilization.

Parallels cannot, of course, be pushed too far. The careful evaluation of grain in terms of wheat, contained in two documents of the third century,¹³ bears witness to a mode of thought which we hardly share: it suggests, too, the influence of a much greater uniformity in climatic conditions than we enjoy, although the mediæval assize of bread shows that the same ideas may be

³ *Guide*, pp. 12, 13.

⁴ *Guide*, p. 13.

⁵ *Guide*, p. 14.

¹² *Guide*, p. 15.

⁴ *Guide*, p. 11.

⁷ *Guide*, p. 10.

¹⁰ *Guide*, pp. 14, 15.

¹³ *Guide*, pp. 10, 15.

⁸ *Guide*, pp. 11, 12.

⁹ *Guide*, p. 15.

¹¹ *Guide*, p. 14.

evolved under very different economic and geographical conditions. The Egyptian ratio is of interest: wheat, barley and spelt were esteemed in the ratio of 5 : 3 : 2; dredge (a mixture of barley and wheat) is half as valuable as wheat (the ratio is actually 17 : 9); poppy-seed is twice as valuable, and sesame six times as valuable as wheat.

Mediaeval Agriculture.—The state of mediæval agriculture is illustrated by a number of miniatures, by manuscripts, and indeed by the early printed books on agriculture, for truth to tell agriculture was still mediæval even in seventeenth century England. The last vestiges of villenage had then only just disappeared, and the day of modern invention had only just dawned.

The implements employed in the Middle Ages were of the simplest, and the methods traditional. The oldest illustrations shown in the exhibition are the eleventh century drawings in two English manuscripts in the Cottonian collection.¹⁴ The miniatures in the fourteenth century Louterell Psalter, from which the illustrations here reproduced are taken (Fig. 5), are representative of the whole of the Middle Ages. There is evidence that in the thirteenth century a movement had started for the improvement of agriculture, and on a certain number of estates cultivation was probably brought to a point of efficiency as high as was possible with the existing tools, and in the existing social environment. It was a common-sense efficiency, but it was not a scientific efficiency. Such hand-books as that of Walter of Henley¹⁵ do not go beyond the elements of management; his stock of knowledge is that of a good craftsman; his outlook is not that of a man of science. Such science as the mediæval world had was derived from the agricultural writers of Rome—Palladius, Columella, Cato and Varro.¹⁶ Palladius was translated into English verse in the fifteenth century: but he had really little to tell the English farmer, who drew his instruction from the best practices in the world about him. For in that world there was a good deal of practical good sense, and the standard of cultivation was maintained. The idea that the later Middle Ages experienced a diminution in fertility is a misconception based upon no evidence whatsoever.

The narrowness of the farmer's resources is suggested by the inventory of dead stock in the hands of the bailiff of Kingstone

¹⁴ *Guide*, p. 19.

¹⁵ *Guide*, p. 16.

¹⁶ *Guide*, pp. 16, 21.

Manor (Hereford) in the early fourteenth century.¹⁷ There are three carts and two ploughs, a fork, a spade, some mattocks, corn sieves, a winnowing fan, and much miscellaneous equipment. This list is perhaps not fully representative: but even the best equipped manor would have very few implements not mentioned here.

Local circumstances inevitably reacted upon the design of implements. FitzHerbert, whose book upon *Husbandry* was the first agricultural treatise to be printed in England,¹⁸ mentions the different types of plough used in different districts, and attempts to give reasons for their differences in design. It is clear that the problem of draught had long attracted attention, as indeed it was bound to do: but the process of trial and error had not led to a great understanding of plough design. The few other implements at the farmer's command seem not to have attracted even the little scientific curiosity that expended itself upon ploughs. Hand-tools, however, had been perfected by use, and mediæval drawings and early printed books¹⁹ represent even in small details the tools we find to our hand to-day.

Invention and Inquiry.—The seventeenth century saw the beginning of mechanical invention and carried further the advocacy of manures. Edward Maxey's *New Instruction of Plowing and Setting of Corne* (1601) introduced the idea of drilling²⁰: he was followed later in the century by John Worlidge, who designed (Fig. 8) a "new instrument for sowing of corn."²¹ Jethro Tull made a further advance, although he is best known by his advocacy of "horse-hoing."²² The eighteenth century saw the introduction of superior ploughs and the first organized attempt to minimise the labour of old-fashioned ploughing.²³ In the meantime the range of crops had greatly extended, and by the time of Arthur Young, the art of husbandry as practised by the best farmers was widely removed from the practice of the Middle Ages, although many farmers were still to be found whose minds and ways belonged to the past.

¹⁷ *Guide*, pp. 16, 17.

¹⁸ *Guide*, p. 22. See also Plate I in *Guide* for a Flemish plough, c. 1500, and Fig. 7 for an Italian plough of the same period. The wood block illustrating FitzHerbert's *Husbandry* (see *Guide*, Plate V) presumably represents one of the types of English plough in use at the same period.

¹⁹ See Plates II and IV in *Guide*, and Fig. 6.

²⁰ *Guide*, p. 24.

²¹ *Guide*, p. 26.

²² *Guide*, p. 27.

²³ See *JOURNAL OF MINISTRY OF AGRICULTURE*, Vol. XXVIII, pp. 1086 ff.



FIG. 6.—Frontispiece to the earliest English printed book on horticulture (?), 1525 A.D.

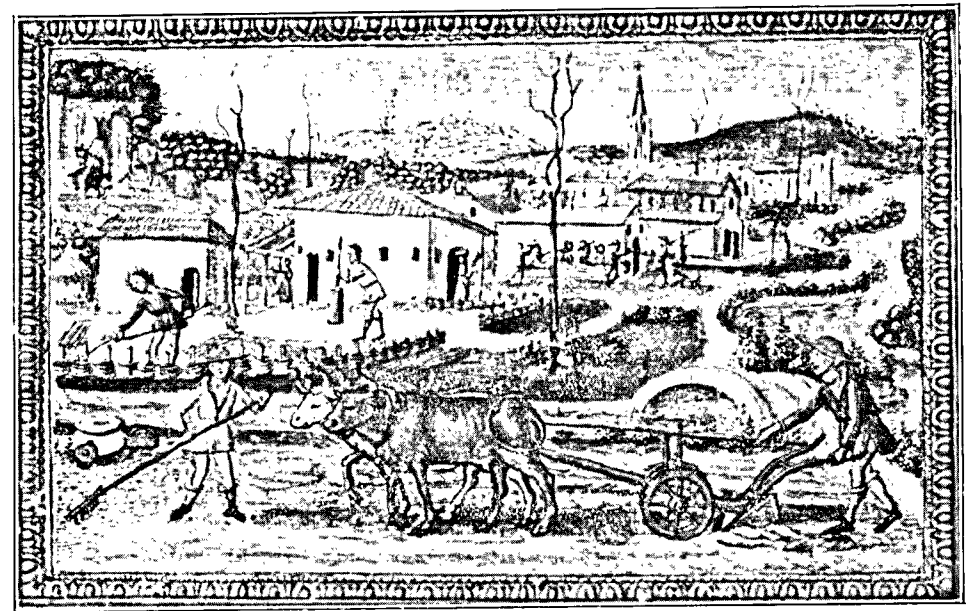


FIG. 7.—Miniature from King's MS. 24, showing Italian plough, c.1500 A.D.

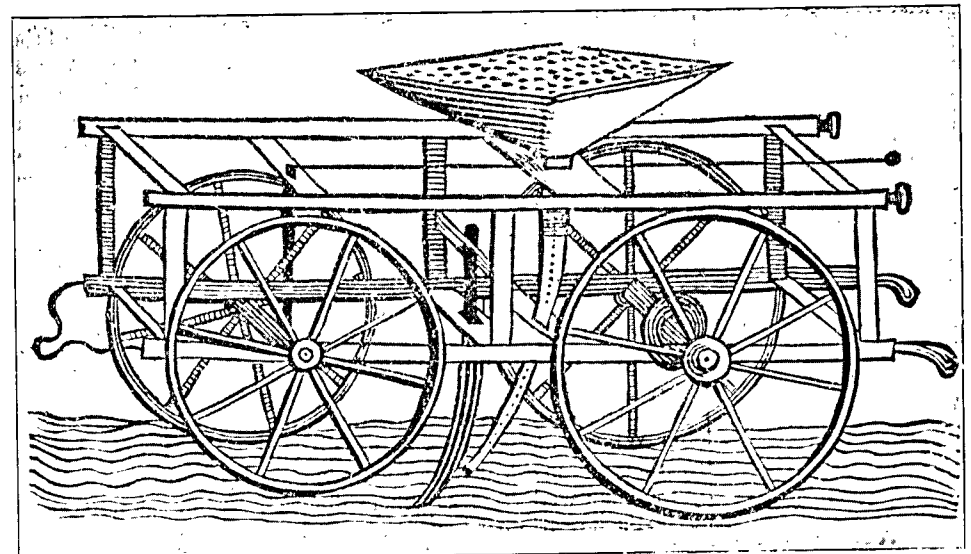


FIG. 8.—Drill designed by John Worlidge, 1675 A.D.

Before the end of Arthur Young's life, all the books represented in this exhibition had been written and printed. The great development of mechanism and of scientific farming was yet to come: but the spirit of inquiry, which was the essential basis of all improvement, is manifest in the writings of the second half of the eighteenth century and the beginning of the nineteenth.

There are here presented specimens of the books of every considerable English agricultural writer, and indeed of some inconsiderable writers who yet have a place in the history of agriculture. The *Guide* which the British Museum has published is by no means a lifeless list of books. It is extremely well illustrated; and he must indeed be learned in the history of agriculture and agricultural writers who can learn nothing from it. We are apt to treat a book as a book and nothing else, and forget that our business is with the writer of it. It is useful to be reminded that of Thomas Tusser it was said that none was better at the theory or worse at the practice of husbandry.²⁴ And are we not the better able to judge William Ellis's *Modern Husbandman* when we know that he was the last to follow his own counsel: "Be yourself the first man up in a morning for sounding at your door your harvest horn to call your men at four o'clock"?²⁵ And again, do we not appreciate the better the real greatness of Arthur Young for his criticism of his own early *Farmer's Letters to the People of England* as an example of "ignorance follow and presumption"?²⁶

Any student of the history of agriculture will be wise not only to see the exhibition at the British Museum but to have the *Guide* under his hand after the exhibition is closed. The excellent list of documents and books, the valuable notes and worthy illustrations (none of them reproduced here), make the *Guide* a permanent possession; it is a wonderful shilling's-worth.

* * * * *

²⁴ *Guide*, p. 23.

²⁵ *Guide*, p. 28.

²⁶ *Guide*, p. 29.

THE WORKING OF THE SEEDS ACT, 1920, IN THE SEASON 1926-27

SEEDS may be said to be the foundation on which the farm and garden crops of the country are based, and if, owing to wrong description or poor quality, that foundation is faulty, the whole structural work of a season, with its expense, its labour and its anxieties, is in jeopardy. A heavy responsibility, therefore, rests with the seller of farm and garden seeds. We are fortunate in this country in having a Seed Trade, the great majority of the members of which fully realize their responsibilities in this connexion and have established a reputation for fair and honest dealing. As in all trades, however, there are the few black sheep who, anxious for immediate profit, are careless of the results of selling poor quality seed. There are also those who, ignorant of the complex character of the article with which they are dealing, store, handle and sell seed much in the same way as they would deal in nails or any similar inanimate and more or less indestructible material. It is in order to protect the farmer and gardener from the machinations or carelessness of the one class or the other that the Seeds Act, 1920, was brought into operation.

Although the necessity of delivering a prescribed statutory statement in the case of every sale may be somewhat irksome to the reputable seedsman, the Act merely requires him to declare particulars about which, before the passing of the Act, he rarely failed to satisfy himself, even though he did not in every case set them out in the form of a detailed guarantee. The duty of bringing the irresponsible sellers of seeds into line with the more conscientious of their fellow-traders, even though it be supported by the penalties imposed on the wrongdoers by legislation, is a slow and arduous task. It is, however, confidently believed that much has already been done in this direction, and that the operations of the Seeds Act have resulted in a general improvement in the quality of the seeds marketed in this country. Odd as it may appear, the most difficult people to bring into conformity with the requirements of the Act are those to whom it offers the greatest advantage and protection.

Farmer to Farmer Sales.—The farmer to farmer sale still remains the most difficult problem of those responsible for the administration of the Act. That quantities of seed are sold each year in this way, and that probably a large proportion

of these transactions do not comply with the requirements of the Seeds Act, are, unfortunately, facts that must be acknowledged. The Ministry is, however, doing everything that is possible with the resources at its command to bring home to the selling farmer his responsibilities under the Act, as well as to the purchasing farmer the advantages he derives from getting properly tested seed. Paragraphs are inserted in the Press and in the agricultural journals; leaflets and circular letters are issued to farmers direct from the Ministry or from its local Inspectors or through the good offices of the National Farmers' Union; lectures are delivered to farmer audiences; immediate contact, either by letter or personal interview, is made with every farmer who advertises in the local newspaper that he has seeds for sale; exhibits illustrative of the requirements of the Act and the advantages of buying good seed are staged at more than 100 agricultural shows each season, etc. As a result of these steps, the position is undoubtedly showing signs of improvement, but it is realized that, without a considerable increase in staff—which the Ministry does not consider justified by the circumstances, even if the resources of the country permitted—it will always be a difficult matter adequately to control farmer to farmer sales.

Farmers' Samples.—Special steps have been taken during the past season to encourage farmers to make greater use of the facilities offered at the Official Seed Testing Station, particularly for tests of seed which they are proposing to sow themselves. These tests, for which only a nominal fee of 6d. per sample is charged, are not valid for use as a declaration under the Seeds Act in the case of a sale, but they are as full and complete as those carried out, at higher fees, for the use of the seller of seeds. There is a slow but steady increase in the number of these sixpenny tests, but, even so, the total is far from satisfactory. During the 1923-24 season, for instance, only one "farmer's sample" was received at the Station for every 20 samples received from seedsmen and others requiring a report for sale purposes. During the past season this proportion has improved to the extent of one "farmer's sample" for every 13 sale samples. It is noteworthy, too, how the number of farmers using the Station varies with the district. For instance, in 1926-27, 37 per cent. of the farmers using the Station for information tests resided in Anglesey, Devon, Hereford, and Kent, whilst from some counties no samples at all were received. The co-operation of a number of County

Agricultural Organizers is being secured in a scheme under which the Organizer acts as a collector of farmers' samples in his county. The samples are sent by the Organizers to the Station and the reports on the tests are returned to the Organizer for distribution and for the collection of the fees, the latter being forwarded to the Station in a lump sum at the end of the season. It is hoped in this way to overcome the apparent disinclination of many farmers to send samples direct to the Station.

Visits to Seedsmen.—During the season 1926-27, some 8,000 visits were paid to seedsmen's premises by inspectors of the Ministry: practically the same number as that of the previous season. Of these visits, 1,500 were to establishments mainly of the type where seeds are sold only as a side-line—generally of a seasonal character—to the normal business, and which had not been called on previously. It was found that in the main the regulations were being carried out in a satisfactory manner, and it seems clear that the requirements of the Act are now a settled and recognized part of the seedsmen's business.

Control Sampling.—1,845 samples of seed were taken on seedsmen's premises during the season for check testing at the Official Seed Testing Station—an increase of some 350 over the number of samples drawn for this purpose in 1925-26. These samples included 281 of clovers, 170 of grasses, 31 of field seeds, 177 of roots, 612 of vegetables, 96 of cereals, and 478 of packeted seed. In the case of 64 of these samples, apart from packeted seed, the check test showed that the seller's declaration was seriously incorrect in a material particular. These included 4 samples of grasses, 21 of clovers, 1 of field seeds, 2 of roots, 29 of garden, and 7 of cereals. In 14 cases the germination was shown to be incorrect to the extent of from 10 to 15 per cent., in 7 cases from 15 to 20 per cent., and in 18 cases the discrepancies amounted to over 20 per cent. In 4 cases the purity was from 3 to 5 per cent. out, and in 4 others from 5 to 10 per cent. In the other cases the principal sources of error were the omission to declare the presence of injurious weed seeds or dodder. Taken as a percentage of the total number of control samples drawn, the discrepancy cases represent .47 per cent., as compared with 6.6 per cent. in 1925-26, 7.7 per cent. in 1924-25, and 11.5 per cent. in 1922-23. This steady decline in the number of discrepancy cases provides most satisfactory evidence of the improvement in the accuracy of the sellers' declarations.

Packet Seed.—In the case of packeted seed, the standard of accuracy during 1926-27 showed a slight falling off as compared with that of the previous season. Of the 478 samples taken, 94·8 per cent. were shown by the check tests to be at or above the minimum percentages of germination and purity laid down by the Regulations, as compared with 95·5 per cent. in 1925-26. Even so there was a satisfactory improvement over earlier seasons, the corresponding percentage in 1924-25 being 94, and in 1923-24, 90·6. Of the samples taken in 1926-27, 2·5 per cent. were below the minimum percentages of germination and purity but above two-thirds of those figures, and 2·7 per cent. were below two-thirds of the minimum. In this connexion, and regard being had to the difficulties which arise each season through the rapid loss of vitality in packet seeds, more especially in the case of onions and brassicas, a special series of investigational tests was carried out at the Official Seed Testing Station during the season.

Control samples of four bulks of vegetable seeds were kept under normal storage conditions at the Station, and portions were tested at intervals of a month. A wholesale seed house kindly undertook to distribute packets from the same bulks to six of its agents. The packets distributed were placed under exactly the same conditions as those under which such seed would normally be kept for sale by the retailer in question. Sample packets were drawn from each retailer at monthly intervals and sent to the Official Station where they were tested simultaneously and under identical conditions. While no very definite conclusions can be drawn from the results of the tests so far made, there are indications that a continuance of investigations along these lines will produce useful information. It is already seen that onion seed of comparatively low germination, that is, just above the minimum of 60 per cent. laid down in the Seeds Regulations, may lose vitality very rapidly when put up in packets. It is also clear that the conditions of storage have a considerable bearing on the loss of germination in the case of such seed. Further experimental work in this connexion is being continued.

Licensed Private Seed Testing Stations.—In a few cases the terms of the licences issued by the Ministry to private stations to test seed for the purposes of the Seeds Act have been altered during the season by extending or restricting the number of kinds of seed that may be tested under the licence. Four licences have been surrendered and four new ones issued,

the total number of licensed stations remaining unchanged. Some 1,300 special samples were drawn at these stations during the season for check testing at the Official Seed Testing Station. These included 286 samples of cereals, 99 of grasses, 327 of clovers, 303 of field and root seeds, and 290 of vegetable seeds. Wherever any marked discrepancy was shown between the result obtained at the private station and that of the Official Station, the matter was fully investigated to ascertain the reason for the variation. The bulk of the discrepancy cases were in respect of samples of mangolds and beets, the Official Station obtaining appreciably higher germination results than the private station in 33 of the 117 samples taken. It is suggested that the reason for this is that the Official Station is better equipped for this class of testing than the average private station. There were also a number of cases in which the Official Station obtained higher germination figures for samples of peas and beans. Variations beyond the prescribed limits occurred with some of the brassica samples, due largely to the poorness of the seed, which made the testing more difficult than usual. It is satisfactory to note that the clover and grass samples gave exceptionally uniform results. In addition to the above check samples, the usual series of "Referee" samples were issued to the private stations during the season. These included uniform samples of cocksfoot, red clover, trefoil, mangold, swede, and tares. The results of the tests on these samples, as compared with similar tests carried out at the Official Station, were more uniform than in any previous year. The results of all these check tests indicate that, on the whole, the standard of work at the private stations is now much higher than when they were originally established.

Training and Examination of Seed Analysts.—The sixth course of training for Seed Analysts was held at the Official Seed Testing Station, Cambridge, from June 28 to July 26, 1927. Twelve analysts attended the course, and all exhibited considerable keenness in the work. At the end of the course fourteen candidates sat for an examination, eleven being awarded a pass certificate.

Seed Analysts' Conference.—On July 29, the Fifth Annual Conference of Seed Analysts was held at the National Institute of Agricultural Botany, and was attended by a large number of seed analysts and others. The Chief Officer of the Official Seed Testing Station reviewed the results obtained at the private licensed stations on the series of referee samples

which had been issued during the 1927 season. Professor Mercer, of the North Ireland Official Seed Testing Station, contributed a paper on the atmospheric conditions affecting purity tests; Mr. M. A. S. Sutton one dealing with the rate of imbibition of *Trifolium incarnatum*; Mr. F. H. G. Neale, of Messrs. Sutton and Sons, dealt with the germination of lettuce; Mr. R. Finlayson and Mr. C. C. Brett, both of the Official Seed Testing Station, also contributed notes on some seed analysts' problems and on loss of vitality in certain agricultural seeds, respectively. During the afternoon the British Association of Commercial Seed Analysts held its annual meeting.

"Seed Analysts' Bulletin."—Four issues of this Bulletin, containing various items of general interest to seed analysts, such as notes on new methods of testing, results of special investigations, work at the Official Stations, the administration of the Seeds Act, foreign seed regulations, etc., were made during the period under review.

International Seed Testing Congress.—The Fifth International Seed Testing Congress, which it was intended to hold in May, 1927, and which was of necessity postponed, will now be held, together with the general assembly of the International Seed Testing Association, at the International Institute of Agriculture, Rome, from May 16 to 19, 1928. The representatives of this country at the Congress will be the Chief Officers of the English, Scottish, and North Irish official seed testing stations.

Seed Wheat Survey.—In order to obtain reliable information as to the quality of the seed wheat sown in the Eastern Counties, a series of special samples was drawn "from the drill" on farms in that area during November, 1926. Owing to various circumstances, it was not found possible to secure as many samples as was hoped, nevertheless the inquiry brought out some interesting particulars. For instance, the first four varieties in order of popularity appeared to be (1) Yeoman and Yeoman II together (34 samples); (2) Square-head Master (20 samples); (3) Little Joss (15 samples); (4) White Victor (11 samples). As regards the extent to which home-saved seed is used, the proportions worked out as follows:—

(a) Purchased from merchant or seedsman	..	48	samples.
(b) Home-saved seed		55	"
(c) Purchased from neighbouring farmer	..	14	"

The prevalence of Bunt is indicated by the fact that only 21 out of 129 samples were found to be entirely free. Of the remainder, Bunt was present and visible to the naked eye in 6 samples, and in 102 samples it was found to be present on microscopical examination. Information as to the treatment for Bunt was also collected. As regards analytical purity, the bulk of the samples tested over 97 per cent. Of the 25 samples in which the purity was below 97 per cent., only 3 were below 95 per cent., the actual percentage of these being 94.6 per cent., 93.6 per cent., and 87.6 per cent. Out of 129 samples 104 gave a germination of over 95 per cent.; 14 were between 91 and 95 per cent.; 4 between 86 and 90 per cent.; and 7 were under 85 per cent., the lowest being 67 per cent. Arrangements were made for a further and more comprehensive series of samples to be taken "from the drill" this autumn. It is hoped that an examination of these will permit of more definite conclusions being drawn.

Sugar Beet Seed.—Special attention has been paid to sugar beet seed during the season. All the beet-sugar factories have been visited for the purpose of drawing attention to the fact that when selling seed to farmer growers it is necessary to comply with the requirements of the Seeds Act in having had a test made in accordance with the provisions of the Act and delivering to the purchaser a statement in writing containing the prescribed particulars. These particulars include, *inter alia*, (1) a statement as to the percentage purity if below 97 per cent., and (2) the percentage of germination, provided that if this is not less than the prescribed minimum of 60 per cent. (clusters) a statement to that effect, which must include the authorized minimum percentage, is sufficient. Some 55 control samples of seed were taken at the various factories, and the check tests carried out on these samples at the Official Seed Testing Station showed that in no case was the percentage purity or germination less than the minimum prescribed in the Regulations.

Testing Seeds for Export to the Colonies.—In order to encourage the trade in home-grown agricultural and horticultural seeds exported from this country to overseas parts of the Empire, the Ministry has arranged, with the assistance of a grant from the Empire Marketing Board, that, in cases where the 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 tests may be made for a limited period

at the Cambridge Official Station free of charge. Samples, which should be of the normal quantities sent for testing, 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 certificate issued by the Official Seed Testing Station in respect of these samples will be used for no other purpose than in connexion with the export of the bulks from which they are drawn to the country specified. Owing to this scheme being put into operation so late in the export season, it was only used to the extent of 453 samples. The scheme is, however, to be continued during the 1927-28 season, when it is anticipated that it will be utilized more freely.

Staining of Imported Seeds.—In the issues of this JOURNAL for August, 1926, and March, 1927, reference was made to the Regulations which are in operation in the United States requiring that all alfalfa and red clover seed or any mixture containing 10 per cent. or more of these seeds imported into the States shall be stained with distinctive colours according to the countries or regions from which they come. Similar import regulations became effective in Canada in October, 1926, more recently in France and, it is understood, are also contemplated by Germany, Sweden, and Czecho-Slovakia. A question was put to the Minister of Agriculture in the House of Commons in March, 1927, as to whether his attention had been drawn to the regulations operating in the United States and Canada requiring imported seeds to be stained distinctive colours, thus signifying their adaptability or otherwise for agricultural purposes, and whether he was prepared to introduce safeguards on similar lines for agriculturists using foreign seeds imported into this country.

The Minister's reply was as follows :—

"I am aware of the Regulations to which my Hon. Friend refers, requiring the staining of certain kinds of seeds when imported into the United States of America and Canada, but I have received no representations as to the desirability of dealing with seeds imported into this country in a similar manner. At the same time the requirements of the Regulations made under the Seeds Act, of 1920, whereby a statement as to the country of origin must be made in the case of a sale of any of the principal kinds of grass and clover seed, should, in my view, afford a sufficient safeguard for agriculturists against the use of seeds coming from countries where the conditions make them unadaptable for use in this country."

Prosecutions.—The following are brief particulars of the cases in which the Ministry has instituted legal proceedings under the Act during the past season :—

(1) An Exeter firm of seedsmen and agricultural merchants was charged with making a false statement as to the percentage of germination of a consignment of Meadow Fescue seed. The case was heard on August 7, 1926, when the defence was put forward that the bag from which the control sample had been taken consisted of old seed which was sent out owing to the error of an employee. The Bench accepted this explanation, but decided that, as the firm must take the responsibility for the acts of their employees, they would inflict a fine of £2 with £2 2s. 0d. costs.

(2) Proceedings were taken on October 15, 1926, under the Seeds Act and the Wart Disease of Potatoes Order, against a dealer of Bromyard, for making statements which were false in a material particular. The defendant had sold a quantity of seed potatoes as being grown in Scotland whereas it was proved that they came from Cambridgeshire. He had also quoted a false certificate number in connexion with the consignment. He contended that these potatoes were sent by mistake, his man loading them out of a truck at the station instead of out of his yard. The Bench imposed a fine of £3 for the offence under the Wart Disease Order and £2 under the Seeds Act, and ordered payment of special costs amounting to £14 11s. 0d.

(3) A case was taken at Bridgnorth on October 25, 1926, in which a seed potato merchant was charged with having sold a quantity of seed potatoes of mixed varieties with a statement indicating that the variety was true within the meaning of the Seeds Regulations, 1922. The defendant acknowledged that he had bought this seed as being mixed, but took the risk of re-selling them as pure. He was fined the maximum penalty of £5 and £3 3s. 0d. costs.

(4) A Berkshire firm of seed merchants was prosecuted on December 20, 1926, for having furnished a declaration with a consignment of Trifolium seed which was not based on the result of a test made in accordance with the provisions of the Act. The defendants pleaded guilty, and the Bench imposed a fine of £2, stating that they thought the offence was more than a technical one.

(5) On December 23, 1926, a case was heard at Bourne, Lincs, against a local firm of potato growers and farmers for selling as "Evergood" two lots of seed potatoes, the crops from which were found to contain about 20 per cent. of rogues. After a prolonged hearing the cases were eventually dismissed on technical grounds.

(6) Proceedings were taken at Epworth on March 3, 1927, against a local seed potato merchant for making a false statement as to the variety of a quantity of seed potatoes. He purchased them from the grower with the description "Class 2 mixed" and sold them with a written description which indicated that they were pure. The resulting crop was found by the Ministry to include 14 per cent of rogues. Defendant pleaded guilty, and was fined £1 and £2 10s. 0d. costs.

(7) A local firm of corn factors was prosecuted at Evesham on March 8, 1927, for making a false statement as to the variety of a quantity of seed potatoes. The defendants were in this case represented by well-known counsel, and the hearing lasted nearly six hours. The Bench were satisfied that a technical offence had been committed but, owing to extenuating circumstances, dismissed the charge on payment of costs.

(8) Proceedings were taken at Portsmouth on May 12, 1927, against a firm of seed packeters in respect of two charges of

making false statements as to the germination of onion seeds. Convictions were obtained in both cases, and a fine of £3 was imposed for each offence, the money to be paid within two months, or in default 21 days' imprisonment for each offence, to run concurrently. This firm was previously convicted for a similar offence in June, 1923.

(9) A florist and nurseryman of Newport, Monmouth, was fined £1 and £1 1s. 0d. costs on July 18, 1927, for making a false statement as to the percentage of germination of some onion seed.

(10) At Caerphilly, on July 19, 1927, a local firm of general merchants was fined £1 and £1 1s. 0d. costs for wrongly stating the percentage germination and purity of some parsnip seed.

(11) On July 20, 1927, a firm of florists and seedsmen at Pontypridd was charged with failing to deliver the required particulars in the case of a sale of garden seeds in packets, and was fined 15s., the Bench warning defendants that the Act must be obeyed in future.

In addition to the above a number of cases were taken in Scotland for offences against the Seeds Act in connexion with consignments of seed potatoes supplied to English customers.

Amendments of Seeds Regulations.—No amendments have been made in the "Seeds Regulations, 1922," so that, unless some unforeseen circumstance should arise, the Regulations will be the same during the season 1927-28 as those which were in operation last season.

NOTE.—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 CORRECT TIME FOR APPLICATION OF SPRAY FLUIDS

H. R. BRITON-JONES, D.Sc., Ph.D., D.I.C., A.R.C.Sc., and
A. H. LEES, M.A.,

Agricultural and Horticultural Research Station, Long Ashton.

In attempting to control the pests and diseases of fruit trees it has become necessary, as the result of continual research work, to define more and more closely the time of application.

At one time it was considered sufficiently accurate to give such advice as "spray in spring" or "give a winter treatment." Modern work, however, has more and more emphasized the necessity of application at a particular stage of development of the plant. Unfortunately these stages cannot be related sufficiently accurately to the calendar, since one winter differs from another.

Attempts have been made to get over this difficulty by using such phrases as "during the dormant season," "in the semi-dormant stage," "when the buds show green," and so on. This, though certainly an improvement on calendar dates, nevertheless leaves too much to the imagination. In the opinion of the writers, the only satisfactory method lay in the preparation of series of photographs showing various types of fruit trees in the required condition. It is with this idea in mind that the photographs illustrating this paper have been prepared.

It has been found necessary to give certain names to the stages illustrated, but the writers do not wish to maintain that these are the best possible. The stages may be roughly defined as follows:—

Dormant: No sign of bud burst to be seen.

Swelling: The buds show the first sign of movement.

The bud scales have separated but no green is showing.

Bursting: The bud has distinctly opened somewhat, and is showing green leaf or flower rudiments.

Burst: A stage in advance of bursting.

Green Flower: A stage in apples and pears where the trusses are showing but no petal colour is evident.

Pre-flowering or Pink: Stages immediately before opening of the flower. Pink stage applies to apples only.

No claim for completeness is advanced, but the attempt has been made to include, for the common fruits, those stages which are most difficult to define. It is, of course, quite possible that the future may prove that other fruits and other stages should be included. In the meantime, the writers would emphasize the desired goal to be attained, namely, that of a clear definition, and acceptance among plant pathologists, of certain stages as most suitable for applying given spray remedies.

The writers are greatly indebted to Messrs. J. C. F. Fryer, R. G. Hatton, R. M. Nattrass, F. R. Petherbridge, Dr. Geo. Pethybridge and Mr. L. N. Staniland for valuable criticism, and to Mr. R. G. Hatton for the use of the negative for Black Currant, Stage III.

STAGE

APPLE

I. Dormant (Fig. 1) ..

Stage at which tar distillate fluids are applied against Aphis eggs, Apple Sucker eggs, Winter Moth eggs (Partial Control) and Brown Rot. Also stage for use of

- caustic soda against Mussel Scale and general cleaning of Lichens, etc.
- II. Swelling (Fig. 2) .. Too late for using tar distillate fluids and 2 per cent. caustic soda washes.
- III. Green Flower (Fig. 3) .. Contact sprays against Aphis, Apple Sucker. Arsenate sprays against Caterpillar.
- IV. Pink Flower (Fig. 4) .. Contact sprays against Capsids. First application for Scab Disease. The second spray against Capsids and Scab is given at petal fall. No illustration of this stage is necessary.

STAGE BLACK CURRANT

- I. Dormant (Fig. 5) .. Suitable for tar distillate fluids against Aphis eggs.
- II. Bursting (Fig. 6) .. Dangerous for tar distillate fluids. Suitable for contact washes against Aphis.
- III. Burst (Fig. 7) .. Stage for lime sulphur 1 : 12, against Big Bud Mite.

STAGE CHERRY

- I. Dormant (Fig. 8) .. Suitable for tar distillate fluids against Aphis eggs, Blossom Wilt and Brown Rot. Also for Bordeaux and Burgundy against Leaf Curl (*Exoascus minor*).
- II. Swelling (Fig. 9) .. Too late for tar distillate fluids.
- III. Bursting (Fig. 10) .. Contact sprays against Aphis.

STAGE GOOSEBERRY

- I. Dormant (Fig. 11) .. Tar distillate fluids against Aphis eggs.
- II. Swelling (Fig. 12) .. Dangerous for tar distillate fluids.
- III. Bursting (Fig. 13) .. Too late for tar distillate fluids. Contact washes against Aphis.
- IV. Pre-flowering (Fig. 14) .. Second spraying of contact washes against Aphis if necessary. First application against the American Gooseberry Mildew.

STAGE PEACH

- I. Dormant (Fig. 15) .. Tar distillate fluids against Aphis and Brown Rot (*M. cinerea*).
- II. Swelling (Fig. 16) .. Burgundy or Bordeaux for Leaf Curl, immediately before. Late for Leaf Curl sprays. Only partial control of this disease is effected when applied at this stage. Too late for tar distillate fluids.
- III. Bursting (Fig. 17) .. Too late for Leaf Curl. No beneficial effect.

STAGE PEAR

- I. Dormant (Fig. 18) .. Tar distillate fluids for Blossom Wilt and general cleaning of Lichens, etc.
- II. Swelling (Fig. 19) .. Too late for tar distillate fluids. Stage for lime sulphur 1 : 12, against Pear Leaf Blister Mite.
- III. Green Flower (Fig. 20) .. Stage for giving first application of spray against Scab. Second at petal fall, and third three weeks later.

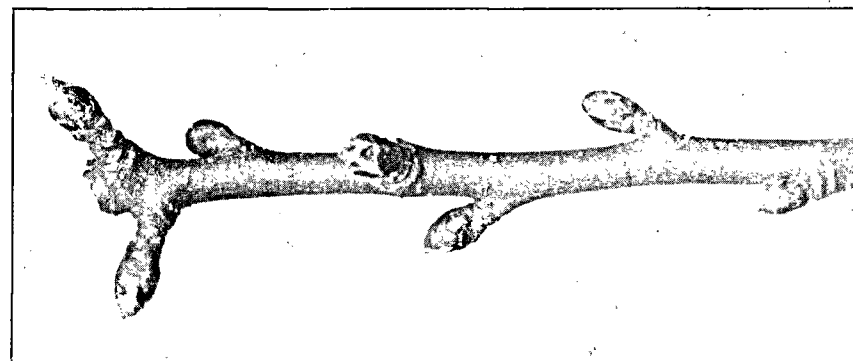


Fig. 2.—Swelling.

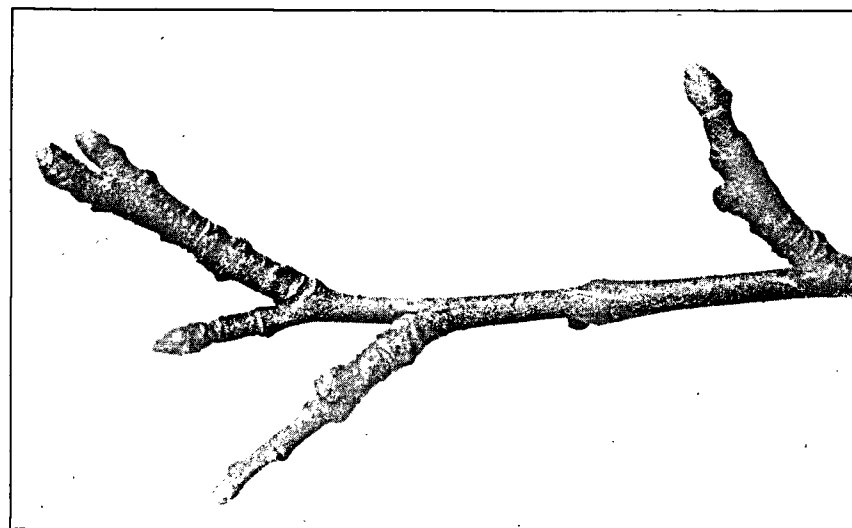


Fig. 1.—Dormant.

APPLE.

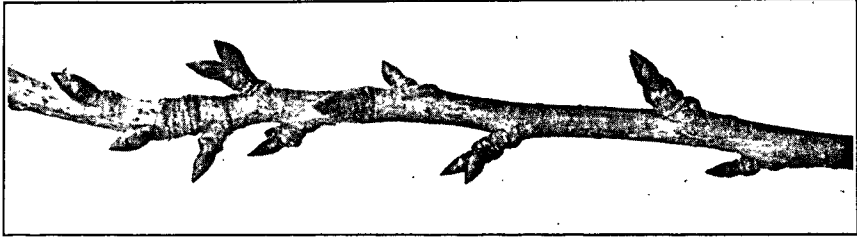


FIG. 8.—DORMANT.

CHERRY.

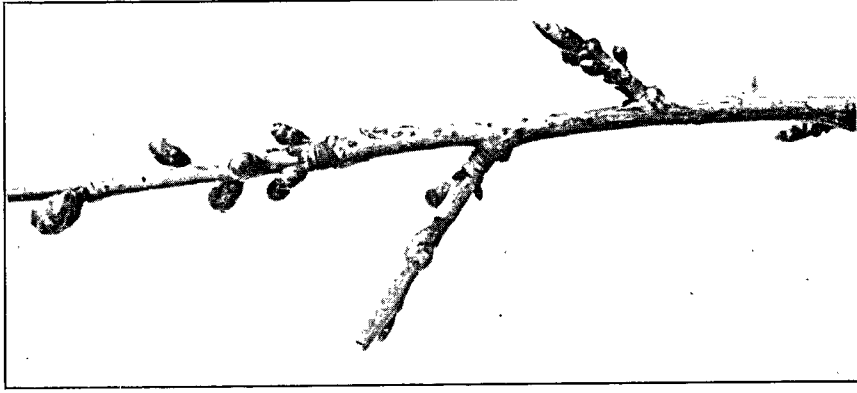


FIG. 9.—SWELLING.

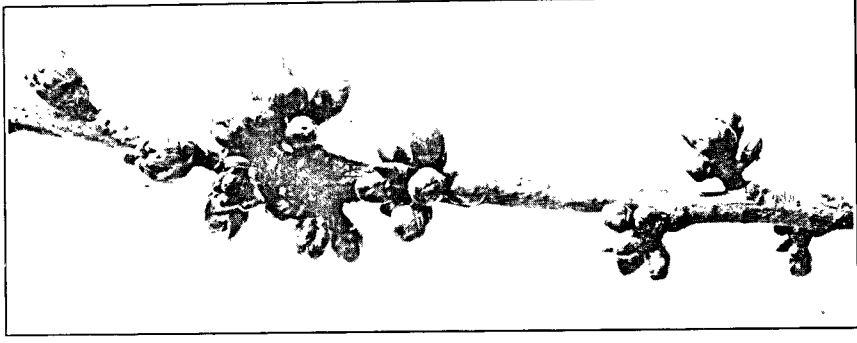


FIG. 10.—BURSTING.

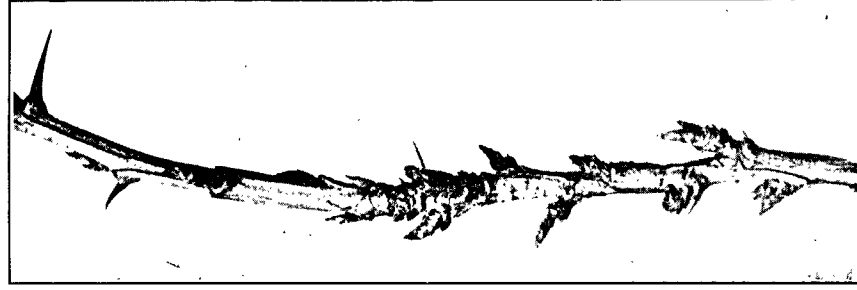


FIG. 11.—DORMANT.

GOOSEBERRY.

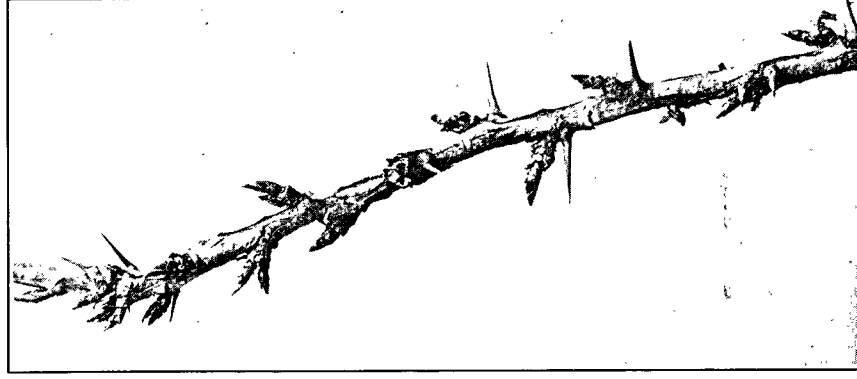


FIG. 12.—SWELLING.

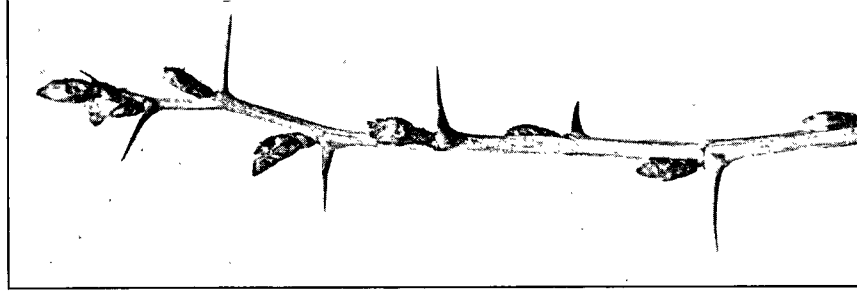


FIG. 13.—BURSTING.

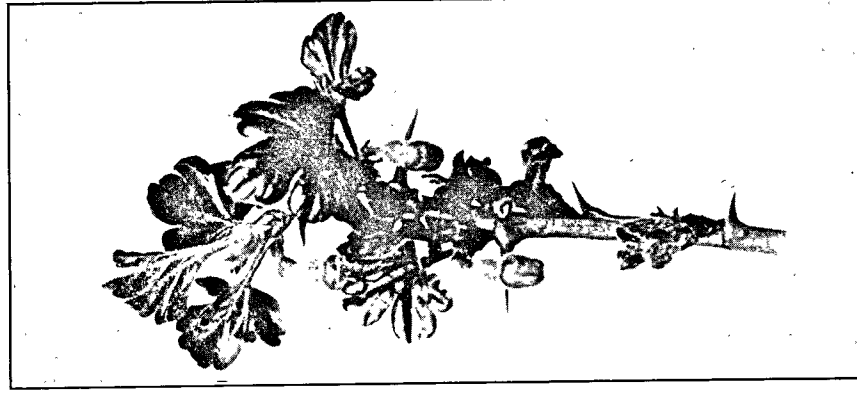


FIG. 14.—PRE-FLOWERING.



FIG. 15.—Dormant.



FIG. 16.—Swelling.

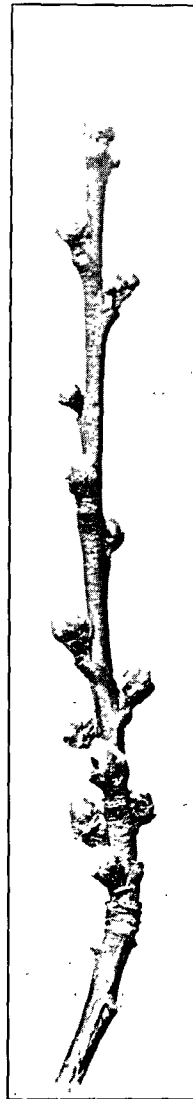


FIG. 17.—Bursting.

PEACH.

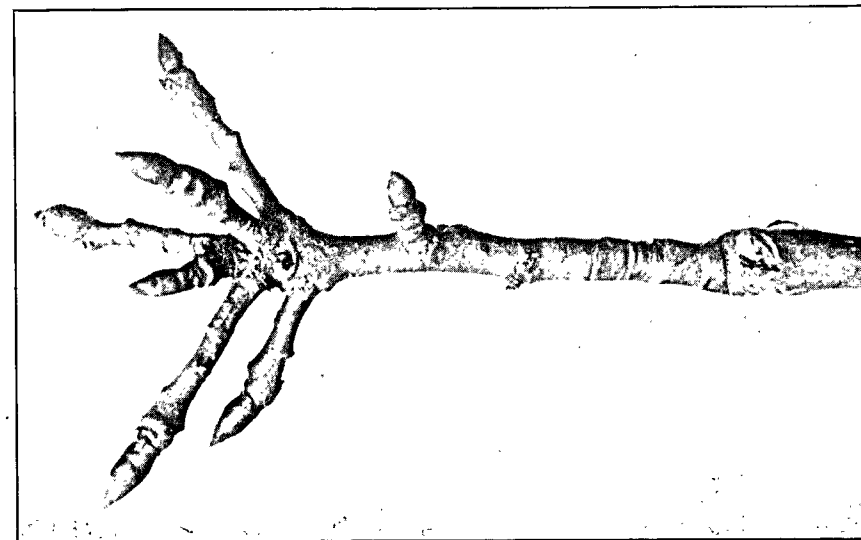


FIG. 18.—Dormant.

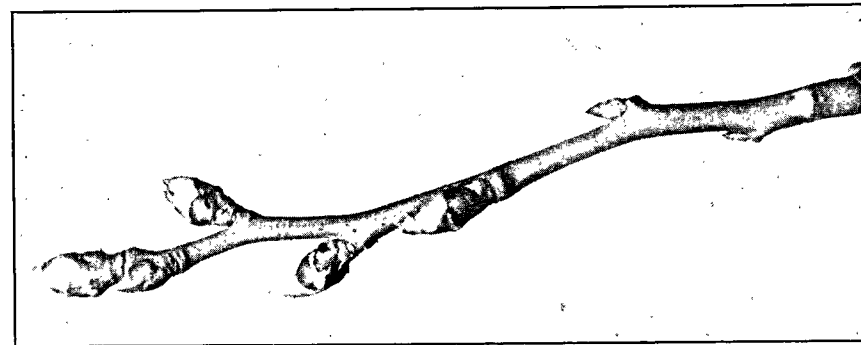


FIG. 19.—Swelling.

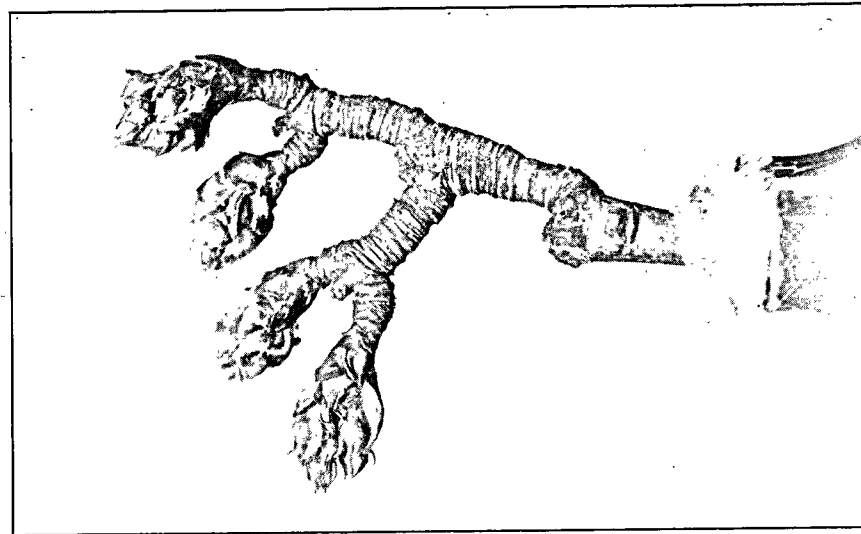


FIG. 20.—Green Flower.

PEAR.

816.5

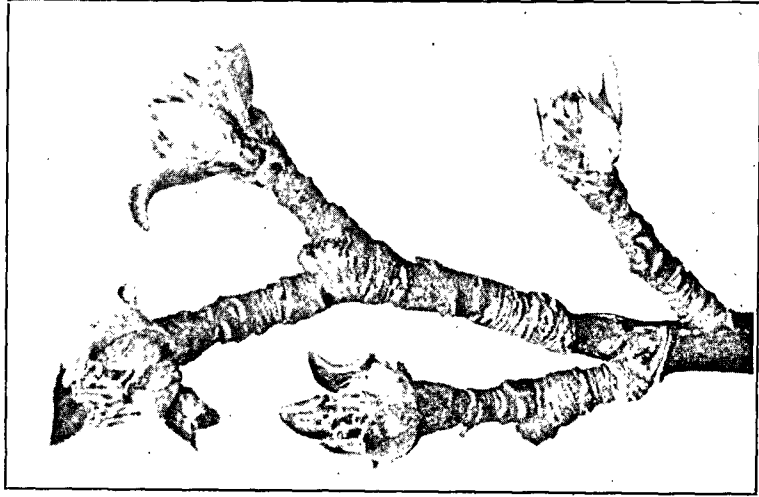


FIG. 3.—Green Flower.

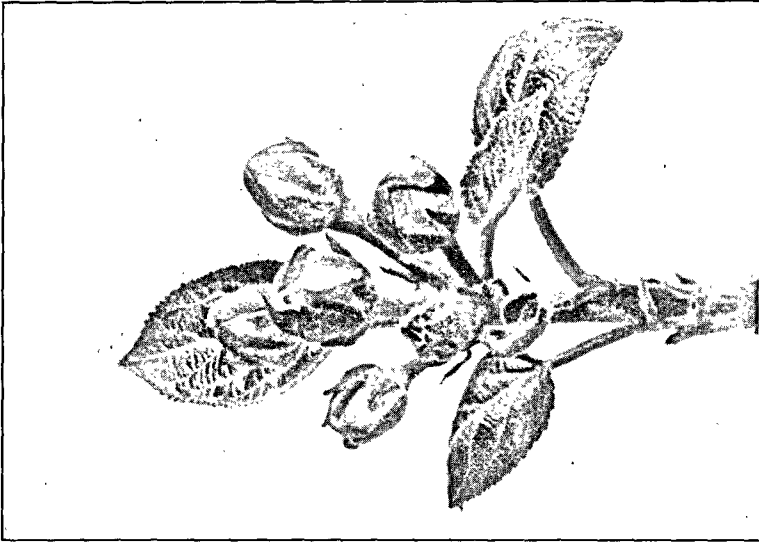


FIG. 4.—Pink Flower.

APPLE.

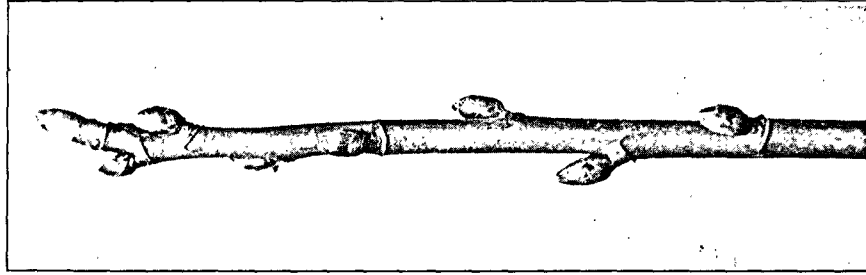


FIG. 5.—Dormant.
BLACK CURRANT.

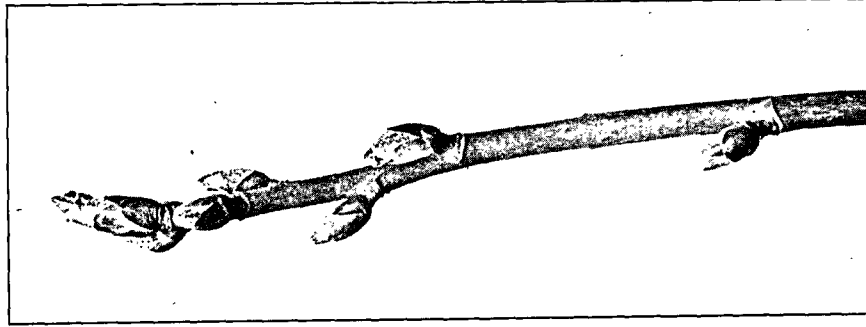


FIG. 6.—Bursting.

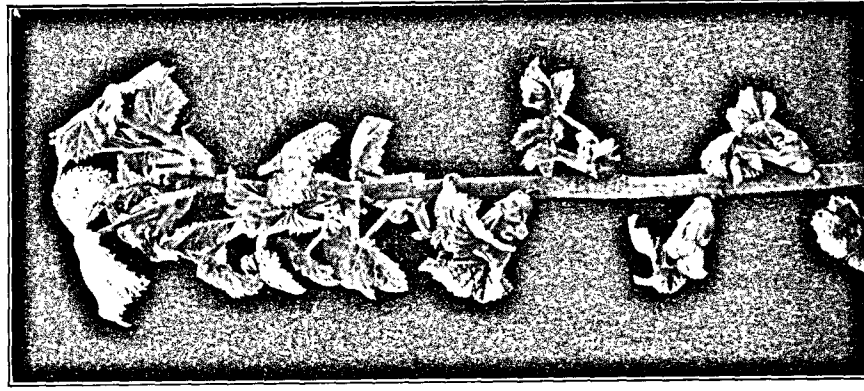


FIG. 7.—Burst.

STAGE	PLUM
I. Dormant (Fig. 21) ..	Tar distillate fluids against Aphis, Winter Moth eggs (Partial Control), and Wither Tip and Brown Rot disease. Also 2 per cent. caustic soda for general cleaning.
II. Swelling (Fig. 22) ..	Too late for tar distillate fluids and 2 per cent. caustic soda wash.
III. Pre-flowering (Fig. 23) ..	Contact sprays against Aphis, and arsenate sprays against Caterpillars.

* * * * *

THE PROBLEM OF AGRICULTURAL MARKETING*

(1) **Clearing the Air.**—The marketing of agricultural produce is a subject on which there is much confusion of thought and not a little misrepresentation. This is particularly so at the moment because the need for marketing reform has been zealously advocated of late, and, here and there, in the Press and on the platform, extravagant claims have been made and ambitious proposals put forward, which are to be regretted if, for no other reason, than that they raise a cloud of controversy which obscures the main issue. It is desirable, therefore, to clear the air, and I want to start by dissociating the cause of better marketing from two suggestions that have been made: (1) that better marketing is a remedy for agricultural depression, and (2) that it involves the displacement of the existing machinery of distribution.

Better Marketing not a Remedy for Agricultural Depression.—To take the first of these: The present depression, grave though it may be, will, let us hope, pass away as earlier depressions have. It is due mainly to monetary causes of international moment, and no agricultural remedy, as such, can avail. Marketing reform would, it is true, help the agricultural industry and further the work of rescue, but it is to be regarded as a permanent and necessary improvement in business efficiency, of service alike in times of prosperity or of distress.

The Aim to Aid and not Displace the Distributive Machine.—The second suggestion that is made is that the purpose of better marketing is to oust the distributor. This suggestion is a

* Being a note of an address delivered at Kendal on October 8, 1927, by Mr. A. W. Street, the Head of the Markets and Co-operation Branch, Ministry of Agriculture and Fisheries, at a meeting convened jointly by Lord Henry Cavendish-Bentinck, M.P. (Lord-Lieutenant of Westmorland) and the County Branch of the National Farmers' Union.



Fig. 23.—Pre-flowering.



Fig. 22.—Swelling.



Fig. 21.—Dormant.

PLUM.

persistent offender and too often diverts the attention of farmers from proposals which approach the problem by a simpler route and have, at least, the merit of practicability. As I hope to show, better marketing does not mean replacing the existing machinery of distribution by a farmer-owned co-operative system which would probably break down under its own weight, but rather aiding the existing machinery to function to greater advantage, so far as home produce is concerned, than it does to-day.

(2) **Organized Assembling: the Producer's Sphere.**—That is not to say that agricultural co-operation has no part to play in the constructive work that lies ahead. On the contrary, collective marketing in one form or another can, and no doubt will, contribute materially to economic progress. Let us be clear about it. Leaving aside that form of co-operation known as collective bargaining, there are two main fields open to co-operative endeavour in the merchandizing of agricultural produce. There is the co-operative assembling of produce in the areas of surplus production and there is co-operative distribution in consuming centres. The first calls for very serious consideration, if only because of its important possibilities as a means of giving a better service of home-grown supplies to traders engaged in wholesale and retail distribution in the industrial areas; the second, all things considered, is probably best left alone by producers, although some success has been achieved even in this specialized field.

The Case for Co-operative Assembling.—Let us, therefore, examine for a moment the business ideas underlying co-operative assembling. Apart from any theoretical saving in marketing costs arising from the concentration of agencies and functions—and in this highly competitive world of ours the scope for economies can easily be overstated—there is the fact that, in average circumstances, group marketing is, or should be, more efficient than marketing by individual producers, not only in regard to such services as the preparation, classing, grading, packing and dispatch of supplies, but in the search for outlets and in the orderly feeding of markets. Indeed, experience the world over shows that only in exceptional cases can even the large-scale producer, as an individual, market a standard agricultural product continuously and in commercial quantities; as a general rule, the ungraded contributions of individual producers must first be assembled at convenient centres in order to provide the bulk necessary for the grading process and for the maintenance of graded output.

It is suggested that group marketing through a co-operative organization is more efficient than individual marketing. It is not suggested that it is necessarily more efficient, executively, than the usual form of bulk marketing, namely, the assembling by dealers and merchants of supplies bought at farms and country markets and the preparation and dispatch of these supplies to distant consuming centres. Apart from the question of control, it stands to reason that if the co-operative organization and the country dealer render the same services with the same efficiency, then, in practice, both produce the same results, and it could well be argued that no co-operative organization operating in this field has any right to exist, still less to survive, unless it can give service at least as effective as that of the country dealer and no more costly.

Now, in some places and for some commodities, there may be a superfluity of collectors and dealers; that is a debatable question, which must, on the whole, remain a matter of local interest. What cannot be disputed, and what is of national importance, is that the present system of marketing supplies from areas of surplus production—direct consignment by individual producers, or sale to local dealers who buy to send away—too often fails to ensure that home produce shall reach the large consuming centres in a form and condition and in large enough units to compete on equal terms with imported supplies. Something is missing somewhere. Clearly, one way of meeting this situation is for producers to co-operate to render the preliminary marketing services for themselves, to render services that would otherwise be rendered indifferently or not at all—notably those necessary for the marketing of standardized goods and, incidentally, for reflecting back to the producer the real market price for quality. As any one familiar with conditions in country markets knows, the tendency for local buyers to pay a flat price for good and poor stuff alike is traditional and it is still difficult to secure adequate recognition for quality; consequently, high-quality produce subsidizes low-grade supplies, and, for many commodities, there is little or no incentive to raise the quality level of the home-produced article.

The "Export" Argument.—The suggestion is often made, directly or indirectly, that co-operation has only succeeded in countries where dependence on an export trade has supplied the stimulus. As the Agricultural Tribunal of Investigation pointed out, Germany and Belgium are examples of countries that had no such incentive, and yet they have had a progress

in agricultural co-operation as remarkable in their own way as that of Denmark. Indeed, there are many hundreds, probably thousands, of farmers' co-operative organizations in Europe to-day whose outlook is domestic and not foreign, just as the great majority of the 12,000 farmers' co-operative marketing organizations in the United States are solely concerned with the internal trade of that country. In any case, we must remember that those areas of England and Wales where production exceeds local requirements are, in essence, exporting areas, and regularly send their supplies over distances as long as, and in some cases longer than, those over which supplies travel that are received from Northern Ireland, the Irish Free State, France, Belgium, Holland and Denmark, all of which enjoy relative propinquity to our markets here. It may surprise many to learn that Denmark is nearer than parts of Cornwall to such an important consuming centre as Newcastle-on-Tyne.

The Alternative.—I do not, however, plead for collective marketing by producers. It is a means to an end; it is not the only means; and, however desirable it may be, one would not hold it to be essential to the far-reaching reforms in marketing which I am sanguine enough to believe that this generation will see. It is merely desirable to point out the quite definite part that agricultural co-operation could play in the standardization of supplies for "export" from the surplus-producing areas of England and Wales, and to show how it could and should be an aid and not a rival to the distributive trade in the towns and cities, including, of course, the consumers' co-operative movement. At the same time, it should be realized that in many exporting countries organized assembling and the standardization of product and package are not, in fact, done by co-operative associations, but by merchants and exporters. Even in Denmark, although it is true that about 85 per cent. of the bacon exports are from co-operative bacon factories, it is also true that only about 20 per cent. of the total egg export trade and under 40 per cent. of the butter exports are handled by co-operative associations. The practical point is that the English wholesale market demands products of guaranteed quality, and, for most commodities, some form of organized assembling is an economic necessity if this demand is to be met. If, therefore, for any reason, whether of psychology or environment, home producers are not disposed to co-operate to do the things that, under present arrangements, are too often left undone, then, as an alternative, it is up to them to encourage and support any business enterprises that under-

take to handle home produce on up-to-date lines and place it in the hands of distributors in a form which accords with commercial requirements. It is the function that is important in this connexion, and, from a common-sense business standpoint, producers cannot escape the responsibility for seeing that the function is performed.

(3) **Standardization: the Main Issue.**—The importance of feeding the distributive machine with goods that conform to modern commercial requirements has been emphasized. These requirements can be summed up in the word already used, namely, *standardization*, which has been described as the first principle of modern commerce, the movement from the indefinite to the definite. It is not too much to say that the greatest problem which confronts the British farmer in the marketing field is that of devising a workable system for the standardization of his products.

What it Means.—The coinage is standardized; weights and measures are standardized; everyone knows what standardization means in these instances, and how clumsy and hopeless business would be without standard money or standard quantities. The general standardization of agricultural commodities has much the same significance and would serve a similar purpose. In fact, the reasons for fixing standards of money and quantity are precisely the same as those for defining general standards of quality for an agricultural product, attaching these standards to fixed characteristics such as size or weight in order to arrive at a uniform classification, and for extending the principle, where applicable, to packing and packages.

Relation to Production.—If standard goods are to be marketed, they must either be produced to standard or they must be graded into standard categories. In industries other than agriculture, it is relatively easy, thanks to mechanical processes, to deliver articles complying with exact requirements. In agriculture, Nature often opposes or changes the course of the most judicious measures or precautions and the task is much more difficult. An aggravating circumstance is that production, instead of taking place at one centre and under one direction, takes place on a multitude of independent holdings. Hence, for the marketing of standard farm products, a standard grading system is essential. It is possible, however, for producers of some commodities—*e.g.*, cattle, bacon pigs, table poultry or fruit—to simplify marketing and reduce the extent and cost of the grading service by standardizing their production

types. The fact that this is an obvious and first step towards better and cheaper marketing, and one of great importance to home producers in present circumstances, is gradually gaining recognition.

Consider beef cattle for a moment. Our overseas competitors have entrenched themselves in the large wholesale markets by supplying carcasses that are carefully graded to weight and quality at the source. The retailer can go to the meat market from day to day with the reasonable certainty of being able to purchase overseas carcasses that will yield joints of the size and quality that his customers have learned to expect. He can even rely on sending a written order without visiting the market at all. He has only to make allowance for necessary seasonal differences. It is obviously impossible for our farmers to reach a similar degree of standardization except by breeding to type. We are a comparatively small country, agriculturally, and we have many breeds, each with its own characteristics. The great variety of type and breed can be clearly seen in any live-stock market. That, however, does not mean that we should give up the ideal of levelling up our live stock, so that a standard article is available for the big consuming centres. One would not suggest that all farmers should concentrate, for instance, on one breed of cattle. We have many excellent breeds, which are, in general, most successful in their own area. If we wish to make the most of the commercial cattle of each breed, we need to ascertain as closely as possible the demand of the buyers, and then endeavour to bring those cattle up to that standard throughout the whole district in which the breed is found. Only then shall we be able to meet the demand of the large buyers for an ample supply of a standardized article. We have also to consider that, in the case of all live stock, the butchers' demands are changing because the demand of the public is changing. During the last 20 years, the change has been in the direction of smaller joints and a greater proportion of lean meat. This is too extensive a subject to go into here—but there is nothing more vital to the economic prosperity of the British breeder and feeder than that his live stock should conform to the changed demand which many circumstances have combined to bring about.

The reaction of a standardization policy on production is, of course, of supreme importance. The recognition of quality which such a policy implies definitely encourages the production of quality goods. It has recently been stated, for example, that it is now possible to attribute 90 per cent. of Denmark's

continued success on the English market to better production and that only 10 per cent. is attributable to better marketing, although better marketing was the cause that produced the effect. A standardization policy in this country would, therefore, help the home producer to concentrate on the quality end of the market. Certainly, if standardization raised the average quality of the home output so that a larger proportion than at present were of first quality and commanded first-quality prices, a notable contribution would be made to the economic well-being of the industry.

Commercial Advantages of Standardization.—Standardized grading increases the speed with which business can be conducted. It provides a basis for a system of selling in which inspection need not invariably precede purchase; it makes possible the accurate determination of values and the quotation of comparable market prices; it reduces buyers' risks, minimizes disputes, encourages long-period contracts between sellers and buyers, widens the market all round and, in general, facilitates sale from assembling points in producing areas to distributors in consuming centres. It facilitates credit accommodation and, in particular, the financing of such operations as storage. The standardization of containers is also of considerable importance in this connexion. It is obvious that, if one or two types of packages be selected as best adapted to trade requirements and these types alone are manufactured, not only are cheaper packages possible but, with standard methods of packing, the quantity element is standardized. Thus standardization means increased business efficiency and a corresponding reduction in marketing costs; it has also important reactions on consumer-demand to which reference will be made later.

Because of its superior economy, the standardization of grades (and, where applicable, of containers) is an inevitable reform, just as the general standardization of gauge for all main lines of railway was inevitable from the start. It is true that it may be more difficult to work out acceptable standards for some agricultural commodities than for others, but the difficulties will gradually be overcome with the evolution of improved marketing technique. It remains to be added that the commercial advantages of standardization are important enough in regard to a commodity like potatoes, of which British farmers supply over 90 per cent. of the country's requirements, but they are of overwhelming importance in regard to those home-produced commodities which have to

face the competition of imported supplies. To appreciate this latter fact, let us examine the trend towards standardization in other countries.

The Trend Abroad.—At the recent World Economic Conference at Geneva, the standardization of agricultural products was recommended in the interests both of producers and consumers. Certainly, standard classification and grading are becoming increasingly necessary in international trade. In most exporting countries, minimum quality standards are prescribed which supplies must attain before export is permitted; such supplies, in practice, enjoy a privileged position on the world market. A glance at some of the recent developments is instructive. The Dominions have made important progress since the war in the standardization of commodities for export trade—notably, dairy produce, eggs, meat, and fruit. The grading of New Zealand carcasses of mutton and lamb is a classical example of standardization in regard to type, weight, and finish. Rapid strides have also been made, as regards dairy produce, by European countries—Holland, Denmark, Sweden, Norway, Latvia, Estonia, and Finland. The definition of standard grades for eggs has been taken in hand by most Baltic countries since the war, and also by Northern Ireland and the Irish Free State. The standardization of Danish bacon supplies is common knowledge. In Holland, the quality, packing, net count, and weight of fruit and vegetables exported have been subject to a scheme of control for the past three years. In March of this year, Italy passed legislation designed to give the buyer of Italian fruit and vegetables a guarantee of quality and so to improve the value of Italian products on foreign markets. It is understood that Northern Ireland is contemplating the introduction of a standard grading system for potatoes and dairy produce in the near future, and that Canada will shortly promulgate national grades for dressed poultry. This shows the trend clearly enough; it also shows the startling rapidity with which developments are taking place in countries immediately concerned with our market here. This, however, is not the whole story.

The "Export" Argument Again.—Even more striking are developments in the United States, where standard grades are fast being worked out and announced by the Federal Department of Agriculture. Grades to fit commercial conditions have now been established for over three-quarters of the agricultural products of the Union, including 35 different kinds of fruit and vegetables. A notable advance last year was the

formulation of grades for live stock, beef carcasses, and wool. The important point regarding this work in the United States is that it is emphatically not inspired solely by considerations of export business, since many, if not most, of the commodities concerned do not move beyond the home market and are being standardized in the interests of economy and for the simplification of business dealing. Then, again, standard grading systems are operative in Canada for potatoes and eggs, for example, yet these commodities are mainly produced for the Canadian market. Clearly, we cannot dismiss standardization with a wave of the hand as being a peculiar requirement of export trade.

Let us pursue this a little further. In Germany, the competition of dairy produce of guaranteed quality from Holland, Denmark and the Baltic countries has been increasing in severity. This has produced a situation there very similar to that here, in that German produce is challenged in its own markets by an influx of standardized goods from abroad. It is admittedly more difficult for an importing country to adopt a standardization policy than it is for an exporting country to do so, but the German dairy-farmer has decided that the difficulties have, somehow, to be overcome if his goods are to hold their own against foreign competition, and he is displaying great activity. A little over two years ago, organized farmers in the province of Schleswig-Holstein made the first move, and instituted a butter-control on Danish lines; about the same time, the Rhenish Provinces blazed the trail for the cheese-makers. Since then one dairying province after another has followed suit and development is still proceeding. The standardization and uniform packing of dairy produce, and its classification according to type, are now the declared objectives of the German Government. There is reason to think that, in the not too distant future, Germany will take up the question of the standardization of agricultural products in general.

Home Produce Must be Standardized.—Every thoughtful man must recognize the urgent necessity for standardizing the grading of home produce as far as may be practicable. There are three reasons for deliberately resorting to such a policy. One reason is that, as already indicated, it means more economical marketing. Another is that ungraded, nondescript supplies, or supplies graded in a multitude of different ways, cannot make the same appeal to the distributive trades, and especially to the wholesale distributor, as standardized imported goods that can be handled in bulk and meet require-

ments in every detail ; the distributor is in the business for his living, and he is not interested in home production for home production's sake. The third reason is that some clear-cut method is necessary by which superior home-grown produce may be definitely distinguished from that proportion of home produce—small though it may be—which is of low quality and acts as a drag on the market for home produce in general. Exporting countries keep their low-grade supplies at home and only send us their best. The least that we can do is to see that our best is distinguished from our worst, and that good and bad alike are not marketed under the same designation.

Taking a broad view, we may disregard direct sales from producer to consumer, or even, for that matter, from producer to retailer. Direct trade on these lines is, of course, considerable, but it is a limited trade and has but limited potentiality compared with the enormous demand of the wholesale distributive machine. Where standardization is clearly desirable, at any rate as a first step, is in regard to supplies of home produce that are surplus to local requirements and rely on the wholesale distributor for a market. There is valuable ground to be won back for the British producer in this way. It is to be remembered, too, that if, through standardization, the demand for home produce can be improved in the large consuming centres, the benefit will be felt away back in the remotest village.

Hopeful Signs.—The first steps have already been taken. The British Glasshouse Produce Marketing Association has been working since 1922 a standardization scheme, which provides for standard grades and packages and a registered trade-mark. This year, producers of Cheshire and Cheddar cheese have, respectively, formed federations for the purpose of controlling the quality of their products by means of trade-marks and a qualifying standard. For fruit, a number of commercial grading and packing stations are springing up, most of them being private businesses, there being as yet but little tendency among producers to co-operate for this purpose. One or two large-scale conditioning, grading and packing plants for poultry have recently been established, and also one or two packing stations where eggs are graded to standards and packed in standard non-returnables ; here, again, the development is mainly non-co-operative, but, from the standpoint of better marketing, most sound and promising. Then there are those co-operative organizations for the classing, bulking and central sale of Wool—Kent Wool Growers, Southdown Wool Growers

and Eastern Wool Growers. A start has been made ; how can we accelerate progress in order to meet the needs of the situation without undue delay ?

(4) *The Line of Advance.*—Those countries that have introduced measures of compulsory standardization are usually exporting countries, and the regulations, in many cases, only apply to exported goods. In Canada, as already stated, the standard grading of eggs and potatoes is, however, obligatory even in domestic trade. In the United States, the policy followed is to promulgate grades which experience shows to be feasible, and to do all that is possible on a voluntary basis to work them into the trade ; compulsory grading to standards is only, I think, applied by Federal law to grain and cotton, and, in these cases, compulsion was demanded by all interests concerned. For other commodities, the standards are, at the moment, permissive or tentative, supported in the former case by an inspection service. Compulsory grading laws have, it is true, been passed by several States of the Union, but the great majority of producers came into line beforehand and the legislation was only aimed at a small but irritating minority. Although the adoption of permissive standards is being extended mainly by educational means, progress has been extremely rapid for many commodities. Already 85 per cent. of the commercial potato crop, for example, is voluntarily sold under the Federal grades.

The system adopted in the United States has much to recommend it. Certainly, mandatory legislation is to be avoided if other means can be found. It should be remembered, however, that, in the United States, the domestic market is not invaded to any great extent by standardized goods from abroad, and there is thus no question of *force majeure*. As far as this country is concerned, if we are to continue on the present voluntary basis, the best line of advance would seem to be (1) for the Ministry of Agriculture, after due inquiry, to suggest standards which, in the light of trade experience, are regarded as suitable, and (2) for some special incentive to be devised which will encourage their rapid adoption in view of the quality pressure of imported supplies.

A National Mark.—With regard to (1), the Ministry of Agriculture has recently suggested standard grades for a number of commodities and demonstrated them publicly ; others will be suggested and demonstrated as investigations proceed. As regards (2), a national quality mark, duly safeguarded against misuse, might well supply the special incentive desired.

example, it could be used concurrently with the private marks of commercial fruit-growers, or the marks recently registered by producers of Cheshire and Cheddar cheese, provided always that the goods conform to the standards laid down by authority. These are, however, matters of detail. The essential point is that, under safeguards to be devised, the national mark could be used, in some form, as a label, stencil, stamp or tab, on most kinds of agricultural produce, or on the containers, as convenient. It could be applied, for example, to packets of beet sugar and flour, to egg cartons, to fruit boxes and to potato sacks. There may be difficulties, but it is perhaps not impossible to devise a workable scheme by which wrapping-paper, bearing the national mark, would be usable for English meat and poultry of standard quality. In this way, one home-grown product would advertise and support another, and all users of the mark, whatever the commodity with which they may, as individuals, be concerned, would be vitally interested in protecting it from abuse and in preserving its reputation.

National Advertising.—In the same way, all authorized users of the mark would be interested in securing for it the widest publicity and could create a common fund for that purpose. From the standpoint of the industry as a whole, this would be more effective and economical than an arrangement by which producers of this commodity or that contribute to "Eat More ———" campaigns that may be successful in some degree, but are liable to be mutually destructive, since the human stomach cannot be stretched indefinitely. In any event, except for commodities like fresh milk, that are wholly produced at home, such campaigns are likely to benefit imported supplies to an equal if not greater extent than home-grown.

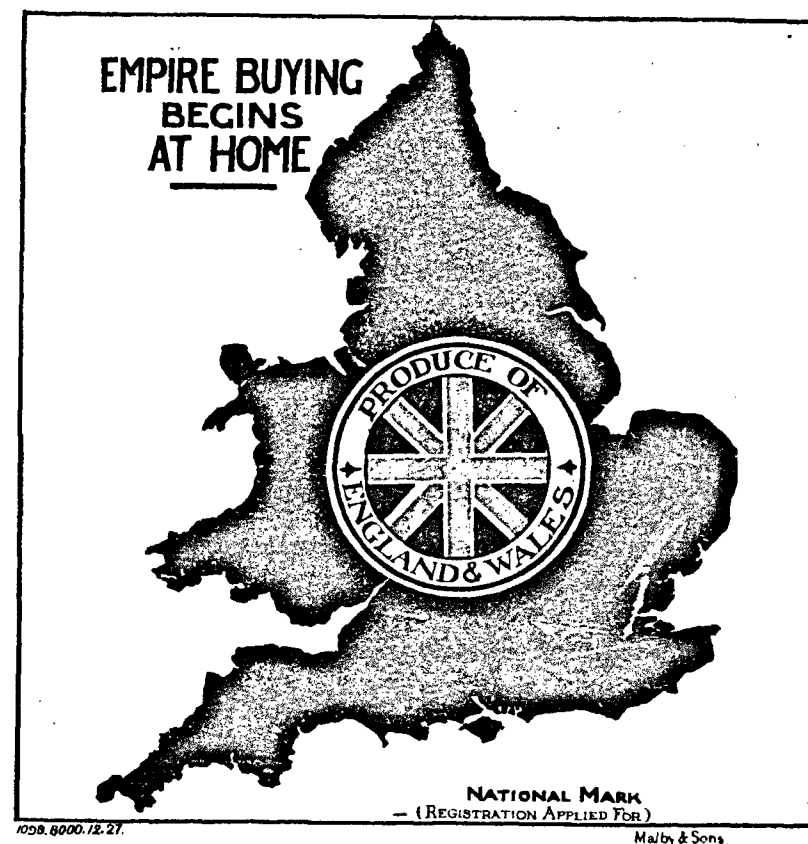
Then again, one hears much of the efforts of the Empire Marketing Board to foster Empire trade, and sympathizes greatly with them. The Board has laid down, and it has been accepted without demur, that the home consumer should be encouraged to select home produce first, Dominion and Colonial produce second, and to buy foreign produce only if there is no Imperial alternative. The efforts of the Board are to be sustained over a period of years. Clearly, there is here a great and unprecedented opportunity for the home producer. But just as it is useless for the Empire Marketing Board to expect the housewife to buy Dominion produce unless it compares favourably with foreign produce in price and quality, so is it equally necessary that home produce be worthy of the first place and able to maintain it. Under existing conditions,



828 A

A national quality mark is a familiar enough device in international trade. We may take the export butter market as an illustration. There is, for example, the "Kangaroo" mark of Australia, the "Fern" mark of New Zealand, the "Lur" mark of Denmark, the "Rune" mark of Sweden. Among other countries employing national butter marks are Holland, Norway, Finland, Latvia, Estonia and Lithuania. In order to bring in an impartial authority standing outside the actual trade, and in the interests of publicity, such marks are usually the property of the Government concerned; their use is only authorized on goods, or packages containing such goods, that reach a prescribed standard of quality and comply with certain conditions as to packing, etc. The marks are regarded as national trading assets and are guarded most carefully by strict inspection. They are a valuable auxiliary to quality control. In each case, they have been resorted to in order to gain improved access to the English wholesale market. Cannot we use the same device in order to improve the demand for our own goods on our own market? Cannot we, too, fly our flag and use a mark which is at once an indication that the goods to which it is applied are of English origin and of guaranteed and defined quality? The mark here shown, which is the property of the Ministry and cannot, of course, be used without the Ministry's permission, is put forward to illustrate the principle; it is designed to be effective in retail and semi-wholesale as well as in wholesale trade.

In any scheme involving the employment of a national mark for English produce, it would probably be necessary to register individuals who were authorized to use the mark, to arrange for the sampling and inspection of consignments and for the withdrawal from an individual of the right to employ the mark in the event of non-compliance with the conditions laid down. Nevertheless, the use of the mark would remain entirely voluntary and only those who wished to take advantage of it would be subject to the measures necessary to ensure that the mark was really a guarantee of quality and reliability. For convenience of administration, it may prove desirable to delegate responsibility for controlling the use of the mark to area associations of producers and others concerned. Certainly, each commodity would require a separate organization for this purpose. Further, it would be essential from the start to secure the active co-operation of the distributive trades in the towns and cities. It should be added that the national mark need not displace any existing mark; for



COUNCIL OF AGRICULTURE FOR ENGLAND

THE twenty-fifth meeting of the Council was held at the Middlesex Guildhall, Westminster, on Thursday, October 20, 1927: Mr. W. R. Smith in the Chair. The CHAIRMAN, on behalf of the Council, welcomed to the meeting Sir Charles Howell Thomas, the new Permanent Secretary of the Ministry of Agriculture, succeeding Sir Francis Floud.

Statement by the Minister.—The Rt. Hon. WALTER GUINNESS, in the course of his address to the Council, said that it was meeting under very depressing and difficult conditions. The early promise of a good harvest had been spoilt by bad weather, and now, although it was too early to judge finally as to results, he was afraid that the condition and quality of the crops would leave a good deal to be desired. As regards quantities, the estimates of the barley and oat yields were above average, and wheat slightly below average. He hoped that sugar beet, at least in the eastern part of England, might do something to mitigate the general bad record. There were now 229,000 acres under sugar beet; four new factories were opening this month, and five of those working last year would have their capacities greatly increased for this season; there were six schemes for new factories under consideration.

Taking the year as a whole, there had been much greater freedom from Foot-and-Mouth Disease. In the first nine months there had been 33 outbreaks as against 183 outbreaks in the same period of 1926. This month there had been nine outbreaks, eight of which were in Somerset and all connected. The disease had spread in Somerset through the failure of farmers to report as soon as their animals showed symptoms of trouble, and the cause had been discovered by the patrolling of the Ministry's Inspectors. Experience had shown that if only immediate notice of disease was given the outbreaks could be stamped out in their initial stages. The outbreaks were especially unfortunate from the point of view of the export of pedigree stock. The provision of quarantine stations was, however, being pressed forward, so that export of such stock could take place under certain conditions, even though outbreaks were occurring in the country. It was hoped that the first station, that in London, in the erection and preparation of which the Empire Marketing Board had helped, would be opened early next year.

The Minister emphasized the importance of the work of the Imperial Agricultural Research Conference, and referred to

recent advances which had been brought about through research in agriculture all over the world. Marquis Wheat in Canada, Yeoman Wheats in this country, and the increase in supply and cheapening of price of practically all artificial manures were obvious examples. Last month, the price of nitrogenous manures was only 3 per cent. above the pre-war figure. The Minister said that the most hopeful factor of all was that agricultural research and education were being widely appreciated by farmers, and that already a generation had been produced which was willing to look to science for help and guidance in its difficulties. He then informed the Council of the action taken by the Government in connexion with a resolution passed at their last meeting, in suspending the 33½ per cent. duty on the importation of synthetic urea until next March so as to enable agriculturists to obtain supplies pending the production of the article in this country.

Turning to the work under the new Small Holdings Act, the Minister stated that 29 counties had sent in 55 schemes involving a charge on the rates and a consequent contribution from the Exchequer. He thought it was satisfactory that so many counties had been found ready to take advantage of the opportunities under the Act and to bear their share of the cost involved. The CHAIRMAN thanked the Minister, on behalf of the Council, for the address.

Improvement of Marketing of Agricultural Produce.—The Rt. Hon. Sir FRANCIS ACLAND, Chairman of the Standing Committee, presented a preliminary report for the Council's consideration, as follows:—

STANDING COMMITTEE'S PRELIMINARY SUGGESTIONS ON THE SUBJECT OF THE IMPROVEMENT OF MARKETING OF AGRICULTURAL PRODUCE

(1) That it is of urgent importance that the agricultural industry should consider the better marketing of agricultural produce in the light of the material now available, with a view to securing for the producer greater control over his product than he has at present.

(2) That among the primary objects to be aimed at are closer touch with the consumer and better standardization both in the quality and quantity of supplies; and that the services which might be rendered in these ways would entitle the producer to receive a larger share of the price which the consumer pays.

(3) That, though the assistance of the State would be necessary in setting up the marketing organization and machinery required for different classes of products, the movement must be primarily that of the producers, success being impossible without a guarantee of supplies.

(4) That, in order that producers should be willing to undertake the responsibility for initiating, setting up and seeing through new marketing systems, they must be certain in advance that the profits accruing shall be secured to the industry.

however, the would-be consumer of home produce has two difficulties to face: (1) the lack of effective means of identification, and (2) the fact that there is frequently no assurance of finding the same thing twice. Everyone knows that when English produce is good it is the best in the world; where, for example, can the finest English beef or the English new-laid egg be rivalled? The trouble is that, in the nature of things, there must always be a certain amount of home-grown produce which is of poor quality, and that, at present, this often masquerades under the name of the best to the prejudice of the reputation of home produce as a whole. When the housewife buys home-grown produce in the belief that she is buying the best, and she gets cow-beef or incubator eggs, she naturally says, "If this is home-grown, then I shall buy imported next time." It is here that the national mark comes in. The national mark would stand specifically for quality and for quality only; it would also stand for continuity of quality and, above all, it would stand for England and Wales.

Let us consider, in this connexion, the advertising campaign in support of Empire produce which the Empire Marketing Board is carrying out in the Press and by means of posters. The Board is doing its utmost in this campaign to keep home produce to the fore in a general way, and there is no doubt that good is being done, but how much more downright good would result if the Board could focus its activities, as far as home produce is concerned, on a national mark which could be advertised on the hoardings and in other ways, which could be the emblem of home produce in general and, by its implications in the matter of quality, not only divert demand from foreign goods, but create an ever-expanding demand for home products?

It should be remembered that it is an essential part of the plan that the national mark should be applied, where possible, to retail packages, such as cartons, packets, etc., as well as to wholesale containers, and so carry its message into the very homes of the people. What better means could be devised of winning for the farmer the sympathy of the large industrial population of this country?

Then there is the participation of home produce in the displays of Empire produce which are staged, from time to time, under the aegis of the Empire Marketing Board at trade and other exhibitions. One needs to be associated with the staging of these public displays to form an idea of the advance that would be made if such a thing as a national mark were in

existence for home produce, around which could be weaved a story that would make a new and effective appeal both to the distributor and to the consumer.

In this connexion, it is important to realize that Orders under the Merchandise Marks Act, requiring the stamping of imported goods, would not in the least diminish the necessity for building up the goodwill of home produce in the large consuming centres, by means of a standardization policy expressed through a national mark. On the contrary, although such Orders might make the results more effective, they would equally render the policy more urgent and necessary.

The Consumer's Position.—Finally, let us consider briefly the likely reaction of the consumer to a standardization policy applied to home-produced supplies. Canada can teach us something here. About five years ago, Canada introduced legislation for the compulsory grading of eggs in both domestic and export trade. For the previous twenty years, the estimated *per capita* consumption of eggs in the Dominion had been static, although it was greater than the consumption in this country. Since the advent of standardization, the *per capita* consumption has nearly doubled, so that practically two eggs are eaten now where one was before. This shows how the consumer reacts to dependable quality. It shows also that, fundamentally, the question is one of confidence. If, therefore, home products can be standardized as far as possible, then the normal appeal of standard products may be expected to bring an all-round improvement in demand for home produce. If, in addition, the preference of the consumer for home-produced supplies can be mobilized—a preference which, in the absence of a national mark and quality guarantee, has never been given half a chance—there is no reason why standardized home products should not gradually regain the ground lost to foreign supplies of competitive quality so far as the seasonality of production will allow. This way lies security for the progressive expansion of the industry.

(5) **Conclusion.**—I have presented the case for better marketing; suggestions for your consideration are now before you. They are only suggestions, just as the whole of the Ministry's marketing work—the Economic Series of marketing reports, the marketing demonstrations and so on—is intended to be suggestive. It is hoped, however, that in them the outlines of a marketing policy may be found.

* * * * *

(5) That the question of benefiting the agricultural community by placing the purchase of wheat and meat, whether home-produced or imported, under national control deserves careful consideration.

(6) That the Council of Agriculture for England may take a useful part in the movement for better marketing by preparing a report covering the scope of the above resolutions, and indicating the practical steps which would be required, and that, to this end, the Standing Committee be instructed to act as they may think best, with a view to presenting a draft report at the next meeting of the Council.

Sir Francis, after explaining the report, said the Committee did not ask the Council to adopt it unless it desired to take up the question of marketing seriously.

Brig.-Gen. H. CLIFTON BROWN, M.P. (West Sussex), said that the Standing Committee, in their inquiries, might consider what wider conditions should be attached to the present regulations governing loans to co-operative enterprises. A Society should be able to obtain loans for such purposes as manufacturing feeding stuffs for the use of its own members. The point had cropped up in connexion with a certain co-operative society which milled a "balanced ration" recommended by the Reading Dairying Institute. The ration was made up of home-grown cereals, plus 10 or 15 per cent. of maize. The Ministry of Agriculture was unable under its regulations to make a loan to assist the society. The MINISTER replied that he feared it was not possible for State money to be used to subsidize the farmer in competing with the manufacturing industry. If such an application were granted it would be difficult to know where to stop in subsidizing those who worked up the produce of British farms.

Mr. ROBERT HOBBS asked whether transport was meant to be considered under the terms of the report. Sir FRANCIS ACLAND replied that it would be considered. Mr. GEORGE DALLAS spoke in favour of the adoption of the report, stressing the importance to the industry of stability of prices. Mr. H. C. GARDNER (Worcester) considered that it was wrong to say that there were too many men between the producer and the consumer, and that they swallowed up the profits. There were no more between the farmer and consumer than between the manufacturer and the retailer of goods. On the question of transport, not only were railway charges higher, but the service was poorer than before the war. Dr. CROWTHER said he was firmly persuaded of the necessity for the grading and standardization of goods before they reached the consumer. He was not, however, persuaded that it was the producer's business to do that grading. The majority of producers were probably not competent to grade to the degree that is essential

for proper marketing. He also found, as a producer, that for one particular article, namely, eggs, it was quite unprofitable for him to undertake their grading and standardization. On the general question of co-operative marketing, however, he felt very strongly that it was far and away the most important issue that British agriculture had to solve at the moment.

Mr. H. DENT BROCKLEHURST (Glos.) said that the two co-operative fruit markets in Gloucester experienced the greatest difficulty in collecting the produce of the small grower. Organized collection and transport was a prime necessity in their case. Mr. A. MATTHEWS (Hereford) said that, short of a system of supply direct from the producer to the consumer, the mere putting goods on the market in a different way was not going to improve matters.

Mr. GEORGE HEWITT said that co-operation amongst farmers was essential. A farmer invited to co-operate was sometimes found to be butcher as well as farmer, and to prefer to make a sacrifice on his farming business and get it back on butchering. Such a man was likely to stand out from any co-operative scheme. Co-operative organizations were also up against private trusts who were willing to lose, sometimes, thousands of pounds if they could undersell or over-buy the co-operators.

Lord BLEDISLOE, Parliamentary Secretary to the Ministry, said that the Ministry welcomed this report, and hoped the Council would adopt it, but with a caveat in respect of paragraph 5. The Ministry doubted whether such a scheme as there referred to could be in the best interests either of producers or consumers. He was glad to hear that transport was to be considered, as the charges for produce, which had to be paid for at the higher rates, were higher than in any other important country in the world. This country was the most attractive food market in the world, and, by co-operation or otherwise, our farmers should aim at getting as large a proportion as possible of the home trade. The Marketing Branch of the Ministry, which was being materially assisted by the Empire Marketing Board, was working hard at the problem: demonstrations on better marketing were being given at agricultural shows and were proving of value. He thought, with Sir Francis Acland, however, that the movement was primarily a producers' movement.

In reply to the discussion, Sir FRANCIS ACLAND agreed that at present individual efforts to grade and standardize produce did not always pay for the work involved; that would be so as long as they were merely individual efforts. It did not

in the least prove that all individuals would not get a better price when they graded in the same way. The report was adopted unanimously.

Electricity Development in Rural Areas.—In the absence of Sir Douglas Newton, M.P., Sir FRANCIS ACLAND moved the following resolution :—

That the Council request the Standing Committee to consider the question of electrical development in rural areas, and to examine the reasons and difficulties which have retarded the supply of electricity in England as compared with Continental countries, and to report as to the best methods of overcoming them; also to advise as to the nature of the representations which should be made to the Government for the provision of facilities to encourage the distribution of current in this country in a similar manner to distribution on the Continent.

Mr. DENTON WOODHEAD seconded. The MINISTER OF AGRICULTURE said he welcomed the suggestion that the Council should take up this subject. The Ministry had already given much consideration to it and had rather come to the conclusion that what was necessary was a general survey of the position and not a technical inquiry. Foresight in the planning of the "grid" would, however, have a lasting effect on the possibilities of a cheap supply to rural areas. The Ministry was having inter-Departmental discussions with the Electricity Commissioners and the Ministry of Transport on the subject. Mr. WEARMOUTH (Durham) said he had had electricity on his 300-acre farm for about 14 years; all his grinding and mixing of food, all stacking of corn, thrashing, etc., was done by electricity. At the present time the cost of equipment would probably be too expensive for most farmers, and it might be possible to help under a short-term credits scheme.

The resolution was put to the meeting and carried unanimously.

Holidays for Agricultural Workers.—Mr. JOHN BEARD moved the following resolution :—

That the Council of Agriculture for England recommends that, in view of the difficulties of including the agricultural workers within the provisions of the Unemployment Insurance Acts, a Committee be appointed to examine the possibilities of setting up a scheme whereby agricultural workers shall be assured of two weeks' holiday per annum with pay: the funds for such a scheme to be raised by

- (a) Contribution from the workers;
- (b) Contribution from the employers;
- (c) Contribution from the Government;

and the Committee also to examine if and how it is possible for the administration of such a scheme to be placed under the control of the Agricultural Wages Board.

Mr. BEARD said that the problem was not so much that the agricultural labourer was unemployed as that he was over-employed. Four million pounds per annum would probably be the State's share in the cost of the scheme. Conditions were different formerly, for when a man left his place at the end of his hiring year he had five or six days' holiday paid for, which he would take before he started on a fresh job. That was gone, and there was nothing to take its place.

Mr. DALLAS seconded the resolution.

Lord BLEDISLOE said that the Government would be unable to accept the resolution if it were passed. He had every sympathy with the agricultural worker, but he could not agree that he was over-employed. There appeared to be no logical connexion between unemployment insurance and holidays, and any scheme for holidays, certainly in the present financial stringency, must be left to the industry itself. In any case, the workers in other industries and their employers would naturally take strong exception to being taxed for such a purpose as was suggested. Mr. BRUFORD (Somerset) objected to the proposal on several grounds, particularly on that of the farmer's financial position. His own men got a holiday when they wanted it; not a fortnight's holiday, but a day here and there as they asked for it. Mr. BEARD, in reply, said that the workers had had no opportunity to show whether they would or would not appreciate a fortnight's holiday. He thought they would appreciate it, and, like other people, wish to get to a seaside resort, or to London, or elsewhere. The motion was put to the meeting and lost.

Agricultural Rating.—The Rt. Hon. Lord STRACHIE moved :—

That this Council requests the Government to increase the grant under the Agricultural Rates Act, so that agricultural land may be relieved from all local rates.

Lord STRACHIE moved this amendment on the ground that farming land constituted the raw material of the farmer and should not be taxed. He did not think that the additional relief would cost more than 3½ or 4 million pounds. In giving such a grant, the Government would assist not only agriculturists but those who owned houses and other property in rural areas, and who had to help in making up the deficit through the grant under the Act of 1896. In his own area the effect of the grant would be that the local rates would be reduced by 2s. 9d. in the £. He did not think that farmers

could expect their buildings and farms to be entirely free from rates. A manufacturer was rated on buildings and houses, and so should be the farmer. At Cardiff, recently, when two agricultural members had moved a stronger resolution, the Minister had pointed out that someone would have to pay for the relief if it could be granted, that under present conditions the Government had not the necessary funds, and he could hold out no hope that the change could be brought about in the lifetime of the present Parliament. This was strange if the Government, as was stated recently, had increased the number of its officials, had the resources of the Road Fund, and were finding money under the Small Holdings Act. Farmers had had no relief from the Government up to the present moment; indeed, more burdens were being put upon them. Industries from which farmers bought were safeguarded, and no safeguarding was forthcoming for agricultural produce. The Valuation Act and the Tithe Act also were going to increase local rates. The Milk and Dairies Order was throwing a heavy expenditure on owners. Mr. BRUFORD seconded the motion. He said that money was being squandered on roads and there was much waste of money all over the country. He thought the Ministry should try and stamp out the depression as it was trying to stamp out Foot-and-Mouth Disease.

The MINISTER, in the course of his reply, said that the Government was anxious to do all it could, within the necessary limits which were well known, to relieve the burden of taxation upon agriculture, both centrally and locally. He was glad that Lord Strachie had now been converted to the conservative policy in this matter. He thought that Lord Strachie's proposal to benefit, not only the agricultural ratepayers, but all rural ratepayers as well, at the expense of the taxpayer, would amount to much more than 4 millions, probably to as much as 9 millions. The Government was responsible for the taxpayers' money, and responsible to the industries of the country as a whole, and he was bound to say quite frankly that, much as he would like to see more done in the way of relieving the burden upon the farmer in his present difficulty, this proposal was absolutely out of the question. Mr. ROBERT HOBBS suggested that there might be some method of meeting the case in a partial way. For example, by a rebate on the rate on the poorer plough land, say, that rated at less than 25s. an acre, so that it would be kept from being laid down to grass. That would

help to keep up employment, and not cost very much. After Lord Strachie had replied to the debate the motion was put to the Council and lost by 21 votes to 18.

Reorganization of Food Council.—Mr. C. B. FISHER, C.B.E. (Northants), moved as follows :—

That the Council of Agriculture for England suggests that the Food Council might usefully be reorganized by giving the producers and consumers equal representation with a view to bringing their organizations more in touch with one another.

Mr. FISHER said that he did not propose to criticize the work of the Food Council, but only its constitution. It was appointed in 1925 and consisted of 12 members, only one of whom, as far as he knew, was acquainted with agriculture, namely, Mr. C. S. Orwin. The Council was a permanent body, charged with the duty of maintaining a continuous survey of food supplies and prices. His view was that the Council was the right body on which to have representatives of consumers and producers. The Ministry of Food had had a Producers' and Consumers' Council, which met periodically, to the great benefit of both parties. His experience as Chairman of the Travelling Milk Commission was that such meetings had led to good results. Mr. J. O. ADAMS (Northants) seconded. Lord BLEDISLOE said that the Ministry had been in communication with the Food Council and the Board of Trade on this matter. The Food Council had been set up on the lines of having no person representing any particular producing or trade interest on it, and indeed the best of all tribunals of this sort was not one composed of interested parties. He agreed with Mr. Fisher about the work of the Travelling Milk Commission, but war expedients were not such as could be followed in times of peace. If producers were put upon the Food Council, wholesalers and retailers would wish to be similarly represented. The Board of Trade was unwilling to increase the membership of the Council, though it was prepared to meet the resolution to the extent of appointing an agricultural assessor to assist the Food Council in the consideration of every case of British agricultural produce prices. At the instance of the Conservative Parliamentary Agricultural Committee, the prices of fruit and vegetables would shortly be considered, and such an assessor would be appointed. Mr. FISHER, in reply, said that such an appointment would help to some extent, but he did not think it went far enough. The great question was the discussion of matters by consumers' and producers' representatives. It would, no doubt, be very helpful to the Food Council to hear what the producer had

to say as regards condensed skimmed milk importation, also as regards the importation of potatoes. The consumer never got the full benefit of plentiful supplies.

The motion was put to the meeting and carried.

Agricultural Long-Term Credit.—Mr. CHARLES ROBERTS (Cumberland) moved the following resolution :—

That the Council notes with satisfaction the Prime Minister's statement of his intention to make more credit available for farmers, and to introduce a scheme of long-term credit, and hopes that nothing will prevent a well-considered measure for these purposes from being passed during the coming session into law.

Mr. ROBERTS said he put forward this resolution for the following reasons: that, although it had been stated that the Government would deal with the problem next year, there was some uncertainty because the banks had not yet decided to support the scheme, and the Minister had said at Cardiff that he would proceed with it if the farmers desired it. (The Minister here interposed and said that his statement to that effect referred only to short-term credit.) Mr. Roberts said that if the Minister would define the position and give the Council some indication of the direction in which the mind of the Government was travelling, the Council might be able to give some helpful and constructive criticism. He hoped that long-term credit would not be confined to farmers who had bought their farms in any particular period; a new method of financing the industry was really required. Taking a long view, he wondered how the capital requirements of farms were going to be met without some change. One turned from the state of things in this country, where the banks found £20,000,000 for land purchase and £26,000,000 for equipment, to the case of Germany, where £400,000,000 had been found on the mortgage credit system, and the United States, where £2,000,000,000 had been similarly found. He drew the conclusion that there was no lack of credit facilities in those countries, as there was here. As regards short-term credit, he hoped that the Government would give a new definition of the chattel mortgage proposed in the Report on Agricultural Credit in 1926. It would be a real help to extricate farmers from their dependence on dealers, auctioneers and traders generally, and it would also help the new co-operative societies.

On the point of a Government subsidy, he did not think one, either direct or concealed, was required. Doles were only temporary expedients and palliatives. A new land bank

giving first mortgages on farms and attracting the investing public by bonds secured collectively on the corpus of the first mortgages, the mortgages being repayable by easy instalments of principal and interest, would be most helpful. He considered that a Government guarantee might help to familiarize investors with this new kind of security and would not seriously weaken the national credit. Sir FRANCIS ACLAND seconded the motion. The MINISTER OF AGRICULTURE welcomed Mr. Roberts' helpful speech and the opportunity it gave him to clear up one or two doubtful matters. The Government was proceeding generally on the lines of the Report on Agricultural Credit and was aiming at a standard system of long-term reducible mortgages. The negotiations with the banks were going on in a more active form than ever, and he was hopeful that a satisfactory conclusion would be reached. As regards short-term credit, the chattel mortgage would be of great assistance in certain cases, but for various reasons the idea had not found favour with the Farmers' Union, the merchants or the banks. Certain modifications of the original suggestion were being considered, and the Government was quite prepared to deal with the matter on self-supporting economic lines if those who would use the facilities thought it worth while. With the great industrial upheaval last year, or even this year, when we were living in the backwash of the upheaval, the Government did not feel that the time was ripe to go on with agricultural credit schemes. Next year, however, it had every intention of bringing forward the best scheme that it could prepare with the co-operation of the banks and all concerned.

The resolution was put to the meeting and carried.

* * * * *

NATIONAL INSTITUTE OF AGRICULTURAL BOTANY

WINTER WHEAT, BARLEY AND OATS TRIALS, 1924-27

THE National Institute of Agricultural Botany, with the co-operation of the Ministry of Agriculture, the Norfolk Agricultural Station, the Lord Wandsworth Agricultural College, Harper-Adams Agricultural College, Seale-Hayne Agricultural College, and the East Anglian Institute of Agriculture, has just completed a three-year series of wheat trials

and a two-year series of winter barley and winter oats trials. The unusually accurate and comprehensive nature of these trials makes the results worthy of serious attention. Brief particulars of the trial centres are :—

	Soil	Sub-soil	Altitude
Cambridge ..	Heavy clay	Gault ..	80 ft.
Sprowston, nr. Norwich ..	Gravelly loam	Gravelly boulder clay	100 „
Long Sutton, Hants ..	Medium to heavy loam	Clay over chalk..	450 „
Leegomery, Salop ..	Sandy loam	Sand and gravel..	300 „
Good Easter, nr. Chelmsford ..	Heavy boulder clay	London clay	200 „
Newton Abbot, Devon ..	Loam of medium depth	Shale ..	320 „

Winter Wheats.—The comparative grain yields of the wheats in 1926-27, and for the three seasons 1924-27, are given in Tables I and II. The yield of the control variety, Squarehead's Master, is taken as 100, and the yields of the remainder are stated as percentages of it. The Long Sutton figures are excluded from the average column of Table II as they are in some respects incomplete.

TABLE I.—1926-27 RESULTS

	Cam- bridge	Nor- wich	Long Sutton	Lee- gomery	Good Easter	General average
Cambridge Browick ..	98.5	101.5	99.0	127.5	98.1	104.9
Wilhelmina ..	116.8	101.1	96.0	126.3	114.6	111.0
Fox ..	100.4	96.0	99.6	98.3	98.3	98.5
Yeoman II ..	100.7	101.8	—	109.2	134.2	111.5
Little Joss ..	111.1	105.1	—	109.2	102.8	107.1
Iron III ..	118.9	101.1	104.1	120.2	110.0	110.9
Weibull's Standard ..	117.8	102.4	88.8	114.0	100.0	104.6
Setter ..	—	103.7	—	—	—	103.7
Squarehead's Master ..	100.0	100.0	100.0	100.0	100.0	100.0

Squarehead's Master is generally the earliest, Iron III and Weibull's Standard the latest to ripen. There is little difference between the remainder. Little Joss has the longest

TABLE II.—AVERAGE OF 1924-27 RESULTS

	Cam- bridge	Nor- wich	Long Sutton (a)	Lee- gomery	Good Easter (b)	General average exclud- ing Long Sutton
Cambridge Browick ..	98.6	103.6	94.4	111.5	99.7	103.4
Wilhelmina ..	113.5	106.5	96.6	114.4	114.7	112.3
Fox ..	104.5	100.7	99.2	97.7	93.7	99.2
Yeoman II ..	100.1	102.7	91.5	105.7	114.9	105.9
Little Joss ..	106.5	109.8	95.7	101.4	103.0	105.2
Iron III ..	117.2	92.6	104.1	118.2	105.3	108.3
Weibull's Standard (b) ..	121.0	101.6	—	108.2	97.7	107.1
Setter (b) ..	—	95.2	—	—	—	95.2
Squarehead's Master ..	100.0	100.0	100.0	100.0	100.0	100.0

(a)=Average of two years only: Yeoman II, Little Joss, and Iron III, one year.
(b)=Average of two years only.

and Fox the shortest straw. Fox lodges badly and Little Joss and Squarehead's Master are inclined to the same fault. Yeoman II and Little Joss are the least susceptible to yellow rust; Iron III on several occasions was badly attacked. No one variety was more or less susceptible to "take-all" than any other. Yeoman II is consistently the best for the production of breadmaking flours, with Fox a good second; there is little to choose in this respect between the others. The individual merits of the chief varieties may be summed up as follows :—

Wilhelmina can be relied upon to yield heavily in most districts; it stands well; and does better in the mill than its appearance suggests.

Iron III yields and stands well, particularly on the heavier soils and in the south and west, but clearly is not the best wheat for the gravelly loams of Norfolk, and has shown an unexpected susceptibility to yellow rust. It should be sown early.

Weibull's Standard is a newcomer that yields heavily on the Cambridge clay, with a good straw, but grain of poor quality.

Yeoman II yields rather better than was expected. It can be grown successfully on all the soils described above. It is unique among English wheats for quality, it is rust-resistant, and it stands well enough to pay for intensive manuring.

Little Joss makes the most straw, is rust-resistant, suits light soils, and is clearly the heaviest yielder at Norwich; but it has no claim to quality.

The remainder could well be replaced on any of these soils by one or other of the foregoing. But it should be noted

that these results do not necessarily apply to Northern England.

Winter Oats.—The results for 1926-27 are given in Table III, those for 1925-27 in Table IV. In certain cases only one year's results are available. The yield of Grey Winter, as the control, is expressed as 100.

TABLE III.—1926-27 RESULTS

	Cam- bridge	Nor- wich	Long Sutton	Lee- gomery	Good Easter	New- ton Abbot	Average exclud- ing Lee- gomery
Marvellous..	106.9	118.9	128.7	—	130.7	89.6	115.0
Bountiful ..	100.0	124.5	114.2	—	91.8	87.0	103.5
Black							
Winter ..	94.7	103.3	107.3	103.1	97.8	98.6	100.8
Plentiful ..	87.9	107.5	99.1	111.5	97.8	—	100.8
Victory ..	—	—	—	—	121.7	—	121.7
Grey Winter	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE IV.—AVERAGE OF TWO YEARS' TRIALS, 1925-27
(PLENTIFUL ONE YEAR ONLY)

	Cam- bridge	Nor- wich	Long Sutton	Lee- gomery (a)	Good Easter	New- ton Abbot	Average exclud- ing Lee- gomery
Marvellous ..	116.0	123.4	98.2	—	132.0	103.8	114.7
Bountiful ..	102.1	129.5	99.5	113.0	97.2	103.6	106.4
Black							
Winter ..	94.5	100.8	102.7	115.1	104.4	100.4	100.6
Plentiful ..	87.9	107.5	99.1	111.5	97.8	—	98.1
Victory ..	—	—	—	—	121.7	—	121.7
Grey Winter ..	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(a)=Black Winter two years, remainder one year only.

Marvellous is a coarse white oat that makes few tillers, and a comparatively small bulk of very strong straw, but in sheltered districts generally gives a heavier grain yield than any other winter oat. To sow it in cold or wet districts or on dirty land, however, is to court almost certain failure.

Bountiful is a black oat that produces a good quantity of fairly strong straw, gives a good grain yield, particularly on the lighter soils, and though probably not entirely winter hardy is harder than *Marvellous*.

Black and Grey Winters give a bulk of weak straw, and modest but, thanks to their hardness, steady yields of grain. The quality of the grain of Grey Winter is good, but of Black Winter only moderate. Grey Winters are at once the hardest, the weakest strawed, and the latest of winter oats.

Plentiful is a new variety from Gartons. One year's trial is too short for reliable conclusions, but *Plentiful* seems to produce a large bulk of fairly stiff straw and moderate yields of good quality white oats, particularly on the lighter soils, and to be harder than *Marvellous*. It is the earliest of all these oats to ripen.

The value of *Victory* as a winter oat depends entirely on its hardness; one year at one centre is not enough to test this.

Winter Barleys.—The available information is less than for the two preceding crops, but is given in Tables V and VI. The yield of F. 112, as control, is expressed as 100.

TABLE V.—1926-27 RESULTS

	Norwich	Long Sutton	Good Easter	Average
Plumage Archer, 1924	94.3	102.1	118.3	104.9
Spratt Archer ..	96.4	—	82.5	89.5
Sunrise	84.0	—	121.9	103.0
Archer	94.0	—	—	94.0
Squarehead Winter (6-row)	—	95.2	—	95.2
F. 112 (6-row) ..	100.0	100.0	100.0	100.0

TABLE VI.—AVERAGE OF TWO YEARS' TRIALS, 1925-27

	Norwich	Long Sutton	Good Easter	Average
Plumage Archer, 1924	95.3	105.9	—	100.6
Squarehead Winter ..	93.5 (a)	96.7	—	95.1
F. 112	100.0	100.0	—	100.0

(a)=1925-26 result only.

To draw conclusions from these scanty data is risky, but F. 112, a new 6-row barley of Dr. Beaven's that has shown signs of malting quality, has yielded better than the ordinary 6-row winter on every occasion, and seems particularly suitable for the light Norfolk soil. It looks, too, as though the experiment of sowing spring varieties in autumn may, in the case of Plumage Archer 1924, justify itself on an average of seasons on the heavier soils, and on the light soils as well if its outstanding quality is taken into consideration. Both these two varieties stand well.

Full reports on these trials will be published later in *The Journal of the National Institute of Agricultural Botany*.

* * * * *

LICENSING OF STALLIONS UNDER THE HORSE BREEDING ACT, 1918

THE number of stallions licensed under the Horse Breeding Act, 1918, in England and Wales, during the licensing year ended October 31, 1927, was smaller than in the previous year, but the rate of decrease was much less rapid than in any preceding year since the Act came into force. It would therefore appear that the sharp decline in horse-breeding which has been taking place in the past few years is now coming to an end.

The total number of licences issued for the service season of 1927 was 1,537, a reduction of only 71 as compared with 1926, whereas the decrease recorded last season was 241.

Service Season	1921	1922	1923	1924	1925	1926	1927
Shires	2,463	2,174	1,634	1,195	953	829	772
Other heavy horses ..	636	591	486	424	350	324	328
Light horses (including ponies)	717	714	641	591	546	455	437
Totals	3,816	3,479	2,761	2,210	1,849	1,608	1,537

TABLE II

BREED	Number examined	Number refused	Percentage refused	DISEASE								
				Roaring	Whistling	Sidebone	Ringbone	Cataract	Defective Ge- nital Organs	Bone Spavin	Stringhalt	
PEDIGREE												
Shire	751	19*	2.5	5a	9b	3c	—	1	—	—	—	1
Suffolk	143	4†	2.8	1	3d	—	—	—	—	—	—	—
Percheron	42	1	2.4	—	—	1	—	—	—	—	—	—
Thoroughbred	154	4†	2.5	—	1e	—	—	2	—	1	—	—
Hackney	83	2	2.4	—	—	—	—	1	—	—	—	1
NON-PEDIGREE												
Heavy	82	4†	4.9	—	—	1	1	2	—	—	—	—
Light	29	1	3.8	—	—	—	—	—	1	—	—	—
Pony and Cob	27	2	7.4	—	1	—	—	1	—	—	—	—
Total Refusals	—	37	—	6	14	5	1	7	1	1	2	

* Including three refused on previous year's examination.

† Including one refused in each case on previous year's examination.

(a) One also affected with Cataract.

(b) " " " Roaring.

(c) " " " Stringhalt.

(d) " " " " and Bone Spavin.

(e) Also affected with Bone Spavin.

TABLE I

PEDIGREE STALLIONS i.e., Stallions entered or accepted for entry in the recognized stud book of their breed	BREEDS, HEAVY				BREEDS, LIGHT							BREEDS, PONY AND COB						TOTAL			
	TYPES				TYPES							TYPES									
	Shire	Clydes- dale	Suffolk	Percheron	Hackney	Thorough- bred	Arab	Cleveland Bay	Welsh Roadster	Hunter	Yorkshire Coach	Others	Welsh	Fell	Dales	Polo and Hiding	Shetland		Welsh Cob	Dartmoor	—
Licensed	732	110	139	41	81	150	12	5	1	4	2	—	19	18	9	21	9	52	1	—	1,406
Refused	19	—	4	1	2	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	30
Applications	751	110	143	42	83	154	12	5	1	4	2	—	19	18	9	21	9	52	1	—	1,436
NON-PEDIGREE STALLIONS i.e., Stallions not entered or accepted for entry in a recognized stud book	TYPES				TYPES							TYPES									
	Shire	Clydes- dale	Suffolk	Percheron	Hackney	Thorough- bred	Arab	Cleveland Bay	Welsh Roadster	Hunter	Yorkshire Coach	Others	Welsh	Fell	Dales	Polo and Hiding	Shetland	Welsh Cob	Dartmoor	Others	
	40	11	—	1	26	16	3	5	—	1	2	1	2	3	6	1	—	13	—	—	131
	1	—	—	—	3	1	—	—	—	—	—	—	—	—	1	—	—	1	—	—	7
	41	11	—	1	29	17	3	5	—	1	2	1	2	3	7	1	—	14	—	—	138
	772	121	139	42	26	97	153	17	5	2	6	1	21	21	15	22	9	65	1	—	1,537
	20	—	4	1	3	3	4	—	—	—	—	—	—	—	1	—	—	1	—	—	37
Total applications ..	792	121	143	43	100	157	17	5	2	6	2	1	21	21	16	22	9	66	1	—	1,574

The percentage decreases in the totals of heavy and light horses respectively were fairly similar, but it is noteworthy that the whole of the reduction in heavy horses was in Shires.

In 40 cases, applications for licences were refused by the Ministry, but appeals against refusals were lodged under paragraph 12 of the Regulations in six cases, and three appeals were successful.

Very few cases again of infringement of the Act were reported this season. Only one unlicensed stallion was reported on the road, while in two cases unlicensed stallions were reported as being exhibited for service. Proceedings were taken by the police in one case, and a conviction obtained. Nine stallions, though licensed, were found to be travelling unaccompanied by the licences.

Stallion owners in possession of licences for the year ended October 31, 1927, 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.

* * * * *

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1927

Produce of Hops.—Preliminary statement showing the estimated total production of hops in the years 1927 and 1926, 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, 1917-1926. (See table opposite.)

The average yield per acre in England this year is estimated at 11.1 cwt. per acre as compared with 13.0 cwt. last year, and at $\frac{3}{4}$ cwt. below the ten years' average. The heaviest crop was obtained in Kent, where the yield over the whole county was $11\frac{1}{2}$ cwt. per acre, being slightly more than 2 cwt. under last year's figure, and $1\frac{1}{2}$ cwt. below the average.

In the Weald, the yield was less than $10\frac{3}{4}$ cwt. per acre or $1\frac{1}{2}$ cwt. below average. Mid and East Kent obtained crops of $11\frac{1}{2}$ cwt. and nearly 13 cwt. per acre respectively, the former being $2\frac{1}{2}$ cwt. and the latter $\frac{1}{3}$ cwt. per acre below the ten years' average for those districts. The yield in Sussex is estimated at $10\frac{1}{2}$ cwt., which is almost 3 cwt. less than last year, and nearly 1 cwt. per acre below the average. Hampshire

Counties, etc.	Estimated Total Produce		Acreage Returned on June 4		Estimated Average Yield per Acre		
	1927	1926	1927	1926	1927	1926	Average of the Ten Years, 1917-26
	Cwt.	Cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
East ..	41,000	63,000	3,173	3,496	12.9	15.2	13.2
Mid ..	55,000	78,000	4,790	5,259	11.5	14.8	14.0
West ..	68,000	82,000	6,329	6,941	10.7	11.8	12.1
Total, Kent	164,000	213,000	14,292	15,696	11.5	13.6	13.0
Hants ..	8,900	14,400	948	1,034	9.4	13.9	11.2
Surrey ..	1,600	2,200	150	177	10.8	12.5	10.3
Sussex ..	22,000	31,000	2,149	2,384	10.3	13.2	11.2
Hereford ..	41,000	49,000	3,593	4,166	11.3	11.7	9.4
Worcester ..	17,000	21,000	1,773	2,032	9.8	10.4	9.7
Other Counties*	1,000	1,400	99	110	10.1	12.5	8.1
TOTAL	255,500	332,000	23,004	25,599	11.1	13.0	11.9

* Salop, Gloucester, and Berkshire.

NOTE.—Inquiries made during the past month indicate that the area of hops actually picked was less than the area returned on June 4. The estimated total produce shown above for 1927 represents the quantity estimated to have been picked.

with a yield of under $9\frac{1}{2}$ cwt. was $1\frac{3}{4}$ cwt. per acre under average. The West Midland counties, however, produced above average crops, although these were about $\frac{1}{2}$ cwt. below last year's figures. Hereford with a yield of $11\frac{1}{4}$ cwt. per acre was nearly 2 cwt. above average, whilst Worcester, with a little more than $9\frac{3}{4}$ cwt. per acre, was only slightly in excess of the average for the previous ten years.

The total production over the whole of England in 1927 is estimated at 255,500 cwt. or 76,500 cwt. less than last year and 15,000 cwt. below the average production of the ten years 1917-1926. As was the case last year, Kent produced 64 per cent. of the total hop crop, but the quantity was only 164,000 cwt. as compared with 213,000 cwt. in 1926.

* * * * *

DECEMBER ON THE FARM

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

Seasonal Notes.—December, like the three preceding months, owes its name to its position in the old Roman year, which commenced in March. Thus it was, as its name implies, the tenth month. By our Saxon ancestors it was known as Winter-monath, and later as Helig-monat or Holy month. Even before the institution of Christmas celebrations, this time of the year was one in which there was much holiday-making and feasting in rural districts. The field operations of the year being completed, this was obviously the season when a little relaxation from agricultural labours could be most conveniently arranged.

In ancient Latium, the Saturnalia or festival of Saturnus, the god of agriculture, was celebrated about the middle of December. During the week of this festival no public business could be transacted; the slaves enjoyed special liberties, and all ranks devoted themselves to feasting, games and mirth. The houses were decorated with evergreens, presents were interchanged, and other customs were observed which exhibit a remarkable resemblance to those of our own Christmas.

The hanging up of the mistletoe is a survival of the Druidical rites that were performed at the time of the winter solstice. The mysterious protective and curative properties of the plant were, however, attributed only to specimens found growing on the oak. The burning of the Yule log is an ancient ceremony handed down from our Norse ancestors, who were

sun worshippers, and on the shortest day kindled huge bonfires in honour of the beginning of the lengthening of the hours of daylight.

With the change in rural organization and the greater facilities for recreation now available, seasonal festivities tend to hold a less prominent position than formerly. Many old customs observed at this time of the year have entirely disappeared. The lapse of one of these, at any rate, is not a matter for regret: it was the custom of "bleeding" the horses on St. Stephen's Day, December 26. The horses were first galloped until they perspired freely, then they were bled copiously. This superstitious rite was believed to insure the animals against maladies and sickness during the ensuing year.

Field Operations.—December is often a month when the soil is so continuously wet that drilling of corn is impossible, and such seed as is sown must be covered either by skim ploughing or merely by harrowing. From about the middle of the month until mid-January, however, the soil temperature is commonly so low that, in the greater part of the country, seed put into the ground lies dormant until the return of milder conditions in the latter month. Some farmers believe that the influence of low temperature is beneficial to grain production, but there is evidence that winter oats at least yield equally well if sown after the coldest weather has passed. It is remarkable, however, how long December-sown seed can lie in the soil and then come up well when warmer conditions return.

Apart from attention to live stock, farm operations in this month consist partly in taking advantage of periods of dry weather or hard frost for carting out manure, cross ploughing, winter ridging and splitting of ridges, completing the ploughing of stubbles and other operations in which horse labour may be utilized, and partly in fill-up duties in which only manual labour can be applied. Opening drain mouths, cutting grips and furrows across headlands to lay corn land dry, pleaching hedges, overhauling implements and machinery in readiness for next season, repairing roads and gateways and similar jobs are all necessary, and when thoroughly carried out facilitate progress in the busy seasons. Draining, slagging and liming are larger operations for which opportunities can usually be found in this month.

Loss of Plants.—It is necessary in farm practice to sow several times as much seed corn as would be needed to produce a full stand of ears if every seed produced a mature plant.

A large proportion of the seedlings perish during the winter, so that, instead of two plants per inch of drill row, a seedling every two inches is a good stand; and, when it comes to the point of deciding whether to plough up or leave a thin plant of wheat in March, one plant in six inches may be deemed sufficient to avoid re-sowing. It might be thought that by the operation of the law of natural selection a very hardy strain of wheat would be obtained by saving seed grown on the farm; but the thinning out of the plant in winter is caused by so many different factors that the seedlings which survive the conditions of one field or one winter may not be the most capable of enduring the winter conditions of another field or season.

Late-sown corn is subject to the depredations of birds, larks especially, which pull up the blade during germination to get at the seed corn at its foot. The larvæ of frit fly, wheat bulb fly, wireworms and slugs may under certain conditions levy heavy toll on winter corn during the milder weather. The braird obtained from weakly germinating seed—such as often results after wet harvest weather—is prone to thin off badly in winter; but the more common causes of loss of plant between November and March are those of a physical nature. These produce the four separate troubles of (1) throwing out, (2) drowning out, (3) freezing off, and (4) rotting off.

Throwing out is the name given to the damage caused by alternate freezing and thawing, when the stem is torn through between the seed-corn and the blade. When a light frost occurs on a moisture-laden seed bed, the surface is lifted, and when the soil goes down after thaw and perhaps rain, the plant stands higher out of the ground than it did before. When a more severe frost is followed by a surface thaw and then frost returns while the roots are still bound in the frozen part of the soil, the upper part of the plant is torn away from the lower part and later remains detached and projecting out of the ground. Late-sown wheat drilled too deeply on moist land is most subject to this trouble. Fields lying towards the sun are worse in this respect than those with a northern aspect, as they thaw during the warmer parts of the day and freeze again at night. During the time when snow is on the ground, the melting of the snow in the middle of the day adds to the moisture content and increases the expansion of the soil on freezing. Loose seed beds and corn drilled on leas that have not been ploughed early enough are more prone

to this trouble than fields prepared in accordance with the accepted rules. Drainage and water-furrowing are necessary preventive measures.

Drowning out is caused by such an excess of moisture in the surface layers of the soil that the rootlets are unable to obtain the air necessary to their life. Working the seed bed too fine may be one cause of the trouble; an impervious subsoil may be another; lack of surface drainage due to flat ploughing and absence of water furrows may be a third cause. The crop suffers more in mild than in cold weather, when excess of moisture is the trouble, and a quick thaw after snow may aggravate the complaint. As in other cases of excess of moisture, prevention of the excess should also be tried by opening ditches which lie on the higher side of the field, thereby preventing seepage of moisture from the higher levels.

Freezing off occurs only when the frost is severe and the land not covered with snow, and also when the effects of the frost are accentuated by sharp dry winds or sunshine. It is probably a drying effect as much as a rupture of the plant tissues. The higher parts of a field are more likely to suffer from this cause than the lower-lying parts, which may escape the winds somewhat. A rough seed bed, with clods that shelter the seedlings from the wind, is the time-honoured method of preventing this complaint.

Rotting off is the trouble which may overtake a winter-proud piece of winter corn when snow comes and its surface becomes first thawed and then frozen to an air-tight cap. If frost precedes the snow, little harm results, because the breathing activities of the plant are thereby retarded; but, when the roots are able to continue their activities and the leaves are cut off from the air, they yellow off and die. Late-sown corn, having only small leaves, is free from this danger.

Farm Economics.—There is no difficulty in realizing that information derived by research in agricultural chemistry, botany, bacteriology and other applied sciences can be of great service to the farmer. Likewise a knowledge of the results of farm experiments and of the methods of husbandry pursued by successful farmers in different districts is of easily recognizable value to all who desire to review and improve their practice. Although perhaps the most important branch of agricultural study, economics has not in this country as yet gained the recognition to which it is entitled by reason of its intimate connexion with the main objects of the farmer—the earning of profit. Scientific manuring, correct feeding,

and even the efficient execution of farm operations are not in themselves the end but only the means to the end.

That 50,000 German farmers are co-operating in the investigation of the financial aspects of farming—by having their accounts properly kept and co-ordinated—is a fact that should at least raise the question of whether our farmers have given this matter sufficient attention. The importance which the Germans attach to this work may be better understood when it is explained that they have about 500 farm book-keeping offices which carry out the accountancy work, and that these offices are self-supporting institutions, organized by the agricultural societies and chambers, and maintained by the fees charged for their services.

Interest in farm economics work is of later origin in this country; we have now, however, in addition to the Institute for research in this subject at Oxford, specialist economic advisory officers at the agricultural colleges or university agricultural departments at Newcastle, Leeds, Sutton Bonington, Cambridge, Oxford, Wye, Reading, Newton Abbot, Bristol, Newport, Manchester and Aberystwyth. Each of these officers is making investigations into farming costs and returns on as many farms in his area as his facilities will permit, or as the farmers in his area will collaborate to ensure. In the Bristol area, an Accounting Society has been formed with a membership of about 50 farmers.

Some of the above-mentioned advisory officers have recently published reports, or interim reports, on the results of their first three years' work; but it must suffice here to state some of the main objects of the investigations. Perhaps the first is to work out standards by which economic efficiency in farming can be measured. Just as a crop of wheat is regarded as good or otherwise in comparison with a standard of four quarters per acre, so we require standards with which to compare the financial data of farming—to enable us to say, for example, whether in a given case an expenditure of £25 in labour per £100 of produce obtained, is higher or lower than it might be under ordinary good management.

Other objects are to obtain authentic data on the financial results of agriculture at different times and under different systems; to compare extensive and intensive methods; and to investigate the influence of various factors on production costs. There is no doubt that when the requisite fundamental data have been established, the farmer will have the further incentive to keep proper accounts, *viz.*, that he will be able to make excellent use of the advisory facilities at his disposal.

NOTES ON MANURES FOR DECEMBER

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

Rothamsted Experimental Station.

Liming.—December is not a very active month as far as the application of manures is concerned, but suitable slack periods often arise which enable chalking or liming to be undertaken. The liming of land, although widely practised in former years, tends to be neglected at the present day. The cost is often considerable, and when the land is only slightly acid the effects are neither so striking nor immediate as those associated with the use of fertilizers. The benefit of liming in such cases consists of a distinct and lasting all-round improvement in the performance of the land as regards cropping and workability, rather than a rapid and transient increase in fertility. In more serious cases of soil sourness, however, the lack of lime is the governing factor, and until this is remedied, fertilizers used alone have little effect, and certain crops fail entirely. The addition of lime to heavy land, which is working badly owing to lime shortage, will often bring about such an improvement as to put the treated land into a different class. At Rothamsted, areas which have been chalked in former years are easily distinguished from the neighbouring untreated land by their better working qualities. The mellow appearance of the chalked areas can often be noted from a considerable distance.

It is now recognized that certain crops are more sensitive than others to soil acidity. Some will fail in the absence of lime on soil on which others can flourish. Lucerne, clovers, barley, and sugar beet fall into the first group; potatoes, oats, and rye are well-known examples of crops which can tolerate a certain degree of acidity. The nature of the crop to be grown is therefore a factor to be considered when the liming of land is in question.

The increasing cultivation of sugar beet will no doubt cause much land, which grew potatoes quite well, to be carefully examined for lime deficiency. A case of this kind occurred at the Woburn Experimental Farm when a series of sugar beet plots was put down on land which could grow good potatoes but turned out to be sour in places. The coincidence of a dense growth of spurrey, and failure of the beet in patches, was very striking; in other places much less spurrey was seen and the beets were good.

Farmers are advised to consult their County Agricultural Organizer before undertaking the liming of a field, for cases have occurred in which it was proposed to lime land that on examination turned out to be naturally supplied with chalk. Moreover, the adviser can give a good indication of the correct amount of lime to use. Too light an application may still leave the land acid, while damage can result from heavy doses of quicklime, especially on light soils.

Mixing Fertilizers.—The practice of mixing artificials on the farm has much to recommend it where farmers have the necessary knowledge of the properties of the individual fertilizers, and are prepared to take a little trouble to carry out the work thoroughly.

A few points need attention if the best results are to be obtained. A good dry manure shed, with a concrete mixing floor and separate bins for the raw materials, is a great advantage, as with storage accommodation it is possible to purchase requirements in good time and, frequently, at favourable prices. It is also essential to know what constituents may be mixed satisfactorily in order to avoid the losses which may arise when unsuitable materials are brought together. These losses are of three kinds :—

- (1) Loss of plant food.
- (2) Loss of water solubility.
- (3) Loss of physical condition.

The best example of the first case is the loss of ammonia which results on mixing salts of ammonia, such as the sulphate or muriate, with lime, or materials containing lime, *e.g.*, basic slag.

The second case arises if water soluble phosphates are mixed with lime or substances containing it. The damage here, though appreciable, is perhaps not so serious as in the former case.

The last case is especially troublesome to farmers, as materials which run together and cake on mixing are very difficult to handle subsequently and regrinding is not possible on the farm.

Samples of manures which, through bad storage facilities, have picked up moisture and become sticky are to be avoided in making mixtures; but some fertilizers—*e.g.*, nitrate of lime and to a less extent nitrate of soda—become damp when exposed to the air, even under the best conditions, and are best applied alone.

A little stickiness can be got over by the use of a small proportion of a conditioner, such as steamed bone flour, while if some of the nitrogen is supplied in the form of organic manures—*e.g.*, dried blood, rape dust, and so forth—the mechanical conditions of the mixture are improved, although the cost per unit of nitrogen will be a little higher.

A good way of mixing the constituents is to spread them in thin layers, one on top of the other, on the floor; then shovel the whole into a heap, taking care to get some of each constituent in each shovelful by shovelling right to the bottom of the layers. The main heap should be turned several times and finally passed through a $\frac{1}{2}$ -in. screen. The material held on the screen may then be pulverized with a suitable rammer or the back of a shovel and added to the bulk, which should then be turned again, and, for specially good working, the mixture may then be passed through a $\frac{1}{4}$ -in. riddle.

Since mixtures which have been skilfully compounded will sometimes lose condition on storage, it is advisable to use home-made compounds as soon after mixing as possible. In addition to the ordinary compound fertilizers, something has been done in recent years to supply two or more constituents ready mixed to meet certain definite needs. For example, those who know by experience that their grassland needs potash as well as phosphate, can supply the two together by using one of the various mixtures of phosphatic manures and potash salts which are on the market. On the Continent a beginning is being made with high-grade complex fertilizers of known composition and constituents whose balance is varied to suit different soil types and crop requirements. These products are more concentrated and more fully declared in their composition than the ordinary compounds as known in this country, and their progress will be watched with interest.

Manures for Sugar Beet.—Interest continues to be shown in the food requirements of sugar beet, as it is generally admitted that good manurial treatment is necessary to make the most of the crop. It should be emphasized, however, that correct manuring will not cover up deficiencies caused by faulty cultivation and, of the two factors, the latter is probably the more important. Much work has been done on the Continent concerning the effect of manures on the yield and quality of sugar beet and, while the results cannot be taken over into English practice without confirmation, the

main findings do, at any rate, give us a guide as to what to expect in our experiments.

In his book on sugar beet culture, Professor Roemer sets out the evidence relating to the manuring of sugar beet in Germany.* Some of the points made are as follows:—

(1) The crop has great powers of utilizing the soil supply of plant nutrients, but manuring is necessary, nevertheless, to obtain satisfactory yields.

(2) A medium application of dung, not exceeding 12 tons per acre, is the basis of the manuring and should be ploughed in before the new year. Heavy quantities of good dung applied late tend to delay ripening. The use of dung considerably reduces the quantity of artificials required.

(3) Green manure is valuable as an economizer of farmyard manure, but not as a substitute.

(4) Nitrates, ammonium salts, and cyanamide are effective in the order named, the superiority of nitrates being more marked in dry districts. The two latter sources of nitrogen should be applied before sowing. Top dressing should be confined to nitrates, and, to avoid late ripening, application should not be delayed after mid-June. Used in moderation and properly applied, artificial nitrogenous manures do not depress the sugar content.

(5) A readily available supply of phosphate should be at the disposal of the plant in early life. Water-soluble phosphate is recommended for this purpose.

(6) Potash is required except on rich soils where generous dunging is given. Muriate of potash suits the heavier soils, and the salt in the low-grade potash salts is beneficial on the light soils. Potash exerts a small but favourable influence on the sugar content. Potash salts should be applied well before sowing time, the lower the grade the greater being the interval. Winter application of potash manures is good practice, except on light soils.

(7) Liming is necessary to success on acid soils, but on light soils too much lime may damage the crop.

(8) Dressings recommended for German conditions are:—

	No Dung	With Dung
Muriate of potash or equivalent	2 cwt. per acre	0-1½ cwt. per acre
Superphosphate or equivalent	3-4 " "	1½-2 " "
Nitrate of soda or equivalent	3½-5 " "	1½-3½ " "

It is pointed out, however, that these general recommendations should be modified to suit local soil and agricultural conditions.

* *Handbuch des Zuckerrübenbaues*: Berlin, 1927.

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 November 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 7	14 8
Sulphate of ammonia:—					
Neutral (N. 20·6%)	..	10 5*	10 5*	10 5*	9 11
Calcium cyanamide (N. 19%)	..	8 12†	8 12†	8 12†	9 1
Kainit (Pot. 14%)	..	3 2	2 17	2 19	4 3
Potash salts (Pot. 30%)	..	4 17	..	4 15	3 2
" (Pot. 20%)	..	3 12	3 2	3 8	3 5
Muriate of potash (Pot. 50·53½%)	..	9 10	8 5	8 17	9 12
Sulphate " (Pot. 48·51½%)	..	11 10	10 5	11 1	11 12
Basic Slag (T.P. 32%)	..	3 8§	3 3§	3 3§	..
" (T.P. 30%)	..	3 6§	3 1§	3 1§	2 15e
" (T.P. 28%)	..	..	2 12§	2 13§	..
" (T.P. 26%)	..	..	2 6§	2 7§	..
" (T.P. 24%)	..	2 10§	2 1§	2 2§	..
Ground rock phosphate (T.P. 58%)					
Very fine grade†	..	2 15	..	2 10d	0 10
Fine grade‡	..	2 10	..	2 7d	0 10
Superphosphate (S.P. 35%)	..	3 0	..	3 4	3 0
" (S.P. 33%)	..	..	..	3 2	..
" (S.P. 30%)	..	2 15	2 15	2 18	2 15
Bone meal (N. 3½%, T.P. 45%)	..	8 15	8 10	8 10	8 7
Steamed bone flour (N. ½%, T.P. 60·65%)	..	5 17†	6 2†	6 5	5 17
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.

NOTES ON FEEDING STUFFS FOR DECEMBER

H. E. WOODMAN, Ph.D., D.Sc.,
School of Agriculture, Cambridge.

The Manurial Value of Sugar Beet Tops.—Inquiries are frequently made as to the value which should be assigned to sugar beet tops when they are ploughed into the land as manure. With the object of securing reliable information on this matter, numerous samples of beet tops were collected for examination from a large number of farms in the Eastern Counties during the harvesting of the 1926 crop. The writer would like to take this opportunity of thanking all those farmers who so willingly co-operated with us in the carrying out of this investigation.

For purposes of comparison, the samples were divided into four broad groups, according as to whether they were grown on light, medium, heavy or fen soils. The samples were received over a period of about two months, beginning October 8, 1926. Every sample as it arrived was chopped up in a large mechanical meat-mincer fitted with revolving knives. The minced mass was well mixed, and representative samples of known weight were dried down in a steam oven for the moisture determination. The dried residues were finely ground up, and, after air-drying, were utilized for analytical purposes.

The three constituents to be estimated for a determination of manurial value are nitrogen, phosphoric acid and potash. In view of the small extra labour involved, however, it was decided to secure further data in respect of content of total ash, silica, soda and lime. The mean results for the four groups of beet tops are recorded in Table I.

TABLE I.—NITROGEN AND MINERAL CONTENT OF SUGAR BEET TOPS.
(Results Given as Percentages of Dry Matter.)

Soil Type	Nitrogen Per cent.	Total Ash Per cent.	Silica Per cent.	Phosphate Per cent.	Potash Per cent.	Soda Per cent.	Lime Per cent.
Light ..	2.00	19.63	5.22	0.68	3.56	2.70	1.86
Medium .	1.85	19.16	5.57	0.57	3.07	2.78	2.31
Heavy ..	2.12	17.49	1.61	0.56	3.53	2.06	3.65
Fen ..	2.38	16.21	0.52	0.48	3.34	3.15	1.84

Since considerable variation was found in the mineral composition of samples of beet tops included in any one group, care must be exercised in attempting to discover correlations between mineral content and soil type. The only conclusion

that can be drawn with certainty is that fen-grown tops contain much smaller percentages of silica than beet tops from other types of soil. It would appear from the results which were obtained for the individual samples that the mineral composition is more affected by chemical factors, such as manurial treatment, soil reaction and so forth, than by the mere physical characters of the soil.

It will be noted that, in general, sugar beet tops are extremely rich in inorganic constituents, the quantity of total ash in the individual samples ranging from 13.7 to 26.0 per cent., with an average value of 18.5 per cent. The mean percentages of silica-free ash in the samples from the heavy and fen soils show striking agreement, being 15.9 and 15.7 per cent. of the dry matter respectively. The corresponding figures for the light and medium soil samples of tops were 14.4 and 13.6 per cent. respectively.

Other general features which were brought out consistently by the analytical results are: (1) the high percentages of potash, soda and lime in the tops, and (2) the relatively low percentage of phosphoric acid. These facts are further illustrated by the figures recorded in Table II, where the average composition of the silica-free ash in the sugar beet tops is compared with corresponding data for mangold leaves.

TABLE II.—MINERAL COMPOSITION OF BEET TOPS AND MANGOLD LEAVES.

(Results Given as Percentages of Silica-free Ash.)

	Beet Tops Per cent.	Mangold Leaves Per cent.
Lime (CaO)	14.5	11.0
Phosphoric acid (P ₂ O ₅) ..	4.0	6.7
Potash (K ₂ O)	23.2	31.8
Soda (Na ₂ O)	19.0	20.1

Table II indicates that mangold leaves display the same characteristics in respect of mineral composition as do sugar beet tops. The proportion of phosphoric acid is low, whereas lime, soda and potash, especially the last-named, are present in large amount. The high percentage of soda is of special interest, explaining why the mangold crop responds successfully to dressings of nitrate of soda mixed with common salt, and suggesting that, in certain circumstances, lack of sodium compounds might constitute the limiting factor in the growth of the sugar beet crop. It looks as if the nitrogen supplied to this crop should always be given, in part at any rate, in the form of nitrate of soda.

The necessary data for calculating the manurial value of a ton of fresh sugar beet tops are given in Table III. Owing to

the low dry-matter content which characterizes the heavy yields of tops obtained on fen soils, it is necessary to adopt a separate standard, as shown in Table III, in assessing their manurial value.

TABLE III.—MANURIAL CONSTITUENTS IN FRESH SUGAR BEET TOPS.

	<i>Average (excluding fen-tops) (Percentage dry matter = 17.2 per cent.) Per cent.</i>	<i>Fen-grown Tops (Percentage dry matter = 12.9 per cent.) Per cent.</i>
Nitrogen	0.34	0.31
Phosphoric Acid	0.11	0.06
Potash	0.58	0.43

If the beet tops are ploughed into the land, it may be assumed that the whole of the nitrogen, potash and phosphoric acid is available as manure. If stock are allowed to consume them off the land, then it is assumed that only half of the nitrogen and three-quarters each of the potash and phosphoric acid go into the resultant manure. The current price per unit of the manurial constituents, as recorded month by month in this JOURNAL, should be employed for calculating the manurial value per ton. Thus, on the basis of the October prices, one ton of ploughed-in beet tops would have a manurial value of 5s. 11d., while for tops consumed off the land the value would be 3s. 6d. per ton.

In order to calculate the manurial value per acre, it will be necessary to weigh the yield of tops from a small plot of known area and then arrive at the desired figure by the process of simple arithmetic. Examples of the yields of both tops and roots from crops grown on typical soils are given in Table IV, which has been compiled from data very kindly supplied by the writer's colleagues, Mr. J. C. Leslie and Mr. F. Hanley. In studying these figures, it should be remembered that they have been secured in a season, namely 1927, which has been somewhat abnormal from the standpoint of the sugar beet crop. In particular, the weather conditions have been such as to favour the abundant growth of beet foliage.

TABLE IV.—YIELDS OF BEETS AND BEET TOPS ON TYPICAL SOILS (1927)

<i>Type of Soil</i>	<i>Beets (unwashed) Tons per acre.</i>	<i>Beet Tops Tons per acre.</i>
Black fen over clay ..	11.6	20.9
Gravel loam	10.4	13.4
Medium land over chalk	18.8	12.4
Medium land over gravel	17.0	12.1
Typical light land ..	8.9	11.7
Light land over chalk ..	9.1	10.8

It must also be borne in mind that, quite apart from the potassic, phosphatic and nitrogenous constituents, beet tops contain a large percentage of non-nitrogenous organic matter. The beet sugar component will presumably undergo very ready breakdown in the soil, without, however, contributing materially to fertility. It is this consideration which, in the writer's opinion, constitutes the main objection to the wholesale ploughing-in of beet tops. Surely it is better to secure productive utilization of such energy-rich sugar (say 300lb. to 400 lb. per acre) in the bodies of farm animals than to allow it to decompose wastefully in the soil. Whether the incorporation of such amounts of sugar will affect the activities of the bacterial population of the soil, the writer is not in a position to state with certainty. Investigations at Rothamsted, however, have shown that the addition of the simpler carbohydrates to the soil causes a rapid increase in bacterial numbers, and further, that actual increases of nitrogen, presumably through the agency of *Azotobacter*, occur in soils to which sugar has been added.

With this month's account, the writer will conclude these notes on the subject of sugar beet tops. We are engaged at the present time in making a study of the nutritive properties of another important beet by-product, namely, sugar beet pulp, and it may be that an opportunity will arise for the discussion of the results of this investigation when, in due course, the sugar beet season of 1928 comes round. Meanwhile, for the benefit of readers who may desire more detailed information than it has been possible to give in these Notes, the following list of references is appended:—

- (1) "The Utilization of Sugar Beet By-Products." H. E. Woodman, *Jour. Min. Agric.*, XXXIII, 109, 1926.
- (2) "The Ensilage of Sugar Beet Tops." H. E. Woodman and A. Amos, *Jour. Agric. Sci.*, XVI, 406, 1926.
- (3) "The Nutritive and Manurial Values of Sugar Beet Tops." H. E. Woodman and J. W. Bee, *Jour. Agric. Sci.*, XVII, 477, 1927.

* * * * *

MISCELLANEOUS NOTES

Research Scholarships, Agricultural Scholarships, and International Conference Grants THE following awards have been made by the Ministry on the recommendations of the Development Commissioners' Advisory Committee on Agricultural Science :—

(1) AGRICULTURAL RESEARCH SCHOLARSHIPS :

Name	Subject of Study
J. M. Bannerman	Economics
G. W. Chapman	Soil Chemistry
A. C. Fraser	Veterinary Science
D. E. Fraser	Animal Nutrition
E. W. Russell	Soil Chemistry
B. A. Southgate	Animal Nutrition

(2) AGRICULTURAL SCHOLARSHIPS FOR INTENDING AGRICULTURAL ORGANIZERS, LECTURERS, ETC. :

Name	Subject of Study
J. B. Short	Economics
A. H. Wilson	Economics, with special reference to Small Holdings
R. H. Wynne	Economics

(3) INTERNATIONAL CONFERENCE GRANTS :

Name	Institute	Conference
R. A. Fisher	Rothamsted Experimental Station	Scientific and Technical Commission for Agricultural Statistics, Rome
J. Hammond	Animal Nutrition Research Institute, Cambridge	International Congress in Genetics, Berlin
M. S. Pease	Small Animal Breeding Research Institute, Cambridge	do.

* * * * *

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 October, 1927, together with the quantity produced during the corresponding month in 1926, was as follows :—

	Number of factories operating	Quantity of home-grown beet sugar manufactured cwt.
1927	15*	715,098
1926	12†	583,929

* Four factories had not commenced working in October, 1927.

† Two " " " " " 1926.

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended September, 1927, compared with the corresponding period in 1926. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	July to September, 1927		July to September, 1926	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	28	7,233	55	7,737
Brazil	14	2,785	72	4,838
Costa Rica	11	373	7	165
Colombia	14	1,229	0	0
Uruguay	13	1,210	9	1,020
Belgium	30	670	0	0
Irish Free State ..	702	10,221	1,087	14,556
Canada	134	10,300	0	0
Union of South Africa ..	45	3,839	0	0
Southern Rhodesia ..	22	875	0	0
South-West Africa ..	15	580	0	0
Other countries ..	16	1,001	31	2,592
Total	1,044	40,316	1,261	30,908
SHEEP AND LAMBS				
Argentina	185	4,717	157	3,883
Peru	50	625	0	0
Chili	17	755	7	203
Uruguay	40	1,340	70	2,664
United States of America	59	1,052	0	0
Irish Free State ..	1,195	3,279	357	1,085
Canada	326	5,190	0	0
Union of South Africa ..	40	428	0	0
South-West Africa ..	50	600	0	0
Other countries ..	23	812	31	599
Total	1,985	18,798	622	8,434
SWINE				
Argentina	9	245	9	140
Belgium	2	40	2	35
Poland	4	250	4	230
Germany	9	234	4	124
Latvia	15	238	1	32
France	31	232	3	68
Irish Free State ..	421	787	232	1,356
Union of South Africa ..	10	259	0	0
Falkland Islands ..	22	77	0	0
Other countries ..	8	241	37	842
Total	531	2,603	292	2,827

London Dairy Show.—A demonstration was staged at the London Dairy Show from October 18-21, dealing with the

**Demonstrations
in Marketing
Home Produce**

marketing of eggs and poultry and of pigs and pig products. This demonstration was well attended and proved very successful.

Marketing of Potatoes.—The marketing of potatoes was demonstrated for the first time at the Holland (Lincs) County Potato Show at Spalding, on October 27. This demonstration was repeated at the Durham Potato Show on November 2, and at the York Potato Show, Doncaster, on November 8. In every case it attracted a large number of visitors and aroused a considerable amount of interest and discussion among local grower. and merchants.

The demonstration illustrates the methods of dressing and packing main crops and earlies, both home and imported, and puts forward certain suggestions for improvement at different points. At the various shows, most interest appeared to be aroused by that part of the exhibit which draws attention to the present systems of marketing main crop potatoes, and particularly to the lack of any precise trade definition for marketable ware potatoes.

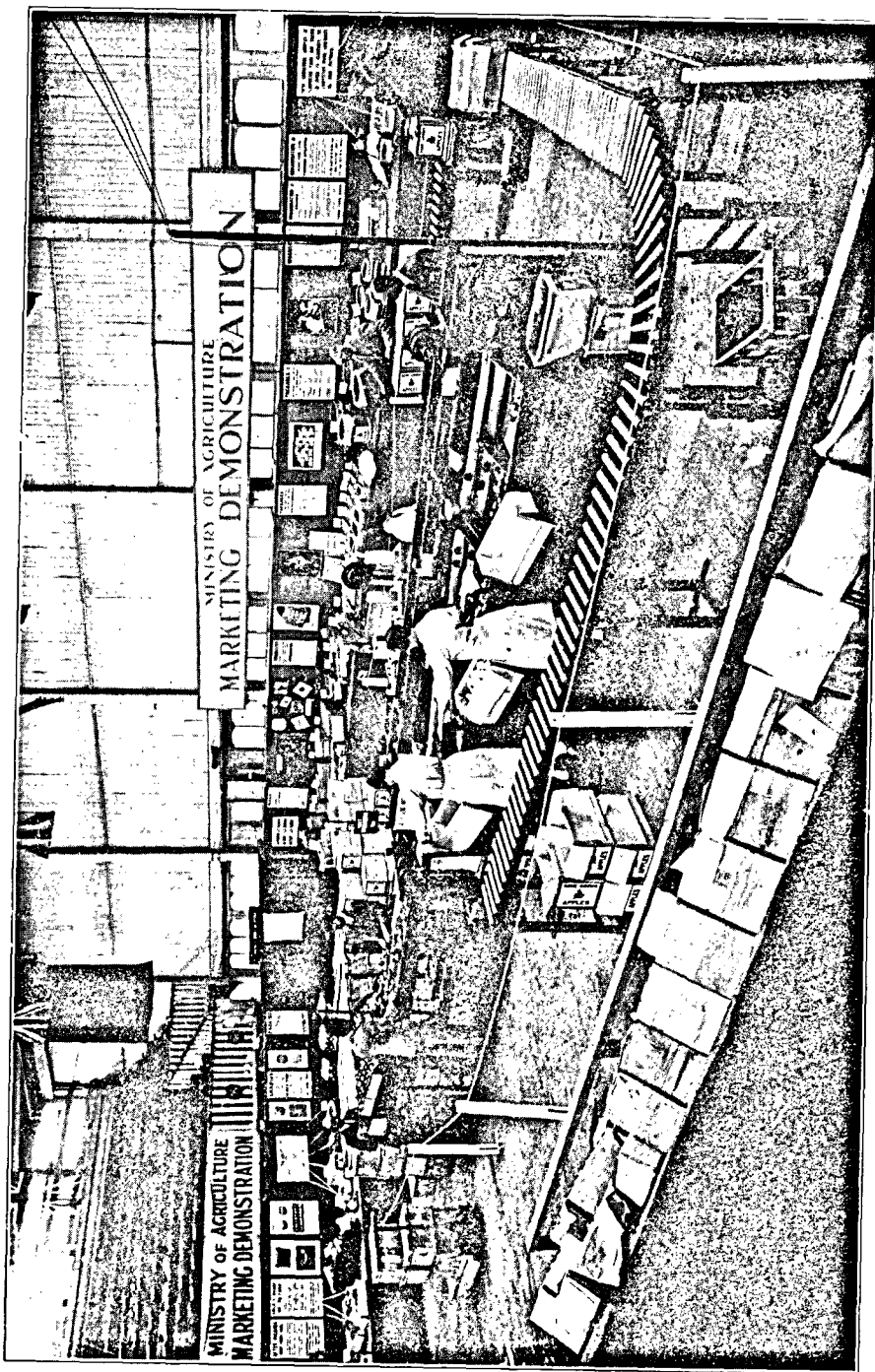
Since standardization is the key to commercial success in marketing many other products, its application to potatoes is suggested. By way of illustrating the principle involved, the Ministry, at each demonstration, put forward for consideration certain suggested standard grades for household ware potatoes. Size having been taken as the basis, the following standard grade sizes were proposed, *viz.*: for Grade A 1 a minimum of $1\frac{3}{4}$ in., for Grade A $1\frac{5}{8}$ in., and for Grade B $1\frac{1}{2}$ in., with a maximum in each case of $3\frac{1}{4}$ in. The following tolerances were also suggested as suitable for application to all grades of potatoes, *viz.*:—

- (a) Earth and extraneous matter, a maximum of 2 per cent.
- (b) Diseased and damaged potatoes, 3 per cent.
- (c) Under- or over-sized potatoes, 5 per cent., and
- (d) Admixture of variety, 5 per cent.

In the view of the National Federation of Fruit and Potato Trades Association, the grades put forward by the Ministry form a suitable basis for discussion between all parties concerned. At the Imperial Fruit Show in Manchester, this grading system was demonstrated on a small scale, and, at a joint meeting held there on November 3, between representatives of Liverpool and Manchester Retailer Fruiterers'



A view of the Ministry's Potato Marketing Demonstration at the Holland (Lincs.) Potato Show at Spalding.



Fruit Marketing Demonstration at the Imperial Fruit Show, Manchester, showing the process of grading home-grown apples with the Cutler Grader.

Associations, Manchester Wholesale Potato Traders, the C.W.S., and representatives from the Cheshire and Lancashire Farmers' Unions, the grades laid down by the Ministry were unanimously approved, but it was resolved, also unanimously, that the tolerances under the above headings (a), (b), and (c) should be altered to 3 per cent. in each case, with a maximum total defect of 6 per cent., and, in addition, a variety tolerance (d) of 4 per cent.

On November 8, at a joint meeting held in Doncaster, consisting of twenty representative farmers and twenty merchants, standard grading was freely discussed, and a resolution of approval passed. Here, however, the meeting resolved that the tolerances under the headings (a) and (b) should be altered to read 3 per cent., and that under (c) to read 4 per cent., and refer to under-size only.

It is very satisfactory to observe the amount of interest aroused in the large potato-growing districts of the country by the Ministry's new marketing demonstration, and somewhat gratifying to observe the amount of support for the principles demonstrated, and the extent of agreement on details already attained among both growers and merchants.

Imperial Fruit Show.—At the Imperial Fruit Show, which was held at Belle Vue Gardens, Manchester, from October 28 to November 5, the Empire Marketing Board took over the whole of one building and organized a most effective display of Empire fruit. As usual, the Great Britain exhibit was organized by the Ministry in collaboration with the National Farmers' Union and other national associations. On one side, there was an imposing display of choice fruit drawn from the principal fruit-growing districts of England, notably Kent, Herefordshire, Worcestershire, Essex, Norfolk and Cambridgeshire, and also a small exhibit of England's most important vegetable crop—the potato—graded in accordance with the national standards suggested by the Ministry. A striking display of tomatoes, cucumbers and hothouse fruits from the Lea Valley and Worthing districts was arranged by the British Glasshouse Produce Marketing Association. This Association was also good enough to supply the roses and chrysanthemums with which the stand was decorated. The other side of the stand was devoted to fruit products. The central feature was an illuminated tower composed of bottled fruits supplied by the Food Manufacturers' Federation, which also arranged for the exhibit of jams and preserves. A display of all-English cider was made by the National Association of Cider Makers. The

rapid development of the canning industry in England was demonstrated by the wide range of canned fruits and vegetables exhibited by the National Food Canning Council.

The Empire Marketing Board made a grant to the Imperial Fruit Show Committee for the free distribution of Empire fruit to visitors to the Show. Of this money, 45 per cent. was allocated to Great Britain (40 per cent. for fresh fruit and 5 per cent. for canned fruit); the distribution of the 22,500 samples involved was made from the Great Britain stand through the agency of the National Farmers' Union. A feature of the Empire Marketing Board display was a demonstration kitchen; and, in addition to securing representation of home produce in the general cooking demonstrations, the Ministry arranged for the chef of the First Avenue Hotel, London, to demonstrate the preparation of special potato dishes. Leaflets describing these dishes were distributed by the Ministry gratis.

* * * * *

THE Poultry Advisory Committee of the Ministry of Agriculture and Fisheries has been reconstituted, and its terms of reference have been extended so as to enable it to advise the Ministry on all matters submitted to it in regard to the exercise by the Department of any powers and duties relating to the poultry industry. It will also consider means which can usefully be adopted to improve existing methods of egg and poultry production and marketing in England and Wales, make recommendations, and take such other action as seems desirable to secure the adoption of improved methods by the producers, distributors and other persons concerned.

The Chairman of the Committee is Mr. P. A. Francis, M.B.E., of the Ministry of Agriculture and Fisheries, with Mr. S. Street-Porter, of the National Poultry Council, as Vice-Chairman. Mr. A. W. Street, C.I.E., M.C., of the Ministry of Agriculture and Fisheries, has been appointed Vice-Chairman for marketing questions. In addition to five members nominated by the Minister to represent the interests of producers and distributors respectively, members have been nominated by the National Farmers' Union, the National Poultry Council, the National Federation of Dairymen's Associations, the National Federation of Retail Fruiterers, Florists and Fishmongers, the Federation of Grocers' Associations, the Incorporated Association of Retail Distributors, the British Association of Refrigeration, and other organizations. A nominee of the Railway

Clearing House has also been appointed to represent the railway companies.

The Secretary of the Committee is Mr. W. E. Walters, of the Ministry of Agriculture and Fisheries, with Mr. G. W. Thomas, of that Department, as Assistant Secretary for marketing.

* * * * *

THE following special research grants for the academic year, 1927-28, have been awarded by the Ministry on the recommendation of the Development Commissioners' Advisory Committee on

Special Research Grants Agricultural Science :—

(a) RENEWALS.			
Institution	Subject	Investigator	
Bangor	Liver Rot in Sheep	R. F. Montgomerie	
Bangor	Loss of Phosphates by Leaching	G. Griffith	
Cambridge Botany School	Shab Disease of Lavender	C. R. Metcalfe	
Cambridge Plant Breeding Institute	Good and Bad Fields of Wheat	L. R. Doughty	
East Malling	Incidence and Control of Apple Scab	M. H. Moore	
Imperial College	Loose and Covered Smuts of Barley	S. Dickinson	
Manchester	Slug Control	J. Wood	
(b) NEW APPLICATIONS.			
Cambridge Department of Agriculture	Publication of Paper. "The Economy of a Norfolk Fruit Farm"		
Liverpool	Cause or Causes of Deaths amongst Ewes at Lambing Time	S. H. Gaiger and K. D. Downham	
Oxford Agricultural Economics Research Institute	Farm Labour Organization	W. R. Dunlop	
Reading: National Institute for Research in Dairying	Calcium Chloride or Calcium Lactate as remedies for Milk Fever	W. L. Little	
South-Eastern Agricultural College, Wye	Virus Disease of Hops	—	
		* * * * *	

THE general level of the prices of agricultural produce during October was 40 per cent. above pre-war, and three points lower than in September, and eight points below

The Agricultural Index Number the figure recorded a year previously. The fall in the general index figure during the month under review is attributable mainly to the lower prices obtained for fat cattle and fat pigs,

these classes of live stock having experienced a rather poor demand during recent weeks.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

				Percentage Increase compared with the Average of the corresponding month in 1911-13					
Month				1922	1923	1924	1925	1926	1927
January	..	..	..	71	67	60	71	58	49
February	..	..	..	75	63	61	69	53	45
March	..	..	..	73	59	57	66	49	43
April	..	..	..	66	54	53	59	52	43
May	..	..	..	69	54	57	57	50	42
June	..	..	..	64	49	56	53	48	41
July	..	..	..	67	50	53	49	48	42
August	..	..	..	68	52	57	54	49	42
September	..	..	..	59	52	61	55	55	43
October	..	..	..	61	50	66	53	48	40
November	..	..	..	63	51	66	54	48	—
December	..	..	..	61	55	65	54	46	—

Grain.—Wheat prices declined during October, and at 10s. 6d. per cwt. the average for the month was 7d. lower than in September, the index figure falling by six points to 42 per cent. above the level of 1911-13. A year ago wheat was 11s. 4d. per cwt. and 53 per cent. dearer than pre-war. Barley and oats, however, showed increases of 3d. and 1d. per cwt. respectively during October, and at averages of 13s. 9d. and 9s. 2d. were 62 and 33 per cent. above the base years. In the corresponding period of 1926, barley averaged 12s. 1d. per cwt., and oats 8s. 1d. per cwt., and the relative index figures stood at 42 and 17 per cent. above the pre-war level.

Live Stock.—The prices of fat cattle have continued to decline, and second quality cattle sold on average at about 41s. per live cwt. during the month under review, the index figure at 23 per cent. above pre-war being seven points below that recorded in September. Store cattle, also, were cheaper and the average fall in price was about 5s. per head with a corresponding decline of five points in the index figure to 19 per cent. above the base years. An increase in the price of dairy cattle was noticeable during October, this being the usual tendency at this season of the year, but the rise was proportionately slightly less than in the corresponding period of the base years and the index figure is one point lower at 27 per cent. above the 1911-13 level. There was a fall of $\frac{1}{4}$ d. per lb., estimated dressed carcass weight, in the price of fat sheep as compared with September, while values for store sheep were

maintained at practically the same level as those ruling in the two previous months, but as a rise in prices occurred in October of the base years, the October index number for store sheep is nine points lower at 40 per cent. above pre-war. Bacon pigs averaged 8s. 9d. per 14 lb. stone and pork pigs 10s. 3d., as against 9s. 7d. and 10s. 8d. in the previous month, and at 22 per cent. and 35 per cent., respectively, above pre-war both descriptions are selling at the lowest level reached in recent years. The index number for store pigs was eight points lower at 56 per cent. above the base years 1911-13.

Dairy and Poultry Produce.—The contract prices for milk for the season 1927-28 have followed much the same course as in the previous season, the October price in most districts being about $4\frac{1}{2}$ d. per gallon higher than in the previous month. In the Manchester area, however, prices have not altered appreciably from those ruling during September, but on the whole the general level of prices at 57 per cent. above the base years is only three points below the level recorded in October, 1926. Butter averaged about $\frac{3}{4}$ d. per lb. more in October than in September, but, as the increase was proportionate to that which occurred in October, 1911-13, the index figure remained unaltered on the month at 41 per cent. above pre-war. Cheese, also, showed a slight increase in price, but in this instance the rise was proportionately less than in the corresponding period of the base years and the index figure declined by three points to 56 per cent. above 1911-13. An increase of about 6d. per dozen in the average price of eggs brought the index figure for October to 66 per cent. above pre-war, a rise of twelve points on the month, but two points below the level of a year ago.

Other Commodities.—At 72 per cent. above the base years, potatoes were somewhat dearer than in September, when they averaged 46 per cent., but on the whole the position is not much different from that of a year ago, when potatoes were 81 per cent. dearer than pre-war. Hay prices were about 2s. 6d. per ton higher than in September, but the index figure remained unaltered at 18 per cent. above 1911-13, a small increase in values being customary at this season of the year. Apples and pears sold at comparatively low prices during October, the former realizing only about 20 per cent. more than in pre-war years. Vegetables realized about 50 per cent. more than in 1911-13, as against about 40 per cent. in September. Wool prices were practically unaltered from those ruling in September, and the index figure was unchanged at 43 per cent. above the level of the base years.

Index numbers of different commodities during recent months and in October, 1925 and 1926, are shown below :—

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

Commodity	1925	1926	1927			
	Oct.	Oct.	July	Aug.	Sept.	Oct.
Wheat	40	53	56	56	48	42
Barley	44	42	57	64	62	62
Oats	33	17	33	43	35	33
Fat cattle ..	48	35	30	34	30	23
Fat sheep ..	62	52	45	45	45	41
Bacon pigs ..	70	74	43	36	34	22
Pork pigs ..	71	81	49	43	41	35
Dairy cows ..	48	38	25	25	28	27
Store cattle ..	32	25	26	26	24	19
Store sheep ..	69	47	55	48	49	40
Store pigs ..	88	142	80	70	64	56
Eggs	90	68	31	44	54	66
Poultry	48	48	52	43	37	43
Milk	74	60	55	55	65	57
Butter	71	52	42	38	41	41
Cheese	77	30	58	57	59	56
Potatoes ..	53	81	61	30	46	72
Hay	1	6	6	16	18	18
Wool	46	32	40	42	43	43

* * * * *

UNDER the chairmanship of Sir Daniel Hall, K.C.B., F.R.S., a Grassland Conference, which all persons interested in are cordially invited to attend, will be held

Grassland Conference at the Midland College at the Midland Agricultural and Dairy College, Sutton Bonington, Loughborough, on Tuesday, January 10, 1928. The

proceedings will open at 10.45 a.m. with a short address by the chairman, after which Professor R. G. Stapledon, M.A., Director of the Welsh Plant Breeding Station, Aberystwyth, will read a paper on "Grasses and Grazing"; and he will be followed by Dr. J. Hanley, Professor of Agriculture, Bristol University, with a paper on "The Manuring of Grassland." At the afternoon session, papers will be read on "Grassland Problems," by Mr. J. G. Stewart, M.Sc., of the Ministry of Agriculture and Fisheries; on "Recent Developments in Grassland Management," by Mr. R. Lindsay Robb, N.D.A., late Principal of the Newton Rigg Farm School; and on "Grassland Experiments and the Feeding Value of Grass," by Mr. H. J. Page, B.Sc., late Head of the Chemical Department

at Rothamsted. The papers will be short to allow ample time for discussion. Arrangements have been made to provide luncheon (charge, 2s.) for a limited number (up to 100), also tea (charge, 1s.). Visitors may also secure board and lodging accommodation at the College for the Conference at an inclusive charge of 10s. 6d. per day by booking in advance. Particulars of, and tickets for, the Conference may be obtained on application to Dr. Thos. Milburn, the Principal of the College, which is ten minutes' walk from Kegworth Station on the L.M.S. Railway.

* * * * *

THE idea of holding an international poultry congress originated with Dr. Edward Brown some time before the year 1914, but, before plans could be

The Third World's Poultry Congress completed, the Great War temporarily arrested all development in this direction. On the conclusion of hostilities, the

project again came up for consideration, and it was agreed that, in view of existing conditions, the inaugural congress should be held in one of the non-belligerent countries. Accordingly, on the invitation of Her Majesty the Queen of Holland, the first Congress was held at The Hague during the summer of 1921, and three years later the second Congress took place at Barcelona, under the patronage of the King of Spain and the Prince of the Asturias, both of whom gave it their active support.

The third World's Poultry Congress, held at Ottawa in the Dominion of Canada from July 27 to August 3 this year, was attended by some 3,000 delegates representing 43 countries, and must be regarded as one of the outstanding events in the history of the industry. The Congress was organized in five sections, and considered 150 papers submitted by specialists in the several branches of research, instruction, and marketing. The Exhibition in connexion with the Congress proved an extremely popular feature, being visited by at least 140,000 persons. Apart from an extremely fine display of live birds from many countries, of which 350 were sent from this country, the Exhibition was arranged in national sections, and consisted mainly of educational and scientific exhibits. The British section comprised items illustrating diseases, breeding, and nutrition, and pictures and models relating to various phases of the industry. Some valuable pigeons and poultry belonging to His Majesty the King and H.R.H. the Prince of

rate is 6d. per hour (instead of 5d. per hour as at present), with overtime at 9d. per hour (instead of 7½d. per hour as at present). (b) An Order fixing special differential rates of wages for overtime employment on the corn harvest of 1928. The rate in the case of male workers of 21 years of age and over who are not boarded and lodged by their employer is 1s. 3d. per hour, and in the case of foremen, beastmen, shepherds and waggoners who are boarded and lodged, 1s. per hour, with lesser rates for other lads. In the case of female workers of 16 years of age and over the overtime rate is 11d. per hour.

West Riding of Yorkshire.—An Order to come into operation on November 24 (i.e., the day following that on which the existing rates are due to expire), continuing those rates until November 23, 1928. The minimum rates in question in the case of male workers remain as at present fixed, viz.: For workers living-in, foremen £85 16s. 0d., beastmen and shepherds £83 4s. 0d., and waggoners £78 0s. 0d. per annum, with lesser rates for lads, these wages being in respect of a week of 48 hours in winter and 52½ hours in summer, with in addition 12 hours on weekdays and three hours on Sunday in connexion with the care of and attendance upon stock. For waggoners and other horsemen, beastmen and shepherds of 21 years of age and over not living-in, 42s. per week of the same number of hours; and for other male workers of 21 years of age and over 36s. per week of 48 hours in winter and 52½ hours in summer. Overtime is payable in the case of all male workers of 18 years of age and over at 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.

Cardiganshire.—An Order to come into operation on November 15, continuing (with amendments in the case of male workers of 15 to 17 years of age) the operation of the existing minimum and overtime rates of wages for male and female workers until November 14, 1928. The minimum rate in the case of male workers of 21 years of age and over is 31s. for a seven-day week of 54 hours, with overtime at 8½d. per hour, and in the case of female workers of 18 years of age and over 5d. per hour, with overtime at 6d. per hour.

Radnor and Brecon.—An Order to come into force on November 1, continuing the operation of the existing minimum and overtime rates of wages for male and female workers until April 30, 1928. 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, and in the case of female workers of 18 years of age and over, 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 November 15, legal proceedings were instituted against five 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 :—				Arrears			No. of workers con- cerned
County	Court	Fines	Costs	of wages			
		£	s.	d.	£	s.	d.
Sussex	.. Battle	1	0	0	0	7	6
Glos.	.. Thornbury	30	0	0	3	0	0
Somerset	.. Shepton	2	5	0	0	19	6
	Mallet						
Yorks N.R.	Stokesley	1	10	0	0	18	0
Dorset	.. Sherborne	4	0	0	21	0	0
		£38	15	0	£26	5	0
		£195	19	11	13		

* * * * *

Foot-and-Mouth Disease.—Since the report in last month's issue of the JOURNAL, fourteen outbreaks of foot-and-mouth disease have been confirmed, all of which have occurred in new areas.

A fresh centre of disease was discovered on October 31 at Broad Hinton, Swindon, Wilts, and three further cases have been confirmed in that district.

Disease was also discovered at Windsor, Berks, on November 8, and cases at Slough, Bucks, on November 11.

New centres were in addition brought to light at Totton, Southampton, and Minstead, Lyndhurst, Hants, on November 16; and fourteen further outbreaks have been confirmed in that area.

Sixty-four outbreaks in all have been confirmed since January 1 last, involving 16 counties and the slaughter of 1,931 cattle, 1,884 sheep, 1,172 pigs, and 2 goats.

* * * * *

NOTICES OF BOOKS

The Care and Handling of Milk. By Harold E. Ross. Professor of Dairy Industry, New York State College of Agriculture. (London: Kegan Paul, Trench, Trübner & Co., Ltd. 1927. Pp. xv + 342. 61 illustrations. Price 18s. net.)

Increasing knowledge of the value of milk and milk products for human consumption has made the problem of providing the population of large towns with an adequate and safe supply a question of international importance. Great advance has been made, both in this country and in America, during recent years, but new problems constantly arise which can only be solved by constant study and commercial application. This book is written by a scientific dairyman possessing wide practical and teaching experience, and is a valuable contribution worthy of study by students and by those actively engaged in the production and distribution of milk and its products. Although much of the information is based on American conditions and practice the underlying principles remain the same.

The book is well illustrated, and contains throughout useful plans and data of value to practical dairymen, whilst references are made to recent original researches which have been absorbed into commercial practice in America.

Gas Storage of Fruit. By Franklin Kidd, D.Sc., Cyril West, D.Sc., and M. N. Kidd, M.A. Special Report No. 30, Food Investigation. Department of Scientific and Industrial Research. Pp. vii + 87. (London: H.M. Stationery Office, Adastral House, Kingsway, London, W.C. Price, 1s. 9d. net.)

In this Report, issued by the Department of Scientific and Industrial Research, there has been set out a review of the experiments in storing

Wales were also included. The exhibits displayed by the Canadian Departments of Agriculture, both Dominion and Provincial, were naturally prominent, but it is satisfactory to note that the British section also attracted much attention, and was favourably commented on by many of the delegates.

The Right Hon. Stanley Baldwin attended a special meeting of the International Association of Poultry Instructors and Investigators for the purpose of conveying the invitation of the Imperial Government to hold the next World's Poultry Congress in Great Britain. The Congress, he said, could be assured of the support of the British Government and the Ministry of Agriculture, and a cordial welcome from the numerous poultry organizations in this country. As this invitation was unanimously accepted, the next Congress will be held in Great Britain in 1930.

* * * * *

Marking of Imported Oats and Oat Products.—The Public Inquiry into the application for an Order-in-Council under the Merchandise Marks Act, 1926, to require the marking of imported oats and oat products, will be held in Room 104, at 10 Whitehall Place, London, S.W. 1, commencing at 10.30 a.m. on Wednesday, December 14, 1927, and continuing, if necessary, at the same time on the two following days. Applications to be heard in evidence and any other communications with regard to the matter should be addressed, as early as possible, to the Secretary of the Standing Committee, Mr. H. J. Johns, 10 Whitehall Place, London, S.W. 1.

* * * * *

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on October 25 and November 15, 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 out the Committees' decisions :—

Cambridgeshire and Isle of Ely.—An Order to come into operation on November 1, fixing minimum and overtime rates of wages for male and female workers and to continue in force until October 31, 1928. The minimum rates in the case of male workers of 21 years of age and over are for horsemen, cowmen and shepherds, 37s. per week of the hours necessary for the performance of the customary duties of workers so employed, and for all other classes of male workers 30s. per week of 48 hours in winter and 50 hours in summer (instead of 51 hours in summer as at present). The overtime rates for all classes of male workers of 21 years of age and over 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, 1928. The minimum rate in the case of male workers of 21 years of age and over is 35s. per week of 54 hours, with overtime at 9d. per hour, and in the case of female workers of 18 years of age and over, 6d. per hour for all time worked.

Essex.—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 further notice, with the amendment that the overtime rate of wages for Sunday work shall apply to all employment on Christmas Day, Boxing Day, Good Friday, Easter Monday and Whit Monday. 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 10d. per hour on Sundays and on the public holidays mentioned above. In the case of female workers of 21 years of age and over the minimum rate is 5½d. per hour for all time worked.

Oxfordshire.—An Order to come into force on October 31, continuing the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers until further notice, with the amendment that the overtime rate of wages for Sunday work for male workers shall apply to all employment on Christmas Day, Boxing Day, Good Friday, Easter Monday, Whit Monday and August Bank Holiday. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 48 hours in winter and 50 hours in summer, with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays and on the public holidays mentioned above. The minimum rate for female workers of 18 years and over is 6d. per hour for all time worked.

Warwickshire.—An Order to come into force on October 30, continuing the operation of the existing minimum and overtime rates of wages for male and female workers until October 27, 1928. 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.

East Riding of Yorkshire.—(a) An Order fixing minimum and overtime rates of wages to come into operation on November 24, when the existing rates are due to expire, and to continue in force until November 23, 1928. The minimum rates of wages for male workers are as follows : Workers of 21 years of age and over who are not boarded and lodged by their employer, 35s. per week of 52½ hours in summer and 48 hours in winter ; workers who are boarded and lodged by their employer, foremen 32s. per week or £81 12s. 0d. per annum, beastmen and shepherds 29s. per week or £73 19s. 0d. per annum, and waggoners 28s. per week or £71 8s. 0d. per annum. These rates are payable in respect of a week of 48 hours in winter and 52½ hours in summer, with in addition not more than 12 hours on weekdays and three hours on Sunday in attendance on cattle and horses. Lesser rates are fixed for other lads. The overtime rates of wages in the case of male workers of 21 years of age and over are 10d. per hour on weekdays and 1s. per hour on Sundays. In the case of female workers of 16 years of age and over the minimum

apples in an atmosphere appreciably richer than air in carbon dioxide. Normal air consists of a mixture of gases of which nitrogen (79 per cent.), oxygen (21 per cent), and carbon dioxide (0.04 per cent.) are the chief constituents. The oxygen in the air is essential for the existence of live fruits, whilst the carbon dioxide is one of the products of respiration.

It seemed, therefore, that by using an atmosphere less rich in oxygen and more rich in carbon dioxide than is air, that the activity of living fruit might be slowed down and in consequence its storage life extended. The laboratory large-storage experiments confirmed this, though these were not entirely satisfactory because of the continued changes in temperature, the excessive moisture which accumulated in the stores, and mainly because of the losses of carbon dioxide gas through the walls of the storage chambers. In some cases, diseased fruit confused the results of the experiments.

Readers of the report will be able to follow how the work proceeded—step by step—from the laboratory to the small storage chambers, and eventually to the storage of large blocks of apples in houses of commercial size. Finally, this method of gas storage is compared with cold storage in the following words: "The generalization may, therefore, be made that gas storage at 46.5° F. and cold storage in air at 34° F. are approximately equally effective in retarding ripening and in prolonging the storage life."

Dictionary of Bacteriological Equivalents.—By William Partridge. (London: Ballière, Tindall and Cox. 1927. Pp. xii + 141. Price 10s. 6d. net.)

This little book of about 140 pages measures 7½ in. by 5½ in., and costs half a guinea. It is compiled by a Public Analyst from acknowledged sources, and runs on the same general lines as Artschwager and Smiley's *Dictionary of Botanical Equivalents* issued by the same publishers. It contains some 8,000 words or short phrases in French, German, Italian and Spanish with their equivalents in English. The words are mainly those encountered in bacteriological literature, but there are many names of chemical substances and also some connected with general micro-biology and plant pathology. A captious critic might quarrel, perhaps, with some of the English equivalents given; for instance "leaf mould disease (tomato)" is not altogether suitable for "Blattfleckenkrankheit"; again, "'fur' of a mould" hardly expresses "Myzelrasen," although mycologists do not yet seem to have found a really suitable equivalent for the word Rasen in this connexion. In our laboratories we do not take our "Leitungswasser" from a hydrant but from a tap, and a "Gliederzelle" is not always a zygospore. "Eingeschliffen" is not to grind in, and "Reifes Sporangium" means more than "sporangium containing spores." Misprints appear to be few, but "Farbflüssigkeit" should of course be "Farbflüssigkeit." The book will be found useful as supplementing ordinary dictionaries, but the author would be well advised, should a second edition be called for, to submit his proof sheets to one or two scientific men familiar with the special literature in the languages concerned, with a view to improvement in some of the English equivalents.

* * * * *

Printed under the Authority of HIS MAJESTY'S STATIONERY OFFICE, by the London Calcutta Press Ltd., 74 Swinton Street, Gray's Inn Road, London, W.C.1. w14328.

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXIV. No. 10.

JANUARY, 1928.

NOTES FOR THE MONTH

It is hoped that a considerable improvement in the conditions of rural housing will be secured through this Act, which was placed upon the Statute Book at the end of 1926. There is general agreement among agriculturists as to the desirability of improving the housing conditions of rural workers, and it was in order to assist in this direction that the Housing (Rural Workers) Act was passed.

A circular (No. 756) issued by the Ministry of Health gives full information with regard to the assistance available, and a copy can be obtained from the Stationery Office, Adastral House, Kingsway, W.C. 2, or through any bookseller (price, 2d.); and the Local Authorities (usually the County Council) administering the schemes in particular districts will give intending applicants any advice or help practicable.

Any inquiries as to the assistance available in particular districts should be addressed to the County Council, but, briefly, it may be said that the Act authorizes both grants and loans for the conversion into dwellings of buildings not previously used for that purpose, and for the improvement of existing dwellings. Grants may be made, where the estimated cost of the works is not less than £50, up to two-thirds of the estimated cost, with a maximum grant of £100. Loans may be made up to a maximum of 90 per cent. of the value of the property.

Grants may be made for works of structural alteration, repair, addition, the provision of water supply, drainage or sanitary conveniences and other like works.

Conditions are attached to ensure that grants will only be made for houses occupied by agricultural workers or persons receiving similar wages, and that the rent for a period of 20 years will be maintained at the normal agricultural rent increased by 3 per cent. on the owner's share in the estimated

cost of the works. The following example will show how the Act will work :—

A cottage is let at 4s. per week and is to be enlarged or improved at an estimated cost of £150. Towards this £150 the Local Authority can make a free grant of £100 and the owner will pay the balance of £50. The owner is authorized to charge interest on his £50 at the rate of 3 per cent., which would amount to £1 10s. per annum. The rent of the cottage would therefore be increased to 4s. 7d. per week.

Assistance towards the amount contributed by the owner may also be obtained, if desired, by way of loan from the Local Authority.

Practically all the authorities responsible for the administration of the Act have now established their machinery for the operation of the Act and obtained approval of their scheme by the Minister of Health. Facilities for the improvement of houses are therefore available, and, as the Act is of a temporary character, and is due to expire in 1931, it is desirable that owners of houses who wish to obtain the advantage of the Act for their tenants should submit their proposals without delay.

* * * * *

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 November, 1927, together with the quantity produced during the corresponding month in 1926, was :—

						cwt.
1927	..	..	..	..	..	1,423,277
1926	..	..	..	..	..	875,713

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

						cwt.
1927	..	..	..	..	..	2,138,378
1926	..	..	..	..	..	1,465,810

* * * * *

IN recent years, unremitting attention has been devoted to the problem of ensuring a clean milk supply. While it is naturally essential that clean methods

Milk Transport : shall begin at the source of the milk—on the farm, in feeding and milking the cows, straining and cooling, etc.—it is equally necessary that devoted care shall be exercised after the milk leaves the farm. To this end, continued endeavours have been

made for many years past to improve the conditions of transport and delivery to the consumer. Milk churns for railway transport were gradually improved so that pilfering, entry of dust, etc., could be avoided, time taken in transit has been greatly reduced; and immense improvements have taken place in the conditions under which milk is held for sale and for retail delivery.

During the last two or three years, rapid motor transport in large glass-lined tanks, holding about 1,000 gallons (see Figs. 1 and 2), has been introduced and has proved very satisfactory for distances up to about 100 miles. Farmers are able to deliver their milk to a central depot, and in these tanks, which are insulated to avoid extremes of heat and cold, the milk may then be conveyed quickly, in excellent condition, and with much less trouble to all concerned than by the usual railway milk-churn. By this means, cleanliness has been improved and bacterial count reduced considerably. (These motors were introduced by Messrs. S. Reece and Sons, Ltd., Liverpool.)

A further step, which bids fair to effect even greater improvement, is the recent extension of the tank system to railway transit. In this, the milk is delivered to a country depot, where, after cooling to about 38° F., it is passed into 3,000-gallon steel tanks, lined with glass enamel and insulated from air temperatures by a thick layer of cork. In these tanks (see Fig. 3) the milk is preserved fresh and sweet as it would be in a glass vessel, and its temperature is maintained almost constant during transit—not varying more than 1° F. The tank method also effects a great saving in dead weight haulage costs compared with ordinary milk churns—an economy, in fact, of 72·5 per cent. On arrival at destination, it is blown out by compressed and filtered air at the rate of 150 gallons per minute, pasteurized by holding at 145° F. for half an hour, rapidly cooled and passed into other tanks, from which it is automatically filled into clean, sterilized bottles, and sealed with compressed cardboard caps. The bottles are then placed in boxes and taken by roller conveyors either to closed motor lorries for delivery to various London districts or to cold store.

The successful adoption and extension of the use of tanks for the conveyance of milk would seem to depend, in no small measure, on the exercise of extreme care in the selection of the farms which are to supply the milk for filling to the tank. It can be well understood that one inferior lot of milk mixed with

a tank of, otherwise, sound milk might do a lot of harm. The use of the tank, coupled with the employment of a purchasing scheme in which provision is made for a bonus on quality, should prove a distinct step forward.

The glass-lined tanks for rail transport of milk have been introduced by the United Dairies, Ltd., and the L.M.S. and G.W. Railways have co-operated in this useful work.

* * * * *

THE inquiry into the general character of walnuts grown in this country, instituted by the Ministry in 1924 and kindly undertaken by Mr. Howard Spence, of

Walnut Survey Ainsdale, Southport, was continued in 1926. That season, however, was unfortunately characterized by the practical failure of the home crop owing to the unfavourable weather conditions in the spring. Trees flowered well, but the crop was ruined by late frosts and high winds, and only in isolated cases did any considerable quantity of nuts mature. Of one tree which bore no crop it was reported that this was the first failure during the 30 years in respect of which records had been noted, and, in the case of many other trees from which samples had been taken for examination in previous years, failure was recorded for the first time for long periods.

The factors responsible for this failure in England also affected the crop in France, where the season was one of the worst of recent years. The Californian crop also fell below average, the production of 11,740 tons of unshelled walnuts representing only about 40 per cent. of the production in 1925.

As was only to be expected in the circumstances, the prices of walnuts in English markets were rather high, and a study of the prices reveals the interesting fact that, although generally inferior in quality, English nuts can command a much better price than nuts imported from the Continent. There is little doubt, therefore, that, with an improvement in quality, such as it is hoped to secure as a result of the present inquiry, home-grown walnuts will find a ready market.

Only 21 samples of home-grown walnuts were received for examination, about 25 per cent. of these being samples from trees reported upon in 1924-25. Under these conditions, it was hardly to be expected that much of value would be contributed to the inquiry, and no new nut showed

the combination of qualities desired, *viz.*, good colour, size, contour, percentage of kernel and of oil, flavour, sealing, crop yield, low moisture content, and absence of astringency. Repeat tests confirmed the relatively better quality previously noted in a few samples, but this was insufficiently marked to warrant propagation other than experimentally in one or two cases.

The propagating trials being carried out at East Malling Research Station have experienced a considerable set-back owing to the loss of valuable young grafted trees from the damage occasioned by severe frosts at the end of April and beginning of May, 1927. A number of the young grafted trees imported from France, however, already show some female flowers and, although it is inadvisable to allow nuts to form on young trees, a few of these will be hand-pollinated in the next year or two in order that observations of the quality of the nuts when grown under English conditions may be made as early as possible.

Graft wood obtained from Canada and the United States of America, including California, was unfortunately not so good in quality as that received in the previous year, but arrangements are being made for further supplies of scion wood to be obtained from reliable sources during the coming winter in order that the experiments in the propagation of the best foreign varieties may be extended.

* * * * *

FACTS disclosed at recent meetings of the Small Holdings and Agricultural Committees for the West Riding of Yorkshire shed a very favourable light on the

Notes on position of the statutory smallholders in
Small Holdings the county. It was stated that the
and Allotments outstanding rents amounted to only
£107 14s. 5d., which represented about

0.4 per cent. of the rent roll. The Chairman of the Agricultural Committee, in commenting on the figures, felt justified in describing the position as most satisfactory, especially in view of the losses that the tenants must have sustained as a result of the depression in agriculture in recent years. He further stated that, when inspecting the Council's estate from time to time, he seldom heard a complaint from the smallholders, who numbered about 550.

It is no doubt partly a result of the success attending the small holdings movement in this county that the demand for holdings there is so keen. Fifteen men were recently interviewed by a Sub-Committee for the purpose of selecting tenants for three vacant holdings. The Chairman of this Sub-Committee subsequently stated that these men had worked on the land all their lives, and out of their small wages they had managed to save sufficient money to enable them to take a small holding. The average amount of capital possessed by these men was about £450 and they were all described as really good-class applicants. Similar evidence is received from time to time as to the keenness of the demand for small holdings in other counties, and clearly indicates the necessity for the statutory powers conferred on county councils to enable them to satisfy the needs of suitable applicants for holdings.

Further evidence of the value of the work carried out under the powers of the Small Holdings and Allotments Acts is afforded by the success achieved by many of the tenants who have been provided with land under the Acts. The satisfactory position of the tenants of the West Riding County Council has already been commented on. One or two recent instances of the success of individual smallholders may also be mentioned. One tenant of the East Riding County Council, who in the spring of 1922 entered into occupation of an equipped holding of 20 acres, has now made application to the Council for a fully equipped holding of 50 acres which falls vacant next spring. In 1922 this man was worth £280, but to-day his assets, including £400 in the bank, are valued at £700. He has made this money mainly by retailing milk in a neighbouring seaside resort. A somewhat similar case has arisen in Derbyshire, where the tenant of a 44-acre holding has applied for permission to vacate it in order to take over the tenancy of a farm of 104 acres. This man is in a position to pay over £600 for the ingoing valuation. It may also be mentioned that numerous applications have been received by the Council for the holding which he is vacating.

An equally striking example may be quoted of the value of those provisions of the Acts which deal with allotments. The parish of Crowland in the Holland division of Lincolnshire has a population of less than 3,000, but the Parish Council has been very enterprising in an endeavour to meet the great local demand for land and has let no less than 500 acres of fen land as allotments, mostly in one-acre plots. This is a remarkable achievement in so small a parish and, moreover, has proved

a very successful venture. The allotments, which are mainly devoted to the production of potatoes and other roots, have proved a real source of wealth to the community. It is stated that the profits derived from the allotments have enabled many of the tenants to take over small holdings or to set themselves up in other small businesses. Losses through bad debts are negligible and the undertaking shows a satisfactory balance in hand.

* * * * *

THE Ministry's pig marketing demonstration was staged at the Birmingham Fat Stock Show (November 26 to December 1), the Smithfield Show, Royal Demonstrations Agricultural Hall, London (December 5 in Marketing to 9), and the West of England Fat Home Produce Stock Show, Plymouth (December 13 and 14).

The series of demonstrations of fruit grading and packing, given at various centres in the West Midlands and at the Imperial Fruit Show at Manchester in September and October, was continued by a similar demonstration at Swanley, Kent, on December 14 and 15. The principal feature of these demonstrations, and one that has attracted considerable attention, was the mechanical grading of apples by means of the Cutler grader.

The following subjects were demonstrated at the 22 shows and other centres attended during 1927 :—

Eggs	..	..	..	..	..	10 times
Poultry	..	..	..	..	..	10 times
Fruit	..	..	..	..	..	8 times
Pigs and Pig Products	..	..	..	..	..	8 times
Potatoes	..	..	..	..	..	3 times

It is generally agreed that a great deal of useful work has been done by means of these demonstrations. A final programme for 1928 has not yet been settled; it is, however, anticipated that it will be possible to break fresh ground during the year, as both regards the commodities dealt with and the districts visited.

At the various demonstrations, a steady demand for the Reports in the Ministry's Economic Series has been experienced—about 5,000 copies having been sold through this channel alone.

THE Central Valuation Committee, constituted in accordance with the provisions of the Rating and Valuation Act, 1925, for the purpose of promoting uniformity in valuation, has recently been considering the question of the entries to be made in the new valuations lists under the Act, in respect of land used for the rearing of poultry, and of osier beds.

The Ministry of Agriculture and Fisheries supplied, for the information of the Committee, a detailed description of the various kinds of buildings used for the rearing of poultry, and information descriptive of the lands used for the growing of osiers.

The Committee has now made to the Minister of Health its representations with regard to these subjects, and these have been circulated to the various rating authorities. The publication containing these representations is the third series of such representations made to the Minister of Health.*

The Committee points out that there is evidence of a diversity of opinion and of practice as to the entries to be made in the valuation lists in respect of the considerable areas of land being used for the rearing, for profit, of poultry. In some parts of the country, the land so used is being given the 75 per cent. exemption from rates which is allowable in respect of "agricultural" land, while in other parts that exemption is not being given—on the ground that the land so used is not "agricultural." A similar diversity of opinion and of practice at present exists with regard to land used for the cultivation of osiers.

With regard to land used for the rearing of poultry, the Committee recommends that, in preparing and revising the new valuation lists under the Act of 1925, all rating and assessment authorities should consider all the circumstances in which poultry are kept in arriving at a solution of the question whether the land is to be regarded as "agricultural land."

In the case of a general farm, the Committee does not think that the fact that poultry are allowed to wander over and eat the grass, insects, worms, etc., in the meadows and pastures and pick up the corn in the stubbles after harvest, takes the land out of the category of "land used as arable, meadow, or pasture ground only."

* The publication may be purchased directly from His Majesty's Stationery Office, or through any bookseller, price 2d. net.

In the case of a poultry farm proper, the Committee thinks that, in so far as it consists of grassland, it should be regarded as "pasture ground only," and that arable land should be regarded as "agricultural land" even if it is used to grow a crop for feeding poultry. The Committee is also of opinion that the presence of poultry on "allotments" and "orchards" does not prevent them from coming within the definition of "agricultural land."

On the other hand, a poultry farm proper which consists of bare land should not be held to be land used as "arable, meadow, or pasture ground only."

With regard to the question whether rateable buildings used for the rearing of poultry are buildings which, under the Act of 1925, should be given the 75 per cent. exemption from rates, the Committee draws attention to the fact that, to be eligible for this exemption, the buildings must be occupied *together with* "agricultural land," and must be used *solely in connexion with agricultural operations thereon*. With regard to the second part of this definition, the Committee thinks that the keeping of poultry on land is an agricultural operation thereon, but that points of difficulty may arise in connexion with the word "solely."

The Committee gives the detailed classification of poultry holdings, supplied by the Ministry, and expresses its opinion as to which types of holding should or should not be regarded as "agricultural land," and as to which types of building should or should not be regarded as coming within the definition of buildings to which the 75 per cent. exemption will apply.

With regard to the question of osier beds, the Committee recommends that, where the circumstances connected with the cultivation of osier beds are such that the lands used for the beds would necessarily have to be regarded as "arable land only" (e.g., where the osiers are periodically planted and renewed, and the ground is periodically ploughed or hoed or otherwise cultivated), the rateable value of the beds should be entered in the new valuation lists under the head of "agricultural land," but that, where periodical planting and renewing and periodical cultivation are not carried on, the rateable value should be entered under the head of "Hereditaments not specified in later columns."

* * * * *

EMPIRE CO-OPERATION IN AGRICULTURAL RESEARCH

W. R. BLACK, B.Sc.,

Secretary, Imperial Agricultural Research Conference.

In October and early November of 1927, there was held in this country a conference—the first of its kind—between workers conducting research in agriculture, and officers responsible for the administration of such research, throughout the British Empire, the object being to secure a greater measure of co-operation between such workers and officers than had hitherto been achieved. The proposal for holding such a conference originated with the Agricultural Research Council of Great Britain in July, 1925, and the proposal received the approval of the Imperial Conference, 1926, which urged the respective Governments of the Empire to give it the fullest possible support. The Imperial Conference, 1926, recommended that the Ministry of Agriculture and Fisheries should be responsible for organizing the Conference, and this responsibility was willingly accepted by the Ministry.

Organization of Conference.—To assist the Ministry in the work of organization, the Minister, the Rt. Hon. Walter Guinness, M.P., appointed an Organizing Committee for the Conference (of which the Rt. Hon. Lord Bledisloe, Parliamentary Secretary to the Ministry, was chairman), consisting of representatives of Government Departments in the Mother Country and of the Dominions and Colonies.

The Organizing Committee were fortunate in securing the permission of the Lord Great Chamberlain to the use of the Grand Committee Room in Westminster Hall, Houses of Parliament, for the plenary sessions of the Conference, and in obtaining, from His Majesty's Office of Works, ample accommodation for the numerous Committees of the Conference. In order that the delegates might be made aware of the progress achieved in agricultural research in the Mother Country since the war, a tour of visits to research institutes in England and Wales, Scotland, and Northern Ireland was planned; the arrangements for the tour were facilitated to a remarkable degree by the readiness with which the authorities responsible for the conduct of research into agriculture and allied subjects offered their co-operation. The principal centres visited were Cambridge, Billingham, Edinburgh, Aberdeen, Belfast, and Oxford. Offers of hospitality were received from Governments, Universities, and civic authorities in such measure that the Committee were able to arrange a very full programme of entertainment.

Acknowledgment must be made, in particular, to the Government Hospitality Fund, the Board of Agriculture for Scotland, the Government of Northern Ireland, the Universities of Cambridge and Oxford, the Lord Bridge, Edinburgh, Aberdeen, Belfast, and Oxford, the Lord Mayor of London, the Edinburgh Corporation, the Aberdeen Corporation, the Imperial Institute, and Synthetic Ammonia and Nitrates, Ltd. Reference must also be made to the arrangements by the Great N.E. Railway Company for the comfort of the delegates while travelling, these including the placing of a special train at the disposal of the Conference without extra charge, the provision of meals, and co-operation in the provision of a special cinema film exhibit on the train.

The Organizing Committee also drew up an agenda which proved to be substantially that adopted by the Conference: and arranged for the collation of the material forwarded by the different Governments and the preparation of a large number of documents which it was considered would be of value to the Conference in its deliberations.

Countries and Departments Represented.—The Conference was attended by some 200 delegates and representatives. The following Dominions, Colonies, etc., were represented: Canada, Australia (Commonwealth, New South Wales, and Queensland), New Zealand, Union of South Africa, Irish Free State, Southern Rhodesia, India (and Burma, Madras and Punjab), Barbados, British Guiana, Ceylon, Cyprus, Federated Malay States and Straits Settlements (and the Rubber Research Institute of Malaya), Gambia, Gold Coast, Iraq, Kenya, Leeward Islands, Malta, Mauritius, Nigeria, Northern Rhodesia, Nyasaland, Palestine, Sierra Leone, Tanganyika (and Amani Research Institute), Trinidad (and Grenada, Windward Isles, and the Imperial College of Tropical Agriculture), Uganda, Zanzibar, and the Sudan. The following Government Departments, etc., in this country sent delegates: The Ministry of Agriculture and Fisheries (including the Royal Botanic Gardens, Kew), Dominions Office, Colonial Office, India Office, Empire Marketing Board, Development Commission, Department of Scientific and Industrial Research, Imperial Institute, Board of Agriculture for Scotland, Ministry of Agriculture for Northern Ireland, Department of Overseas Trade, Forestry Commission, Medical Research Council, Imperial Bureau of Entomology, Imperial Bureau of Mycology, Overseas Settlement Department, Board of Education, University Grants Committee, Scottish Education Department, Linen Industry Research Association, Empire Cotton-Growing Corpora-

tion, the High Commissioners for Canada, South Africa, Australia, New Zealand, Southern Rhodesia, the Irish Free State, and India, and the Agricultural Research Council of Great Britain.

The Conference was opened by the Rt. Hon. Walter Guinness, M.P., on October 4, 1927. Thereafter, the Conference appointed the Rt. Hon. Lord Bledisloe, Parliamentary Secretary to the Ministry of Agriculture and Fisheries, as chairman, and the Rt. Hon. W. G. Ormsby-Gore, M.P., Lord Lovat, and Major Elliot, M.P., vice-chairmen. The Secretariat of the Conference, under the direction of the writer and Mr. E. M. H. Lloyd, of the Empire Marketing Board, was provided by the Ministry of Agriculture and Fisheries and the Empire Marketing Board.

Message from H.M. the King.—The first act of the Conference was to send the following message of greeting to His Majesty the King :—

“The Imperial Agricultural Research Conference, at their first meeting, desire to offer to Your Majesty an assurance of their loyal devotion and of their resolve that the present Conference shall be instrumental in promoting friendly co-operation throughout Your Majesty’s Empire among all those who are engaged in the advancement of agricultural science and its application to the needs of the agricultural industry.”

His Majesty’s gracious reply was in the following terms :—

“I have received your message with great pleasure. Please convey to the Conference an expression of my sincere thanks and of my interest in their work, of which I realize the great importance to the prosperity of all parts of the Empire.”

Agenda.—The most important subjects in the agenda were adjudged to be those of an administrative character, viz. :—

- (1) The Recruitment, Training and Interchange of Workers.
- (2) The Establishment of a Chain of Research Stations.
- (3) The Establishment of further Imperial Bureaux; and the Interchange of Information.
- (4) Periodical Conferences.

After discussion of each of these subjects by the full Conference, they were referred to an Administrative Commission which, in turn, set up three Committees to deal with them (subjects 3 and 4 being taken by one Committee). The chairmen of these three Committees were (1) Mr. F. L. Engledow, (2) Major W. Elliot, M.P., (3) Sir R. Greig.

The specialist questions, submitted to the Conference, were classified as follows, and their consideration was referred to specialist Committees with the chairmen indicated :—

A. ANIMALS.

- (1) Veterinary Science (Chairman : Sir A. Theiler).
- (2) Animal Nutrition (Chairman : Professor T. B. Wood).
- (3) Animal Genetics (Chairman : Dr. F. A. E. Crew).
- (4) Dairying (Chairman : Dr. S. S. Cameron).

B. (5) SOILS AND FERTILIZERS (Chairman : Sir John Russell).

C. PLANTS.

- (6) Plant Pathology (including Mycology) (Chairman : Sir D. Prain).
- (6) Plant Breeding (Chairman : Professor A. E. V. Richardson).
- (8) Fruit (Chairman : Mr. W. T. Macoun).

D. (9) ENTOMOLOGY (Chairman : Dr. G. A. K. Marshall).

E. ECONOMICS.

- (10) Agricultural Economics (including Marketing) (Chairman : Mr. C. S. Orwin).
- (11) Preservation and Transport (Chairman : Mr. H. T. Tizard).

Thirty-three memoranda were submitted on administrative questions and 91 on specialist questions. These were grouped into 15 documents printed and stencilled, the memoranda being prefaced by précis of their contents and a general review of the objects dealt with. Various other documents were specially printed for the Conference, the chief of which were* :—

- (1) A review of Agricultural Research Work in Great Britain and Northern Ireland ;
- (2) A review of Agricultural Research Work in the Overseas Empire ;
- (3) A list of Agricultural Research Workers in the British Empire ;
- (4) Abstracts of papers on Agricultural Research in Great Britain during the period October, 1926, to March, 1927.
- (5) A description of an Exhibit on the History of Agricultural Literature specially prepared for the Conference by the British Museum.

The following is a very short summary of the recommendations made by the Conference.

Chain of Research Stations.—The establishment of central tropical and sub-tropical research stations should be governed primarily by the ascertained needs of Empire research in particular fields of agriculture, rather than by considerations of geographical distribution. These stations should be located in territories affording specially advantageous conditions for the study of each problem. They should in the main confine themselves to “long range” and “wide range” research.

* A limited number of copies of these are available and may be obtained from the Secretary of the Conference; the charge for No. 5 is 1s.; the rest are free.

Bureaux and Interchange of Information.—The functions of a clearing station should be to collect, collate and disseminate information of a scientific and technical character; to reply to inquiries on scientific and technical problems from agricultural departments and scientific workers in any part of the Empire; and, particularly, to facilitate intercourse among groups of workers on closely allied problems.

For the present, the organization of additional laboratories for attacking Imperial problems is considered to be outside these functions. Such stations are best established in conjunction with existing research institutions. They should be commenced in small numbers and on a modest scale.

The establishment of Imperial clearing stations, on the scale of bureaux, is recommended for *Soil Science* (at Rothamsted Experimental Station), *Animal Nutrition* (at Rowett Research Institute, Aberdeen), and *Animal Health* (in London). The last should include and absorb the section dealing with Animal Diseases now comprised in the Bureau of Hygiene and Tropical Diseases.

The establishment of Imperial clearing stations on a smaller scale—"correspondence centres"—is recommended for *Animal Genetics* (at the Animal Breeding Research Department, Edinburgh University), *Agricultural Parasitology* (at the Institute of Agricultural Parasitology, London School of Hygiene and Tropical Medicine), *Plant Genetics* (Cambridge Plant Breeding Institute for plants other than herbage plants, the latter to be dealt with at the Welsh Plant Breeding Station), and *Fruit Production* (at the East Malling Research Station).

The Imperial Institute and the Royal Botanic Gardens, Kew, should continue the useful work they are doing in acting as Imperial clearing stations in *Economic Botany*, and also in other directions in the case of the former Institute. As regards *Dairying*, it might be desirable to explore the best means of securing systematic collection and dissemination of information on the subject, and (in this connexion) the question of the publication of an Empire journal on dairying research. On *Preservation and Transport* the Low Temperature Research Station should undertake the duty of arranging for the interchange of lists of new and useful publications on those subjects. The establishment of a single publicity bureau for the Empire is not recommended, nor is a central clearing station for work other than that specified for the Imperial bureaux and correspondence centres.

The work of the central research station should not impair or replace the scientific work of any Agricultural Department in its proximity. In providing advice, it should limit itself to that directly resulting from its research activities; in special conditions it might serve as a convenient base of operations for a travelling advisory staff. No teaching work should be undertaken except in so far as the advanced instruction of a limited number of post-graduate students can be undertaken with advantage to the research work in progress.

A total superior staff of some 10 highly qualified men will probably prove to be the minimum staff of a central research station. Besides adequate capital expenditure, an annual maintenance expenditure of the order of £20,000 per annum must be envisaged. If there is no reasonable prospect of such staff and funds being provided, the establishment of a station should be postponed. Contributions might be expected from both public and private sources, and, besides money, might include gifts of land and in kind.

The form of control of a central station must be such as to ensure that the work of the institution shall not be diverted from a programme of free research.

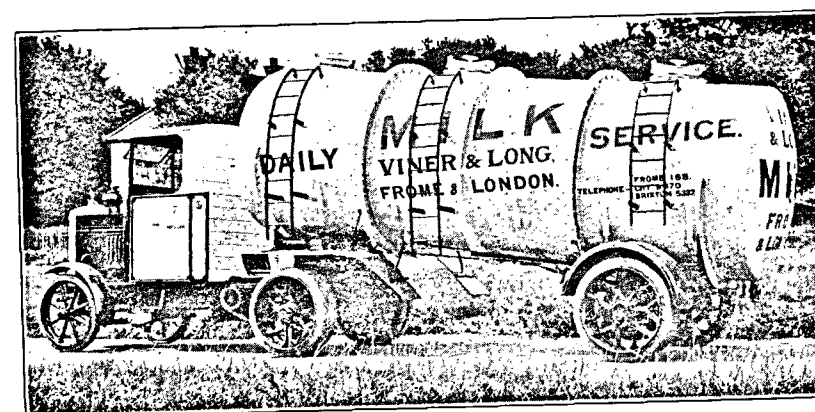
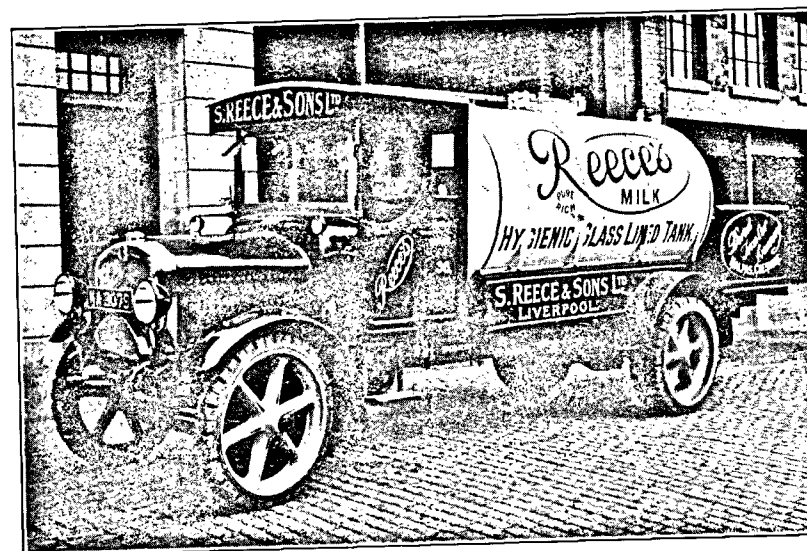
A programme of establishment of central stations was indicated by the Conference. Most of these must eventually be in the Colonial territories. So far as these territories are concerned, the development or modification of the programme is a matter primarily for the proposed Colonial Agricultural Research Council.*

The plan for a station in Northern Queensland was noted by the Conference; the establishment of further stations in the self-governing parts of the Empire must be a matter for further consideration by the Governments concerned.

The establishment of a central station for diseases of animals is of great importance, but presents difficulties. As a practical measure, an existing station should be expanded for the purpose, and such expansion of the South African Station at Onderstepoort is suggested.

The need for a central research station for irrigation problems should be further explored; and a sub-committee of the Civil Research Committee could suitably be appointed to report upon the subject in its various aspects.

* The establishment of an Agricultural Research Council to co-ordinate agricultural research in the Non Self-governing Dependencies was recommended by the Committee on Agricultural Research and Administration of the Non Self-Governing Dependencies.



FIGS. 1 and 2.—Glass-lined tank lorries.

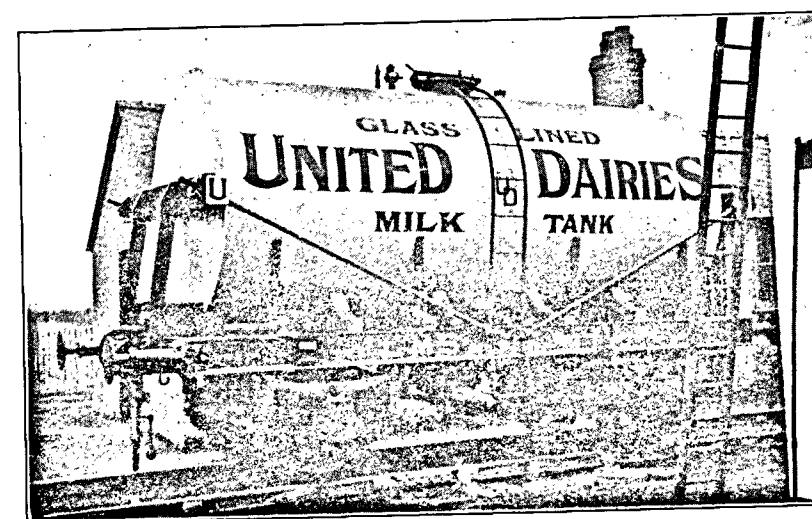


FIG. 3.—Railway glass-lined tank truck.

The funds of the new Imperial bureaux and correspondence centres should be administered by an authority on which the Governments of the Dominions and India and certain Government Departments in the Mother Country should be represented. In addition each bureau should be advised by a technical committee nominated by the Governments concerned and reporting to the financial supervisory body; correspondence centres should, as far as practicable, also be conducted on these lines.

Uniformity in methods of indexing, recording and publication should be secured by bureaux and correspondence centres.

The sums of £13,000 for Imperial bureaux and £7,000 for correspondence centres, in all, per annum, for five years in the first instance, should be sufficient for the programme outlined.

A "List of Agricultural Workers in the Empire" prepared for the Conference should be revised and periodically circulated. A general survey of Agricultural Research in the Empire, prepared for the Conference, should be revised on the occasion of the next Conference.

The Conference will meet again in Australia in 1932. Specialist and regional conferences are desirable; the initiative in convening them should be left to the authorities immediately concerned.

Recruitment and Training.—The advance of agriculture demands that every effort should be made to attract candidates of the highest class and to equip them with the best possible training.

For the specialist officer, a sound honours training in the pure sciences, including at least one biological subject, is essential. Equally essential is such a knowledge of agriculture as will enable him to appreciate clearly the rôle of science in agriculture.

For the agricultural officer, wide agricultural knowledge, a practical outlook and administrative ability constitute the first requirements. Next come scientific knowledge adequate for the full utilization of scientific results in agriculture and for close collaboration with his specialist colleagues. Character and health are of first importance.

Recruitment for a Colonial Agricultural Service.—Adequate emoluments, facilities for work, and satisfactory superannuation arrangements are necessary in the interests of recruitment as well as for the ultimate efficiency of the Service.

The nature, amenities and prospects of the Service must be made more clearly and more widely known.

Scholarships to boys still at school are not recommended. School-leaving scholarships to the universities should be considered. Inducement in the form of scholarships of any kind is wise and fair only if the Service be made to provide really good careers. A flourishing agriculture throughout the Empire is the best guarantee of a market for Empire manufactures. It is, therefore, suggested that the founding of scholarship schemes to promote agriculture deserves the attention of all industries, agricultural and other.

The predominance of the physical sciences over the biological sciences in all educational institutions, from the elementary schools to the universities, is one of the gravest difficulties in the supply of officers for the Agricultural Service. It is essential to view this difficulty as one of education as a whole, not merely of agricultural education. The help of educational authorities should be sought without delay.

The Colonial Office Agricultural Scholarship Scheme.—The existing scheme,* strengthened and suitably modified, may be expected to meet requirements for the present, provided that it be extended to cover Veterinary Science. The scholarship scheme will be greatly facilitated if Colonial Governments supply advance warning of their staff requirements.

The Training of Colonial Office Agricultural Scholars.—The broad object of post-graduate training is to develop the scholar into the officer. Systematic training courses cannot be prescribed. It must be left to the universities and colleges to ensure that scholars have every opportunity to profit from instructional facilities and to develop themselves to the standard desired in the Service. Every possible step must be taken to free from unnecessary difficulties the share of universities in training scholars. Training should include some investigational work, and scholars should, whenever possible, be under a supervisor, himself engaged in investigation and with experience of teaching.

The training should continue to be normally one year in Great Britain and one in a tropical country, e.g., at the Imperial

* The Colonial Office award annually a number of post-graduate scholarships in agriculture and agricultural science with the object of creating a pool of properly qualified candidates from which the vacancies in the Colonial Agricultural Departments can be filled. Further particulars are contained in a leaflet issued by the Ministry or may be obtained from the Private Secretary (Appointments), Colonial Office, 38, Old Queen Street, S.W.1.

College of Tropical Agriculture, Trinidad. Careful co-ordination of the work in these separate years should be effected. Short specialist courses should be avoided and soundness in fundamentals be the first aim. Provisions for training must be flexible, and the personal interest and services of the body administering the scheme for scholarships and training are the real guarantee of success.

An Imperial Basis for Recruitment and Training.—Scholarships and post-graduate training on an Imperial basis are impracticable. Scholarships and appointments to the Colonial Agricultural Service are, it is learnt with pleasure, already open, in practice, to suitable men from all parts of the Empire. The stimulation of further interest in, and recognition of, the importance of science in agricultural development should again be urged upon all the Governments of the Empire.

Study-Leave.—Facilities for study-leave are essential to the success of an agricultural service. Existing facilities are, in general, inadequate. Specific financial provision and appropriate increases in staff to make study-leave possible are an urgent necessity.

Study-leave should always have a specific object and be planned with great care for the sake of both the officer and the institution he visits. No central agency is necessary for study-leave arrangements. The bureaux and correspondence centres should be able to facilitate appropriate connexions and arrangements.

Interchange of Workers.—Routine interchange is deprecated. Beneficial interchanges will suggest themselves. Interchange would bring many benefits, some of which would reach beyond the strict limits of agricultural progress. Throughout the Empire, existing facilities are inadequate, mainly because of financial difficulties. The help of the appropriate authorities should be sought for this powerful aid to Imperial agriculture.

Veterinary Science.—The Conference afforded a unique opportunity for the exchange of ideas between veterinary science workers, from which great benefit was derived.

There is need for a clearing-house of information on this subject. Existing facilities are inadequate. A Bureau of Animal Health is proposed to deal with State veterinary hygiene and medicine, including legislative measures for the control of animal diseases. The headquarters should be in

London. It should incorporate the veterinary activities of the existing Bureau of Hygiene and Tropical Diseases.

Various concessions as regards training are made in different parts of the Empire to students of other sciences who pass over to veterinary training. Adequate specialized professional training cannot be accomplished in less than three years. Every effort should be made to encourage veterinary students to take university degrees, and undergraduate scholarships for the purpose are recommended.

Animal Nutrition.—A bureau for Animal Nutrition should be established at the Rowett Institute.

Animal Genetics.—There is need for further research in animal genetics. The work at Cambridge and Edinburgh on the physiology of reproduction should be developed; the formation of active centres of research in animal physiology throughout the Empire should be encouraged.

Those concerned with live stock breeding and improvement should be given an understanding of genetics. Veterinary officers of the tropical and sub-tropical Colonies and the animal husbandry and live stock specialists of the Dominions should be equipped with an advanced knowledge of this subject.

The Animal Breeding Research Department of Edinburgh University should be regarded as the centre for training in animal genetics. The facilities of that department should be amplified and developed. The Colonial Office and the Governments of the Dominions and India should increase the number of post-graduate fellowships, which would enable suitable men to come to that centre. That Department should also serve as an information centre in this subject.

Dairying.—Further study is required of nutritional and breeding problems and of the physiology of milk production. Systematic investigation of the economics of dairy production is of importance. The Empire Governments should encourage the study of the problem of effecting improvements in the flavour, carrying quality, etc., of Empire dairy produce imported into Britain.

Greater uniformity should be established throughout the Empire in the official specifications prescribed for volumetric glassware used in testing milk and milk products.

The importance of interchange of dairy research workers is stressed. An Empire journal of dairy research is suggested.

Interchange of information should take place on the technique of cost accounting and methods of farm surveys. Material collected by the two methods of work should serve national and inter-Imperial purposes as well as local needs.

The continuance and development of organized research in marketing, and the supply of market intelligence, is one of the most effective means of benefiting Empire agriculture.

Adequate agricultural statistics should be collected throughout the Empire. The World Agricultural Census of 1930-31 affords a unique opportunity of collecting such statistics.

Next Meeting of Conference.—During the course of the Conference, Mr. Julius, the Head of the Australian Delegation, announced that so strongly did the Government of the Commonwealth of Australia recognize the value of the contact between scientific workers and administrators in agricultural science afforded by such Conferences, that his Prime Minister, Mr. Bruce, had cordially invited the Conference, should it decide to meet periodically, to hold its next meeting in Australia. The invitation was very readily accepted by the Conference, which resolved that its next meeting should be in Australia in 1932.

Following the acceptance by the Conference of the invitation of the Prime Minister of Australia, a message was transmitted from Mr. Coates, the Prime Minister of New Zealand, by the Hon. Sir James Parr, High Commissioner for New Zealand, extending a cordial invitation to all those delegates who attend the next Conference afterwards to visit New Zealand, where they will receive a hearty welcome. Mr. Coates also stated that the New Zealand Government would co-operate with the Government of the Commonwealth of Australia in making the Conference in every way valuable and successful. This invitation was received with great pleasure by the Conference, and Lord Bledisloe, in replying to the invitation, stated that he was sure that as many as possible of the delegates to the next Conference would be most happy to include New Zealand in their itinerary.

* * * * *

ROYAL COMMISSION ON LAND DRAINAGE

THE Report of the Royal Commission on Land Drainage, appointed in March last, was issued on December 7.*

As announced in the issue of this JOURNAL for April, 1927, the Commissioners, under the chairmanship of Lord Bledisloe, were directed "to inquire into the present law relating to Land Drainage in England and Wales and its administration throughout the country; to consider and report whether any amendment of the law is needed to secure an efficient system of arterial drainage without undue burdens being placed on any particular section of the community; and to make recommendations having regard to all interests concerned."

The Royal Commission examined orally 53 witnesses, including representatives from the Ministry of Agriculture and Fisheries, the Ministry of Health, the various classes of drainage authorities and local authorities, and several drainage engineers; and written evidence was presented by 111 drainage authorities. Typical drainage areas in this country were inspected, and a tour of inspection in Holland was made at the invitation of the Netherlands Government.

The evidence submitted shows that there are in England and Wales 361 drainage authorities of various types, of whom 198 operate under special Acts, and the remainder are Commissions of Sewers and elective Drainage Boards functioning under the general Land Drainage Law. In addition, there are throughout the country large numbers of small areas which, in pursuance of local Acts or the general Inclosure Acts, have been the subject of Inclosure Awards containing provisions with regard to the construction and maintenance of drainage works. Several County Councils have also obtained drainage powers under private Acts. An examination of the powers of these various bodies reveals that the administration of arterial drainage is conducted by a confused tangle of authorities established by piecemeal legislation over 500 years, and exercising a great variety of powers and functions, and that there is no uniformity of method, of powers, or of liability.

On the evidence before them, the Commissioners have arrived at the conclusion that to remove anomalies, secure reasonable uniformity, and provide for efficient administration,

* Copies of the Report (price 1s. 3d. net) can be purchased through any bookseller, or direct from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2.

Soils and Fertilizers.—There is need for a Soil Bureau, which should be located at Rothamsted Experimental Station.

Memoranda on soil classification, on principles fundamental to fertilizer trials, and on soil deterioration resulting from shifting cultivation, disafforestation, etc., have been or are being drawn up and should be passed to the new bureau for study. Methods of mechanical analysis of soil should be studied by the bureau.

Plant Breeding.—An information organization for plant breeding is recommended. The Cambridge Plant Breeding Institute is suggested as a suitable centre for crops in general, and the Welsh Plant Breeding Station for herbage plants.

Plant Pathology.—Lists of plant diseases should be prepared by Governments of the Empire. The Imperial Bureau of Mycology should publish and distribute such lists.

The attention of Empire mycologists is called to the preparation by the British Mycological Society of a list of common and scientific names of plant diseases with a view to uniformity in nomenclature. The list should be circulated to Governments.

The Imperial Bureau of Mycology should prepare a list of books and periodicals to be regarded as the minimum requirement for a Government mycologist; a copy of the list should be forwarded to departments concerned.

The Imperial Bureau of Mycology should draw up a list of institutions to whom the papers and bulletins on mycology and plant pathology published officially should be supplied by Governments.

Funds should be provided for the more extended study of the fundamental nature of virus diseases in plants.

Fruit.—The interval between the planting of fruit trees and the time when they come into bearing is so great that the losses consequent on mistakes at an early stage are extremely serious to the grower.

The most pressing questions needing research are those relating to the orchard in its early stages, the most important being: (a) The study of stock and scion and their inter-relations; (b) Surveys of fruit areas to determine the relation of various factors to tree growth and fruitfulness; (c) Chemical studies relating to the tree and its crop; (d) The associated physiological studies. A greatly extended inquiry should be undertaken, and fresh workers should be employed on these studies.

Other questions of importance are the utilization of low-grade fruit, the preservation and transport of fruit, and especially the control of diseases and pests. The provision of a suitable centre for research and advisory work on fruit preservation and by-products is urged.

Facilities should be granted for horticultural research workers in the various countries to visit other parts of the Empire.

Entomology.—At the quinquennial Imperial Conferences of entomologists each entomological service of the Empire should be represented by at least one entomologist. These conferences should occasionally be held at centres other than London. Travelling fellowships for entomologists should be established.

More attention should be paid to the biological control of insect pests. The work of the Imperial Bureau of Entomology in this direction should be further aided. More attention should be given in universities to research and teaching in pure entomology.

Insecticides and Fungicides.—A chemical investigation of insecticides and fungicides should be undertaken by chemists, working in collaboration with entomologists and plant pathologists.

Preservation and Transport.—The time is not ripe for the establishment and development of a clearing house for the interchange, throughout the Empire, of information concerning research into the preservation and transport of agricultural products. Machinery should, however, be set up at the Low Temperature Research Station for the interchange of lists of new and useful publications. It is, separately, desirable to promote the direct reference of problems, preferably by personal conference and collaboration.

All parts of the Empire should undertake the solution of fundamental problems of preservation and transport.

Scientific inspection of overseas cargoes should be carried out, on arrival in this country, by representatives of the country of origin whenever possible.

Agricultural Economics.—The importance of the study of economic conditions was stressed, as well as the need for Governments of the Empire to secure the services of whole-time agricultural economists on the staffs of their Departments of Agriculture. The attention of universities throughout the Empire should be drawn to the dearth of technically trained workers in this subject.

it will be necessary to consolidate and amend the whole of the general law governing land drainage in this country, but two outstanding points have emerged from their investigations.

In the first place, they state that nothing has been more striking in the course of their inquiry than the revelation of the complete mutual independence of the various drainage authorities over the country. They think, therefore, that there can be no remedy for this lack of co-operation, which is largely the result of the piecemeal character of drainage legislation and the haphazard manner in which drainage authorities have been set up, short of some co-ordinating authority, in each Catchment Area where drainage works are required, exercising control over the main channel and banks of the river and working in the closest collaboration with the drainage authorities concerned with the internal drainage of the Catchment Area.

The second point of prime importance which has impressed the Commissioners is the consequence of the rule of "benefit." Under the existing law, drainage rates cannot be charged on any person who does not benefit from, or escape danger by, the drainage works in respect of which the rates are levied. The Commissioners are of opinion that, in consequence of this rule, drainage authorities have wholly inadequate areas over which they may levy rates, and that, in many instances, not only is land burdened with a drainage rate so heavy as to cripple the resources of the owner, but the amount which can be raised is so small that even essential works of maintenance cannot be efficiently carried out. The Commissioners therefore lay stress on the importance of the extension of the area of rating for the upkeep of main rivers, in order to include a much wider area than can be brought in under the existing interpretation of the principle of "benefit." They do not suggest that the doctrine of benefit should be altogether abandoned, but they are of opinion that the benefit of land drainage to any given area is not confined to the discharge of water beyond its own boundaries, but includes some responsibility for its passage to the sea. They point out that each natural river in the country is the artery which drains the lands in its Catchment Area, and that its very existence is the strongest proof of its necessity. Moreover, owing to modern conditions of roofing, paving, water supply, sanitation and so on, the waters from the uplands reach the mouth of the river much more rapidly, and in some instances in much greater volume, than they did formerly, with the result that rivers

are now called upon to discharge functions for which they were not designed by Nature.

From these two considerations, the Commissioners conclude that the Catchment Area is the proper drainage unit. Each Catchment Area, where a drainage problem exists, should be provided with a Catchment Area Authority, constituted mainly of representatives of the County and County Borough Councils in the area, which should have sole control for drainage purposes of the main channel of the river from its source. The funds required by the Authority would be raised by precept on the Councils of Counties and County Boroughs in which the Catchment Area lies, but the proportionate rate to be paid in respect of the uplands should be less than that paid in respect of the lowlands, which are the only lands at present chargeable. The Commissioners consider that the carrying out of this recommendation would impose no unfair burden on the upland districts, while it would aid materially the solution of many of the difficulties confronting drainage authorities at the present time.

The Report emphasizes the serious need for land drainage in many parts of the country. The depression in agriculture during the last 20 years of the nineteenth century made it increasingly difficult for owners of agricultural land to maintain at their own cost an efficient system of land drainage over large areas, and these difficulties have been aggravated in some parts by the scarcity of labour during the great war and its increased cost since. With the heavy fall in the prices of agricultural products and the splitting up of estates during the last few years, the serious waterlogging of land may be expected to become even more prevalent unless adequate steps are taken to ensure that drainage operations, in many cases of an extensive character, are carried out efficiently and economically. On this subject, the Report quotes some striking estimates made by the drainage engineers of the Ministry of Agriculture and Fisheries. At least 1,755,000 acres of land are in immediate need of drainage, of which 1,279,000 acres are said to suffer from flooding occasioned by defective or obstructed arterial channels, while 476,000 acres consist of land capable of improvement by means of small drainage schemes for the clearance of main ditches and other small watercourses.

The Commissioners, however, conclude their Report with a warning to the effect that, in the present condition of agriculture, it may not be possible, without State assistance,

to carry out substantial works of land drainage, and they are strongly of the opinion that, until the State is prepared to accept due financial obligations with regard to such works as the deepening and widening of main rivers and the preservation of sea walls and embankments against the excessive and violent encroachments of tidal water, very little progress can be made, even under the scheme which they have adumbrated, in the efficient drainage of agricultural land.

In addition to the proposals for the setting up of Catchment Area Authorities and for the extension of the area of rating, the Commissioners make recommendations on a number of points which, although subsidiary in character, are, nevertheless, of importance. The Report should be carefully studied by all interested in this subject.

* * * * *

FRUIT AND VEGETABLE GROWING IN RHONE VALLEY

H. V. TAYLOR, M.B.E., A.R.C.Sc.,

Horticultural Commissioner, Ministry of Agriculture and Fisheries.

TRAVELLING by rail southwards through France to Mentone, Cannes, Nice and other parts of the Riviera, the train enters the Rhone Valley at Lyons and follows it southwards until Marseilles is reached. In the centre is the river Rhone, at some seasons seen as a mighty rushing torrent, at others as a contracted stream of swiftly flowing waters. Smaller rivers enter the Rhone on either side—the slow and peaceful Saône at Lyons, the Doux at Tournon, and the Isère at Valence.

From the train there can be seen the grape vines in the valleys and on the hill sides, fruit plantations in the valleys and olive trees on the mountain sides; but few realize that the great area for the cultivation of early fruit and vegetables lies in the Rhone Valley or in the valleys made by its tributaries.

A day's tour in the neighbourhood of Lyons, Avignon or Toulon is sufficient, however, for the traveller to reach the little towns of Villefranche, Vienne, Chateau Rénard, Carpentras, Cavaillon, and Solliès Pont, all of which are surrounded with fields of fruit and vegetables, the land of which is cared for and tilled with the hand labour of the French peasant much as private gardens are tended in this country. The lines of tall cypress trees and reed fences, seen from the train in the regions south of Avignon, are there to break the cold winds from the Alps, lest they do damage to the tomato, melon, aubergine or

fruit crops. The canals from the rivers are taking waters to the fields where peasants use it to irrigate the crops. On the average, holdings run between two and five acres. The small-holders, though they have not yet accepted the idea of co-operative trading, have accepted the need for the existence of societies (both trading and non-trading), of which there are a number throughout the Valley.

Societies.—At Lyons is the office and headquarters of the Syndicat Agricole du Sud-Est, which is a society of 240,000 members (producers, merchants, exporters and others), formed for the development and protection of the agricultural and horticultural industry in the Sud-Est. It is a non-trading organization, but exercises an important function in development work. There are trading syndicates (associations) in the vicinity, notably one at Villefranche—"Syndicat Agricole de Villefranche et du Anse"—which buys in bulk and distributes to its members tools, manures, insecticides, fungicides and machines of all kinds. At the stores of this society were seen stacks of powder insecticides and fungicides, and a powder spraying machine, "La Sirene," which is said to be very popular. Quite a number of these trading syndicates exist, although there was not time to visit more than this one.

One gathered that the growers used insecticides and fungicides extensively—especially for the vines, and to a lesser extent for the pears and peaches, which are the next important crops.

The Plantations at Lyons.—The fruit plantations at Lyons are owned by the cultivators, and contain a mixture of grape vines, peaches (grown as bush trees), pears, and cherries, with smaller quantities of apples and red and black currants.

The freshly planted pear trees were of the espalier type, but the older ones were of a type not seen hitherto, nor in any other than the Rhone district. Of pears, the William predominated, with Beurré Hardy and Clapp's Favourite next. There were smaller quantities of Louise Bonne and Souvenir du Congrès. The B. Napoleon, B. Jaboulay, B. Pelissier, B. Blanc dur, and B. de Charmes were the chief cherries grown.

Vienne, which lies immediately south of Lyons, and the surrounding district were visited on July 20. The fruit plantations contain mixed fruits—plums (Washington, Oullins and Greengage), peaches, apricots in plenty, pears (notably Clapp's Favourite and Williams), and cherries, all closely interplanted with grape vines, these last for wine making. So closely are the trees and vines planted that all tillage work must be done by hand, necessitating a steady daily toil from

sunrise to sunset for the peasant and his family. One plantation belonging to a merchant was tilled by paid factory labour, and these people, after doing the normal eight hours in the factories, did four hours' work more per day in the plantation to augment their daily earnings. The wages for a full day's work on the land would be from 16 to 20 francs (2s. 8d. to 3s. 4d.) per day. On each cherry tree in this plantation there was a trap hanging in which a sugar bait, containing arsenical poison, had been placed during May to poison the adult flies of the Cherry Fruit Fly, which are said to feed on the sugar solutions. This form of control was noticed in other places, though fewer traps were used.

The growers at Vienne seldom consign their produce to distant markets, but sell it, without grading and proper packing, to the wholesale merchants, of whom there are a very large number resident in the town itself. A visit was paid to the premises of one merchant, and, at the time, Washington and Greengage plums, Clapp's Favourite pears, as well as peaches and apricots, were being delivered by the peasant growers into the premises. After the baskets were weighed, the fruit was turned out on to the grading table, where it was graded by hand to the special standards of this particular firm. The packing was being done by girls, and, while the individual fruits were not wrapped in paper, a really firm pack of peaches, pears, and plums was secured by using plenty of wood wool. Light and cheaply made crate or boat packages were being used, though, for some of the English markets, the "sieve" still held its own. Hand work predominated. The only machine used was a light tool for fastening the covers on to the packages with wire.

At Tain, to the south of Vienne, I visited a large and well cultivated fruit farm owned by M. Predier, formerly a solicitor. This proved to be one of the very few commercial fruit farms where hired labour (wages 20 francs per day) did most of the work. Water pipes ran through most fields, so that the land could be irrigated when necessary, or the growing fruits could be sprinkled with water to develop colour and good appearance, an operation deemed to be very important by this progressive grower. Spraying machines of the hand-pressure pump style were plentiful, and the proprietor was evidently a firm believer in the value of spraying. In the farm building, a cold-storage chamber had been installed, together with a packing shed, where girls were busy grading—not too finely—and packing peaches, pears, and apricots. These plantations contained pears,

peaches, apricots, cherries, plums, a few black currants, and some apples. Away to the south of Tain, and on to Valence, was a valley of lucerne, wheat, and mangolds, with tethered goats and oxen peacefully grazing. Tethering is necessary because no hedges or fences exist, and a stranger to the district could not discern where the boundary of each farm lay. Vines, cherries, and peaches, though never disappearing entirely, became less and less frequent south of Valence, until Avignon was reached. Here a large area on both sides of the Rhone is planted to fruit and vegetables, with perhaps Avignon, Chateau Rénard, Cavaillon, and Carpentras as the most important centres for markets.

Avignon : Irrigated Lands.—The alluvial soil in the Avignon region is very calcareous, becoming very dry during the hot summer, when the sun shines very brightly for months together; but, when this fertile land is supplied with water, good crops can be raised. Consequently, various schemes have been devised for bringing water to the fields for irrigation purposes; and some of these systems are of long standing, for Arthur Young, in his travels in 1787-89, commented on the extended irrigation schemes used in this district, and said it was a practice not known in England. At Chateau Rénard, a canal system, constructed by a private syndicate (company), leads the waters of the Durance to the fields in the cultivated areas. The cultivators pay for the water and are allowed use during certain specified hours of the day. At Cavaillon, Carpentras, and other places, similar water companies exist for similar irrigation purposes. Where no such irrigation scheme exists, each man must construct his own irrigation system if he would have fertile land. At the small town of Aramon, where the vegetable holdings usually do not exceed two acres, each man has a system for pumping water from wells and leading it to channels between the rows of vegetables grown in every small field. At times the pumps are worked by hand, at others by horses, though, latterly, a few petrol motors, and even electric motors, have been installed. In the whole of the Avignon region, the wind from the north is strong, and it has been found necessary to provide the plants with shelter, sometimes by planting long single rows of cypress trees, or by encouraging the hedges of tall canes. Where melons, tomatoes and aubergines are grown, fences of these canes, 9 ft. high, are raised. The small vegetable farms are thus split into very tiny fields by wind breaks, and have water channels running through them in all directions.

Each district of this area yields its own special products, and is, therefore, famed for some particular crop—Cavaillon and Carpentras for asparagus and petit pois; Chateau Rénard for cherries, peaches, grapes, and pears; Aramon for cantaloup melons, cauliflowers, and salads; and Boulbon for dessert grapes, of which the variety Chasselas was said to be the choicest. Growers, no matter how small their acreage, seldom specialize in one product. Each fruit holding would contain grape vines, cherry trees, pear trees, plum trees, peach and almond trees, a few black currants, all mixed together in such a way that special spraying operations on any one kind of fruit would become extremely difficult; whilst the small vegetable farm would cultivate tomatoes, aubergines, cantaloup melons, petit pois, cauliflowers, haricot beans, salads, and new potatoes.

Street Markets.—The amount of land spared for each crop is necessarily not large, and as these vegetables mature their crops irregularly, individual growers would find a difficulty in producing sufficient bulk on any one day to engage in a really progressive marketing scheme. In practice the marketing methods adopted by the growers are very primitive, for they simply take the produce in the early hours of the morning to the towns, place the packages on the pavements in the street and then make their bargains direct with the wholesale merchants for cash. The towns at these market hours are very active. Carts line the streets, made shady with rows of plane trees (*Platanus orientalis*); whilst the packages of produce almost cover the pavements. The growers stand by their packages and conduct their bargaining with the town merchants, who alone know the best market for each package and its probable value. The street market at Avignon is held every day of the week (Sunday included), and selling may begin when the bell rings at 6 a.m., though the produce usually arrives much earlier. At Chateau Rénard, Cavaillon, and Carpentras, and all the other places, similar street markets exist, although the daily selling time varies with each district and may be as early as 4 a.m.

Topping of packages is not allowed, and where it is thought this has been done the buyers may call in the market overseer, who has sole power to fix the fresh price for the produce, his verdict being binding on both buyer and seller. The wholesale merchants pay cash for their purchases. The packages, when sold, are removed to packing stations in the towns, where the contents are emptied out to the tables, are graded, and finally

packed into the wooden crates and boat packages so commonly used by the French. The produce is consigned by the wholesalers to markets throughout France, England, Sweden, and Germany.

East of the Rhone Valley District.—To the east of Marseilles, and not far from the naval garrison town of Toulon, I found the one and only association of growers which undertakes the selling of produce on a co-operative basis. Four hundred members have combined and employed an auctioneer “crier” to act for them in offering produce to merchants daily on the street pavements, but no co-operative grading, packing or consigning to other markets had been attempted.

The Toulon District.—Not far distant from Toulon is the famous cherry district of Solliès Pont—a district of early production and famous throughout Europe for the large and juicy Reine Hortense cherries. Cherries, peaches (Hale’s Early), apricots, pears (Williams, Beurré Hardy), apples (Reinette du Canada), and figs are also largely grown. The cultivation in the orchards in this area was well done and the trees looked green and prosperous, for there was no shortage of water for irrigation purposes. The cherry trees in some of the plantations here were over grass (Kent method), a practice not often seen in the Rhone Valley, the orchards generally being cultivated clean, although in more than one instance lucerne cover cropping had been practised. This lucerne crop was not allowed to rot down to humus, as is the practice in America, but was cut for cattle fodder.

A Canning Factory.—At Solliès Pont, there exists a canning factory which packs the famous “La Fontaine” brands of peaches, cherries, apricots, pears, and petit pois. This factory is of large size, and equipped with machinery, though not of the modern automatic type used in California. It employs a large number of women, but this is not a serious matter, for wages are not high for such work in France. In this area and right through the Department of the Maritime Alps at Nice, Grasse, Cannes, and Mentone, much fruit and vegetables are bottled, canned, and even preserved as “comfits.” The noted crystallized fruits of commerce—cherry, peach, prune, pear, melon, and mandarine, come from this area.

Flower Growing.—Around Toulon, narcissi are much cultivated for market, the chief variety being the “Paper White”—the earliest narcissus to appear on the London market. Eastwards at Hyères, violets (Princess of Wales) and

asparagus ferns are the chief crops, and, beyond Hyères, mimosa, roses, and border carnations. Last year the production of market blooms in the Maritime Alps Department was: violets, 10,000,000 dozen bunches; roses, 800,000 dozen bunches; mimosa, 2,900,000 dozen bunches; other flowers 1,800,000 dozen bunches.

Very large acreages of flowers are also grown for the perfume industry, which is centred round Grasse, white jasmine, orange flowers, geraniums, lavender, mint, roses (Damas), violets, tuberoses, and cassier being the most important. Growers have co-operated to some extent in the perfume industry, and there exist four societies of some importance—the Nerolium, with 1,000 members, specializing in orange blossom perfume; the Hartus, with 900 members, specializing in jasmine; the Cooparum and the Union Floriale, each with 300 members, interested in rose, jasmin, etc. The flower industry and the perfume industry increase in size annually and are at present in a very prosperous condition.

The Agricultural Work of a Railway Company.—The Paris-Lyon-Mediterranean Railway Company, which serves the Rhone Valley, does a good deal to increase crop production in the district and to keep the varieties to the kinds in demand on the market. The company now has a special staff of technically trained agriculturists, and has undertaken measures of assistance quite unique for a European railway company. In order to develop fruit and vegetable growing in certain regions, the company made a free distribution to growers of 26,500 fruit trees, 170,000 grafts of selected grapes (Chasselas), 164,000 black currant bushes, 810,000 asparagus roots, 140,000 strawberry plants, 69,000 cuttings from artichokes, and many packets of seeds of tomatoes; and even sent experts down to demonstrate methods of grafting and planting these varieties. When the strawberry plants, of the variety "Miner," at Carpentras failed to crop satisfactorily, the company had the variety transplanted in Saône-et-Loire for a time and then redistributed the regenerated plants to the growers at Carpentras. The company takes an interest in pests that cause damage to the crops, has assisted the authorities in campaigns for the control of the olive fly, the cherry fruit fly, and vine pests, and has made grants to the Entomological Stations at Saint Genis-Laval and Menton to stimulate researches in plant pests. It has also collected products of the Rhone district and staged exhibits of them in the Hall of the Lyons Great Trade Exhibition.



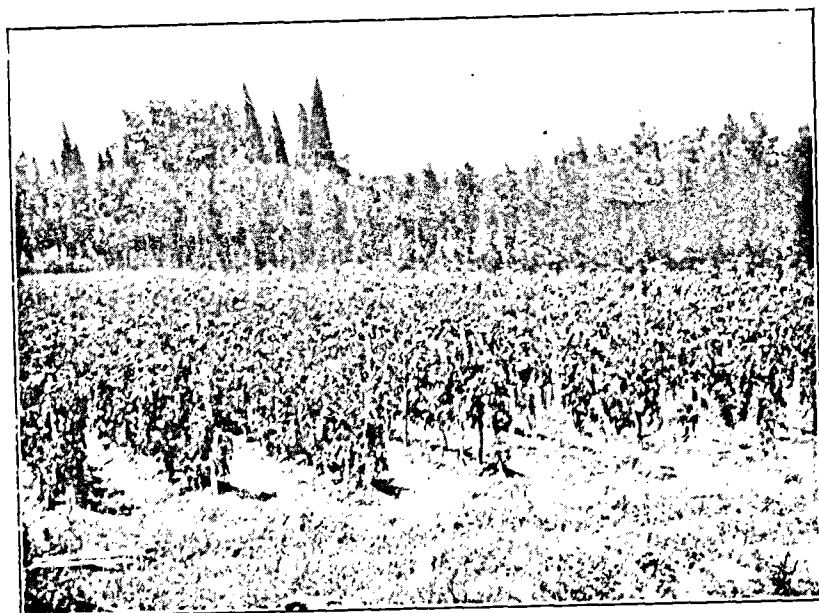
Peaches in the Rhone Valley.



A mixed plantation of peaches, pears and soft fruit in the Rhone Valley.



Beds of Cantaloup melons and rows of Aubergines. Water flows down the channels between each row. (Rhône Valley.)



Rows of tomato with water channels between the rows. (Rhône Valley.)
A shelter belt on the right.

Agricultural publications are issued on any matters of real importance to the growers, or where the company wishes to inform them of the needs of foreign markets. These publications have dealt with mulberry cultivation, the control of the cherry fruit fly, the peach, corn growing, and the exportation of fresh fruits and vegetables to England. From the last interesting little booklet, it appears that London and Hull are the two great centres for distribution of French produce. The "sieve" is preferred by London salesmen to all other packages, though a non-returnable package is recommended for Hull. For both markets, the exact weight should be given, and the packing should be uniform throughout. A table is included wherein is set out the varieties of fruits and vegetables suitable for the English markets. Milner, Alphonse, and Ladette strawberries are recommended; Williams, Beurré Hardy, and Duchesse pears; greengages, Blue Rocks and Pond's Seedling plums; Mayflower and Hales' Early peaches, and the Cantaloup and La Cavaillon melons. These publications and the other assistance given must be extremely useful to the French growers and have an important influence in fostering a more progressive spirit amongst the existing cultivators and a desire for development in others.

Conclusion.—The fruit and vegetable growers of the Rhône Valley owe much to the real advantages which Nature has provided—fertile soils, an abundant water supply, and plenty of sunshine—for these all help, not only in the task of raising a crop, but in bringing it to full coloured maturity. The growers, too, own the land which they cultivate, the majority having inherited it from their fathers, and therefore have no rents or charges to pay. The labour is usually provided by the owners and their families, so that little outside expenditure is incurred. The grower's lot is a happy one, for, substantially aided by Nature, he is able to secure large crops at little expense and is quite ready to cash them at values that would be considered uneconomic by our growers in England. The industry in the Rhône Valley has been established many years, and though, no doubt, important processes of development and improvement have been made, the present peasants are in a large measure merely carrying on old-established practices of cultivation, production and marketing, year by year, without much change. The lay-out of the plantations seems to be of a less commercial type than is the case in the United States of America, in Canada or in this country; machinery is less used, and in methods of pruning and spraying

the French growers are certainly not more advanced than those of England. Refrigerated fruit stores, which have developed so much in recent years in America, Canada, and England, have hardly started in the areas of production in the Rhone Valley. Nor have the French growers made any serious alterations in their marketing methods. On the other hand, the country merchants, aware of the market demand for graded and standardized produce, have established packing stations and set up an organization capable of preparing the French produce for the market in accordance with present requirements.

In the Rhone Valley, the peasants confine their attention to production and sale of ungraded produce; they leave to private firms the initiative of working schemes of irrigation, of erecting factories for making boxes, and of building houses for grading, packing, and marketing the fruit. In effect, it may be said that the fruit industry in the Rhone Valley is working on an individual basis—each grower having his own special business which he works and develops on his own lines. In that sense, the fruit industry is worked differently from the similar industries of America and Canada, where growers have united to form very large trading associations for performing all these functions on co-operative lines.

* * * * *

THE USE OF WATER-BOWLS: INFLUENCE ON MILK YIELDS

DURING the two winters 1925-26 and 1926-27, a co-ordinated experiment was carried out at certain Agricultural Colleges and Farm Institutes, to obtain information on the effect of the installation of water-bowls on the milk yield of dairy cows. During the first winter, difficulties occurred in carrying out the trials on uniform lines, and, although the general results were similar to those obtained in the second winter, it has been thought undesirable to include them in detail in this report, which is therefore confined to the 1926-27 experiment.

The centres concerned were the four Farm Institutes at Reaseheath (Cheshire), Cannington Court (Somerset), Usk (Monmouthshire), and Plumpton (East Sussex). (In the 1925-26 experiment, the Midland Agricultural College also took part, but was unable to participate in 1926-27.) Various types of water-bowls were installed at each centre, the manufacturers being Messrs. Alfred Herbert, Ltd., Messrs.

George H. Gascoigne Co., Ltd., Messrs. George W. King, Ltd., Messrs. Beatty Bros., Ltd. and Messrs. Young and Co. (Westminster), Ltd. These makers presented the water-bowls to the Institutions taking part, and the scheme of experiment was discussed with and approved by them before it was adopted. This scheme, as revised for the second winter's trials, is given hereunder. The trials were commenced on the following dates: Monmouthshire Agricultural Institute, October 4, 1926; Somerset Farm Institute, January 15, 1927; Cheshire School of Agriculture, January 16, 1927; East Sussex Farm Institute, January 23, 1927. All cows under experiment were turned out for exercise twice daily in a place where water was provided irrespective of whether they had access to water-bowls or not. At Plumpton, milking was carried out three times daily, and at the other centres twice daily.

Revised Scheme, Winter, 1926-1927.

- I.—The trial shall be between two lots of cows, each lot to consist of 5 or 10 cows in varying periods of lactation, but selected so that the lots are made as even as possible in all respects. Every endeavour should be made to include only cows whose lactation will not be unduly interfered with by drying off before the conclusion of the experiment.
- II.—Both lots of cows shall be fed and treated alike in all respects except that only one of the lots shall have continuous access to fresh water provided through the agency of water-bowls. Both lots shall be turned out for exercise once (or twice according to the custom of the district) each day in a place where water is provided, and these shall be the only occasions when the cows not provided with water-bowls have access to water.
- III.—The trials shall extend over two periods, each of five weeks' duration, with an interval of one week between the first and second periods.
- IV.—Lot I shall be supplied with water-bowls during the first period, but not during the second period, and Lot II shall be supplied with water-bowls during the second period, but not during the first period.
- V.—Each trial period shall be preceded by a preliminary period of two days for the cows to become accustomed to the use of bowls.
- VI.—The trials shall be conducted next winter at such periods as may be most convenient to the Institute between October 1, 1926, and May 1, 1927.
- VII.—During the trial periods, a careful record shall be kept of the yield of each cow at each milking.
- VIII.—The butter-fat yielded by each lot during each trial period shall be estimated once each week by "Gerber" from a composite sample composed of sub-samples drawn one from each meal's milking, and preserved with bichromate of potash, or such other preservative as will maintain the condition of the same unimpaired.

IX.—If convenient means exist for recording the weights of both lots of cows at the commencement and, at the end of each trial period, it is advisable that these weights should be taken.

X.—Careful note shall be taken throughout the trial (a) of the readiness or otherwise with which the cows take to the use of the bowls, (b) the working efficiency of the types of bowls, and (c) ease with which they are kept clean.

XI.—The results obtained at each centre, as well as the observations of those in local charge of each trial, shall be collected together and a joint report issued thereon.

Rationing.—The cows taking part in the trials were fed as follows:—

Wales Farm.

15lb. hay and 30lb. mangolds.

4lb. dairy cubes* for each gallon of milk.

Monmouthshire Agricultural Institution.

20lb. hay

40lb. roots

1½lb. decorticated ground nut cake

1½lb. decorticated ground nut cake

2lb. maize meal

} For maintenance and first gallon.

} For each additional gallon.

Somerset Farm Institute.

16lb. hay and 20lb. mangolds.

3½lb. concentrates for each gallon of milk. (Concentrate mixture was 1 part decorticated ground nut cake, 2 maize meal, 1 crushed oats, 2 palm kernel meal, and 1 linseed cake.)

Cheshire School of Agriculture.

Yield lb.	Hay. lb.	Mangolds. lb.	Concentrates. lb.
Up to 25	20	25	3½
26 „ 30	20	25	7
31 „ 35	18	25	10½
36 „ 40	18	25	12
41 „ 45	16	25	14
46 „ 50	16	25	17½
51 „ 55	14	25	19
55 „ 60	14	25	21

and bran mash.

From February 10, 1927, in this case, 6lb. of hay per cow was replaced by 15lb. of silage, and the concentrate mixtures were, for January and February, 1 part decorticated cottonseed meal, 2 palm kernel cake, 2 thirds, and 2 maize gluten meal, and, for March, 1 part decorticated cottonseed meal, 2 parts palm kernel cake, 1 thirds, and 1 Indian meal.

Results.—Milk Yield.—The milk yields of the cows, included in the experiment, are set out in Appendices 1 and 2. Appendix 1 (p. 922) shows the total amount of milk yielded by each group of cows, with and without access to water-bowls. Appendix 2 (pp. 918-921) indicates the mean daily yield each week for each cow in the Cheshire trials, and the weekly yield for each cow in the three other trials.

* Composition: 1 part extracted soya bean meal, 1 decorticated earth nut cake or meal, 2 maize meal, 2 palm kernel meal, 2 rice meal (1 per cent. salt), and 1 malt culms (1 per cent. steamed bone flour).

Butter-fat Content.—No general conclusion can be drawn from the results. At Plumpton and Usk the results favour the bowls, whilst at Reaseheath and Cannington Court the results are against them.

Weight of Cows.—At each centre (except Plumpton, which has no cattle-weighing facilities) the weight of the cows at the beginning and end of the periods, with and without bowls, was recorded. The data so obtained are neither for nor against continuous access to water. The Cheshire results were slightly against the bowls, those in Monmouthshire were slightly in their favour, whilst, at Cannington Court, there was an almost uniform decrease in weight throughout the trials of Lot I.

Discussion of Results.—The results in terms of milk yield show that at three of the four centres some advantage was derived from the use of water-bowls, whereas at the fourth centre (Reaseheath, Cheshire) the yield was slightly less with water-bowls than without. Viewed as a whole, there was a total net increase in yield of approximately 1 per cent. when water-bowls were in use compared with the yield from the same cows watered in the ordinary way without the use of bowls.

In discussing these results, however, several important qualifying facts must be borne in mind. In the first place, it is probably true that dairy herds at Farm Institutes are watered with greater convenience and regularity than would normally be the case on many private farms; in other words, the advantage gained from the use of water-bowls, which allow continuous access to water in the cow-stalls, may not be so marked as might be the case on ordinary farms, at any rate as far as milk yield is concerned. Further, the experiment now under review can only be regarded as an interim contribution to the solution of the question whether the use of water-bowls increases milk yield, inasmuch as it is impossible, within the scope of a single trial, to take into account all the factors, other than outside watering, which may be assumed to influence yield—such, for example, as the water-content of the ration, the stage of lactation of the cow, and the potential milk yield of the cow.

Although, therefore, the conditions of the experiment in regard to points like rationing, state of lactation, and yield of cows were so devised as to give as practical a test as was possible, it would not be fair to suggest that in all cases the influence of water-bowls on milk yield was as limited as was the case in the trials now reported. Moreover, quite apart

APPENDIX 2.
MONMOUTHSHIRE AGRICULTURAL INSTITUTION
TABLE SHOWING INDIVIDUAL RECORD (WEEKLY SUMMARY) OF EACH COW IN LB.

In- dex No.	Name	Period since last calving.	Group 1, on water continuously.					Total for five weeks.	Group 1, on intermittent water supply.					Total for five weeks.
			1st week.	2nd week.	3rd week.	4th week.	5th week.		1st week.	2nd week.	3rd week.	4th week.	5th week.	
		Weeks.												
M 1	AshtonDuchess	6	225	216	192½	191	181	1,005½	141½	145½	148	142½	125	702½
M 2	Daisy ..	31	194½	178	169½	154	150½	845½	147½	150½	142½	136	113½	690
M 3	Daphne ..	27	138½	136½	119½	120½	109½	624½	109	101½	91½	91½	79	472½
M 4	Dowdrop ..	8	145½	133½	116	115	111	621	101½	96½	98½	98	98	493
M 5	Primrose II. ..	½	251½	265	263	232	247½	1,259	213½	195½	170½	174½	157½	917½
	Totals ..	..	954½	928½	860½	812½	799½	4,356½	713½	690	657½	642	572½	3,275½

In- dex No.	Name.	Period since last calving.	Group 2, on intermittent water supply.					Total for five weeks.	Group 2, on water continuously.					Total for five weeks.
			1st week.	2nd week.	3rd week.	4th week.	5th week.		1st week.	2nd week.	3rd week.	4th week.	5th week.	
		weeks.												
M 6	Lady Viola II.	6	238	207	185	174½	158½	963	181½	169½	168½	160½	154½	834
M 7	Mustardseed ..	19	170	163½	152½	150½	153½	790½	139½	130½	129½	123	123	651½
M 8	Lady Eileen ..	25	120½	115	104½	102½	102½	545½	85½	79½	74½	66	59	364½
M 9	Rosemary ..	4	122½	125½	127½	120½	123½	619½	102½	100½	107½	104½	94½	509
M 10	Lady Diana ..	11	166½	154½	161½	144½	136½	764	113½	110½	107½	109	102½	543
	Totals ..	..	817½	765½	731½	693½	674	3,682½	622½	591	587	568½	533	2,902

APPENDIX 2 (Contd.).
SOMERSET FARM INSTITUTE.

TABLE SHOWING INDIVIDUAL RECORD (WEEKLY SUMMARY) OF EACH COW IN LB.

In- dex No. of cow.	Name.	Period since last calving.	Lot 1, on water continuously.					Total for five weeks.	Lot 1, on intermittent water supply.					Total for five weeks.
			1st week.	2nd week.	3rd week.	4th week.	5th week.		1st week.	2nd week.	3rd week.	4th week.	5th week.	
		weeks.												
S 1	Surprise ..	19	182½	173	185½	179	177½	897½	180½	177½	174½	170½	151½	853½
S 2	Hawthorn ..	..	424	412	412	394½	380½	2,023½	339½	331½	307½	287½	265	1,530½
S 3	Dorothy ..	13	133½	134	141½	136½	129½	675½	139	130	131½	133	121½	655½
S 4	Ethel ..	9	142½	148½	152½	148	143½	735	140½	145½	142½	145½	139	712½
S 5	Ellen ..	9	88	89½	90½	89½	88½	446½	79½	73½	71	72½	73½	369½
	Totals ..	..	970½	957½	982½	948½	919½	4,778½	878	857½	826½	809½	750½	4,121½

In- dex No. of cow.	Name.	Period since last calving.	Lot 2, on intermittent water supply.					Total for five weeks.	Lot 2, on water continuously.					Total for five weeks.
			1st week.	2nd week.	3rd week.	4th week.	5th week.		1st week.	2nd week.	3rd week.	4th week.	5th week.	
		weeks.												
S 6	Bluebell ..	28	145	159½	158	155½	142½	760½	111½	98	84½	88½	75½	457½
S 7	Dairymaid ..	..	243½	243	256½	236½	224½	1,204½	204½	200½	200	191½	177½	974½
S 8	Evelyn ..	5	171½	173½	174½	175½	160½	855½	166½	154½	161	161½	153½	797
S 9	Damsel ..	½	179½	198	195½	197	193½	964	197½	189	185½	179½	169	920½
S 10	Elizabeth ..	9	89	88½	86	89½	86	439½	90½	88½	88	92	89	447½
	Totals ..	..	829	862½	871	854	807½	4,223½	770	730½	718½	713½	664½	3,597

APPENDIX 2 (Contd.).
WALES FARM, PLUMPTON.
TABLE SHOWING INDIVIDUAL RECORD (WEEKLY SUMMARY) OF EACH COW IN LB.

In- dex No. of cow.	Name.	Period since last calving.	Group A, on water continuously.					Total for five weeks.	Group A, on intermittent water supply.					Total of five weeks.
			1st week.	2nd week.	3rd week.	4th week.	5th week.		1st week.	2nd week.	3rd week.	4th week.	5th week.	
W 1	Nameless	6 weeks.	374½	364½	355½	332	340½	1,766½	324½	317½	328	346½	321½	1,637½
W 2	Daftodil	2	388½	416½	421½	425½	410½	2,062½	410½	404½	410½	421½	415½	2,062½
W 3	Chervil	6	297½	297½	294½	278	268	1,435½	231½	223	218	207	196½	1,075½
W 4	Hawthorn	14	251½	258½	253½	257½	252½	1,273½	248½	241½	233½	237½	235½	1,196½
W 5	Moss Rose	2	227½	221½	238½	240½	244½	1,173	205½	226½	234½	252	245½	1,164½
	Totals	..	1,539½	1,558½	1,563½	1,533½	1,516½	7,711	1,420	1,413	1,424	1,465	1,414	7,136

In- dex No. of cow.	Name.	Period since last calving.	Group B, on intermittent water supply.					Total for five weeks.	Group B, on water continuously.					Total for five weeks.
			1st week.	2nd week.	3rd week.	4th week.	5th week.		1st week.	2nd week.	3rd week.	4th week.	5th week.	
W 6	Hollyhock	2 weeks.	462½	471½	460	459½	462	2,315½	423½	440½	378½	384½	398½	2,025½
W 7	Mignonette	2	343½	327½	335½	340½	334½	1,681½	350½	342½	328½	293½	286½	1,601½
W 8	Rosemary	10	227	238½	236½	234½	230	1,166½	239½	237½	237½	240	228½	1,183
W 9	Wallflower	7	197	210½	208	215½	221½	1,052½	230½	221½	221½	219½	218½	1,111½
W 10	Sweet Pea	6	293½	310½	307½	307½	307	1,526½	310	301½	305	278½	282½	1,477½
	Totals	..	1,523½	1,558½	1,547½	1,557½	1,555½	7,742½	1,553½	1,543½	1,471½	1,415½	1,414½	7,398½

CHESHIRE SCHOOL OF AGRICULTURE.
TABLE SHOWING INDIVIDUAL RECORD (AVERAGE DAILY YIELD PER WEEK) OF EACH COW IN LB.

Index No. of cow	Registered No.	Period since last calving.	Group 1, on water continuously.					Interval week.	Group 1, on intermittent water supply.				
			1st week.	2nd week.	3rd week.	4th week.	5th week.		1st week.	2nd week.	3rd week.	4th week.	5th week.
C 1	12	7 weeks.	38.9	37.7	36.4	36.4	33.8	35.8	33.3	30.7	31.4	29.7	32.1
C 2	85	14	19.4	18.6	18.8	19.0	18.9	19.0	17.5	17.6	17.0	16.0	16.2
C 3	44	8	30.8	29.1	28.6	27.9	26.8	26.6	24.9	25.8	25.4	23.3	24.4
C 4	84	14	30.4	30.0	28.0	29.7	26.8	26.3	25.9	27.8	25.6	24.8	27.8
C 5	57	12	21.4	17.7	16.6	16.6	14.4	14.0	14.2	15.7	13.4	13.0	14.0
C 6	5	13	23.3	23.6	21.9	23.8	21.9	21.9	21.1	20.3	18.1	19.1	20.6
C 7	86	13	23.6	20.8	19.4	18.0	18.5	19.1	19.3	18.9	18.4	16.1	18.9
C 8	55	1	44.6	43.6	42.4	42.4	40.6	40.9	45.9	37.6	36.9	34.1	35.7
C 9	1	1	43.0	39.3	39.7	37.7	36.3	35.6	34.0	31.9	31.9	30.4	30.4
	Average	..	30.6	28.9	28.0	27.9	26.4	26.6	26.2	25.1	24.2	22.9	24.5

Index No. of cow.	Registered No.	Period since last calving.	Group 2, on intermittent water supply.					Interval week.	Group 2, on water continuously.				
			1st week.	2nd week.	3rd week.	4th week.	5th week.		1st week.	2nd week.	3rd week.	4th week.	5th week.
C 10	48	2 weeks.	41.1	39.2	35.3	31.8	28.9	31.7	28.7*	27.7	22.6	23.9	22.0
C 11	64	14	24.5	24.4	23.6	23.8	23.4	25.6	24.4	23.8	22.3	22.1	24.3
C 12	3	3	16.3	16.0	12.8	11.2	10.7	11.9	10.5	10.3	9.3	9.5	9.3
C 13	6	13	34.8	34.9	33.5	33.4	31.7	34.0	30.6	31.3	29.7	30.4	30.4
C 14	81	14	19.5	19.4	18.3	17.6	18.2	19.9	18.2	18.2	17.4	17.9	19.3
C 15	89	12	21.2	19.1	18.8	19.1	17.1	18.5	18.2	17.1	17.1	15.6	16.8
C 16	59	1	32.5	32.5	30.4	28.6	27.3	28.0	26.8	26.0	23.5	22.0	22.1
C 17	9	8	43.0	42.7	39.0	38.8	36.0	36.6	35.1	32.3	32.9	31.1	31.8
C 18	88	12	29.3	27.6	23.9	26.0	23.4	26.7	24.8	25.1	23.4	22.3	24.6
	Average	..	29.1	28.4	26.2	25.6	24.1	25.9	24.1	23.5	22.0	21.6	22.3

* Cow No. 48 was visibly affected by mastitis in this week. Probably this had affected the yield for two weeks previously.

plums, more especially damsons, had proved unexpectedly susceptible to damage, even when, from their general appearance, the trees appeared safe to spray. The results of trials instituted to obtain information on this matter are given in this part.

Field Trials.—These trials were carried out in association with the West Midland Province and the Agricultural Organizers of the following counties: Gloucester, Somerset, Wiltshire, and Worcester. The trials were distributed as follows:—

Gloucester .. 2 centres.	Wiltshire .. 2 centres.
Somerset .. 1 centre.	Worcester .. 2 centres.

Two brands of tar-distillate washes were used at 4, 8 and 10 per cent. strengths. The brands tested were Carbokrimp and Mortegg. The sprays were applied in the dormant season, during January and February.

Marking.—The system of marking employed was the same as used in 1925, and was based on an estimation made by the writers in the field. The method does not attempt to differentiate more finely than an estimated 10 per cent., but has the advantage over any quasi-statistical method in that it does not involve any errors due to preliminary sampling. 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, lesser intensities of attack being allotted corresponding smaller numbers.

The insects present were Apple Sucker, Aphis, Caterpillar, and Capsid Bug. Since all strengths of both washes, with the exception of one trial, gave complete control of Apple Sucker and Aphis, and thus supported the results of 1925, only the results for Caterpillar and Capsid Bug are tabulated.

In Table I, the results are given for the six centres. At the seventh centre, excessive rain, after the application of the washes, rendered the results unreliable. In this case, *Psylla* eggs hatched to a small extent, even after 10 per cent. Carbokrimp, and there was no essential difference between the result obtained by using 10 per cent. and that obtained by the use of 4 per cent.

TABLE I.

Caterpillar (mostly Tortrix)								Capsid Bug							
	*Bf.	Bt.	L.	P.	S.	W.	Average	Bf.	Bt.	L.	P.	S.	W.	Average	
Control .. 3	3	3	3	2	1		2.5	3	0	5	2	3	0	3.25	
10 per cent. Mortegg .. 0	0	0	0	0	0	0	0	1.5	-	0.5	0	1	-	0.75	
8 per cent. Mortegg .. 0	0	1	1	-	0		0.4	2	-	1	1	-	-	1.0	
4 per cent. Mortegg .. 0	1	2	1	1	1		1.2	3	-	4	1	1	-	2.25	
10 per cent. Carbokrimp 0	0	0	0	0	1	0	0.17	2	-	1	0	2	-	1.25	
8 per cent. Carbokrimp 0	0	1	1	1	1	0	0.5	3	-	2	1	1	-	1.75	
4 per cent. Carbokrimp 0	1	3	2	2	1		1.5	3	-	5	1	1	-	2.5	

* Bf. = Bransford; Bt. = Bratton; L. = Lydney; P. = Pinvin; S. = Stawell; W. = Warminster.

Effect of the Different Strengths of Washes.—Owing to the variation in the figure, indicating intensity of attack on the control trees, it is impossible to compare the effect of any one strength for two different centres. The results have therefore been averaged for the two insects concerned.

4 per cent. strength.—Although both washes obviously had some effect, both on Caterpillar and Capsid Bug, the reduction was negligible from a practical standpoint. These results confirm the conclusion drawn from the 1925 trials (5).

8 per cent. and 10 per cent. strengths.—In all four cases, where a comparison is possible, the figures indicate an appreciable superiority in killing-power for the higher strength.

Summary.—While admitting that such figures cannot be pressed too far, in view of the small attack on the controls and the practical difficulties inherent in county field trials, the fact that the figures are in every case in favour of the 10 per cent. cannot be ignored. In endeavouring to control serious pests such as Caterpillar and, more especially, Capsid Bug, such an additional killing-power, obtained by so small an extra expense, is worth employing. A comparison between the two brands, based on the same figures, shows that, in these trials, Mortegg has maintained the slight superiority previously shown for 1925.

from yield, the use of water-bowls possesses decided advantages in that they save labour and give a cleaner and more wholesome supply of water than is usually available. Most types of bowls are easy to work and keep clean, and the cows take to them readily.

In the opinion of those responsible for the experiment, therefore, the installation of water-bowls is desirable, if practicable, where clean, wholesome, and sufficient water is not available when the cows are turned out to drink.

It is probable that the experiments will be continued.

APPENDIX 1.

TABLE SHOWING TOTAL YIELDS WITH AND WITHOUT WATER-BOWLS.

Monmouth Agricultural Institution (5 cows in each group).

With bowls.		Without bowls.	
lb.		lb.	
Group I ..	4,356½	Group II ..	3,682½
Group II ..	2,902	Group I ..	3,275½
	<u>7,258½</u>		<u>6,957½</u>

Net increase with bowls, 300½lb.

Cheshire School of Agriculture (9 cows each group).

With bowls.		Without bowls.	
lb.		lb.	
Group I ..	8,938	Group II ..	8,401½
Group II ..	7,156½	Group I ..	7,747½
	<u>16,094½</u>		<u>16,148½</u>

Net decrease with bowls, 54lb.

Wales Farm, East Sussex (5 cows each group).

With bowls.		Without bowls.	
lb.		lb.	
Group A ..	7,711	Group B ..	7,742½
Group B ..	7,398½	Group A ..	7,136
	<u>15,109½</u>		<u>14,878½</u>

Net increase with bowls, 231½lb.

Somerset Farm Institute (5 cows each group).

With bowls.		Without bowls.	
lb.		lb.	
Group I ..	4,778½	Group II ..	4,223½
Group II ..	3,597	Group I ..	4,121½
	<u>8,375½</u>		<u>8,345</u>

Net increase with bowls, 30½lb.

Total net increase with bowls, 508½lb.

FURTHER EXPERIMENTS WITH TAR-DISTILLATE WASHES

A. H. LEES, M.A. (*Research Entomologist*),
and

L. N. STANILAND, A.R.C.Sc., D.I.C. (*Advisory Entomologist*),
*Agricultural and Horticultural Research Station, Long Ashton,
Bristol.*

DURING recent years, various accounts [(1) to (8)]* of the action of tar-distillate washes have been published, indicating the prominence which such washes now enjoy. In 1921 (3) the first sample of Carbokrimp was brought into this country by a member of the Long Ashton staff, and small-scale trials with this sample soon proved its egg-killing powers. Since then many other trials, both on a small and large scale, have been carried out. After the first proof that this fluid actually possessed egg-killing powers, attention was concentrated on the testing of various brands [(3) and (5)]. During the course of these trials it became obvious that there were certain points arising from them on which further information was greatly needed.

It became clear, from the results obtained by various workers, that, approximately, 5 per cent. of a good wash was sufficient for the control of aphids and apple sucker under good conditions. There was not sufficient information available, however, to show the effect of higher strengths on such resistant eggs as those of capsids and winter moths, although field experiments (5) had already proved that 8 per cent. strength of wash for this purpose was distinctly better than 4 per cent. The first part of this paper therefore deals with the results of trials specifically set out to test the advantages, if any, of 10 per cent. over 8 per cent. strengths.

It was soon found, too, in working both small-scale and field trials, that factors were present which caused unexpectedly poor results. A suspicion arose that exposure after spraying was one cause of divergence from the expected results. The rainfall encountered was, obviously, a possible factor, and experiments carried out to test this point are set out in the second part of the article.

The third part deals with the time at which plums and black currants become susceptible to damage from the use of these washes. It had been found in extensive field trials that

* The figures indicate references at the end of the article.

The Effect of Rain following the Application of Tar-Distillate Washes.—In the work on tar-distillate washes, carried on from year to year at Long Ashton, it has been found that the results were influenced not only by the different brands of wash used but, also, by some other unknown factor or factors. In the season of 1924, for instance, nearly all the brands tried gave very good results, while, in 1925, the same brands gave poor results. In some cases, it is true, this divergence was due to the fact that some brands were not up to the previous year's samples, as shown by their behaviour in field trials elsewhere; but at least two brands were still, apparently, up to the previous year's samples. The comparative figures for 1924 and 1925 for one of the better washes may be quoted here. Thus, at a 10 per cent. strength of wash for 1924, the percentage hatch of treated aphid eggs (*A. pomi*) was 0·0 against 12·0 per cent. for 1925. At 5 per cent. the figures were ·55 against 20; for 2½ per cent., 3 against 37; and for 1 per cent. strength, 27 against 58. The season of 1924 seemed, therefore, to be far more favourable than 1925 for the action of the washes. Indeed, 1925 was so bad that all the brand tests, then being conducted at Long Ashton, proved valueless, the percentage hatches being not essentially different from the controls.

In 1926, an attempt was made to test, specially, the effect of spraying conditions in respect of exposure to rain. For this purpose small apple trees covered with aphid eggs (*A. pomi*) were potted up and sprayed with Carbokrimp at 5 per cent. and 2½ per cent. strengths. They were all thoroughly dried under cover in the insectary, where ventilation and temperature were almost the same as outside, but where they were protected from rain. After 24 hours' drying, they were submitted to various treatments, some in a very moist, cool greenhouse and some outside. One or two pots were sprayed with water before they were properly dry, these not being given the preliminary drying treatment in the insectary, and some had extra sprayings with water after they were dry, in addition to normal exposure outside. In this manner, the effects of dry warm air, average dry cool air, and a very moist cool air, on the hatching of the eggs, were tested, all of them being protected from actual rain. Table II shows the results obtained from the various treatments. The number of eggs used were not actually counted, but were estimated by a method based on the counting of six sub-multiple samples. Owing to errors thus introduced, one control figure appears as more than 100 per cent. hatch.

TABLE II.—PERCENTAGE HATCH OF *A. pomi* EGGS AFTER CARBOKRIMP.

TREATMENT	5 per cent. strength		2½ per cent. strength	
	No. of eggs	Percentage hatched	No. of eggs	Percentage hatched
Warm greenhouse ..	1,800	·4	340	11·4
Moist " ..	986	1·1	1,120	17·8
" " ..	696	·3	394	20·0
Insectary " ..	360	1·1	148	18·9
" " ..	853	8·1	320	17·5
Outside ..	546	34·1	1,600	41·8
" " ..	626	19·5	1,166	50·4
" " ..	310	24·2	606	100·0
" " ..	693	42·0	613	63·8
" " ..	320	30·0	1,413	51·6
" " ..	493	25·7	193	22·8
" " ..	673	11·9	660	61·8
" " ..	416	1·2	353	32·3
Extra spraying with water	246	50·4	306	29·1
" " " "	296	18·6	5,566	33·2
Sprayed " with " water				
before dry ..	646	47·3	266	53·7
" " " "	2,566	24·5	573	73·6
Control ..	210	108		
	103	58		
	1,337	27·4		

It is clear that those eggs which were given protection from rain hatched in much smaller numbers than those exposed to rain, whether the 5 per cent. or 2½ per cent. strength be considered. For 5 per cent. strength, the average hatch of protected eggs is 2·5 per cent. against 23·6 for the unprotected, and, for the 2½ per cent. strength, the average hatch for protected eggs is 17·1 per cent. against 53·6 for the unprotected. There seems little doubt, therefore, that the effect of protection is to increase greatly the effectiveness of the wash. The air temperature and humidity in the case of the protected plants seemed to make very little difference, though there is a suggestion that the higher temperature and drier air of the warm greenhouse caused a slight reduction in hatch at the 2½ per cent. strength. The possible influence of moisture, as distinguished from rain, seems to be ruled out by the low hatch obtained in the moist greenhouse treatment. A fairly constant relative humidity of 85 per cent. was here secured, the result tending to show that the action of the spray is not a desiccation effect.

The evidence from the measurements of rainfall occurring in the month of February, during the years 1924, 1925 and

1926, supports the view that the relative failure of the wash in the latter two years was due to washing by rain. The figures are given in Table III.

TABLE III.—RAINFALL IN INCHES IN FEBRUARY AT LONG ASHTON.

Date	1924	1925	1926	Date	1924	1925	1926
February				February			
1	—	.26	.05	16	—	—	.20
2	—	.12	.05	17	—	—	.62
3	—	—	.11	18	.07	.02	.06
4	—	.43	.06	19	—	.03	.02
5	—	.07	.06	20	—	—	.015
6	—	.18	.03	21	—	.03	.005
7	—	.01	.02	22	—	—	.025
8	.13	.06	.01	23	—	.15	.01
9	.02	.13	—	24	.09	.33	—
10	.20	.60	—	25	—	.76	—
11	—	.35	—	26	—	.16	—
12	—	.04	—	27	.01	.56	.05
13	—	.12	.005	28	—	.12	—
14	—	—	.32	29	.02	—	—
15	.15	.12	.19				
Total					.69	4.65	1.91
No. of rain days					8	22	20

The treatments in all the years were given either towards the end of January or early in February, and the February rainfall therefore represents, in these cases, the rainfall most likely to affect the hatching. The differences in the wet Februarys of 1925 and 1926 are well marked, both in respect of total amounts and also of rain days.

Further evidence, supporting the view that rainfall following spraying hinders the proper action of the spray, has been obtained from two other sources. County trials in the Bristol district for 1926 gave, in certain cases, somewhat erratic results. In one case, especially, no difference could be detected in the action of two standard washes at 4, 8 and 10 per cent. strength. Even *Psylla* had hatched out to some extent following a 10 per cent. application. Inquiry revealed the fact that application had been made in showery weather.

In another case, in connexion with an experiment at Long Ashton, on the damage effect of tar-distillate washes on plums, described in the third part of this paper, *Aphis* had hatched out to some extent after an application of 8 per cent. strength on January 19 and February 2, and to a decidedly larger extent after an application of 6 per cent. on February 1. Various casual observations on commercial plantations also add support to this view.

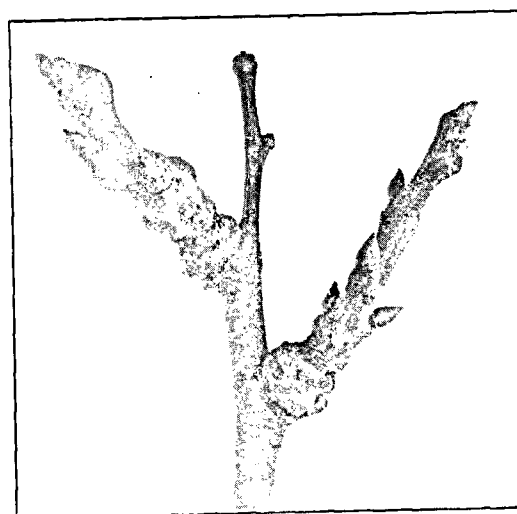


FIG. 1.—Victoria.

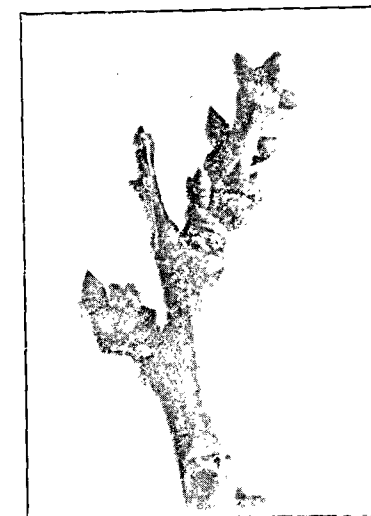


FIG. 2.—Czar.



FIG. 3.—Prolific.

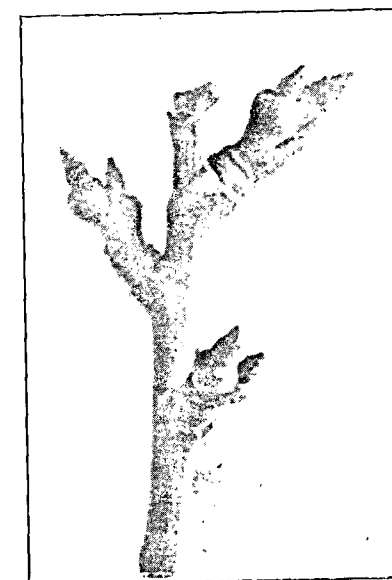


FIG. 4.—Monarch.

Condition of Buds on Plums, January 19, 1926.

BB

998-C

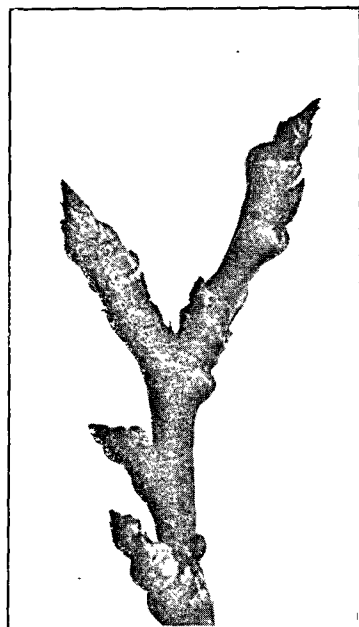


FIG. 5.—Prolific.

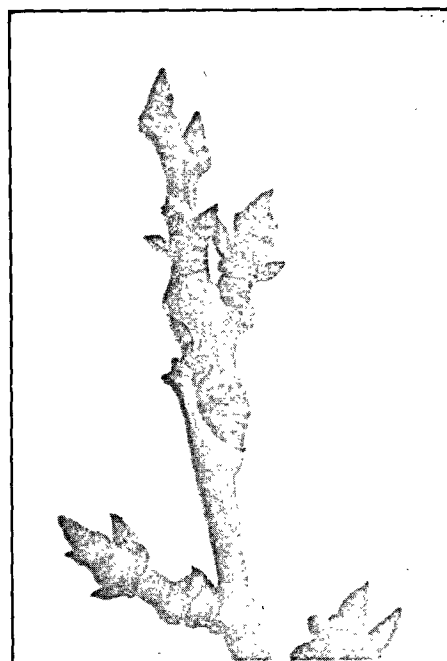


FIG. 6.—Monarch.

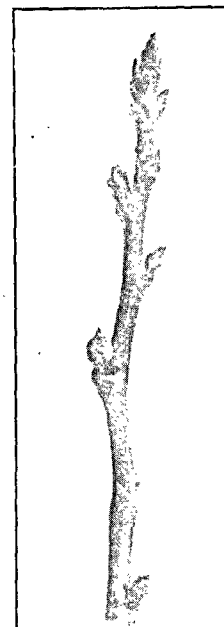


FIG. 9.—Monarch.
(Feb. 11.)



FIG. 10.—Czar. (Feb. 11.)

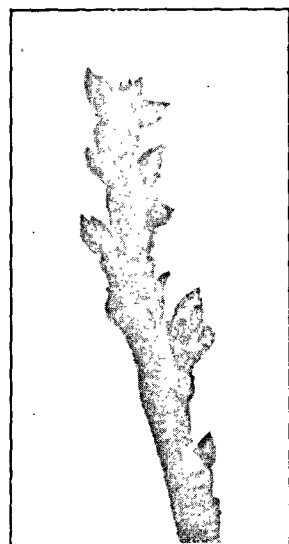


FIG. 7.—Czar.



FIG. 8.—Victoria.

Condition of Buds on Plums, February 1, 1926.

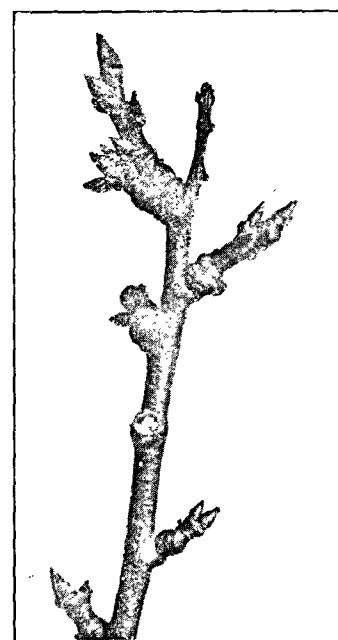


FIG. 11.—Prolific. (Feb. 11.)

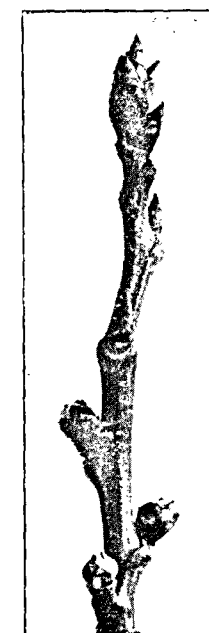


FIG. 12.—Monarch.
(Feb. 17.)

Condition of Buds on Plums, February 11 and 17, 1926.

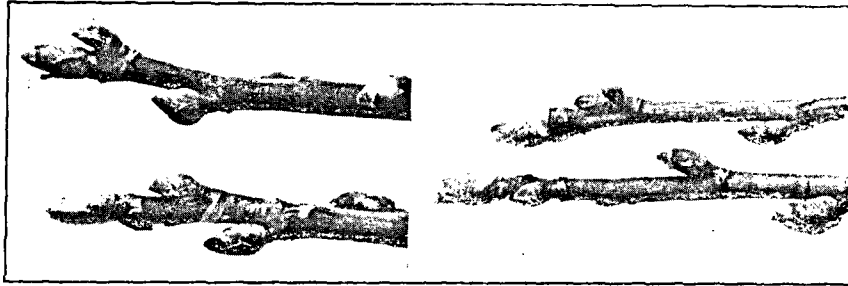
Fig.
14Fig.
15

FIG. 14.—Condition of Buds on Black Currant (Seabrook's Black), Feb. 17, 1926.

FIG. 15.—Ditto. Feb. 24, 1926.

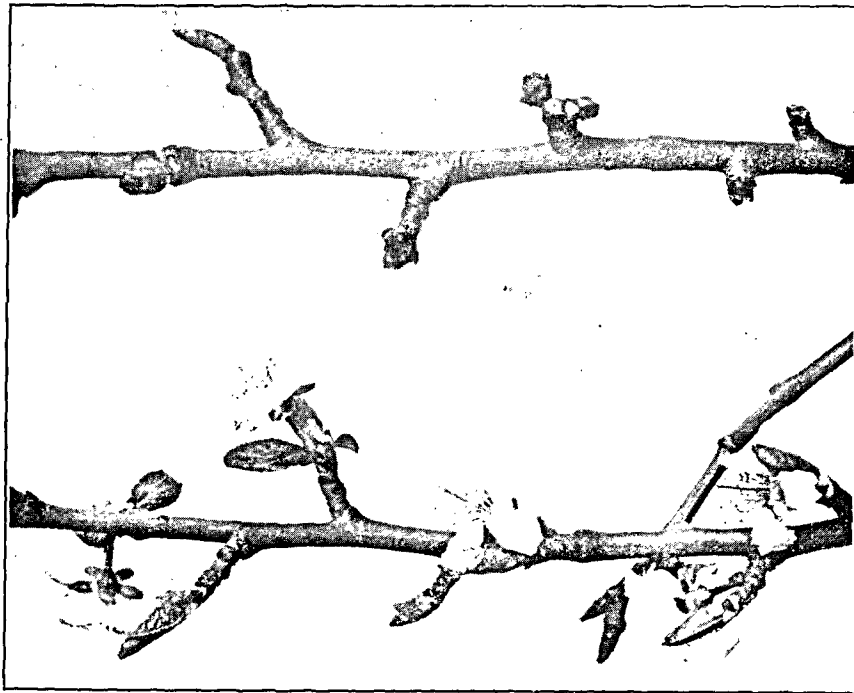


FIG. 13.—Illustrating character of damage by too late application of tar-distillate wash to Plums.

Left-hand specimen sprayed during "safe" period: undamaged.
Right-hand specimen sprayed during "unsafe" period: flower buds destroyed, wood buds severely retarded.

Conclusion.—The evidence, from all sources, strongly suggests that rain following the application of a tar-distillate wash, even if dry weather follows for 24 hours, causes a lowering of the effectiveness of the wash. This action does not appear to be due to the failure of any possible desiccation effect but to the direct washing action of rain. There is no evidence yet to hand to show what period of drying is necessary for effectiveness nor how much rain can be endured with impunity. These results suggest that there is still room for improvement in tar-distillate washes in the direction of greater resistance to washing by rain, and it is hoped to initiate experiments for removing this weakness.

Time of Application in Relation to Bud Damage.—Plums.—Four varieties of plums were selected as suitable for testing their susceptibility to damage by tar-distillate washes. The varieties were Victoria, Czar, Monarch, and River's Early Prolific, the trees being 10 years old. The spray used was Carbokrimp, the strength being 8 per cent. One tree of each variety was sprayed on the following dates: January 19, February 1, February 11, February 19, February 24, and March 4, 1926.

The trees sprayed on February 1 were, owing to a mistake, sprayed at 6 per cent. strength. Accordingly one tree of each variety was sprayed on February 2 at the 8 per cent. strength.

A typical sample of the shoots on each tree was taken at the time of spraying and photographed. By this means a record of the state of the bud at the various times of spraying was obtained.

The amount of damage was judged by eye. Where all the flower buds were killed 10 marks were given, as in Fig. 13; where no damage was visible the number 0 was assigned. Intermediate amounts of damage were given corresponding intermediate marks.

Results.—The trees were examined for damage on March 24, 1926. The results are expressed in Table IV.

TABLE IV.—TAR-DISTILLATE SPRAY DAMAGE TO PLUMS, 1926.

	Jan. 19	Feb. 1	Feb. 2	Feb. 11	Feb. 17	Feb. 24	Mar. 4
Czar ..	0	0	3	7	7	7	10
Prolific ..	0	0	1	5	6	8	10
Monarch ..	0	0	1	1	7	10	10
Victoria ..	0	0	7	8	9	10	10

The condition of the buds in the four varieties at the various times of spraying is shown in Figs. 1 to 12. Spraying on January 19 with 8 per cent. strength (Figs. 1-4) produced no damage. On February 1, a 6 per cent. strength was employed by mistake and no damage followed (Figs. 5-8). On February 2, the mistake was rectified by the use of an 8 per cent. strength on four more trees, and damage followed as the result of the higher strength. It was most marked in Victoria, though the photograph taken at spraying time (Fig. 8) would strongly suggest that the stage was a safe one. Czar (Fig. 7) showed slight damage, but the buds had swollen a little at the time. Prolific and Monarch showed only a trace of damage. It is remarkable that an increase of 6 to 8 per cent. in the strength of the wash should have caused so great an increase of damage when applied at practically identical dates. On February 11, damage was serious on Czar and Prolific, but on Monarch there was still only a trace of injury. This was unexpected in view of the swollen condition of its buds when sprayed (Fig. 9).

It is clear from the above that the calendar date affords no safe guide for the time of spraying. On the other hand, this trial shows, rather unexpectedly, that the condition of the bud, as judged by the eye, also fails in this respect, though it is admittedly a more satisfactory method than the calendar date. Some other test, applicable under field conditions, would appear to be desirable.

Black Currants.—The variety of black currant used was Seabrook's Black. Four bushes were sprayed on February 11, February 17, February 24, and March 4, 1926, respectively, the strength of Carbokrimp being 10 per cent. in each case. Samples of the buds were taken and photographed as in the case of the plums. The bushes were examined on March 24, 1926.

Results.—The bush sprayed on February 17 showed no damage, while the bush sprayed on February 24 was slightly checked. It will be seen from the photographs that the bush sprayed on February 17 had buds distinctly swollen (Fig. 14), while the buds of the bush sprayed on February 24 (Fig. 15) had opened and were showing green tips.

From these trials it is clear that the variety of black currant used is highly resistant to tar-distillate washes. It must not, however, be assumed that a similar condition of bud in other varieties will, necessarily, show equal resistance to tar-distillate washes, since the tightness of bud differs considerably with the variety.

Conclusions.—(1) In field trials with Mortegg and Carbokrimp, at strengths of 4, 8 and 10 per cent., the insect eggs present being Psylla, Aphis, Tortrix, Small Winter Moth and Capsid Bug :—

- (a) Psylla and Aphis were controlled effectively by all three strengths.
- (b) The 10 per cent. strength for both washes gave a small but consistent improvement over the amount of control obtained by the 8 per cent. strength on Caterpillar and Capsid Bug.
- (2) The effect of considerable rain following the application of 5 and 2½ per cent. Carbokrimp, after preliminary drying, was to lower the effectiveness of the spray, both in small-scale and field trials.
- (3) The time at which spraying with Carbokrimp became dangerous on four varieties of plums depended :—
 - (a) On the strength employed.
 - (b) On the condition of the buds. This condition could not be determined by the calendar dates, and only to some extent by the appearance of the bud to the eye. Some other method applicable in the field was necessary.
- (4) The time at which a 10 per cent. strength of Carbokrimp became dangerous to Seabrook's black currant was shown to be after the buds had already swollen distinctly.

REFERENCES.

- (1) Lees, A. H. (1922) Egg-Killing Washes; *Ann. Rept. Agric. and Hort. Res. Sta., Long Ashton*.
- (2) *Id.* (1923) Egg-Killing Washes; *Jour. Pom. and Hort. Science*, III, p. 174.
- (3) *Id.* (1924) *Id.*: *Id.* IV, p. 104.
- (4) Lees, A. H., and Briton-Jones, H. R. (1924) Plum Aphis and Brown Rot Control: *Id.* IV, p. 196.
- (5) Lees, A. H., and Staniland, L. N. (1925) Tar-Distillate Wash Trials in the Bristol Province: *Ann. Rept. Agric. and Hort. Res. Sta., Long Ashton*, 1925.
- (6) Petherbridge, F. R., and Dillon-Weston, W. A. R. (1926) Trials of Tar-Distillate Washes in East Anglia: *This JOURNAL*, July, 1926.
- (7) *Id.* (1926) *Id.*, October, 1926.
- (8) Jary, S. G. (1926) Trials of Tar-Distillate Washes in the West Midlands: *Id.*, November, 1926.

THE CULTIVATION OF SHALLOTS AND LEEKS

SHALLOTS.

Soil and Preparation.—Shallots are not cultivated commercially to any great extent in England, but are grown fairly extensively in gardens and allotments. They require an open site and thrive best in a well-cultivated, well-drained, rich soil containing plenty of organic manure. The soil should be dug or ploughed in the autumn or early winter, and should be left rough during the winter to allow the frost to "weather" it and to reduce it to a good friable condition before planting time arrives.

Manuring.—A dressing of farmyard manure should be applied in the autumn. This should be either ploughed in at the rate of 20-25 tons per acre (in the case of field cultivation) or dug in at the rate of three barrow-loads per square rod (for garden cultivation).

Should farmyard manure not be obtainable, the grower must rely on artificial manures, a suitable dressing of which would be 1 lb. sulphate of ammonia, 3 lb. superphosphate and 1½ lb. sulphate of potash per square rod. This dressing should be applied immediately before planting and should be raked or harrowed in. On a clay soil, the sulphate of potash could be reduced.

Planting.—Shallots can be grown from seed, but this is not the general gardening practice and is not recommended. The ordinary method of culture is to plant "bulbs" or "cloves." The best type of bulb for planting is one of fair size, conforming to type, and, above all, sound and healthy. These are planted when the soil is in an open, workable condition in February or March, the earlier the better. They can be planted much earlier provided the soil is in suitable condition.

In field cultivation, a corn drill is sometimes used for marking out the rows; the planters follow the drill and plant the bulbs in the rows thus marked out.

The rows should be 9-12 in. apart and the bulbs should be planted 6-9 in. apart in the rows. They are simply pressed into the soil by hand, leaving only the tips showing above ground.

Subsequent Cultivation.—This consists of keeping the surface soil stirred by hoeing, in order to keep down weeds and to conserve the moisture in the soil underneath.

When the young bulbs are nearly fully developed—i.e., some time in June—it is advisable to draw the soil slightly away from the plants. This assists ripening.

Harvesting.—The yellowing of the leaves in July will indicate that the crop is ready for lifting. The bulbs should be pulled up by hand on a fine day and spread out in rows on the ground to ripen off. They should be left thus for several days to allow the tops to become thoroughly dried out. In gardens they may be spread out on boards or on sheets of corrugated iron to keep them off the ground if there is any risk of rain.

Storage.—Shallots should be stored in a light, dry, airy shed. They should be kept in shallow boxes if possible, but if these are not available they may safely be stored in a heap, not more than 18 in. deep, on the floor of the shed. The floor, however, must be thoroughly dry.

Shallots may be kept in this way through the winter and until the following March.

Varieties.—The two types most commonly grown are the Jersey and the Russian. The latter is a red-skinned shallot, grows to a greater size than the former, and is the more suitable for garden cultivation. The Jersey, being the smaller, is better for commercial culture for the pickle trade, which demands small bulbs.

Insect Pests.—Shallots are not very liable to attack by insect and allied pests, the only one which is responsible for any serious loss being the Onion Fly (*Phorbia cepetorum*, Meade), of which a full account is given in the Ministry's Leaflet No. 31.

The flies appear in early summer and lay their eggs on or close to the plants. The eggs give rise to maggots, which tunnel in the bulbs and destroy them. Three broods usually occur during the season. In districts where the fly is prevalent the rows should be treated with some deterrent to prevent the flies from laying their eggs in the neighbourhood of the plants.

Fungus Diseases.—Shallots may suffer from any of the diseases to which the onion is subject. The chief of these are Downy Mildew, White Rot, and Smut, fully described in the Ministry's Leaflets Nos. 178, 345 and 365 respectively. With regard to the first-named, it has recently been proved that the

mycelium of the mildew may hibernate in the bulbs. On planting such infected bulbs, the mycelium grows up into the foliage; and, under suitable weather conditions, the fungus grows out from the surface of the leaves and produces myriads of spores, which serve to spread infection to any variety of onions which may be near.

LEEKES.

Field Cultivation.—In commercial practice leeks usually follow a crop of spring cabbage or spring greens which received a heavy dressing of manure and was cleared off the land about the end of May.

Raising the Plants.—The earliest batch of plants is raised in cold frames, from seed sown in January. Plants for the main crop are raised in a seed-bed in the open from seed sown in March or April, either broadcast or in rows about 6 in. apart.

In some districts the seed is drilled in rows in the field in February or March. Where this method is practised, the seed is drilled thinly and the plants are not subsequently thinned out.

Planting Out.—When the plants in the seed-bed are about 6 in. high, they are ready for transplanting into the field. The first lot of plants from the cold frames should be ready for transplanting in May.

The plants are taken from the seed-bed, the long roots trimmed with a knife, and the tops of the leaves cut off square, leaving about 4 in. of stem. The plants should be laid neatly in flat boxes with the tops all pointing the same way, and taken to the field in the boxes for planting out. They should be planted 1-2 in. deep in holes made with a stout dibber, and in rows 12-15 in. apart, allowing 9-12 in. between the plants. In the north of England it is common to allow only 5-6 in. between the plants.

After planting, the crop should be rolled with a light flat roller to tighten the soil round the roots.

Subsequent Cultivation.—This consists of hoeing, to keep the crop free from weeds and the surface soil loose, thus conserving the moisture underneath. Horse-hoes may be used for the first hoeing, after which hand-hoes should be employed.

Manuring.—It is bad practice to give the land a dressing of farmyard manure immediately before a leek crop, and, as the leeks generally follow a crop of greens which was heavily manured in the preceding season, manure is not normally required. If, however, the crop appears to be backward, a

top-dressing of 1 cwt. nitrate of soda or sulphate of ammonia per acre will be beneficial.

Harvesting.—The first leeks should be ready for sale about the beginning of September, and lifting may be done throughout the autumn and winter as the leeks are required.

When there is a risk of the ground becoming frozen during winter, it is advisable to lift several days' supply of leeks at a time, and to protect them by a covering of leek trimmings, sacking, or other material.

In districts where the crop is grown from seed drilled in the field, instead of from transplanted seedlings, it is usual to lift alternate rows first. When these have been disposed of, the remainder of the crop is marketed.

Marketing.—Leeks are usually sent to market tied with a willow rod round the leaves, in flat fan-shaped bunches, the bunching being done in the field as the crop is lifted. At the beginning of the season, when the leeks are small, the bunches contain about twelve leeks, the number being reduced to about six as the leeks become larger. The best leeks should be placed in the centre of the bunch. After bunching, the ends of the leaves should be cut off in order to give the bunch a neat appearance. If there are any small leeks, they should be bunched in the same way and marketed as "seconds."

In some markets the demand is for washed leeks, in which case the bunches are taken to the washing shed, where they are washed free of soil. As the bunches are taken from the water they should be placed on a draining board to dry.

Varieties.—(a) *Early*: Giant Carentan.

(b) *Main Crop*: Musselburgh, Lyon.

The Musselburgh is probably the most popular variety.

Garden Cultivation.—*Soil and Preparation.*—Leeks can be grown successfully in any fertile, well-drained garden soil, but they thrive best in a fertile soil, rich in organic matter. They are often planted on land which has just been cleared of another crop, such as early potatoes or early peas, when little soil preparation is usually required, since the soil will probably be in a friable condition. It is important, however, that there should be a good depth of well cultivated soil before the seedlings are planted.

Raising the Plants.—For ordinary garden or allotment purposes the seed should be sown thinly in the row in a seed bed in the open in mild weather during March.

Planting Out.—Planting out takes place in May or June. When the seedlings are large enough to handle, the most forward may be transplanted into any available piece of ground. As more ground becomes vacant more seedlings can be taken from the row and planted out. Before taking out any plants the row of seedlings should be watered thoroughly in order to soften the ground and to permit the removal of the plants with as little damage as possible.

In transplanting, a stout dibber is used for making holes, 6 or 7 in. deep, in rows 15 in. apart, and 8 or 9 in. between the plants. The plants are simply dropped into the holes and a little soil is put in to cover the roots.

Transplanting should, if possible, be done in showery weather, but if the soil is dry it is an advantage to water the plants in.

Manures.—For the successful cultivation of leeks, it is essential that the land should be in good heart. Farmyard manure should not be applied immediately before a leek crop, nor should it be required when the leeks follow a crop of early potatoes or peas.

After the plants are established, an application of artificial manure will usually be found to give good results. This should consist of 1 lb. sulphate of ammonia or nitrate of soda per square rod, and it should be applied in two doses, the first soon after planting, and the second about a fortnight later.

On less fertile soils, this dressing should be supplemented by 3 lb. superphosphate and 1½ lb. sulphate of potash per square rod. These fertilizers should be applied to the soil before planting.

Subsequent Cultivation.—This consists chiefly of hoeing, which fills up the holes round the stems of the plants, keeps down weeds, and produces a soil mulch which conserves the moisture in the soil underneath.

As growth proceeds the soil should be drawn up lightly round the stems. This should be done in two operations, and has the effect of increasing the length of blanched stem.

Gathering the Crop.—Leeks are essentially a vegetable for use during winter. The first plants should be ready about the beginning of September, and the crop is lifted and used as required throughout the winter.

Insect Pests.—Leeks are frequently attacked by the Onion Fly (*Phorbia cepetorum*, Meade), which has at times caused serious losses. This fly appears in spring and early summer

and lays its eggs on or near the young plants. The maggots which emerge from the eggs enter the root of the plant and feed in the bulb, becoming full-grown in about three weeks. They pupate in the soil, the adult flies emerging in about seven days. There are apparently three main broods during the season.

In districts where the fly is prevalent, the crop should be planted as early as possible to obtain vigorous plants before the flies appear, as they will then be less liable to injury. The plants may also be dressed with some deterrent mixture. Formulæ for such deterrents are given in the Ministry's Leaflet No. 31, where a full account of the pest will be found.

Leeks are also attacked by the Stem Eelworm (*Tylenchus dipsaci*, Kühn), which is described in Leaflet No. 46. The leaves of the attacked plants become swollen and twisted, and the whole plant gradually rots. It is necessary to avoid growing leeks or onions for several years on land that has become infested with eelworms.

Fungus Diseases.—In the north of England, particularly, leeks are sometimes subject to attacks of Rust, caused by the fungus *Puccinia porri*. Spots, scattered or arranged more or less in rows, at first yellowish or reddish yellow, occur on the foliage. These consist of pustules of spores, and the latter, on distribution, may give rise to similar spots on healthy foliage. Later, darker coloured blackish-brown spore-pustules are developed and the spores from these are highly resistant and enable the fungus to persist over winter. The disease is difficult to control, but the removal and burning of affected leaves or plants in the early stages of attack and the avoidance of planting leeks in the same ground in successive years may be recommended where practicable.

Like onions, leeks may suffer from the so-called White Rot disease caused by *Sclerotium cepivorum*. This is fully described in the Ministry's Leaflet No. 345.

Onion Smut, due to *Urocystis cepulæ*, also attacks leeks. This serious disease is scheduled under the Destructive Insects and Pests Acts, and its occurrence in places in England and Wales must be notified immediately, either direct to the Ministry of Agriculture or to one of its Inspectors. Full particulars of the disease will be found in the Ministry's Leaflet No. 365.

* * * * *

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1927

Produce of Crops.—Preliminary statement showing the estimated total produce and yield per acre of the corn, hay and root crops in England and Wales in 1927, with comparisons for 1926, and the average yield per acre of the 10 years 1917-26, is given below.

CROPS	ESTIMATED TOTAL PRODUCE		ACREAGE		ESTIMATED YIELD PER ACRE		AVERAGE OF THE TEN YEARS, 1917-26
	1927	1926	1927	1926	1927	1926	
	000's of cwt.	000's of cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Wheat ..	28,455	26,073	1,635,929	1,592,207	17.4	16.4	17.2
Barley ..	17,246	18,326	1,048,886	1,147,647	16.4	16.0	14.8
Oats ..	26,874	29,807	1,750,637	1,863,452	15.3	16.0	13.7
Mixed							
Corn ..	1,633	1,761	108,328	113,510	15.1	15.5	14.3
Beans ..	3,263	3,166	189,864	201,703	17.2	15.7	15.4
Peas ..	1,011	1,064	76,815	72,699	13.2	14.6	13.8
	000's of tons	000's of tons					
Seeds							
Hay* ..	2,110	2,352	1,586,173	1,577,789	26.6	29.8	28.2
Meadow							
Hay† ..	4,157	4,771	4,317,347	4,358,355	19.3	21.9	20.8
Potatoes	3,055	2,763	513,947	499,410	Tons	Tons	Tons
Turnips					5.9	5.5	6.1
& Swedes	8,643	10,983	714,599	766,626	12.1	14.3	12.4
Mangolds	5,457	7,120	304,580	338,165	17.9	21.0	19.3

* Hay from Clover, Sainfoin, and Grasses under rotation.

† Hay from Permanent Grass.

Note.—Although the adverse weather conditions which prevailed over most of the country both prior to and during harvest impaired the quality and condition of the grain, the principal cereal crops appear to be giving better yields than was at one time anticipated. On the other hand, the yields of root crops are below average, which was to be expected in consequence of the dry conditions during the sowing period and the excessive wet and lack of sunshine during the summer and autumn months.

Corn Crops.—The yield per acre of WHEAT is estimated at 17.4 cwt., which is about 1 cwt. per acre above last year's figure, and slightly above the average of the previous 10 years. The best yields were obtained in the eastern counties, where

they are nearly $\frac{3}{4}$ cwt. above average, and over average crops were also obtained in the north-eastern and east midland counties, in the West Riding of Yorkshire and in North Wales, but over the remainder of the country yields were generally under average. The estimated total production is 28,455,000 cwt., which is 2,382,000 cwt. more than in 1926, but the area under this crop this year was 44,000 acres greater than last year.

Every division of the country, with the exception of South Wales, had over average crops of BARLEY, the best crops being obtained in the eastern, north-eastern and east midland divisions. The yield per acre for England and Wales is estimated at 16.4 cwt., this being nearly $\frac{1}{2}$ cwt. per acre more than in 1926, and over $1\frac{1}{2}$ cwt. in excess of the average for the ten years 1917-1926. The total production on an acreage smaller by 99,000 acres is only 17,246,000 cwt., or 1,080,000 cwt. less than last year, and is the smallest crop ever recorded.

The yield per acre of OATS is estimated at 15.3 cwt. per acre, as compared with 16.0 cwt. in 1926, and in view of the heavy reduction of 113,000 acres under this crop this year the total production of 26,874,000 cwt. is 2,933,000 cwt. below last year's total. The yield per acre is, however, nearly $1\frac{3}{4}$ cwt. above the average for the previous 10 years, practically every county having over average yields.

MIXED CORN has a yield of nearly 15.1 cwt. per acre, or about $\frac{1}{2}$ cwt. below last year's yield. This is, however, $\frac{1}{4}$ cwt. above average. The total production is estimated at 1,633,000 cwt., which is 128,000 cwt. less than last year on a smaller acreage.

BEANS appear to be a better crop than previously forecasted, and the yield per acre is estimated at nearly $17\frac{1}{4}$ cwt., which is $1\frac{1}{2}$ cwt. more than last year, and $1\frac{3}{4}$ cwt. above average, the total production being 3,263,000 cwt., as compared with 3,166,000 cwt. in 1926.

PEAS have not proved so satisfactory as was anticipated, and in spite of the increased area of 4,000 acres this year the estimated total production of 1,011,000 cwt. is 53,000 cwt. below the production in 1926. The yield per acre over the whole country is nearly $13\frac{1}{4}$ cwt., or a little more than $\frac{1}{2}$ cwt. below average.

Hay.—Owing to the wet weather the hay harvest was unduly protracted, and comparatively little was secured in good condition, while a certain amount was never even carted.

The yield of SEEDS HAY is estimated at a little over $26\frac{1}{2}$ cwt. per acre, or $1\frac{1}{2}$ cwt. below average, and as much as $3\frac{1}{4}$ cwt.

per acre less than in 1926. Except in North Wales, every division of the country had under average crops. The total production of 2,110,000 tons is 242,000 tons less than the 1926 crop, notwithstanding an increased area of 8,000 acres this year.

The estimated yield per acre of MEADOW HAY is $19\frac{1}{4}$ cwt. per acre, as against an average of about $20\frac{3}{4}$ cwt. and nearly 22 cwt. last year. Nearly all English counties had under average yields, but over average yields were obtained in a number of Welsh counties. The production was 4,157,000 tons, or 614,000 tons less than in the previous year, while the total production of all hay amounted to 6,267,000 tons, and was 613,000 tons below the average of the 10 years 1917-26.

Potatoes.—The estimated yield per acre of potatoes is slightly in excess of previous forecasts, and this crop is now estimated at 5.9 tons per acre, or about 3 cwt. below average, and nearly $\frac{1}{2}$ ton better than in 1926. Of the more important potato-growing counties Lancashire, Cheshire, Isle of Ely, and the Lindsey division of Lincoln had below average yields, but in the Holland division and in Essex above average yields were obtained. The total production over the whole of England and Wales is estimated at 3,055,000 tons, as compared with 2,763,000 tons in 1926, and 3,214,000 tons in 1925.

Roots.—As anticipated earlier in the year, the estimated yield per acre of TURNIPS AND SWEDES is slightly above 12 tons, or about $\frac{1}{2}$ ton below average, and $2\frac{1}{4}$ tons less than in 1926. Over the whole country the yield of this crop is very variable, Wiltshire being over 3 tons per acre above average, while Yorkshire (North Riding) and Cumberland are respectively $3\frac{1}{2}$ and $4\frac{1}{4}$ tons below average. The total production is 8,643,000 tons, or 2,340,000 tons less than in 1926.

MANGOLDS are also a light crop, the estimated yield per acre of slightly under 18 tons being $1\frac{1}{2}$ tons below average and nearly $3\frac{1}{4}$ tons less than the high yield of last year. Most counties return under average crops. The estimated total production is 5,457,000 tons, or 1,663,000 tons less than in 1926, and is the lowest recorded since 1896.

Estimates which have been obtained of the yield of SUGAR BEET suggest that the yield per acre of washed and topped roots will be below that of last year, and will probably average nearly 8 tons per acre. The acreage under the crop this year was 222,500 acres, as compared with 125,800 acres in 1926, and

the total production is likely to be about 1,700,000 tons, or about 610,000 tons greater than last year. About three-fourths of the total crop is grown in the eastern and north-eastern counties.

* * * * *

NATIONAL INSTITUTE OF AGRICULTURAL BOTANY

TRIALS OF SPRING BARLEY AND SPRING OATS, 1925-1927

THE National Institute of Agricultural Botany, with the co-operation of the Ministry of Agriculture, the Norfolk Agricultural Station, the Lord Wandsworth Agricultural College, Harper-Adams Agricultural College, Seale-Hayne Agricultural College, and the East Anglian Institute of Agriculture, issues the following results of trials of spring barleys and spring oats carried out in the past three seasons. Consideration of the following figures should assist farmers to choose the most remunerative variety; they naturally apply more particularly to the districts in which the trials were made, and it should be noted that the results do not necessarily apply to northern England.

Brief particulars of the trial centres are:—

	Soil	Sub-soil	Altitude
Cambridge ..	Heavy clay ..	Gault	80 ft.
Sproston, nr. Norwich	Gravelly loam ..	Gravelly boulder clay	100 "
Long Sutton, Hants	Medium to heavy loam	Clay over chalk ..	450 "
Leegomery, Salop .	Sandy loam ..	Sand and gravel .	300 "
Good Easter, nr. Chelmsford	Heavy boulder clay	London clay ..	200 "
Newton Abbot, Devon	Loam of medium depth	Shale	320 "

Spring Barleys.—The comparative grain yields of the barleys in 1927 and the averages for the three seasons 1925-27 are given in Tables I and II, with the averages for the same three seasons of the comparative values per acre in Table III. The yield (or value) of the control variety, Plumage Archer 1924, is taken as 100, and the yields (or values) of the remainder are stated as percentages of it. In the case of certain varieties, as indicated by the notes, figures are not available for all three seasons. The references to quality in the comments which follow the tables are based on valuations and analyses made by the Institute of Brewing's Barley Valuation Committee,

and the figures for value per acre on the combination of these valuations with the yield figures.

TABLE I.—RESULT OF YIELD TRIALS, 1927.

	Cam- bridge	Norwich	Long Sutton	Lee- gomery	Good Easter	General Average
Spratt Archer..	104.4	99.6	109.0	106.8	112.8	106.5
No. 824 ..	104.9	102.7	100.0	105.0	104.7	103.5
No. 825 ..	98.5	101.3	101.0	103.2	111.5	103.1
Plumage Archer						
1924 ..	100.0	100.0	100.0	100.0	100.0	100.0
Archer ..	93.7	86.1	98.3	97.7	98.4	94.8
Sunrise ..	99.4	81.3	91.8	101.8	107.7	96.4
No. 25 ..	91.8	105.0	88.1	103.2	100.9	97.8
Archer						
Goldthorpe ..	86.6	94.5	88.5	88.4	99.6	91.5

TABLE II.—AVERAGE OF RESULTS OF YIELD TRIALS, 1925-27.

	Cam- bridge	Norwich	Long Sutton	Lee- gomery	Good Easter	General Average
Spratt Archer..	103.1	106.0	102.4	101.8	104.6 (a)	103.6
No. 824 ..	101.1 (a)	108.9 (a)	98.2 (a)	105.0 (b)	104.7 (b)	103.6
No. 825 ..	101.9 (a)	101.5 (a)	99.6 (a)	103.2 (b)	111.5 (b)	103.5
Plumage Archer						
1924 ..	100.0	100.0	100.0	100.0	100.0	100.0
Archer ..	102.7	96.2	101.5	99.6	99.7 (a)	99.9
Sunrise ..	103.3	90.5	95.9	97.0	101.3 (a)	97.6
No. 25 ..	96.9	103.7	91.3	98.5	92.8 (a)	96.6
Archer						
Goldthorpe ..	94.2	91.0	85.2	88.7	100.1 (a)	91.8

(a) = Average of two years, 1926 and 1927 only.

(b) = 1927 result only.

TABLE III.—AVERAGE OF VALUES PER ACRES, 1925-27.

	Cam- bridge	Norwich	Long Sutton	Lee- gomery	Good Easter	General Average
Plumage Archer						
1924 ..	100.0	100.0	100.0	100.0	100.0	100.0
Spratt Archer..	93.9	107.9	91.5	94.9	103.6 (a)	98.4
No. 825 ..	90.0 (a)	97.6 (a)	87.3 (a)	108.2 (b)	99.7 (b)	96.6
No. 824 ..	88.4 (a)	106.3 (a)	78.4 (a)	111.4 (b)	96.2 (b)	96.1
No. 25 ..	95.8	102.8	90.7	94.0	91.5 (a)	95.0
Archer ..	93.5	91.4	87.8	95.0	98.0 (a)	93.1
Archer						
Goldthorpe ..	87.9	86.4	86.0	90.5	100.0 (c)	90.2
Sunrise ..	89.9	91.5	83.8	91.0	95.0 (a)	89.4

(a) = Average of two years, 1926 and 1927 only.

(b) = 1927 result only.

(c) = 1926 result only.

These are all two-row barleys with rather short straws that stand well. The straws of Archer and Sunrise are rather weaker than the others. Archer Goldthorpe, No. 25, and Plumage Archer 1924, are the earliest varieties; Sunrise and Spratt Archer ripen generally last. There is little difference between the others; but the order varies slightly from district to

district. No one variety is more susceptible than the others to disease. Such differences as there are in yield show general consistency from district to district; but, where the differences are small, the relative yields in any particular year are likely to depend on soil and weather conditions. All the varieties are capable of producing excellent malting samples, and, in general, varietal differences are small compared with those due to soil and season; for this reason, the figures in Table III are less authoritative than those in Table II. The chief varietal feature is the regularity with which Plumage Archer 1924 has proved itself the leading barley for quality on all these soils. The quality of this variety, No. 25, and Archer Goldthorpe, is particularly good on the more retentive soils; there is rather less difference between them and Spratt Archer, Archer and Sunrise on the lighter soils. The finer points of difference are dealt with in the individual descriptions that follow.

Plumage Archer 1924 (ears erect, of medium length and width), although in no instance the heaviest yielder, can be relied upon for an excellent crop in any of these districts on soils in good condition. If anything, it has done best in these trials in Hampshire and Shropshire, but, owing to its fine quality, it is probably on the average the most remunerative barley within the farmer's reach. On light Norfolk soils, however, these trials indicate that

Spratt Archer (ears drooping, long, narrow and rather lax) should be given the preference. This variety probably yields more heavily on a wide range of the lighter soils than any other barley at present on the market, and, as its quality is often not much below that of Plumage Archer 1924, it is well worth growing in any of these districts.

Archer (ears drooping, narrow and of medium length) has a reputation for being a hardy variety very resistant to adverse climatic and other conditions. It is generally of sound quality, but not equal to either Plumage Archer 1924 or Spratt Archer.

Sunrise is a recently introduced barley of the Archer type.

Archer Goldthorpe (ears rather short and wide and slightly bowed when ripe) often makes a pretty sample, but this does not compensate for its low yield.

No. 824 and No. 825 (ears swan-necked, narrow, of medium size and density) are products of an Archer × Plumage cross from the Cambridge Plant Breeding Institute. They

are not yet on the market and have to undergo a further year's test before their future is decided. Their grain, of a bold Chevallier shape, appeals as strongly to the maltster as their yield, in most of these districts, should do to the farmer. Their necks, though fine, are tough, and do not fall even when dead ripe.

No. 25, a selection from Plumage Archer, is similar to that variety botanically and in the field, but in these tests has been slightly inferior in both yield and quality. It is not at present on the market.

Spring Oats.—The results for 1927 are given in Table IV, and the averages 1925-27 in Table V. The figures are less complete than in the case of the barleys. The yield of Abundance, the control, is expressed as 100.

TABLE IV.—1927 RESULTS.

	Cam- bridge	Norwich	Lee- gomery	Good Easter	Newton Abbot	General Average
Golden Rain ..	103.0	110.2	110.6	117.5	134.8	115.2
Victory ..	97.9	127.2	113.2	130.2	131.3	120.0
Thousand Dollar	107.5	111.6	106.7	110.5	103.1	107.9
A 88 ..	88.0	95.8	109.2	101.9	100.0	99.0
Abundance ..	100.0	100.0	100.0	100.0	100.0	100.0

TABLE V.—AVERAGE OF 1925-27 RESULTS.

	Cam- bridge	Norwich	Long Sutton	Lee- gomery	Good Easter	Newton Abbot	General Average
Golden Rain	110.6 (a)	125.3	110.0 (b)	111.0	105.1 (a)	134.8 (c)	116.1
Victory ..	110.3 (a)	118.6	106.4 (b)	107.4	119.1 (a)	131.3 (c)	115.5
Thousand Dollar	107.5 (c)	111.6 (c)	—	105.9	110.5 (c)	103.1 (c)	107.7
A 88 ..	100.0 (a)	112.9 (a)	94.6 (b)	101.8 (a)	106.3 (a)	100.0 (c)	102.6
Abundance..	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Black Tartarian ..	97.2 (b)	100.8 (d)	95.7 (b)	90.8 (d)	104.3 (b)	—	97.8

(a) = Average of 2 years, 1926 and 1927 only.

(b) = 1926 result only.

(c) = 1927 result only.

(d) = Average of two years, 1925 and 1926 only.

All these oats have straws of medium length and good strength and quality, with the exceptions that A 88 is shorter than the average, but unusually stout; and Black Tartarian is rather weaker in the straw than the others. Golden Rain is the first to ripen; Victory, Thousand Dollar, and Abundance are three or four days later; Black Tartarian and A 88 take a few days more. There is little to choose between the varieties as regards resistance to disease.

Golden Rain, which has an open head and rather small grain of pale yellow colour and good quality, heads the list for yield everywhere but on the Essex clay. In yield, however, there is little to choose between it and Victory.

Victory has an open head and white grain of medium size and good quality. At the present stage of the investigations Victory appears to be the most remunerative variety to grow on any of these soils.

Thousand Dollar has an open head and white grain of good quality rather on the large size. This is a pure stock from the Plant Breeding Institute and is not at present purchasable. Its yield is equally reliable on light or heavy soil.

A 88 has a close Tartarian type of head, and large white grain with a thick husk. It is a new variety from the Plant Breeding Institute, and its testing is not yet complete. Its yield is not without promise, and might repay a heavier seed-rate, for it does not tiller well. The stoutness of its straw is an important feature.

Abundance has an open head and white grain of good quality rather on the large size. It is a reliable oat for spring sowing, but has failed to yield as well as any of those already mentioned, and there are some grounds for believing it to be more susceptible to *Helminthosporium* disease.

Black Tartarian has a closed head and black grain of medium size and fair quality. Its failure to yield and its tendency to weakness of straw leaves it with little claim on the farmer's attention in these districts.

* * * * *

JANUARY ON THE FARM

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

Review of 1927.—At this time last year, winter operations were fairly well forward, as a result of an exceptionally dry December which had permitted of field work. January was also a dry month, and conditions favourable to ploughing and early sowing extended until the last week of February, when heavy rains caused floods in the lower districts. The wet period with which February ended continued during the first week of March, but a fortnight of excellent weather followed, during which drilling of spring corn and preparations for roots could be pushed forward. At Lady Day, therefore, land work was up to time and autumn corn looked well.

Wet and stormy conditions marked the passing of March. April likewise opened with wet weather; but after the first week or so its main character was its chilly winds and frosts, which checked the growth of corn and grass and damaged

early potatoes. The drying winds also caused heavy lands to bake and become difficult to work down to a good seed bed, although the dry conditions were not unfavourable to cleaning operations.

Very dry and cold weather with frequent night frosts continued through the month of May; consequently cereals made poor growth, pastures soon lost their spring luxuriance, hay crops failed to fill up, and roots germinated badly. Similar conditions continued until the middle of June, by which date pastures were beginning to fail and the prospects of hay, corn and roots to look poor. Mangolds and sugar beet were backward and patchy, the effects of the pygmy beetle and soil-sourness being aggravated by the unfavourable growing conditions, while turnips and swedes had in many cases been taken by fly, which had necessitated re-sowing.

The change came about the middle of June, when there set in a wet period that continued with only short intervals of fine weather until the end of September. The protracted nature of the hay harvest and the high proportion—about 50 per cent.—of seriously weathered fodder will cause the year 1927 to be coupled with 1879 and long remembered as a troublesome season. Not only the hay, but also the corn-harvest was carried out under difficulties, although in many districts very rapid progress with the corn was made during a period of about fourteen days at the end of August and the beginning of September. By means of very long working days and strenuous efforts, some farmers found it possible to secure the whole of their corn in good condition. In the north and west, however, laid crops entailed delay and involved excess of labour in cutting, while in the earliest districts some of the grain had begun to sprout in the sheaves before it could be housed.

Potatoes rapidly died down in August owing to the incidence of blight and the omission of spraying. Root crops at first improved as a result of the rains, but later bulbed only slowly, owing to lack of sunshine; and in some cases they became weedy. Pastures and aftermaths grew abundantly during the wet weather; but the excess of moisture and lack of sunshine diminished the feeding properties of the grass, necessitating the use of dry foods, and, in the case of sheep, caused trouble in the shape of foot rot. Whether further trouble in the form of liver-fluke will ensue remains to be seen, but prudent flock masters are keeping alert to this possibility.

A change for the better came with October, in which month there were quite three weeks of good weather. This was

occupied in the completion of the corn harvest and the lifting of potatoes and mangolds. In some districts an attempt was even made to secure a little more hay. Stubble cleaning, however, could not be undertaken early enough for a large acreage to be dealt with effectively, and notwithstanding that there was an unusual quantity of bottom weedy-growth among the corn crops, little could be done to reduce the virulence of this except to plough it under. Ploughing was being pushed forward, and a beginning had been made with autumn sowing when wet weather again brought field work to a standstill at the end of October. November also was a wet month, in which there were few opportunities for sowing, and the lifting of the sugar-beet crops was carried on under difficulties. At the time of writing, mid-December, therefore, farm work, and particularly the sowing of wheat, is considerably in arrears. Many farmers are now drilling whenever soil conditions permit, and others who do not care to sow between the middle of December and the middle of January are hoping for opportunities to complete their wheat acreage with ordinary winter varieties before the middle of February. Shallow drilling, liberal seeding, and the application of a moderate dressing of complete fertilizer, are three important precautions when drilling during the cold season of the year.

According to the official estimates, the crop-yields of the past season have proved to be not very different from the 10-year averages. This is better than was at one time expected. The yields of corn are actually higher than average, but potatoes, sugar beet, roots and hay are slightly down. The quality of the produce, however, leaves much to be desired; and not only have costs of production been inflated by the additional labour necessarily employed in their harvesting, but the land has deteriorated both in cleanliness and in physical condition as a result of its continual state of wetness. Grassland as well as arable has, where the drainage is at all defective, visibly deteriorated, which accounts for the many inquiries now being made concerning the practicability of mole draining.

The prices of farm products fell from an index level of 149 in January to 143 in March, 141 in June, and 137 in November. The chief factors in the fall in general price level were the decreasing values of fat cattle, sheep and pigs. Prices of stores followed those of the fat animals, making 1927 a poor year for the breeder as well as for the feeder of live stock. Wool, eggs, milk and dairy produce have either improved or maintained their values as compared with the previous year, but

formerly encountered with this type—the cost of repairing or renewing the track—has been overcome. An English arable farmer who accompanied me, however, while recognizing the value of tractors and the need for mechanical power in arable farming, pointed out that the possibilities of improving the steam-tackle engine have not been seriously considered for many years. In his opinion, the requisite power could be concentrated in an engine of less than half the weight of the ordinary ploughing unit; and that, by the adoption of the most up-to-date principles of boiler construction and engine design, it would be possible to offer the farmer an economical engine that would be suitable both for cable ploughing and for such direct-haulage operations as corn cutting.

* * * * *

NOTES ON MANURES FOR JANUARY

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

Rothamsted Experimental Station.

Artificial Only.—The accepted view, with regard to the use of artificial fertilizers for arable purposes, is that they should be employed as a supplement but not as a substitute for farmyard manure. This arrangement has been found to work well in practice and fits in with the fact that, on the vast majority of holdings, a certain amount of farmyard manure is available for use on the land without any alternative means of profitable disposal. It is also admitted that, on most soils, dressings of dung promote a condition of liveliness and workability quite apart from the manurial action, and that these physical effects are of the greatest value.

It is often assumed, however, that artificial manures used alone are unsuitable for maintaining fertility; and, since in practice it is sometimes necessary to crop without dung for a series of years, it is of interest to examine experimental results obtained by the use of artificials, alone, for long periods. There is no doubt that the successful use of fertilizers without dung requires a knowledge of their properties and their relations to soils and crops; but that they can maintain fertility for a considerable time, and compare not unfavourably with repeated doses of dung, has been shown in a number of trials, the main findings of which may be mentioned here. In most of the recorded cases, yearly applications of farmyard manure have been compared with annual doses of a complete mixture of fertilizers, the dung providing more total plant food than the artificials but, probably, rather less

plant nutrients in a readily available form. Experiments of this type have been carried out on light and on heavy soils, with continuous cropping and with rotation farming; in each case over a number of seasons. The crops grown included a series of market garden crops. Some of the results are :—

ROTHAMSTED (HEAVY SOIL), CONTINUOUS CROPPING.
Average Yields per Acre.

<i>Manures to each Crop</i>	<i>Wheat</i> 71 seasons	<i>Barley</i> 70 seasons	<i>Mangolds</i> 45 seasons
No manure	12 bu.	15 bu.	3½ tons
14 tons dung (approx. 186 lb. N.) ..	34 „	46 „	18 „
Complete artificials— (43 lb. N.)	22 „	41 „	—
(86 lb. N.)	31 „	—	18 „

WOUBURN (LIGHT SOIL), CONTINUOUS CROPPING SINCE 1876.
Average Yields per Acre, 1915-24.

<i>Manures to each Crop</i>	<i>Wheat</i>	<i>Barley</i>
No manure	8.0 bu.	9.6 bu.
7 tons dung (approx. 82 lb. N.) ..	20.6 „	27.7 „
Complete artificials (20 lb. N.) ..	18.4 „	18.7 „

SAXMUNDHAM (HEAVY SOIL), ROTATION CROPPING.
Average Yields per Acre, 1910-23.

<i>Manures to each Crop</i>	<i>Wheat</i>	<i>Man-golds</i>	<i>Barley</i>	<i>Peas and beans</i>	<i>Clover-hay</i>
	13 crops	13 crops	12 crops	10 crops	3 crops
No manure	18 bu.	5 tons	17 bu.	20 bu.	32 cwt.
6 tons dung (72 lb. N.)	29 „	18 „	30 „	39 „	80 „
Complete artificials (30 lb. N.)	30 „	17 „	31 „	36 „	60 „

BRAMFORD (LIGHT SOIL), ROTATION CROPPING.
Average Yields per Acre, 1902-7.

<i>Manures to each Crop</i>	<i>Wheat</i>	<i>Man-golds</i>	<i>Barley</i>	<i>Peas</i>	<i>Clover-hay</i>
	6 crops	6 crops	6 crops	3 crops	2 crops
No manure	19 bu.	12 tons	27 bu.	31 bu.	37 cwt.
6 tons dung (72 lb. N.)	21½ „	16 „	38 „	29 „	33 „
Complete artificials (30 lb. N.)	25 „	18 „	39 „	24 „	29 „

KENT (HEAVY SOIL), DYER AND SHRIVELL; MARKET GARDEN CROPS.
Heavy Dressing of Dung=100.

Manures to each Crop	Cauli- flower 13 seasons	Broccoli 12 seasons	Savoy 13 seasons	Spring Cabbage 12 seasons	Brussels Sprouts 12 seasons
25 tons dung (300 lb. N.) ..	100	100	100	100	100
12½ tons dung (150 lb. N.) ..	82	87	83	92	74
Artificials (135 lb. N.) ..	114	114	112	111	102

The general trend of the above results is in the same direction; and there is no doubt that, under the conditions of the experiments, artificials used alone have maintained the cropping power of the various soils at a level not much inferior to that produced by annual applications of farmyard manure.

Apart from a somewhat more kindly physical condition shown by land receiving farmyard manure, the main difference, between the dunged land and that receiving artificials, lies in the extent of the residual effect which, as we know from certain Rothamsted experiments, is much greater with dung than with artificial fertilizers; and this is particularly so in the case of the nitrogenous constituents.

Cyanamide.—Although by no means a recent addition to the list of artificial manures, calcium cyanamide, which has been extensively used for years on the Continent, has only lately been reintroduced to this country, where it has aroused interest by its relatively low price reckoned on the unit of nitrogen. As first prepared, cyanamide was exceedingly dusty and unpleasant to handle, but improvements in manufacture have done something to combat this. It contains 19 per cent. of nitrogen in the form of calcium cyanamide, with a small proportion of free lime, which, with the other calcium compounds present, is equivalent to about 120 lb. of chalk for every 1 cwt. of cyanamide used. The nitrogen is not immediately available to plants, but has to undergo a series of changes in the soil, partly chemical and partly through the agency of bacteria, the end point being nitrates as in the case of other forms of nitrogen.

The time required for its transformation renders cyanamide somewhat slower-acting than sulphate of ammonia, and for this reason it is best applied well before sowing time. A

further reason for early application is that heavy dressings of cyanamide at sowing may lower the germination of the seed; but this can be obviated if a short time is allowed between applying the manure and drilling the seed. One week's interval for each hundredweight per acre of cyanamide used is said to be sufficient.

Cyanamide, therefore, is a form of nitrogen which should be applied early; its present price—about 9s. 1d. per unit of nitrogen—is attractive; and it might be given a trial as a source of nitrogen for some of the early-sown spring corn, for which purpose the application of 1 to 1½ cwt. per acre might be made after the last ploughing, the manure being worked in during the preparation of the seed bed.

The range of soils on which cyanamide produces its best effect is not, as yet, so fully explored in this country as in the case of nitrate of soda and sulphate of ammonia. Farmers who have not had previous experience with this fertilizer might use cyanamide on part of their area, and apply the same amount of nitrogen to the remainder in the form to which they are accustomed. Such a trial would, of course, only reveal any considerable differences in effectiveness which might exist.

Early Spring Corn.—A manurial programme for the early-sown spring oats and barley may now be considered. In some cases, the land will be sufficiently rich to grow a good crop, as for example after good seeds or sheaved roots. Experience has shown that, at any rate in the wetter part of the country, a light application of phosphate, say 2 cwt. superphosphate per acre, generally helps the crop to stand and fill out under these conditions. On the other hand, if it is known that the land is not in good heart there is reason to provide a more complete dressing containing nitrogen, and, on the lighter soils, potash. This question of potash is important, and many observant farmers are in favour of giving a little potash, especially to spring corn that is to be seeded down, on the ground that, even if the cereal crop does not directly benefit, the clover will do so. Observations of this kind are not confined to light-land farms; they have also been made at Rothamsted on a stiff loam, when the difference, in favour of clover following barley which has received potash, has been very striking. An additional advantage to put to the credit of the potash is the good effect

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 December 14				Cost per unit at London
	Bristol	Hull	L'pool	London	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	..	..	11 7	11 10	14 10
Sulphate of ammonia :—					
Neutral (N. 20·6%) ..	10 8*	10 8*	10 8*	10 8*	10 1
Calcium cyanamide (N. 19%) ..	8 14†	8 14†	8 14†	8 14†	9 2
Kainit (Pot. 14%) ..	3 7	2 17	2 19	3 0	4 3
Potash salts (Pot. 30%) ..	5 2	..	..	4 17	3 3
(Pot. 20%) ..	3 17	3 5	3 9	3 9	3 5
Muriate of potash (Pot. 50·53½%) ..	9 10	8 15	9 1	9 16	3 8
Sulphate „ „ (Pot. 48·51½%) ..	11 10	10 15	11 7	11 17	4 7
Basic Slag (T.P. 32%) ..	3 8§	3 3§	3 3§	..	..
(T.P. 30%) ..	3 6§	3 1§	3 1§	2 15c	1 10
(T.P. 28%) ..	..	2 12§	2 13§	..	..
(T.P. 26%) ..	..	2 6§	2 7§	..	..
(T.P. 24%) ..	2 10§	2 1§	2 2§	..	..
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 10	8 7	..
Steamed bone flour (N. 4½%, T.P. 60·65%) ..	5 17†	6 2†	6 5	5 17	..
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.

§ Price 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.

c F.O.R. Northern rails. 3s. 6d. per ton extra on Southern rails.

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.

of a vigorous plant of seeds on subsequent crops in the rotation. Typical dressings under the above conditions would be 2 cwt. superphosphate, 1 cwt. muriate of potash, 1 cwt. sulphate of ammonia, per acre.

As mentioned above, cyanamide might be given a trial for some of these early dressings, when it could replace sulphate of ammonia approximately weight for weight, but would be best applied as a separate dressing a week or so before drilling.

There is a good deal of evidence to show that, provided the barley crop stands up at harvest, and the nitrogen in the mixture does not exceed the equivalent of 1 cwt. sulphate of ammonia per acre, there need be no fear of a lowered valuation for malting purposes.

* * * * *

NOTES ON FEEDING STUFFS FOR JANUARY

H. E. WOODMAN, D.Sc., Ph.D.,
School of Agriculture, Cambridge.

The Modern Tendency in Animal Husbandry.—No feature of agricultural development is more striking than the marked tendency which has been evinced during recent times in the direction of intensifying the methods whereby meat and milk are produced for human consumption. It has left its mark on every phase of animal husbandry. The pig destined for pork must be fattened during its period of active skeletal and muscular growth, so that it may be enabled to attain the necessary size and condition for slaughter at a comparatively youthful age. The fat lamb is now a common feature, and, in addition, large numbers of cattle are slaughtered at the age of about 18 months to satisfy the demand for "baby beef."

Turning to the dairy cow, few farmers of to-day are satisfied with the modest yields of milk tolerated so complacently by their forerunners in the industry. Rather has this useful animal come to be regarded as a kind of "chemical factory," in which farm foods constitute the raw materials and milk the finished product, the process of conversion being carried out with the utmost intensity and efficiency. Even the humble fowl has not escaped the influence of the prevailing tendency, and is

now being urged to "speed up" its rate of egg production by means of ingenious devices and contrivances.

The reasons for this change of policy (a change which is, by the way, fundamentally sound in the scientific sense) are quite apparent, but do not concern us particularly here. What does concern us, however, is the fact that such a change has not been possible without some drastic revision of the older methods of feeding stock. In the breeding of strains of animals capable of attaining early maturity, the science of nutrition must necessarily keep pace with the art of the breeder. The production of meat and milk is not a process which can escape the implications of the law of the conservation of energy, and intensive production necessarily connotes more intensive methods of feeding. Obviously, in view of this modern tendency, it is imperative that the scientific man should make a closer study than heretofore of the nutritional requirements of young animals. Such studies are, in point of fact, being prosecuted in the case of the pig at the present time in the Department of Animal Calorimetry of the School of Agriculture, Cambridge.

The increased growth rate which must be induced in an animal fed for early maturity must naturally be circumscribed by the limit of the animal's capacity for consuming and digesting food. It may, of course, some day be found possible, by the science or art of breeding, to produce an animal with a capacity for food assimilation much superior to what we are at present accustomed to. This, however, can scarcely be looked forward to with any degree of confidence. The present-day ruminant is already a wonderful digester of food, and is able, by the united digestive activities of bacteria and enzymes, to make very efficient use of many types of constituents which are of little or no use to man. The immediate solution of the problem of enhancing growth rate is clearly to be sought in improved methods of feeding. The digestive powers of the animal must be utilized to the utmost, and, since the capacity for consumption is limited by nature, this end can only be achieved by resorting to feeding stuffs of higher digestibility than those employed in ordinary practice.

In the growing of crops for feeding to highly productive animals, the farmer should be prepared to sacrifice bulk in order to gain feeding value, his object being, "More food value in a smaller bulk." This idea is rapidly gaining ground among the farmers of this country. Pastures are being grazed more

closely than hitherto, so that the herbage may be secured at its phase of minimum fibre content and maximum nutritive value. The growing of other green food for stock should always be so planned that the animals are supplied with a succession of crops in the young and highly digestible condition. In the making of hay for winter keep, the farmer now realizes the advantages of mowing at an early date, before the grass has become coarse and fibrous and of diminished feeding value. The earliest cut of hay should be put aside for inclusion in the rations of rapidly-maturing animals and heavy-milking stock.

The problem of increasing the digestibility of the concentrated foods is not so simple, nor perhaps so urgent, though it will even be worth while to devote some attention to this question. While the cooking of food may increase palatability and ease of mastication, it does not necessarily increase digestibility to any marked extent. In work at Cambridge, for instance, it was found that the cooking of maize for pigs effected only a minor improvement in respect of digestibility. Steaming, followed by rolling into thin flakes, was shown, on the other hand, to bring about a very marked improvement. The writer recalls his first efforts to measure the digestibility of flaked maize. The flaked maize was fed, along with a small allowance of milk, to two Large White pigs, and so digestible was the ration that both animals developed acute constipation, although no such trouble had arisen in an earlier period of the trials, when the animals had been receiving a ration composed of *raw* crushed maize and milk. Accordingly a fresh start had to be made, coarse middlings this time replacing the milk in the ration. There can be no doubt about the extraordinarily good digestibility of flaked maize, and for this reason it is an ideal concentrate for inclusion in rations designed for the purposes of intensive production.

For many years the idea gained from the common interpretation (or misinterpretation) of old scientific work, to the effect that the dairy cow must necessarily be given its maintenance ration in the form of coarse fodder (for example, 20 lb. of hay), has hung like a millstone round our necks. In these days of high production, this idea must be modified. The too liberal use of bulky fibrous food is not consistent with heavy milk production. Much of Mr. Boutflour's success with dairy cows is to be attributed to his timely recognition of this fact, and to his courage in cutting down, very severely

in some cases, the bulky coarse fodder in the maintenance portion of the ration, thus enabling him to increase the concentrated foods, which can best supply the heavy requirements of good milking animals.

It would be interesting to know how far this process of replacement could be pushed without prejudicing the health and well-being of the animal. Trials have been reported from America where dairy cows, while dry in winter, have been fed for limited periods exclusively on corn meal, all coarse fodder being withheld. The animals ceased to ruminate, but did not manifest any signs of suffering or unrest. Bearing in mind the fact that most concentrated foods contain more or less indigestible fibre, he would, nevertheless, be a bold man who would recommend the total elimination of coarse fodder from the rations of even the heaviest milkers. Even in such cases, a small allowance of bulky fibrous food is absolutely necessary, one would imagine, to assist the passage of food residues along the intestinal tract.

Space forbids more than this general reference to the problems involved in feeding for early maturity or intensive production. The writer hopes to deal with certain aspects of the question in greater detail on future occasions. The question of adequate mineral supply, for instance, is one which requires the most careful consideration, since the more rapidly an animal is induced to grow, or the more heavily a dairy cow is made to yield milk, the greater becomes the danger of mineral shortage. The efficient ration for rapid production must supply not only an abundance of easily digested organic matter, but also a generous amount of the requisite mineral substances. Should the feeding stuffs composing the ration be deficient in this latter respect, it is imperative that such deficiency be made good by the addition of a suitable mineral supplement.

In the Notes for next month, it will be shown that an all-round standard of high productivity is unlikely be reached in this country until means have been found for increasing very materially the amount of concentrated food available for farm animals. Professor T. B. Wood's views on this outstandingly important question will be outlined, together with his suggestions as to how the difficulty, arising from the shortage of concentrated foods, may be overcome without any very serious disturbance of the present conditions of farming.

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

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	10 7
Maize	81	6.8	8 12
Decorticated ground nut cake	73	41.0	12 15
" 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 2.45 shillings, and per unit protein equivalent, 2.03 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 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
Beans	66	20.0	10 2
Good meadow hay	31	4.6	4 5
Good oat straw	17	0.9	2 3
Good clover hay	32	7.0	4 13
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 unit starch equiv.	Pro-tein equiv. %
	s. d.	lb.	£ s.	£ s.	£ s.	100 lb.	s. d.	d.	%
Wheat, British ..	—	—	10 7	0 13	9 14	72	2 9	1.47	9.6
Barley, British feeding ..	—	—	9 0	0 10	8 10	71	2 5	1.29	6.2
„ Canadian No. 3 Western ..	38 6	400	10 15	0 10	10 5	71	2 11	1.56	6.2
„ American ..	36 9*	—	10 5	0 10	9 15	71	2 9	1.47	6.2
„ Danubian ..	36 9*	—	10 5	0 10	9 15	71	2 9	1.47	6.2
„ Karachi ..	38 0†	—	10 12	0 10	10 2	71	2 10	1.52	6.2
„ Persian ..	35 6	—	9 18	0 10	9 8	71	2 8	1.43	6.2
„ Russian ..	37 3	—	10 8	0 10	9 18	71	2 9	1.47	6.2
Oats, English, white ..	—	—	10 0	0 11	9 9	60	3 2	1.70	7.6
„ „ black and grey ..	—	—	9 15	0 11	9 4	60	3 1	1.65	7.6
„ Irish, black ..	—	—	9 10	0 11	8 19	60	3 0	1.61	7.6
„ „ white ..	—	—	10 13	0 11	10 2	60	3 4	1.78	7.6
„ Argentine ..	29 0	320	10 3	0 11	9 12	60	3 2	1.70	7.6
„ Russian ..	28 6†	—	10 0	0 11	9 9	60	3 2	1.70	7.6
Maize, Argentine ..	36 9	480	8 12	0 11	8 1	81	2 0	1.07	6.8
Beans, English, winter ..	—	—	9 0†	1 6	7 14	66	2 4	1.25	20
Peas, English, blue ..	—	—	15 5†	1 3	14 2	69	4 1	2.19	18
Dari, Palestine ..	—	—	11 5	0 13	10 12	74	2 10	1.52	7.2
„ Persian ..	—	—	10 0	0 13	9 7	74	2 6	1.34	7.2
Millers' offals—									
„ Bran, British ..	—	—	8 5	1 3	7 2	42	3 5	1.83	10
„ „ broad ..	—	—	9 5	1 3	8 2	42	3 10	2.05	10
„ Middlings, fine, imported ..	—	—	10 5	0 18	9 7	69	2 9	1.47	12
„ „ coarse, British ..	—	—	8 17	0 18	7 19	58	2 9	1.47	11
„ Pollards, imported ..	—	—	8 0	1 3	6 17	60	2 3	1.20	11
Meal, barley ..	—	—	11 15	0 10	11 5	71	3 2	1.70	6.2
„ „ maize ..	—	—	9 5	0 11	8 14	81	2 2	1.16	6.8
„ „ S. African ..	—	—	8 12	0 11	8 1	81	2 0	1.07	6.8
„ „ germ ..	—	—	9 2	0 16	8 6	85	1 11	1.03	10
„ „ gluten feed ..	—	—	9 5	1 1	8 4	76	2 2	1.16	19
„ „ locust bean ..	—	—	8 17	0 8	8 9	71	2 5	1.29	3.6
„ „ bean ..	—	—	12 0	1 6	10 14	66	3 3	1.74	20
„ „ fish ..	—	—	21 0	3 10	17 10	53	6 7	3.52	48
Maize, cooked flaked ..	—	—	10 17	0 11	10 6	85	2 5	1.29	8.6
Linseed—									
„ „ cake, English 12% oil ..	—	—	12 10	1 11	10 19	74	2 11	1.56	25
„ „ „ 10% „ ..	—	—	12 0	1 11	10 9	74	2 10	1.52	25
„ „ „ 9% „ ..	—	—	11 12	1 11	10 1	74	2 9	1.47	25
„ „ „ 6% „ ..	—	—	11 10	2 4	9 6	69	2 8	1.43	36
Soya bean „ „ 6% „ ..	—	—	8 0	1 10	6 10	42	3 1	1.65	17
Cottonseed cake „ „ 5½% „ ..	—	—	7 4	1 10	5 14	42	2 9	1.47	17
„ „ „ Egyptian, 5½% „ ..	—	—	12 0*	2 5	9 15	74	2 8	1.43	35
Decorticated cottonseed meal, 7% oil ..	—	—	10 0	1 6	8 14	79	2 2	1.16	16
Coconut cake, 6% oil ..	—	—	10 7*	1 7	9 0	57	3 2	1.70	27
Ground-nut cake, 7% oil ..	—	—	12 15*	2 5	10 10	73	2 11	1.56	41
Decorticated ground-nut cake, 7% oil ..	—	—	9 10*	0 19	8 11	75	2 3	1.20	17
Palm kernel cake, 6% oil ..	—	—	10 0*	0 19	9 1	75	2 5	1.29	17
„ „ „ meal, 6% oil ..	—	—	8 12†	1 0	7 12	71	2 2	1.16	17
„ „ „ meal, 2% „ ..	—	—	6 10	0 9	6 1	51	2 4	1.25	2.7
Feeding treacle ..	—	—	8 0	1 0	7 0	49	2 10	1.52	13
Brewers' grains, Dried ale ..	—	—	7 10	1 0	6 10	49	2 8	1.43	13
„ „ „ „ porter ..	—	—	6 10*	1 9	5 1	43	2 4	1.25	16
Malt culms ..	—	—	—	—	—	—	—	—	—

* At Bristol.

† 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 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 £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 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.

1928.]

MISCELLANEOUS NOTES.

961

MISCELLANEOUS NOTES

AGRICULTURAL produce during November was 37 per cent. dearer than pre-war, as compared with 40 per cent. in the previous month and 48 per cent. in

The Agricultural November, 1926.

Index Number In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

Percentage Increase compared with the Average of the corresponding month in 1911-13

Month	1922	1923	1924	1925	1926	1927
January ..	71	67	60	71	58	49
February ..	75	63	61	69	53	45
March ..	73	59	57	66	49	43
April ..	66	54	53	59	52	43
May ..	69	54	57	57	50	42
June ..	64	49	56	53	48	41
July ..	67	50	53	49	48	42
August ..	68	52	57	54	49	42
September ..	59	52	61	55	55	43
October ..	61	50	66	53	48	40
November ..	63	51	66	54	48	37
December ..	61	55	65	54	46	—

Grain.—Wheat prices declined by 5d. per cwt. on the month to an average of 10s. 1d. per cwt., and at 34 per cent. above the base years the index number was 8 points below the level of October and 32 points below that of November, 1926. A fall of 1s. 5d. per cwt. in the average for barley brought the index figure for this cereal 17 points lower to 45 per cent. above 1911-13, but the November price of 12s. 4d. per cwt. is appreciably above that of a year ago, when the average price was 11s. 6d. per cwt. and the index number 35 per cent. above pre-war. Oats remained at about the same price as in the two preceding months, and at 30 per cent. above 1911-13 were dearer than in November, 1926, but at the same level as in November, 1925.

Live Stock.—A further decline took place in the prices of fat cattle and pigs, and these are now at the lowest levels recorded for the current year. Second quality fat cattle averaged 40s. per live cwt., and at 19 per cent. above the level of the base years the index figure was 4 points lower on the month and 12 points below that of November, 1926. Bacon pigs were 6d. and pork pigs 4d. per 14 lb. stone, estimated dressed carcass weight, cheaper than in October, and the relative index figure declined by 4 and 6 points to 18 and 29 per cent. respectively above pre-war. A year ago bacon pigs were 71

per cent. and pork pigs 76 per cent. dearer than in 1911-13. Store cattle and pigs also showed a fall in price and index number, the former class of stock being about 10s. per head cheaper than in October and the index number 6 points lower at only 13 per cent. above pre-war, while the latter were about 4s. per head cheaper and 12 points lower at 44 per cent. Dairy cattle, fat and store sheep, however, were dearer than in the preceding month, this being the customary movement of prices at this time of year, but whereas the increase in the price of dairy cattle was proportionately higher than in the corresponding period of the base years, the increases in prices for sheep were proportionately lower, and the index figures for fat and store sheep declined by 1 point and 5 points to 40 and 35 per cent. respectively above pre-war. Dairy cattle were 28 per cent. above pre-war, compared with 27 per cent. in October.

Dairy and Poultry Produce.—Butter was about 1½d. per lb. dearer in November than in the previous month, and the index figure was 6 points higher at 47 per cent. above the level of 1911-13, or the same as in November, 1926. Cheese was very slightly dearer, but as the increase was not proportionately so large as in the corresponding period of the base years the index figure was one point lower at 55 per cent. above 1911-13; a year ago cheese was only 28 per cent. dearer than pre-war. Milk contract prices were on average a little higher during November at 59 per cent. above the pre-war level, as against 57 per cent. in October. There was the usual rise in egg prices during November, but the average price per dozen was about 3d. short of that reached in November last year, and the index number was 13 points lower at 47 per cent. above the base years. Poultry prices were generally maintained throughout the month at the levels ruling in October, but geese were dearer and the index number advanced from 43 to 46 per cent. above pre-war.

Other Commodities.—Potato prices were fairly steady during the month under review and the index rose to 76 per cent. above 1911-13, as compared with 72 per cent. in the previous month and 113 per cent. in November, 1926. Hay also was very slightly dearer at 19 per cent. above pre-war. Apples were dearer at about 40 per cent. above prices in the base years, and vegetables at 47 per cent. above pre-war were 3 points lower on the month, cabbages, cauliflowers and Brussels sprouts being cheaper. Wool prices advanced a little, and at 46 per cent. above the level of the base years the index number for November was 3 points higher than in October.

Index numbers of different commodities during recent months and in November, 1925 and 1926, are shown below :—

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

Commodity	1925	1926	1927			
	Nov.	Nov.	Aug.	Sept.	Oct.	Nov.
Wheat	49	66	56	48	42	34
Barley	35	35	64	62	62	45
Oats	30	20	43	35	33	30
Fat cattle ..	48	31	34	30	23	19
Fat sheep ..	63	43	45	45	41	40
Bacon pigs ..	79	71	36	34	22	18
Pork pigs ..	75	76	43	41	35	29
Dairy cows ..	42	34	25	28	27	28
Store cattle ..	32	22	26	24	19	13
Store sheep ..	68	42	48	49	40	35
Store pigs ..	97	135	70	64	56	44
Eggs	80	60	44	54	66	47
Poultry	49	49	43	37	43	46
Milk	74	64	55	65	57	59
Butter	71	47	38	41	41	47
Cheese	75	28	57	59	56	55
Potatoes	60	113	30	46	72	76
Hay	3	4	16	18	18	19
Wool	52	31	42	43	43	46

* * * * *

Universal Cookery and Food Exhibition.—At this Exhibition, which was held at Holland Park Hall from November 15-24, the Empire Marketing

Displays of Board arranged an attractive display of
Home Produce Empire produce. The home produce section was, as usual, organized by the

Ministry in collaboration with the National Farmers' Union, the Food Manufacturers' Federation, the National Food Canning Council, the National Association of Cider Makers, and the National Milk Publicity Council, and was grouped around a lounge in the centre of the Empire Marketing Board stand.

The display of dairy produce included attractive exhibits of trade-marked Cheshire and Cheddar cheeses, as well as crustless cheeses and several brands of tinned milk. With the object of stimulating the consumption of milk, a number of striking features were presented, notably a graphic illustration of Dr. Corry Mann's experiments on the comparative dietetic values of

different foods, including milk. Two cages of white rats were also shown; the rats in both cages had been fed on the same rations, except that in the one case they had water to drink and in the other milk; the rats were only ten weeks old, but the milk-fed ones were already heavier by one-third than the water-fed lot, and were obviously in better condition.

Other exhibits were devoted to fruit, including dessert apples, English tinned fruits, and all varieties of bottled fruits, jams and cider; and a third group covered a good display of English bacon and hams, eggs, preserved meats, cereal products, tinned vegetables, sauces, pickles, etc.

Home produce was well represented at the cooking demonstrations that were given in one of the Exhibition's kitchens.

Display of Home Produce in Fleet Street.—The Ministry has been glad of the opportunity to co-operate in a scheme organized by the *Farmer and Stock-Breeder*. That journal took a shop in Fleet Street for the month of December, and staged there an impressive display of home-produced food, including trade-marked Cheshire and Cheddar cheeses, crustless cheese, Stiltons, condensed milk, butter, eggs, meat, dessert apples, canned and bottled fruits, jams, fresh and tinned vegetables, bacon and hams, preserved meats, cereal products, etc. An interesting feature of the display was an exhibit of beet sugar, and of jams and bottled fruits preserved with this new British product.

As explained by the organizers, the intention was "to demonstrate the resources of our farmers, not only as regards the variety, but also the quality of the foodstuffs they supply; thus to show to the man in the street that British agriculture is far from being the negligible quantity in the national economy that he is sometimes encouraged to believe it is."

The Exhibition attracted a considerable amount of attention amongst the thousands of people passing the shop every day, and the organizers are to be congratulated on their enterprise in initiating this venture and on the success which attended it.

The Prime Minister visited the shop in company with the Minister of Agriculture, and made a thorough inspection of the exhibits. He was particularly interested in the examples of trade-marked Cheshire and Cheddar cheeses and, before leaving, expressed the hope that the Exhibition would be staged in future years on a much larger scale.

Although directed mainly to the consumer, the Exhibition is not without interest to the producer. To quote again from

the *Farmer and Stock-Breeder*: "As we see it, the main lesson of the Exhibition to the producer is not new, but an old one emphasized. We must concentrate on a quality in our produce that will maintain it on a plane of its own. But this is not enough. We must put it before the consumer in a condition that will make its merit apparent, its claim insistent; in brief, good articles, well marketed."

* * * * *

A SCHEME for Pig Recording, confined, in the meantime, to Scottish breeders, is being put into operation immediately by the Animal Breeding Research Department of the University of Edinburgh, to which communications on the subject should be addressed. The scheme has the active support of the Board of Agriculture for Scotland. The details of the scheme are as follows:—

Scheme for Advanced Registry of Pigs in Scotland.—That one or more central testing stations be established.

Note: The first is now established at Edinburgh, and thereafter others may be set up throughout Scotland, in accordance with the desires of breeders in the various districts, and the experience gained at Edinburgh.

A breeder wishing to have a sow tested should inform the testing station within 14 days after the sow has farrowed.

The sow must be of a pure breed and entered in the herd book. She must be mated to a boar of a pure breed who is also entered in the herd book.

An eligible gilt (12 to 18 months of age, and with not less than 12 teats) must farrow and raise to 60 days of age at least seven pigs. In a gilt's litter, no pig may be counted as one, unless it weighs at least 26 lb. at 60 days of age.

A sow (over 18 months of age, and with not less than 12 teats) in order to be eligible must farrow and raise to 60 days of age at least eight pigs. In a sow's litter no pig may be counted as one unless it weighs at least 26 lb.

Four representative pigs (preferably two of each sex) shall be sent to the testing station 60 days after farrowing, the males to be castrated around five weeks of age.

Pigs should be delivered to the testing station carriage paid. These will be paid for at the top price.

No entry fee is required meantime.

The Test.—**FEED**: The feed of the pigs under test will be determined by the authorities at the Rowett Research Institute and will be uniform throughout, varying only with age or weight. It will be designed to encourage as near to optimum development as is practically possible.

All litter groups will be carried to around 200 lb. average liveweight each.

Weights of pigs will be taken on arrival and at regular intervals of 14 days throughout the test.

If one pig dies through disease or accident, the test is continued. If two die, the results will not count.

Measurements of growth will be taken.

Slaughter.—A litter group around 200 lb. in weight per pig will be slaughtered at a recognized bacon factory, and the carcasses graded by a competent judge. The following points will be measured :—

- (a) Percentage loss, live to deadweight.
- (b) Percentage loss, deadweight to cured rolled bacon produced.
- (c) The quality of the Scottish rolled bacon produced.

Award of Points.—Points will be awarded according to the following :—

- | | | |
|--|---|----------------|
| (a) Number farrowed | } | 33·3 per cent. |
| (b) Number weaned | | |
| (c) Average weight at weaning | | |
| (d) Amount of food consumed per pound liveweight | } | 33·3 per cent. |
| (e) Rate at which the litter group reaches 200 lb. average | | |
| (f) Percentage deadweight | } | 33·3 per cent. |
| (g) Percentage curable meat. | | |
| (h) Quality of bacon | | |

Note: This emphasizes (1) prolificacy; (2) good milking of the sow and her ability to bring up a litter; (3) early maturity; (4) economy, and (5) quality.

Litter groups will be placed into Grades I, II or III, according to the number of points obtained. They will also be graded in each of the three groupings specified in paragraph 15 for which 33·3 per cent of the points are awarded. The reasons will be given as to why any litter group fails to reach Grade I.

By this means it is hoped that it may be possible to establish some system of advanced registry similar to that which is at present in force as regards dairy cattle. It cannot be disputed that milk registry in dairy cattle has provided an extraordinary stimulus towards the production of better milk producers. In view of the present circumstances, it is considered that the time is opportune for the application of a

similar scheme in bacon pigs. It is hoped later to extend this scheme in a modified form to pork pigs also, but, in view of the urgent need for a standardization of bacon type, it has been decided to push on with the above.

Advisory Committee.—The first testing station is already established at the Animal Breeding Research Department, West Mains, Edinburgh. A committee, appointed by the Scottish National Association of Pig Breeders and the Scottish Pig Industry's Committee, to advise and guide the work, has approved the above scheme. The Committee consists of :—

The Rt. Hon. Lord Hamilton, K.T., of Dalzell, Motherwell.
Major W. A. Baird, Lennoxlove, Haddington.
Mr. George Bruce, Inchfield, Inch, Aberdeenshire.
Mr. T. R. Cavaghan, of Cavaghan & Gray, Bacon Curers, Harraby, Carlisle.
Mr. J. E. B. Cowper, Gogar Mains, Corstorphine.
Major Falconar-Stewart, M.C., Feddal, Braco.
Mr. A. N. Haig, Springfield, Kinross.
Mr. R. Miller, Ferrygate, Dirleton.
Mr. R. W. L. M'Caig, Foreside of Cairn, by Kirriemuir, Forfarshire.
Mr. Alex. Main, representing the Board of Agriculture for Scotland.

* * * * *

Enforcement of Minimum Rates of Wages.—During the month ending November 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 concerned
		£	s.	d.	£	s.	d.	£	s.	d.	
Dorset ..	Gillingham	12	0	0	2	2	0	43	15	0	3
Yorks, E.R. . .	Bridlington	3	0	0	0	10	0	20	0	0	3
Kesteven and Lindsey	Louth ..	—			5	10	6	11	18	0	3
Derby ..	Burton ..	4	0	0	4	16	0	11	15	0	2
		£19	0	0	£12	18	6	£87	8	0	11

The important point in the case heard at Louth was that the workers were engaged on contracts of service which provided that they should be boarded and lodged by the foreman and paid a net weekly cash wage which was 18s. less than the minimum rates due. In effect this arrangement (other instances of which, it is believed, have occurred in the area) was equivalent to a deduction of 18s. per week in respect of the provision of board and lodging, whereas under the Agricultural Wages Committee's Order the maximum deduction allowable in respect of such provision is 15s. per week. It is interesting to note that the defendant's solicitor stated that the opening speech by the Ministry's legal representative had disposed of any defence which he could have raised, and he would, therefore, have to plead "guilty" to the charges.

Destruction of Weeds.—The Ministry recently served notices under the Corn Production Acts (Repeal) Act, 1921, on four occupiers of lands at Barrow-in-Furness, requiring them to destroy the weeds growing on their lands, and, in three cases, the notices were complied with. On account of the lateness of the season, no action will be taken as regards the remaining occupier, but his lands will be kept under close observation next season.

Authority to lay information on the Ministry's behalf was issued during October in seven cases in which there was non-compliance with notices served under the Act by the agricultural committees of Berks, Essex, Lancashire, Norfolk and East Sussex. Convictions were obtained and fines imposed in four instances; one case was dismissed on grounds of insufficient evidence; while another was not proceeded with as most of the weeds had subsequently been cut. In the remaining case, no report of the result of the proceedings has yet been received.

* * * * *

Foot-and-Mouth Disease.—Since the report in the last month's issue of the JOURNAL, 20 outbreaks of foot-and-mouth disease have been confirmed in Great Britain, seven of which occurred in the Hampshire (New Forest) area already under restrictions.

Disease was discovered at Shrewton, Wiltshire, on November 26, and at Melksham, Wiltshire, on November 29, and four outbreaks have in addition been confirmed in that district.

A new centre of disease was also brought to light at Birmingham on December 10, and four further outbreaks have been confirmed in that neighbourhood.

In addition, disease was confirmed at Lymm, near Warrington, Cheshire, on December 10. A fresh centre was discovered at Werrington, Stoke-on-Trent, Staffs., on December 21.

Eighty-four outbreaks in all have been confirmed since January 1 last, involving 17 counties and the slaughter of 2,507 cattle, 2,227 sheep, 1,542 pigs and 7 goats.

* * * * *

NOTICES OF BOOKS

The Potato: Its History, Varieties, Culture and Diseases. By Thomas P. McIntosh, B.Sc. (Edinburgh: Oliver & Boyd. 1927. Pp. xvi + 264, 38 illustrations. Price 12s. 6d.)

The potato has been in this country for more than three centuries, and even now we cannot claim either to understand all its varieties or even define, with accuracy, the most dependable methods for invariably securing reliable crops. It is, therefore, not surprising that books continue to be written on this plant, which annually supplies enormous quantities of food for our national larder.

The writer deals quite lightly with the origin of the potato and the method by which it was introduced into this country without clearing up exactly the question as to whom the credit should be given for bringing it here; he then proceeds to deal in a most interesting way with the people in this country who have been responsible for introducing new varieties of great value to the community. The pride of place, rightly, is given to Mr. Archibald Findlay, who did work of great national importance in raising "Up-to-date," which became the variety in most general use throughout the whole of the British Isles, and, incidentally, allowed the Scottish people to build up a seed potato trade of great importance.

A great many pages are devoted to the botanical structure of the potato plant, which should prove interesting to the student, though perhaps a little beyond the ordinary commercial grower. The various methods adopted by the German, American and British authorities in classifying varieties into groups have been set out. Naturally, they differ, for all the schemes have been chosen for convenience and do not follow any real botanical scheme. The writer lays great stress on the quality of the seed produced, which we have now learned is of even greater importance than the source of origin.

The theory that potatoes degenerate from senility, as was held since the time of Parmentier in 1786, as the writer shows, was disproved when biologists in the present century showed that by growing potatoes in faulty environments, diseases set in which caused degeneration. The degeneration diseases and, in fact, all the diseases to which the potato is prone, have been fully set out in Part V, which constitutes one of the best parts of the whole book. The chapters on cultivation and manuring, though interesting and clearly written, are less convincing than the other parts.

The book constitutes a valuable addition to the literature of the potato, and will prove of great interest to all persons who are making potatoes the subject of special study. It is well illustrated, and the type is clear.

Sugar: Cane and Beet. By G. Martineau, C.B. (London: Sir Isaac Pitman & Sons, Ltd, 1927. Pp. xi + 159. Price 3s. net.)

This is the fifth edition, revised by F. C. Eastick. It deals mainly with the manufacturing side of the industry, and the reviser has added new material on the beet industry, which had not been established in this country when the book was originally prepared. For those who require a popular and concise account of Sugar, from the field to the market, this "little book," as the author himself calls it in the preface to the first edition, is well worth reading, and for those who wish to go more deeply into the subject it suggests more comprehensive works which they may consult.

Silage.—*Die zeitgemässe Grünfütterkonservierung.* By Ludwig F. Kuchler. (Munich: Verlag Dr. F. P. Datterer & Cie. Pp. xvi + 525. Price, cloth boards, 16s. net.)

Numerous accounts of investigations into the problems of ensilage have been published in this country during the last decade. For the most part, however, these have appeared in the columns of sundry scientific journals which are not always easily accessible to the general reader. It is, therefore, believed that a useful service was rendered by the Ministry when it decided to include a summary of English work on ensilage in its series of Miscellaneous Publications. The publication in question, which constitutes No. 53 of the series, appeared during 1926. Despite the appearance of this monograph, however, it is manifest that the subject is still suffering from the lack of a good general textbook, dealing with the question of ensilage from a wider and fuller standpoint than was possible within the limited scope of a Miscellaneous Publication. This deficiency is given further prominence by the recent publication in Germany of a comprehensive treatise on the preservation of green crops by Ludwig Kuchler. This publication constitutes a praiseworthy attempt to bring together all the available information relating to the scientific and practical aspects of the silage question, and it is greatly to be regretted that its usefulness

in this country will be limited by the fact that a sound knowledge of German is necessary for its intelligent perusal.

The book is divided into ten sections. In the first section, the author traces the development of the idea of ensilage from early Egyptian and Roman days down to modern times. He then proceeds in the second section to deal with the significance of ensilage in relation to agriculture in general. The numerous advantages which result from the adoption of the practice are explained in detail. The section closes with a review of the present position of ensilage in various countries. A long third section is devoted to a very thorough study of the scientific aspects of the ensiling process—the explanation of the changes which modify the nature and composition of green crops in the silo; the losses of nutrient matter accompanying preservation; the conditions which may lead to spoiling; the factors which determine the production of different types of silage; the composition and feeding value of silage; the vitamin content of green crops and silage. It is scarcely feasible in this short review to give an adequate idea of the immense fund of scientific information embodied in this section. The fourth section is given over to practical questions relating to the construction and filling of silos. This is followed by a section dealing with the ensilage of crops in the pit and in the tower. The sixth and seventh sections deal with methods designed solely for the production of "sweet" silage. These sections cannot fail to interest English readers, dealing as they do with recent advances and improvements in Continental practice. The various compression methods for making "sweet" silage (Süss press-futtermittelverfahren), as well as the electrical and inoculation processes for achieving the same purpose, are described in minute detail. The economic aspects of the silage question are discussed in the eighth section, while the ninth section deals with the different crops which are suitable for the purposes of ensilage. The feeding of silage to different classes of farm stock is also fully gone into in this section. In the final section, the author gives an interesting account of his experiences and impressions during the course of his "Silostudien" travels in various lands, including this country.

Herr Kuchler has certainly made out a very convincing case for the adoption of ensilage as a normal feature of agricultural activity, and has given point to the old assertion: The silo is the necessity of the poor and the luxury of the rich; it secures for both a fuller and a more independent life.

A New Review of Agricultural Literature. *Deutsche Landwirtschaftliche Rundschau.* Vol. I, Part 1, October, 1927. (Published monthly by J. Neumann-Neudamm, Anhaltstrasse, 7, Berlin, S.W. 11. Price, 3 reichmarks per copy.)

This publication is a further addition to the group of periodicals devoted to the provision of abstracts of agricultural literature. In an explanatory note the editors, amongst whom figure several recognized authorities in German agriculture, express the intention of surveying the whole field of original work carried out in Germany or abroad. Worthy as such an intention may be, it appears doubtful from the first issue whether it will be implemented satisfactorily. Allowing for development, however, on traditional German lines, which produce such valuable periodicals as the *Centralblatt für Bakteriologie*, *Jahresbericht für Agrikultur-Chemie*, etc., this new periodical may well become a valuable addition to the agricultural technical Press.

ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Stewart, R. M., and Getman, A. K.—Teaching Agricultural Vocations. A Manual for Teachers in Preparation and in Service. (377 pp.) New York: John Wiley & Sons; London: Chapman & Hall, 1927, 15s. [37.]

The Work of Seale-Hayne Agricultural College, Newton Abbot, Devon. (63 pp.) Issued by the College. [378.]

Comber, Norman N.—An Introduction to the Scientific Study of the Soil. (192 pp.) London: E. Arnold, 1927, 7s. 6d. [63.11.]

Aereboe, Friedrich.—Der Einfluss des Krieges auf die Landwirtschaftliche Produktion in Deutschland. (233 pp.) (Carnegie Social and Economic History of the World War: German Series.) Oxford University Press, 1927, 12s. 6d. [338.1 (43); 63 (43); 63 (09).]

International Institute of Agriculture.—L'Intensification de la Production Agricole dans les Divers Pays. No. 3. Suède. (23 pp.) Rome, 1927, 5 liras. [63 (485).]

Jones, Hugh.—Modern Denmark: Its Social, Economic, and Agricultural Life. (83 pp.) London: P. S. King & Son, 1927, 2s. 6d. [63 (489).]

Scottish Society for Research in Plant Breeding.—The Scottish Plant-Breeding Station, Craigs House, Corstorphine: Its Work and Objects. (18 pp.) 1927. [575.4; 63.1952.]

International Institute of Agriculture.—(1) The Loss to Agriculture Caused by Factory Fumes; (2) The Present Position Regarding the Control of Factory Smoke and Noxious Gases. (18 pp.+15 pl.; 8 pp.+2 cld. pl.+8 pl.) Lectures given at the Institute by Professor Hector Cristiani and Dr. Jules Stoklasa. Rome, 1927. [614.7.]

Tharpen, A. C., and Bunker, H. J.—The Microbiology of Cellulose Hemicelluloses Pectin and Gums. (363 pp.+10 pl.) Oxford University Press, London: Humphrey Milford, 1927, 25s. [576.8.]

Partridge, W.—Dictionary of Bacteriological Equivalents: French-English; German-English; Italian-English; Spanish-English. (141 pp.) London: Baillière, Tindall & Cox, 1927, 10s. 6d. [4; 576.8.]

International Labour Office.—International Labour Directory. Part VI: Co-operative Organizations. (110 pp.) London: George Allen & Unwin, 1927, 2s. [334.]

International Labour Office.—Studies and Reports. Series D (Wages and Hours of Work). No. 17. Minimum Wage-Fixing Machinery: An International Study of Legislation and Practice. (155 pp.) Geneva, 1927. London: P. S. King, 2s. 6d. [331.2.]

Field Crops

Board of Agriculture for Scotland.—Miscellaneous Publications, No. 3: The Maintenance of Pure and Vigorous Stocks of Varieties of the Potato. (106 pp.+6 pl.) Edinburgh, 1927, 1s. post free. [63.512—194.]

Roemer, Dr. Theodor.—Handbuch des Zuckerrübenbaues. (366 pp.+7 pl.) Berlin: Paul Parey, 1927, 19 marks. [63.3433.]

University College of Wales, Aberystwyth: Welsh Plant Breeding Station.—Series H, No. 7 (Seasons, 1919-1926): Red Clover Investigations. By R. D. Williams. (136 pp.+19 pl.) 1927, 5s. [63.33.]

Kenya Colony and Protectorate.—Report on Wheat Products in Kenya. By Professor Sir R. H. Biffen. (39 pp.) Nairobi, 1927. [63.311 (6).]

Live Stock and Feeding

Scottish Agricultural Organization Society.—Report of the Scottish Pig Industry Committee. (40 pp.) Edinburgh: Scottish A.O.S. (Ltd.), 5 St. Andrew Square, 1927, 3d. (post free, 4d.). [63.64; 63.64 : 043; 63.6 : 38.]

Wood, T. B.—Animal Nutrition. (2nd Edition.) (226 pp.) London: University Tutorial Press, 1927, 3s. 6d. [63.6043; 612.394.]

U.S. Department of Agriculture.—Department Bulletin, No. 1464: Market Classes and Grades of Cattle. (88 pp.) Washington, 1927. [63.6 : 38; 63.62; 63.60.]

Dairying

Harper Adams Agricultural College.—Dairy Husbandry Bulletin, No. 1: Management of Cows for High Milk Yields. By R. Bouffour. (20 pp.) Newport, Salop, 1926, 1s. [63.711; 63.711 : 043.]

U.S. Department of Agriculture.—Farmers' Bulletin, No. 1532: Dairy - Herd Improvement through Co-operative Bull Associations. (14 pp.) Washington, 1927. [63.711.]

U.S. Department of Agriculture.—Miscellaneous Circular, No. 99: Judging Dairy Cattle. (30 pp.) Washington, 1927. [63.6 (064).]

Canada Department of Agriculture.—Pamphlet No. 79—N.S.: Producing Clean Milk. (16 pp.) Ottawa, 1927. [614.32.]

Oklahoma Agricultural Experiment Station.—Bulletin No. 156: Commercial Buttermilk. (50 pp.) Stillwater, 1926. [63.715.]

Veterinary Science

Broune, Thomas G.—Atlas of the Anatomy and Physiology of the Ox. With an Appendix on Meat Inspection. (32 pp.+11 pl. by George Dupuy.) London: Baillière, Tindall & Cox, 1927, 7s. 6d. [619.2; 614.31.]

National Sheep-Breeders' Association.—A Review of Recent Research in Diseases of Sheep. By T. J. Bosworth. (Report of Twenty-sixth International Conference, held at Newport, Mon., July 4, 1927.) [619.3.]

Fruit Growing and Preserving

Cambridge School of Agriculture: Farm Economics Branch.—Report No. 7 (October, 1927): The Economy of a Norfolk Fruit Farm, 1923-26. By C. W. B. Wright and R. McG. Carslaw. (62 pp.) Cambridge University: Department of Agriculture, 1927, 2s. (post free). [63.41 (42).]

Midland Agricultural and Dairy College.—Bulletin No. 16: The Use of Poultry against Pests of Fruit Crops. (31 pp.) Sutton Bonington, 1927. [63.27; 63.296; 63.651.]

Ontario Department of Agriculture.—Bulletin No. 324: Grafting Fruit Trees. (20 pp.) 1927. [63.41—195.]

Canada Department of Agriculture.—Bulletin No. 80 (New Series): The Strawberry and Its Cultivation in Canada, with Contributed Chapters on Insects Affecting the Strawberry and Strawberry Diseases. (53 pp.) Ottawa, 1927. [63.41.]

Canada Department of Agriculture.—Bulletin No. 77 (New Series): Preserving Fruit and Vegetables in the Home: Results from Experiments in Canning, Pickling, and Preserving. (46 pp.) Ottawa, 1927. [664.84; 664.85.]

Economics

Rew, Sir Henry.—A Primer of Agricultural Economics. (229 pp.) London: John Murray, 1927, 5s. [338.1.]

South-Eastern Agricultural College, Wye: Department of Economics.—Report No. 3: Investigation into Farming Costs of Production and Financial Results. III: The Cost of Horse Labour (with Notes on Tractor Costs). By J. Wyllie. (pp. 71-98.) 1927, 1s. [338.58.]

South-Eastern Agricultural College, Wye: Department of Economics.—Report No. 4: Investigation into Farming Costs of Production and Financial Results. IV: Preliminary Note on Three Years' Financial Results. By J. Wyllie. (pp. 99-102.) 1927, 6d. [338.1 (42).]

Orwin, C. S.—The Teaching of Agriculture: Agricultural Economics, Studies in Scope and Method, No. 1. (7 pp.) The Agricultural Economics Society, 1927, 6d. [37.]

Thompson, R. J.—The Use of Statistics in the Study of Agricultural Economics: Agricultural Economics, Studies in Scope and Method, No. 2. (8 pp.) The Agricultural Economics Society, 1927, 1s. [311; 338.1.]

Street, A. W.—Methods in Marketing Study: Agricultural Economics, Studies in Scope and Method, No. 3. (12 pp.) The Agricultural Economics Society, 1927, 1s. [381; 338.1.]

Acland, Sir Francis.—The Farmers' Dilemma. (24 pp.) London: Land and Nation League, 1927, 6d. [338.1 (42).]

Davison, W. P.—Pooling Wheat in Canada. (275 pp.+35 pl.) Ottawa: The Graphic Publishers, 1927, \$2.50. [334 (71); 63.311 : 38.]

Stamp, Sir Josiah.—On Stimulus in the Economic Life. (The Rede Lecture, 1927.) (68 pp.) Cambridge: At the University Press, 1927, 3s. [338.]

Hawtrey, R. G.—The Gold Standard in Theory and Practice. (124 pp.) London: Longmans Green, 1927, 3s. [332.]

* * * * *

SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

Some Causes of the Variations in the Financial Results of Farming. J. Wyllie. (Jour. S.E. Agric. Coll., Wye, 24 (1927), pp. 173-180.) [338.1.]

The Distribution of Population Between Urban and Rural Areas. E. W. Shanahan. (Econ. Jour., xxxvii, 147 (September, 1927), pp. 395-403.) [312; 325.3.]

- Crop Forecasting in England. *J. A. Venn*. (Econ. Jour., xxxvii, 147 (September, 1927), pp. 404-410.) [31 (42): 311.]
- Agricultural Organization in Belgium. *J. P. McCarthy*. (Studies, xvi, 62 (June, 1927), pp. 317-328.) [331.88; 334 (493).]
- Experiments in Northern Ireland with Various Types of Phosphatic Fertilizers. *G. Scott Robertson*. (Jour. Min. Agric. for Northern Ireland, i (1927), pp. 7-36 + 2 pl.) [63.1672.]
- Cider. *W. H. Bufton*. (Jour. Inst. Brewing, xxxiii, 9 (September, 1927), pp. 450-458.) [663.3.]
- The Control of Tick Infestation and a Related Disease of Lambs in North Wales. *C. L. Walton*. (Parasitology, xix, 3 (September, 1927), pp. 265-273.) [59.169; 619.3.]

Field Crops

- Note on the Losses in Mangels During Storage. *G. T. Pyne*. (Jour. Dept. Lands and Agric., xxvii, 1, pp. 33-35.) [63.332.]
- A Preliminary Investigation on the Variations in Moisture Content of Crops during Storage. *F. L. C. Scrivener*. (Jour. S.E. Agric. Coll., Wye, 24 (1927), pp. 166-170.) [63.31-198; 63.512-198.]
- Notes on Experiments Relating to Loss of Vigour in Stocks of Potatoes. *W. J. Megaw*. (Jour. Min. Agric. for Northern Ireland, i (1927), pp. 37-45 + 3 pl.) [63.23; 63.512.]

Live Stock and Feeding

- The Need for Organization in the Pig Industry. *E. R. Orme*. (Pig Breeders' Ann., 1927-28, pp. 29-35.) [63.64.]
- Pig Testing and Recording for the Purposes of Advanced Registry. *H. R. Davidson* and *A. D. Buchanan Smith*. (Pig Breeders' Ann., 1927-28, pp. 46-62.) [63.64.]
- Growth and Conformation in the Pig. *J. Hammond*. (Pig Breeders' Ann., 1927-28, pp. 76-81 + 1 pl.) [612; 63.64; 63.64: 043.]
- The Economic Value of Pigs on the Farm. *A. G. Ruston*. (Pig Breeders' Ann., 1927-28, pp. 88-97.) [63.64.]
- The Breeding of Commercial Pigs on a Mixed Farm. *P. Webster Cory*. (Pig Breeders' Ann., 1927-28, pp. 126-130.) [63.64.]
- Trade Classification of Pigs. *E. J. Shelton*. (Queensland Agric. Jour., xxxviii, 2 (August, 1927), pp. 174-186.) [63.6: 38; 63.64.]
- The Value of Mineral Supplements to the Breeding Sow (pp. 104-109); Mineral Supplements and Vegetable Protein in Bacon Production (pp. 109-112). *R. G. Baskett*. (Jour. Min. Agric. for Northern Ireland, i (1927). [63.64: 043.]
- The Maintenance Requirements of Cattle on Different Rations and at Different Rates of Production; with a Note on "Dynamic Action." *J. Wilson*. (Sci. Proc. Roy. Dublin Soc., xviii, N.S., 33 (July, 1927), pp. 399-406.) [612.394; 63.62: 043.]
- Silage Investigations: I, Silage and Roots as Farm Crops; II, The Feeding Value of Silage for Dairy Cows and Fattening Bullocks; III, Effect of Fermentation in the Silo on the Feeding Value. *G. S. Robertson, F. Dickinson* and *J. Houston*. (Jour. Min. Agric. for Northern Ireland, i (1927), pp. 70-104.) [63.19832; 63.60432.]

Dairying

- Three Times Milking. *G. Holt-Thomas*. (Jour. Farmers' Club, 1927, Part 5 (June), pp. 85-102.) [63.70; 63.711.]

- The Cow and the Chemist. *A. C. M'Candlish*. (Trans. High. Agric. Soc., Scotland, xxxix (1927), pp. 42-59.) [612.394; 63.711: 043.]
- The Variations in Milk Yields Caused by Season of the Year, Service, Age, and Dry Period, and their Elimination. *H. G. Sanders*. (Jour. Agric. Sci., xvii, 3 (July, 1927), pp. 339-379.) [612.664; 63.711.]
- The Influence of the Age of the Cow on the Yield and Quality of the Milk. *M. K. White* and *T. J. Drakeley*. (Jour. Agric. Sci., xvii, 3 (July, 1927), pp. 420-427.) [63.711.]
- Oiliness in Milk. *A. T. R. Mattick*. (Jour. Agric. Sci., xvii, 3 (July, 1927), pp. 388-391.) [63.719.]
- The Modern Dairy Farm. *Frank Darling*. (Architects' Journal, April 6, 1927, pp. 486-490.) [63.6: 69.]
- A Study of "Flaky" Milk. *F. S. Jones* and *R. B. Little*. (Jour. Dairy Sci., x, 5 (September, 1927), pp. 439-447.) [63.719; 63.712.]
- Methylene-Blue (Reductase Test) in Milk Grading. *M. Grimes, H. S. Boyd Barrett* and *J. Reilly*. (Sci. Proc. Roy. Dublin Soc., xviii, N.S., 38 (July, 1927), pp. 437-441.) [576.8: 7; 63.712.]
- Bacteriological Methods of Examining Ice Cream. (Jour. Dairy Sci., x, 5 (September, 1927), pp. 460-478.) [576.8: 7; 63.715.]
- Camembert Cheese from Pasteurized Milk. *W. Hochstrasser* and *W. V. Price*. (Jour. Dairy Sci., x, 5 (September, 1927), pp. 448-459.) [63.736.]

Poultry

- A Milkless, Greenless, Gritless, All-Mash Ration for Growing Chicks. *C. W. Carrick, S. M. Hauge*, and *R. W. Prange*. (Poultry Sci., vi, 4 (April-May, 1927), pp. 162-166.) [63.651: 043.]
- The All-Mash Method of Feeding Chickens. *D. C. Kennard* and *R. M. Bethke*. (Poultry Sci., vi, 4 (April-May, 1927), pp. 190-200.) [63.651: 043.]
- Do Growing Chicks Require a Vitamin B Supplement to a Mixed Grain Ration? *T. S. Hamilton, L. E. Card*, and *C. H. Kick*. (Poultry Sci., vi, 5 (June-July, 1927), pp. 243-248.) [612.394; 63.651: 043.]
- Raising Turkeys in Partial Confinement. *F. D. Brooks*. (Poultry Sci., vi, 5 (June-July, 1927), pp. 233-238.) [63.652.]
- The Anti-Sterility Vitamin E and Poultry. *R. T. Parkhurst*. (Science LXVI, 1698 (July 15, 1927), pp. 66-68.) [612.394; 63.651: 043.]
- Growth of Chickens as Affected by Sunlight through Window Glass, Through a Glass Substitute, and Direct Sunlight. *E. M. Bethke* and *D. C. Kennard*. (Ohio Agricultural Experiment Station Bimonthly Bulletin, xi, 4 (July-August, 1926), pp. 131-135.) [612.394; 63.651.]

Horticulture and Fruit Growing

- The Fruiting and Blooming Period of the Tomato Plant. Progress Report. *W. Corbett*. (Cheshunt Experimental and Research Station Report, 1926, pp. 72-78.) [63.513.]
- Field Experiment on the Manuring of Gooseberry Bushes. *T. Wallace*. (Jour. Pom. and Hort. Sci., vi, 3 (September, 1927), pp. 184-197.) [63.41-16.]
- Some Factors Affecting the Irrigation Requirements of Deciduous Orchards. *F. J. Veihmeyer*. (Hilgardia, ii, 6 (January, 1927), pp. 125-284 + 3 pl.) [63.13; 43.42.]

964. A

Plant Pests and Diseases and Remedies

- Rhizoctonia "Foot-Rot" of the Tomato. *T. Small*. (Ann. App. Biol., xiv, 3 (August, 1927), pp. 290-295.) [63.24.]
- Mangel Scab: Its Cause and Histogeny. *W. A. Millard and F. Beeley*. (Ann. App. Biol., xiv, 3 (August, 1927), pp. 296-311 + 4 pl.) [63.24.]
- A Study of *Hylemyia (Chortophila) Brassicae* Bouché, the Cabbage Root Fly and Its Parasites, with Notes on Some Other Dipterous Pests of Cruciferous Plants. *K. M. Smith*. (Ann. App. Biol., xiv, 3 (August, 1927), pp. 312-329 + 1 pl.) [63.27.]
- Investigations on the Control of Wireworms. *H. W. Miles and F. R. Petherbridge*. (Ann. App. Biol., xiv, 3 (August, 1927), pp. 359-387 + 2 pl.) [63.27.]
- Reversion of Black Currants: I, Symptoms and Diagnosis of the Disease. *J. Amos and R. G. Hatton*. (Jour. Pom. and Hort. Sci., vi, 3 (September, 1927), pp. 167-183 + 7 pl.) [63.23.]
- Studies on the Resistance of Apple to the Woolly Aphis (*Eriosoma lanigerum*, Hausm.). *R. le Pelley*. (Jour. Pom. and Hort. Sci., vi, 3 (September, 1927), pp. 209-241.) [63.27.]
- An Attack of Cockchafer Larvae on Grassland and Some Experiments in Connection with their Control. *F. V. Theobald*. (Jour. S.E. Agric. Coll., Wye, 24 (1927), pp. 40-43.) [63.27.]
- Caterpillars and Plant Lice Attacking Chrysanthemums under Glass. *F. V. Theobald*. (Jour. S.E. Agric. Coll., Wye, 24 (1927), pp. 44-50.) [63.27-52.]
- The Scarcity of Aphides in 1924 in Southern Britain. *F. V. Theobald*. (Jour. S.E. Agric. Coll., Wye, 24 (1927), pp. 51-53.) [63.27.]
- A New Gall Midge Attacking *Arabis Albida*. *H. F. Barnes and F. V. Theobald*. (Jour. S.E. Agric. Coll., Wye, 24 (1927), pp. 54-55.) [63.27.]
- The Beet Eelworm: Its Life History When Found on Hops in this Country. *C. A. W. Duffield*. (Jour. S.E. Agric. Coll., Wye, 24 (1927), pp. 56-58.) [63.27.]
- The Blossom Beetle Attacking the Seed Crop of Swedes, &c. *C. A. W. Duffield*. (Jour. S.E. Agric. Coll., Wye, 24 (1927), pp. 59-63.) [63.27.]
- Material for a Monograph of the British Cecidomyidæ or Gall Midges. British Gall Midges of Economic Importance, i-v. *H. F. Barnes*. (Jour. S.E. Agric. Coll., Wye, 24 (1927), pp. 65-148.) [63.27.]
- Relation of Size of Oil Drops to Toxicity of Petroleum-Oil Emulsions to Aphides. *E. L. Griffin, C. H. Richardson and R. O. Burdette*. (Jour. Agric. Res., 34, 8 (April 15, 1927), pp. 727-738.) [63.294; 63.295.]
- Lubricating Oils as Insecticides in Dormant Spraying. *E. L. Green*. (Ind. and Eng. Chem., 19, 8 (August, 1927), pp. 931-935.) [63.295.]
- Chemical Hydrated Lime for the Preparation of Bordeaux Mixture. *E. B. Holland and G. M. Gilligan*. (Phytopathology, 17, 8 (August, 1927), pp. 571-572.) [63.295.]
- The Application of Insecticides by Aeroplane. *Dudley Wright*. (Jour. Inst. Aeronautical Engineers, i, 8 (August, 1927), pp. 45-58.) [63.294.]



Display of Home Produce in Fleet Street, London. Corner of the Fruit Section.

922

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXIV. No. 11.

FEBRUARY, 1928.

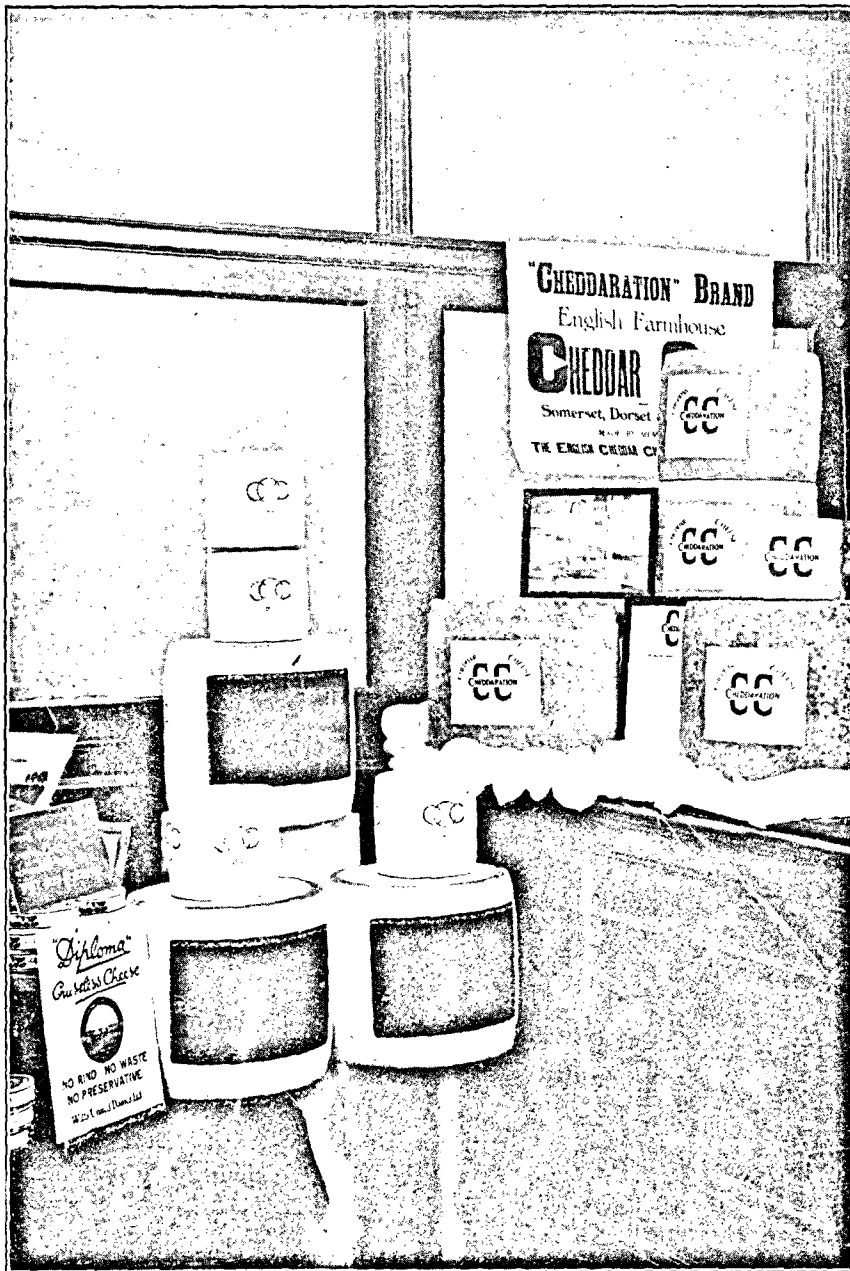
NOTES FOR THE MONTH

UNDER the terms of the Small Holdings and Allotments Acts, 1908-26, small holdings varying in area from one to 50 acres have been provided by every Small Holdings County Council in England and Wales, Competitions and by a number of County Boroughs, in order to meet the needs of suitable applicants. The total area of land sold or let by Councils in small holdings under the Acts is over 440,000 acres, the holdings numbering more than 29,000.

In order to encourage better cultivation and management by the occupiers, several Councils have organized competitions for the best-managed small holdings in their area. Usually such competitions are arranged in conjunction with established agricultural shows in the county, and they may be either limited to holdings provided by the Council or open to all smallholders in the county whose holdings fall within the prescribed categories.

The reports of the judges on the holdings entered for competitions of this kind frequently yield illuminating comments on the position and prospects of the competitors, and go far to dispel the pessimistic views sometimes expressed as to the prospects of smallholders in present agricultural conditions. It is by no means uncommon to find that the judges' reports comment both on the high level of cultivation of the holdings, and on the success and contentment of the competing smallholders. The fact which many critics of small holdings fail to realize is that, in some directions, notably in their comparative independence of hired labour and in the personal care and attention they are able to give to all details of the work, smallholders, by dint of incessant hard work, are in a stronger position than many larger farmers. In many cases, the advantages are more than sufficient to counterbalance the obvious disadvantages of working on a smaller scale. That

3 Q



Display of Home Products in Fleet Street, London. Corner of the Dairy Section, showing trade-marked Cheshire and Cheddar Cheese.

ignorance of the facts is frequently responsible for criticisms, directed against the small holdings movement, is demonstrated by the instances reported in which practical farmers who had no belief in small holdings have been appointed as judges in these competitions, and have subsequently announced that the experience gained in carrying out the necessary inspections of the competing holdings has resulted in their complete conversion.

One of the most recently instituted competitions of this character was held by the Hampshire County Council in 1927. There were 68 entries in all, and the reports of the judges were very favourable. Certain holdings evoked special mention because of the excellence of the crops and cultivation and the neat appearance of the holdings. On the recommendation of the judges the Committee decided to award additional prizes in two of the six classes into which the entries were divided. The judges also called attention to the beneficial effect which the Ministry's Live Stock Scheme is having on the quality of the stock kept on the holdings.

A similar competition held in Norfolk in 1927 produced an interesting report, in which the judges spoke highly of the cultivation, cropping and condition of the arable land, but expressed the view that the pasture land required more attention. They were agreeably surprised at the number of cows kept by the competitors, and drew attention to several instances of pedigree bulls and boars being kept.

The following extracts are taken from reports of competitions held in recent years in Salop and in the Lindsey Division of Lincolnshire respectively :—

Salop.—It has been a great pleasure to find such a high level of management on the respective holdings.

Most of the holdings are heavily stocked, and it has been a pleasurable surprise to us to find the freedom with which purchased concentrated feeding stuffs are being used.

It is also very gratifying to note that, while many ex-service men are making their mark, some of the leading competitors are men who have worked their way up from the position of farm workers and are now obviously ready to take over even larger holdings, thus proving that the small holdings movement is fulfilling a very real function in providing a ladder for the farm worker to better his position in life.

Lindsey.—On visiting the small holdings, nearly 50 in number, it was very pleasing to find that, with the exception of one or two, they are farmed in such a manner that the tenants cannot help but be successful.

Every smallholder seemed contented and happy, and imbued with the desire to improve his position. Given fair seasons and reasonable rents, and a continuance of the good farming which

was so noticeable, we feel sure that the development of small holdings must be an asset to the county.

We also could not help but notice what a great help to these people our County Agricultural Organizer is with his advice and experiments. It was pleasant to see the readiness with which they sought his guidance and advice.

The reports of these competitions also frequently bring to notice striking examples of individual success due to specialization in some particular branch of the farming industry. Thus, mention was made in the report on the Lindsey competition, referred to above, that one of the competitors had won the Breed Championship Prize for curly-coated pigs at Smithfield Show for six years in succession.

Again, in a recent competition in Middlesex, the winner of the first prize in one of the classes was an ex-photographer who now specializes in pigs and poultry, and the judges, in their report on the competition, commented on his original and effective methods of feeding and housing his stock.

Another conspicuous instance of a successful smallholder is reported from Surrey, where the tenant of one of the Council's dairy holdings, though he had had no agricultural experience before the war, has succeeded three times in winning the Clean Milk Competition for his county and has built up a very profitable business.

A final instance may be quoted of the success of a statutory smallholder in open competitions of a less specialized character. An ex-service tenant of the Wiltshire County Council was successful in winning the First Prize and the Ten Guineas Cup presented by the Beaufort Hunt in the open class in a county competition for the best-managed small holdings, and subsequently the same tenant was awarded a First Prize in a class of smallholders and, also, a Twenty-five Guineas Cup presented by the Avon Dale Hunt, open to all farmers, irrespective of area, farming within the limits of the hunt.

The smallholders' wives, by careful attention to the interior of the dwelling house, as well as the garden, play their part in ensuring the success of the prize winners, and numerous pleasing testimonies to the excellence of these domestic items have been noted.

* * * * *

EXCELLENT progress is recorded by the Cheshire Cheese Federation, details of whose scheme were given in this JOURNAL for March and July, 1927. In a report on the first six months' working of their scheme for placing a branded product of guaranteed quality on the market, it is observed that the

been given in this JOURNAL. It is of interest, therefore, to quote an independent opinion. *The Farmer and Stock-Breeder* recently made the following observations based on the experience gained at the exhibition of home produce promoted by that paper in Fleet Street :—

"The difficulty of obtaining regular supplies will remain as long as our present system of marketing continues. It is in this direction that the Marketing Branch of the Ministry can be of real assistance. They have already laid the foundation, and it remains only for loyal support by producers to build up a much sounder system. My experience of the past fortnight has shown clearly that, if we are to regain the confidence of the town buyer, we must not only produce quality but also a more standard article, and continuity of supplies. This cannot be accomplished by individual effort—marketing must be done by co-ordinated enterprise . . ."

"Briefly summarized, the lessons of the exhibition from the producer's point of view appear to us to be as follows :—

"That there is a strong interest in, and a potentially greedy demand, at relatively good prices, for high-class English produce, carefully graded and presented in attractive form.

"That this demand is partially strangled by reason of the difficulty of obtaining supplies that are constant both in quality and quantity.

"That further organization is required for regulating and ensuring this quality and quantity of supply.

"That schemes analogous to those adopted by the Cheshire and Cheddar cheese-makers, and by some poultry organizations, are a necessary foundation for effective organization.

"That, given this organization, the market could be profitably developed by suitable publicity through such exhibitions as *The Farmer and Stock-Breeder* Show and by general advertising.

"That there is scope for more individual enterprise in getting in touch with consumers to provide direct supplies at retail prices.

"That we can develop the market and prices for home-grown produce by studying quality and regularity of supplies.

"That we can combat overseas competition only by attention to quality and service. They can almost always beat us in price; we can always beat them in quality—if we take the trouble."

* * * * *

In the House of Commons, on December 22 last, Major McLean, M.P., asked the Minister if he had any information

**Bounties
on
Imported
Agricultural
Produce**

as to whether any bounties or subventions are given by the Dominions, or by foreign countries, in aid of agricultural produce exported to the United Kingdom. In reply, Mr. Guinness said: Inquiries have been made into this matter, and information has been received in respect

of some 20 countries. No case has been found where any bounty or subvention is given to agricultural commodities which compete with British produce, although

cleaned rice exported from Spain received a subvention of 25 pesetas per ton. The countries to which the above statement applies are Canada, India, and South Africa, Argentina, Chile, Denmark, Egypt, Esthonia, France, Finland, Holland, Italy, Latvia, Lithuania, Roumania, Spain, Switzerland, Uruguay and the United States. Information in regard to New Zealand and Australia is not yet available.

* * * * *

THE Departmental Committee appointed by the Government of Northern Ireland in April, 1927, to inquire into (a) the cost of transit of farm produce; (b) the causes

**Agricultural
Produce from
Northern Ireland** of the difference in prices obtained by producers and the prices charged to consumers; and (c) the methods of marketing agricultural produce generally,

has now issued its report.*

The report states that the cost of transit of farm produce to the British markets is so high that there is a grave danger of a serious diminution in the export of Northern Ireland agricultural produce: examples are given which show that it is cheaper to convey produce to England from the United States and Germany than from Northern Ireland. The Committee, therefore, recommends that commercial carriers should revise existing rates in the most complete and sympathetic manner with a view to aiding the agricultural industry.

Whilst the difference between the prices realized by the producer and those paid by the consumer is dependent on many factors, it is, in the opinion of the Committee, largely determined by marketing methods. The existing system of marketing is condemned; the distributive chain is too long.

In the Committee's view, the discrepancy in price is caused, not by the immoderate profits of the individual, but by the small profits of the many; the present system represents the maximum competition amongst producers coupled with the maximum of alternative markets for buyers, and unnecessarily depresses prices. By way of improvement, the Committee strongly recommends co-operation of producers and the grading and standardization of supplies.

That agricultural co-operation has been a failure in Northern Ireland is recognized, but it is not, on that account, admitted to be impracticable. The Committee considers that much pioneer work will have to be accomplished before co-operation

* Cmd. 65. His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 9d.

Federation is open for membership to any producer of Cheshire cheese in England and Wales who complies with the conditions laid down. The number of applications for membership received up to December 1, 1927, was 284; of these, no fewer than 204 have been registered as accredited makers. The total output of graded cheese during the first six months of the scheme's operation is estimated at 30,000 cwt. Several thousand hundredweights of graded Cheshire cheese have been sold in London and the southern and eastern counties, thus regaining a market which had been lost for many years. Inquiries have also been received from abroad, and sample consignments have been sent for use upon the liners of a steamship company plying between this country and the East.

By a careful study of the state of the world's market, the Federation has been able to notify makers each week of the price which graded cheese should command. In general, the forecasts have proved to be very near the mark. This service is regarded as one of the most helpful consequences of the scheme, and there is said to be an instinctive drawing together of the far-spread and isolated members into closer and more practical co-operation. The fact that graded cheese has realized anything from $\frac{1}{2}$ d. to 1d. per lb. more than the best "ungraded" cheese offered at the same fair, is evidence of the business value of the scheme to makers.

Experience during the first month or two led the Federation to adopt a new rule, which provides that cheese should only be branded with the trade-mark of the Federation after inspection and approval by the official grader. The report states that, "It is notable that this condition requiring official grading has done more than anything else to earn the confidence of all interested in the handling of the product."

The educational value of the scheme has been considerable. The grader, being an expert in dairying, has been able to render assistance to makers who have met with any difficulty, and this service has not been confined to makers who have become accredited; no charge has been made for the advice and help given. It is gratifying that, at the annual dairy shows held during the autumn in various towns, dairies which grade their cheese have been the most successful in carrying off the awards and the bulk of the prize money; with one exception, the championships at these shows have been won by registered makers.

The work of the Federation has been hampered, to some extent, by lack of funds available for publicity, but advertise-

ments have been inserted in trade and other papers, prize money has been given for classes for Cheshire cheese at certain agricultural and dairy shows, and a window dressing competition has been promoted. The Federation has taken advantage of the displays of home produce organized by the Ministry, under the ægis of the Empire Marketing Board, and the graded cheese has been a worthy feature of these stands. In addition, at the International Grocers' Exhibition, London, the Federation had a stand of its own, where a considerable quantity of graded cheeses was cut up and offered in small samples. This exhibition work has resulted in many inquiries and much new business. It may be added that the Federation does not wish to interfere with the established channels of the trade, and has handed all inquiries for graded cheese to factors who support the scheme.

In view of the encouraging nature of the above report, the Ministry has paid the second instalment of the grant of £1,000 which it has made to the Federation in aid of the expenses incurred in the first year's working of this very notable experiment in improved marketing technique.

* * * * *

THE continued expression of the belief that "Empire buying begins at home" is beginning to make an impression on the buying public. The Empire Marketing Board's advertising campaign and the "Empire Buying Begins at Home": exhibitions of home produce arranged, under the Board's ægis, by the Ministry, with the assistance of the National Farmers' Union and other bodies, have played a not unsuccessful part in awakening in townspeople a consciousness of the importance of agriculture and the excellence of the best products of our countryside.

A growing demand will, however, prove of little value to the farmer if supplies of produce of guaranteed quality are not forthcoming continuously and in commercial quantities. Those responsible for the displays at Exhibitions are constantly meeting fresh evidence of the difficulty experienced by the ordinary retailer and the ordinary housewife in obtaining regular supplies of standard home products. Manufacturers using agricultural products also make the same complaint. This difficulty can only be removed if producers are ready to venture on new paths and carry into effect a marketing policy for the good of the industry as a whole. The Ministry's views as to the form which such a policy should take have already

can be generally established, and recommends that, as a preliminary, the Government should initiate an educational campaign in order to create in the minds of the agricultural community—notably of the younger generation—due appreciation of the benefits to be derived from co-operative effort.

Buyers everywhere are now demanding graded and guaranteed produce. Serious injury has been caused to the agricultural industry by the negligence and carelessness of producers and exporters in the methods of grading and packing Northern Irish produce for export. The Committee is therefore in favour of compulsory inspection of exports, but recommends that such legislation should be introduced gradually. Northern Ireland is in grave danger of losing its chief outlets for the important potato industry, owing to the many complaints made by importers of the inferior and undesirable methods of grading and packing. The Committee, therefore, recommends that, as an experiment, legislation should be introduced to deal with the grading, packing, and inspection of potatoes for export; such legislation could be extended later to other agricultural produce for export and also to produce placed on the Northern Ireland market.

Other recommendations are that the postal rates for farm produce should be reduced; that the detention period for live stock entering ports in Great Britain from Northern Ireland should be substantially curtailed if not cancelled; that the production of inferior butter on farms should be discouraged; and that consideration should be given to the establishment of agricultural credit banks.

* * * * *

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 December, 1927, together with the quantity produced during the corresponding month in 1926, was:—

					cwt.
1927	..	..	..	..	1,169,889
1926	..	..	..	..	900,738

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

					cwt.
1927	..	..	..	..	3,315,958
1926	..	..	..	..	2,373,510

BROADCAST TALK ON "BETTER MARKETING"

[The following brief address on "Better Marketing," given by Mr. R. J. Thompson, C.B., of the Ministry of Agriculture and Fisheries, was broadcast from Manchester on December 13 last.]

IN the time at my disposal, I can only glance somewhat hastily at some of the ideas which are being suggested for the better marketing of agricultural produce. I need not argue the desirability of better marketing. Obviously, any method which suggests a way in which the producer can get a greater return for his output is deserving of consideration. It is equally obvious that there is no simple or easy means by which this can be done or it would have been discovered long ago. Fortunately, however, there is an increasing disposition on the part of producers to study the subject. For example, at the recent Imperial Fruit Show, at Manchester, a Growers' Conference was held, and, although the speakers were at liberty to choose their own subjects, they all dealt in one way or another with marketing. This is a good sign, for it is by frank discussion and close investigation of difficulties that progress is made possible.

The producer in this country is exposed to a double competition: (1) he is competing with his neighbours who are selling the same type of produce in the same way, and (2) he is in competition with overseas co-operative societies or companies organized on a business basis, highly capitalized and controlled by men who devote themselves to the task of supplying the demand in the most effective manner.

The result of this organized competition has been to raise the quality of imported produce so that much of it runs a very close second to the best English produce. It is not as good as the best, though it often surpasses it in appearance. It is usually in a superior position on account of regularity of delivery and evenness of quality. In short, for one reason or another English produce is finding it difficult to hold its own on many wholesale markets. The question is, then, whether any change in methods can be adopted which will benefit the producer by giving him better prices or in any case a better demand.

At this point, it is well to realize that the object of marketing is to supply the needs of the buyer and to endeavour to produce the type of article for which he will pay the highest price. It may be said that this is what every producer

endeavours to do, but when one reflects on the multiplicity of sorts and varieties of the same commodities which are offered for sale, it is evident that there is the greatest difference of opinion as to what is required, and that producers in most cases have no very clear idea as to the true needs of the market. They sell the crops they grow or the stock they fatten; but they have not set out deliberately to supply any particular class of article.

The first step, then, is standardization; that is, the selection of the types of produce most suited to the needs of the market, and the definition of these types according to quality, weight, and other characteristics. This is the real secret of the commercial success of imported produce on the home markets. Practically every imported article on the wholesale food market is more or less standardized, and that is the direction in which British produce needs to move. It is a principle which is applicable to all classes of produce. The extent to which eggs are graded by the leading exporting countries is well known and can be seen in almost every grocer's shop; but grading has also been successfully applied to carcasses of beef and mutton, to fruit, poultry, butter, potatoes, wool, cheese, and many other products.

A beginning has been made in this country. Standard grades have been suggested for eggs, poultry, potatoes, and fruit. In the case of fruit, many growers adopt a system of grading, and find it to their advantage. Grading has just been adopted for both Cheshire and Cheddar cheese. The National Federation of Meat Traders have defined the weights and descriptions of pigs which are most suited to the pork and bacon trades. The next step is agreement as to the types and weights of cattle most suited to the meat trade.

It is by classification of produce into grades according to quality that wholesale trading is facilitated, and business, instead of being conducted on retail lines where each consignment differs from the next, is put on a commercial footing. Apart from business advantages, classification of produce in this way results in the producer being paid top prices for top grades, and encourages and stimulates production of first quality stuff. Thus standardization begins on the farm, and one important advantage of marketing on a standard system is to increase the inducement to produce high grade goods.

Think for a moment of the advantage of an increase in the proportion of first quality produce. In most branches of

agriculture, there is no definite standard of what is first quality. It is a matter of opinion which varies from market to market. What is called first quality at one place is frequently only second quality somewhere else. By a grading system, agreed between producers and distributors, qualities are defined, the producer knows what to aim at, the distributor knows what he is buying. There would still be variations in price, but they would depend more on supply and demand, and less on varying ideas of quality. If the producers knew exactly what the buyer wanted, and the grade which would be likely to realize the best price, he would constantly have an inducement to aim at increasing his proportion of best grade produce; and there is always room at the top! The total wholesale value of the English agricultural output has been estimated at £225,000,000. If 10 per cent. of the output could be raised from second quality to first quality, it would make a difference of millions to the advantage of the producer.

Before progress can be made in standardization, agreement must be reached between producers and distributors as to the grades which can advantageously be adopted. Each commodity needs separate treatment, but, in the case of several commodities, the machinery for reaching agreement exists in various advisory committees of the Ministry of Agriculture on which both the producers and the distributive trades are represented. It is not an easy problem, but if it is approached with an open mind, and with a determination to find a solution, the difficulties will, I believe, prove more apparent than real.

The settlement of grades is one aspect of better marketing. For eggs, fruit and poultry, uniform packing and the use of non-returnable packages are equally important, but the crux of the question is how these newer methods are to be put into operation. Producers can do a good deal by aiming at the production of goods of the agreed standards, but to supply the wholesale markets and to develop the demand for British produce, some form of organized marketing is necessary. To take an example from the egg trade, in areas of surplus production, of which there are many in England and Wales, the output of producers within, say, a 10-15 miles radius needs to be collected together at a central egg packing station, where the eggs would be tested, graded, and packed on a uniform system. Poultry and some kinds of fruit are other commodities which lend themselves specially to centralized sale. Whether such depots are managed by

producers, themselves, acting in combination, or by persons working in conjunction with them is not essential; the method is one which, if properly organized, should stimulate production, and by encouraging the best class of produce give results satisfactory to producers.

This is one type of organized marketing. Other commodities would need different treatment, but the essential idea is the collection, grading, and sale for the wholesale market so as to secure uniformity and regularity in supply. If some such system could be adopted, it would have very definite commercial possibilities. It would result in British produce being sold under conditions similar to those which have led to the development of the market for imported produce. It would then be far more easy for the British farmer to secure a larger share in the increasing demand.

There is another point. Advertisement is the life-blood of modern business, but under present conditions it is very difficult to apply advertising methods to British produce. Standardization, combined with organized marketing, makes advertising possible. One means would be the use of a national trade mark, which would not only identify produce as British but would also be a guarantee of quality. The consumer might be induced to look for the national trade mark when making his purchases, and the British farmer might benefit from the patriotic desire to support home industries, which should be such a valuable asset to the home grower.

To sum up, the two ideas which are essential to any scheme of better marketing are the standardization of grades and the organization of distribution. How they can be applied in practice to the agricultural industry is the problem which lies before the farmers of this country, but, in the last year or two, much progress has been made in studying the subject and in providing a basis for discussion. I hope that some of you are familiar with the orange-coloured Reports on Marketing issued by the Ministry of Agriculture. In these reports, standard grades and standard packages for different commodities are set out in detail, and some suggestions are made as to organization. At agricultural shows this year (1927), the Ministry has been illustrating, by practical demonstrations which have been visited by many thousands of people, the proposals contained in these reports.

In addition, small grants are being made to enable promising schemes to be tried, such, for example, as the grading and

branding of Cheshire and Cheddar cheese, and the grading of fruit and vegetables at the Pershore Fruit Market. Thus, a not unimportant beginning has been made. It is not suggested that the Ministry has any complete or cut-and-dried solution of what is an extraordinarily difficult problem, but it has provided something to work on.

In conclusion, I will only say this: the best commercial brains of the Dominions and of foreign countries are at work trying to enlarge their foothold in the British market. The producer in this country cannot afford to ignore changing conditions. He must not be content to sit idly by and say that "what was good enough for my father is good enough for me." In the business world, manufacturers scrap old methods and old machinery when they have out-worn their purpose. In the agricultural world, no less, we need to consider, without prejudice and with an open mind, whether new methods can be devised for selling our farm produce.

* * * * *

THE ORGANIZATION OF THE POULTRY INDUSTRY IN ENGLAND AND WALES *

PERCY A. FRANCIS, M.B.E.,

Poultry Commissioner, Ministry of Agriculture and Fisheries.

I. INTERNAL ORGANIZATION.—The organization of poultry-keepers is perhaps more difficult to effect than that of some other classes of the community, partly because so many people keep poultry merely as a subsidiary occupation, and partly because, with a few exceptions, poultry societies, as distinct from the co-operative marketing associations, have not, as a rule, undertaken in the past any responsibility in connexion with the disposal of their members' produce. Consequently the powerful impetus given to an organization by such questions as wages, hours of labour and prices for produce, has not assisted to any appreciable degree in establishing combinations of poultry-keepers, and the total number of organized poultry-keepers is low in comparison with the total number of people who keep poultry.

The present organization of the poultry industry in England and Wales may be said to present two aspects; the internal and the external. The internal organization includes the activities of those poultry-keepers and other persons directly

* Paper read at the World's Poultry Congress, Ottawa, July, 1927.

or indirectly connected with the industry who, through the formation of societies of one kind or another, endeavour by combination and mutual help to protect their common interests, and to further the development of those branches of the industry in which they are specially concerned. The external organization includes the activities of State and local authorities, educational and State institutions. Sometimes, as may be expected, the work of these various bodies overlaps, but, for the purpose of this brief survey, the broad distinction indicated above is conveniently and sufficiently defined.

Work of Poultry Societies.—The work of the poultry societies or associations set up by poultry-keepers is varied in character, and may include one or more of the following forms :—

Educational activities, competitive laying tests, registration of breeders, control of exhibitions and judges, the maintenance of breed standards, the marketing of poultry and eggs, the supply of poultry-keepers' requisites such as feeding stuffs, etc., and, generally, the encouragement and development of poultry-keeping. In addition, the societies, through their appointed delegates, take their part in the work of the National Poultry Council.

The Poultry Club.—The growth of poultry societies in Britain has been spasmodic and disconnected. The oldest society is the Poultry Club, which was established in 1877 for the following purposes :—

- (a) to promote the breeding and exhibiting of poultry ;
- (b) to defend and protect the interests of poultry-breeders and exhibitors ; and
- (c) to suppress and prevent fraudulent or dishonest practices in relation to or in connexion with the breeding or exhibiting of poultry.

This club, which to-day possesses 4,000 direct members besides the members of nearly 300 associated bodies, is responsible for establishing and maintaining proper breed standards. The club offers many cups and special prizes for competitions at shows, and is represented on the Utility Poultry Judges' Registration Board, which is a joint body having as its main object the maintenance of a panel of judges, for utility classes at shows, who can be depended upon not to give prizes to birds deficient in breed points. The Poultry Club is also represented on the Standards Inquiry Committee, a joint body at present examining the various standards with the idea of eliminating any points detrimental to maintaining a full measure of beauty

and utility in the same birds. With the possible exception of a few extremists, the members of the Poultry Club have always aimed at this happy combination of qualities. Associated with the club are the chief specialist clubs which have been established to further the interests of particular breeds. These specialist clubs in many cases guarantee classes at exhibitions and provide cups and special prizes for the breeds with which they are individually concerned.

There is also a large number of smaller societies of different kinds, some of which have both exhibition and utility interests.

Utility Poultry Societies.—The formation of societies dealing specially with the economic or utilitarian side of poultry-keeping did not follow until some years after the establishment of the Poultry Club ; in fact, it was not until about 1896 that the first of these societies, the Northern Utility Poultry Society, was organized. Shortly afterwards the Utility Poultry Club was formed, and to these two organizations jointly belongs the credit of having established the first public laying competition, which was held in 1897, in Yorkshire. The inauguration of this competition may be said to mark the commencement of a period when the attention of British poultry-keepers began specially to be directed to the economic qualities of the fowl, particularly as regards egg production, and when the foundation was laid of our present-day pedigree utility stocks.

The National Utility Poultry Society.—The Utility Poultry Club ultimately became the National Utility Poultry Society (N.U.P.S.), which has some 3,000 members and from 50 to 60 branches and affiliated societies. In conjunction with the *Daily Mail* newspaper and the London and North Eastern Railway Company, this Society conducts at Bentley, Suffolk, the largest laying trials in this country, and probably in the world, since in 1926–27 over 3,000 birds were under test. This Society, which is responsible for the initiation of Utility Shows, is represented on the Utility Poultry Judges' Registration Board, and on the Standards Inquiry Committee. It maintains a headquarters office in London, arranges trade discounts for its members, and conducts much advisory and lecture work. It is also represented by a weekly paper, *The National Poultry Journal*.

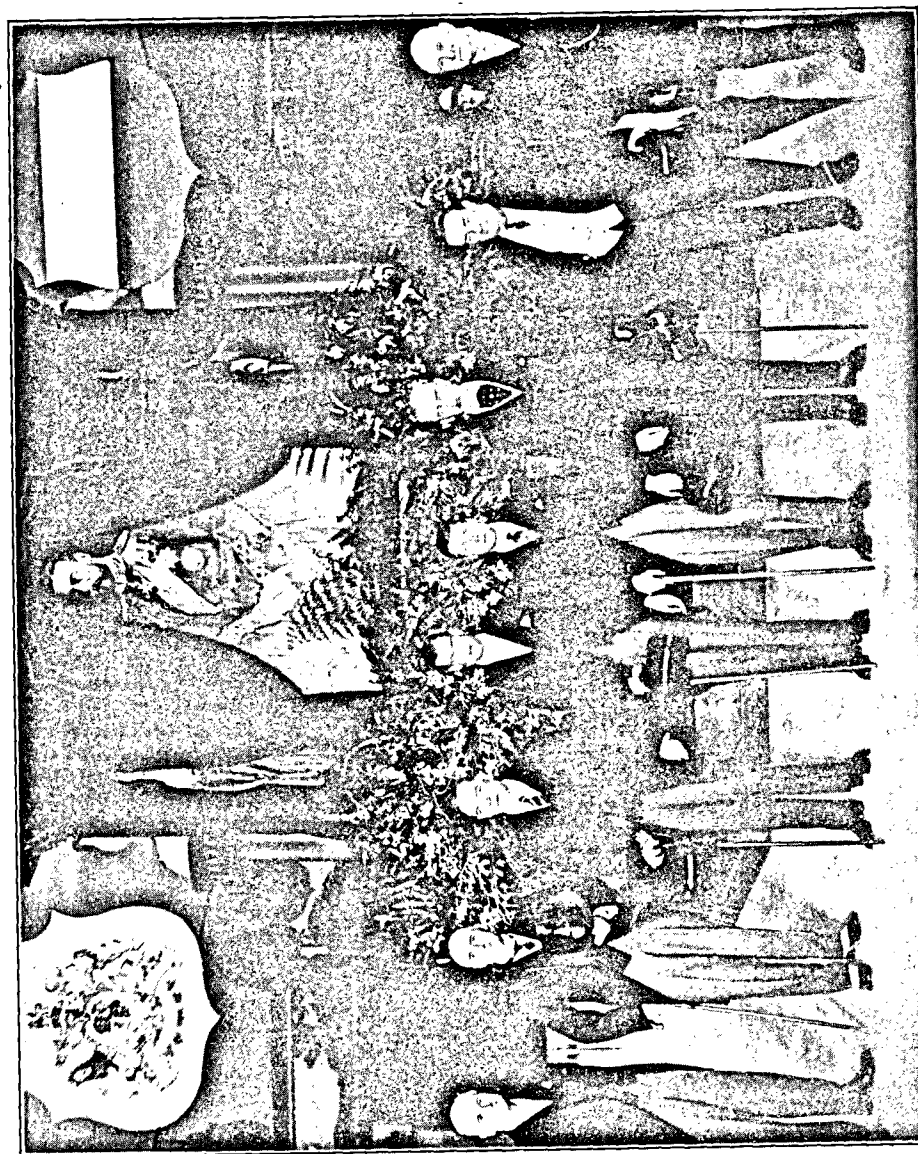
The Scientific Poultry-Breeders' Association.—The rapid growth of the Scientific Poultry-Breeders Association (S.P.B.A.), another large national society, is outstanding in the history of the British poultry industry. Started in 1915 with 80 members, this society now has 7,500 members, and

publishes a weekly paper, *Eggs*, having a circulation of about 13,000 copies weekly. Experiments in connexion with the scientific feeding and rearing of poultry have been conducted by the Society for some years, and recently it has established an experimental farm of its own at Rudgwick in Sussex.

Perhaps one of the most important parts of this Society's work is its scheme for supplying feeding stuffs to its members. The principles of this scheme are somewhat unique, inasmuch as the Society itself handles none of the feeding stuffs supplied, but simply arranges prices for specified quantities of approved foods, in lots of one hundredweight (112 lb.) and upwards, with selected feeding stuffs merchants in the various districts in the country, for supply to members in those areas respectively. These members send their orders, together with the necessary cash, to the Society's headquarters, which, in turn, passes on the orders to the appropriate merchants who distribute the feeding stuffs direct to the members. The Society undertakes responsibility to these members for the quality of the feeding stuffs, and to the merchants for the payment of accounts, and for this service charges its members a small commission. So successful has this scheme proved that in the eight months (ending April, 1927) feeding stuffs to the value of £45,745 were supplied to members, and even those members who have not participated directly in the scheme state that they have been able to obtain lower quotations from their own merchants as a result of its operations, and fewer small poultry-keepers complain of having to buy their feeding stuffs in the retail market while selling their produce in the wholesale market.

The Society has now under consideration a scheme, framed on somewhat analogous lines to its feeding-stuffs distribution scheme, for the purpose of marketing its members' eggs. Under this scheme, the Society proposes to handle no eggs itself, but to appoint selling agents in various consuming centres to whom members would consign their eggs to the order of the Society, which would collect payment from the agents, and after deducting a small commission to cover headquarters' expenses would remit cash to each supplier. Members would be required to agree to specified regulations as to grading, packages, quality, etc., and the Society would undertake responsibility for these matters to the agents and for due payment to members.

The Society also conducts a register of breeders, and in many other ways, which need not be touched upon here, wields a powerful and beneficent influence on the development of the poultry industry.



Distinguished Visitors: The World's Third Poultry Congress, Ottawa, Canada, 1927.
From left to right: Mr. Fred Elford (Director-General of the Congress); Col. the Hon. J. L. Ralston (Dominion Minister of National Defence); The Rt. Hon. W. L. Mackenzie King (Dominion Prime Minister); H. R. H. Prince George; H. R. H. The Prince of Wales; The Rt. Hon. Viscount Willingdon (Governor-General); The Rt. Hon. Stanley Baldwin (British Prime Minister); The Hon. W. R. Motherwell (Dominion Minister of Agriculture).

Utility Duck Club.—The Utility Duck Club, which is a comparatively young association, was established to advance and protect all phases of utility duck breeding, including the production of table ducks. It is the only organization in Britain devoted solely to utility duck breeding, and the considerable increase in the popularity of utility ducks and ducks' eggs, which has arisen during the past few years is almost entirely due to the work of this Club. It has a membership of about 500, and is very active in its propaganda and educational work.

Local and Semi-local Societies.—The four societies briefly described above are national in the scope of their operations, since they draw their members from all over the country. There are, however, a number of Federations and Societies which draw their members from local or semi-local areas. Amongst these may be mentioned the Lancashire Federation of Utility Poultry Societies, to which some 39 societies are affiliated, with a membership of about 3,000. This Federation also performs the somewhat unique function of fixing the prices to be paid for eggs each week in Preston and Garstang markets. Rapid developments have taken place in the poultry industry in Lancashire during recent years, nearly 11 per cent. of the total poultry in England and Wales being now found in this county. Further, several laying tests have been organized, including an International Test conducted by the Lancashire Utility Poultry Society in conjunction with the *Sunday Chronicle* newspaper. Over 1,300 birds competed in this test in 1926-27.

Similar federations of poultry-keepers exist in Yorkshire, Worcestershire, and in the Midland area, and there are numerous smaller utility societies in various parts of the country. One or two of these associations operate schemes for supplying feeding stuffs to their members.

Co-operative Marketing Associations.—Though marketing as a special subject does not come within the scope of this paper, it may be stated that there are some 19 co-operative societies in England and Wales which have been established with the main object of marketing eggs and poultry for their members, while some 22 agricultural co-operative societies include this work in their general activities.

The Poulterers' Company.—A number of traders' associations exist, but no attempt will be made to deal with them in this

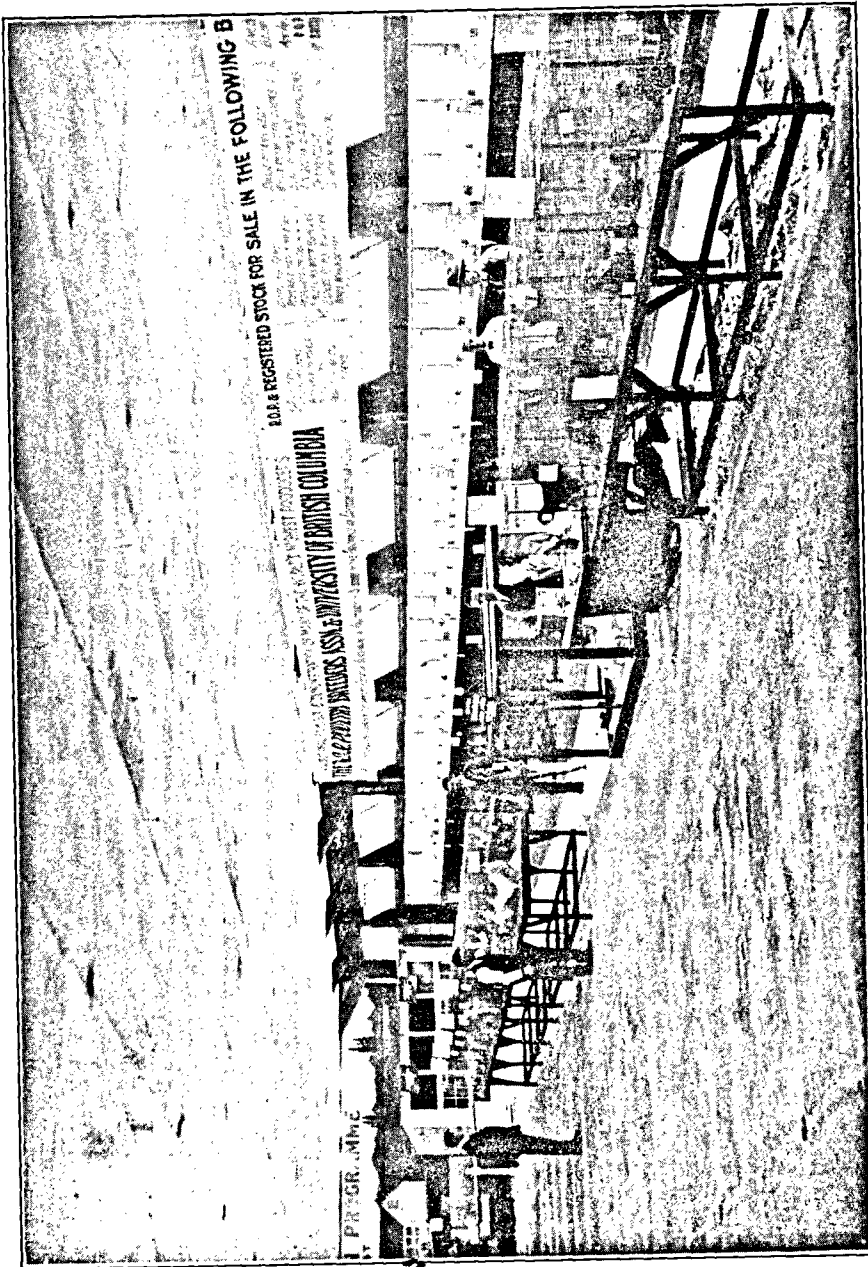
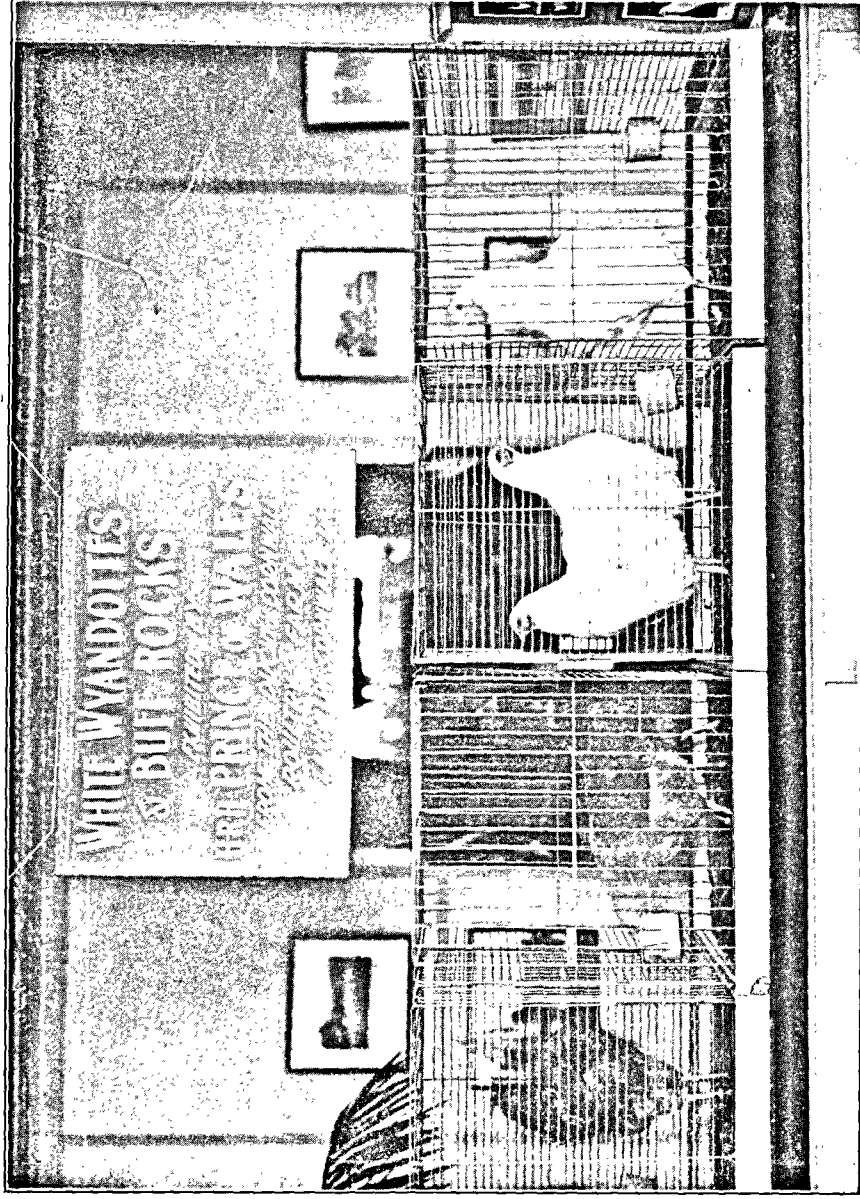


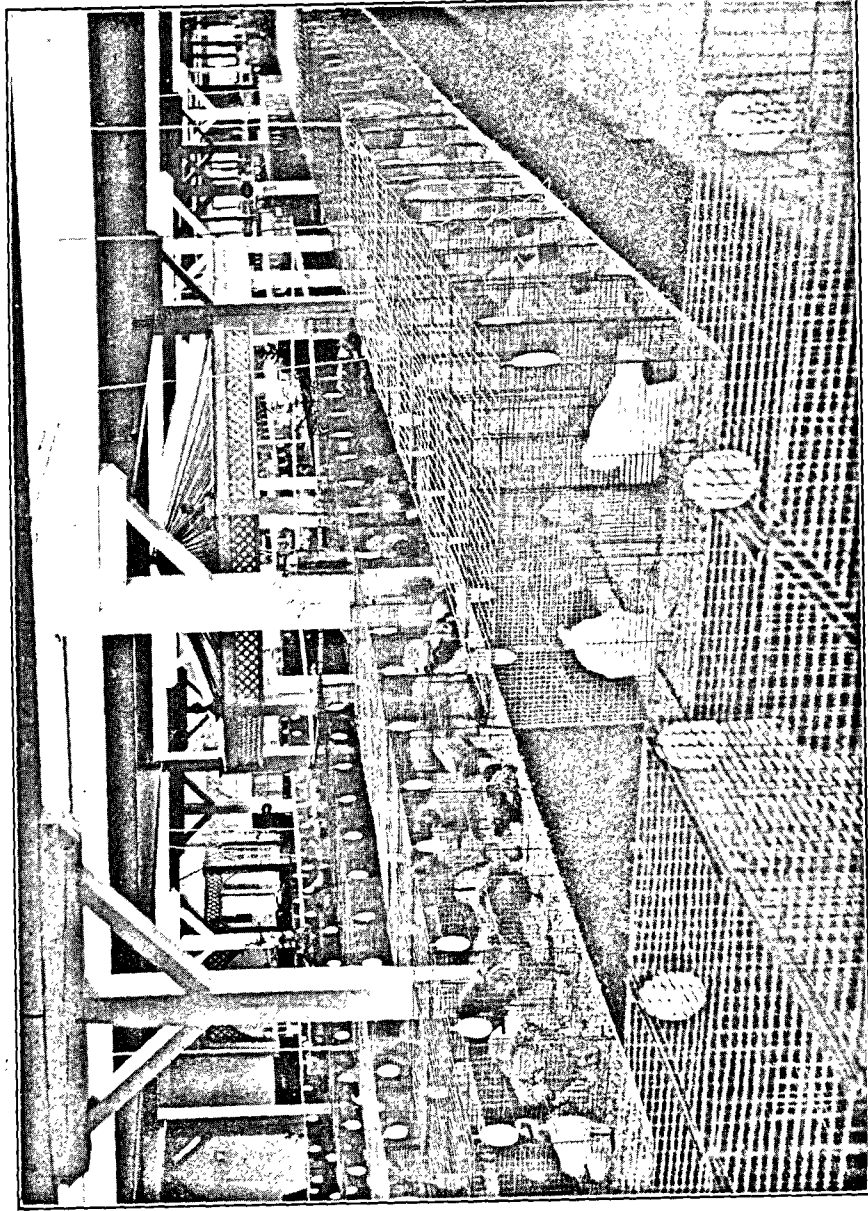
Exhibit of birds by the Record of Performance Association of British Columbia and the University of British Columbia, jointly.

THE THIRD WORLD'S POULTRY CONGRESS, 1927.



The Exhibit of H.R.H. The Prince of Wales.

THE THIRD WORLD'S POULTRY CONGRESS, 1927.



View showing a portion of the general poultry exhibit, at the Third World's Poultry Congress, which comprised over 6,000 birds.

B

992.0

paper. It may, however, be of historical interest briefly to mention the Poulterers' Company, which was incorporated by Royal Charter in 1504 during the reign of Henry VII, though as early as 1345 the consumption of poultry in London was sufficient to maintain dealers in such feathered ware. The Charter was renewed by Queen Elizabeth and later confirmed by Charles II and James II. The Charter was subsequently lost during the Revolution, and the present Charter was granted by King William and Queen Mary, in 1692. The original objects of the Company, amongst other things, were to control the marketing of poultry in the City of London, and within a seven-mile compass; to prevent the selling of bad, unwholesome and deceitful poultry ware; and to prevent any person operating in poultry within that area unless such person had first served a seven years' apprenticeship under a freeman of the Poulterers' Company. The selling of butter, eggs, conies and wild fowl was also apparently under the control of the Company. The Company was given power to penalize any person who conspired to raise the price of their goods unduly within the area. This Company recently showed its interest in educational matters by awarding a scholarship to the Harper Adams Agricultural College in connexion with the National Poultry Institute.

Need for Connecting Link : The National Poultry Council.—

As can be seen from the foregoing brief details, poultry breeders' organizations are numerous and varied in character, and it is obvious that to enable organized poultry-keepers, as a whole, to bring their combined influence to bear upon any problem of common interest some connecting link is essential. In 1920, therefore, largely owing to the efforts of Mr. Edward Brown, its first President, and now its General Secretary, the National Poultry Council was formed to act as the central representative body of poultry societies, clubs, federations of local societies, societies of co-operators or traders engaged in the distribution of eggs and poultry, and institutions or local authorities engaged in poultry instruction and investigational work. At present the Council actually represents the following bodies :—

- 8 General Poultry Societies.
- 6 District Federations.
- 53 Local Poultry Societies.
- 10 Specialists' Breed Clubs.
- 3 Trading Societies.
- 7 Agricultural Colleges.
- 13 County Agricultural Education Committees.

The aims of the Council as set forth in its constitution are :—

“To protect and further the interests of all concerned in the poultry industry, irrespective of whatever branch they may be connected with; to promote the provision of greater facilities for higher training in the subject at public institutions, and the conduct of investigational work of a scientific and practical nature; to influence and co-operate with central and local authorities for the extension of poultry breeding and egg and poultry production; and to undertake such duties as may be assigned to it by the National Poultry Parliament.”

The Council has no ordinary members, but patrons are elected on payment of a specified fee. Life members who have rendered important services to the industry may be elected without payment; otherwise the Council is composed of delegates elected by the affiliated societies, etc., mainly on the basis of their membership, except in the case of colleges and institutions. The Council meets at least three times a year, and it delegates to an Executive Committee full powers of administration between those meetings. The Council arranges an annual meeting called the National Poultry Parliament, which is held each year in a different part of the country. Members of the public, in addition to delegates from constituent societies, are allowed to attend these meetings, but such members of the public have no voting power. The Parliament may authorize the Council to take action on any particular question.

Since its inception in 1920, the National Poultry Council has done work of much value to the industry. Perhaps the most outstanding instance is the Council's success in persuading the British Government to allocate a grant of £50,000 towards the establishment and maintenance of a National Poultry Institute, on condition that the Council obtained from the industry one-fourth of the estimated capital expenditure of £26,000. The Council agreed to raise as their quota a sum of £6,500, and have succeeded in collecting nearly the whole of this amount, and the Institute has begun work.

The National Poultry Institute.—The National Poultry Institute, as now established, is not a centralized institution, but is divided into sections which have been allocated to existing teaching or research centres, partly with a view to economy by avoiding unnecessary duplication of staff and buildings, and partly in order that the work of the Institute might be conducted in close association with, and in the atmosphere of, other agricultural education and research work.

Research into nutrition problems has therefore been allocated to the School of Agriculture, Cambridge University, where similar problems in connexion with larger farm live stock have been under investigation for a number of years. Research in connexion with the genetics of poultry breeding is being carried on by Professor R. C. Punnett, who is "Arthur Balfour" Professor of Genetics at Cambridge University; and poultry diseases are being investigated at the Ministry of Agriculture's Veterinary Laboratory at Addlestone, Surrey. The Teaching and Economic Experimental Centre has been established at the Harper Adams Agricultural College, Shropshire, and I should like to take this opportunity of paying a tribute to the excellent work achieved at that Centre by Professor Willard Thompson, who has now returned to New Jersey.

Two practical experimental centres, one to examine problems in connexion with the production and marketing of table poultry, and the other to investigate the effect of various degrees of in-breeding and out-crossing on laying capacity, have been established respectively at Wye Agricultural College, Kent, and at the Cheshire School of Agriculture, Reaseheath.

The National Diploma in Poultry-Keeping.—The Council has instituted a National Diploma in Poultry Husbandry, and has devolved the responsibility for arranging and controlling the necessary examinations for this diploma upon an Examination Board, which includes representatives from the principal Agricultural Education Institutions, from the English Ministry of Agriculture, and from the Board of Agriculture for Scotland. This diploma is intended to indicate a standard of qualification for County and College Poultry Teachers.

Teachers' Certificate in Poultry Husbandry.—Recently, at the request of the Board of Education, the Examination Board has instituted a Certificate Examination for teachers in public elementary and secondary schools who require a knowledge of poultry-keeping for use as a medium in the general education of children in rural areas.

Other Work of the Council.—Considerations of time and space forbid the description here of all the work of the National Poultry Council, but amongst other achievements it might be stated that concessions have been obtained from railway companies and local authorities; an Arbitration Board has been set up to settle disputes between poultry-keepers; a Legal Defence Fund has been established to protect poultry-keepers from unfair assessments for rates and taxes; a register

of Laying Trials has been opened; and the Council now proposes to set up a register for individual birds whose performances in registered laying trials reach a prescribed standard. The Council has also for several years past actively endeavoured to obtain legislation for enforcing the marking of all imported eggs with an indication of their origin. The Merchandise Marks (Imported Goods) Act, which has recently been enacted, gives power, provided certain specified conditions set out in the Act are satisfied, for such marking to be enforced. Finally, the Council has recently turned its attention to marketing problems, and has appointed a special committee for this purpose.

The National Farmers' Union.—Before concluding this Section dealing with internal organizations, reference must be made to two organizations which, whilst not primarily poultry associations, take an active and continually increasing interest in the development of the poultry industry.

The National Farmers' Union, which is the largest association of farmers in Great Britain, has some 110,000 members, 59 county branches, and 1,000 local branches, and exercises a powerful influence in the realm of general agriculture. It may be regarded as of hopeful augury for the future of poultry-keeping on general farms in Britain, and as a sign of the more universal recognition of the growing importance of farm poultry-keeping, that this powerful Union has recently set up an Headquarters Poultry Committee, whilst some 39 of its county branches have established local Poultry Committees, and the number of these is steadily increasing. A few county branches have also inaugurated schemes for marketing their members eggs.

It is probable that at least 60 per cent. of all the eggs and poultry produced in Great Britain come from general farms and small holdings where poultry are kept as a branch of farm live stock. The possibilities of expansion in this direction are very great, and Britain's chief hope in the future of supplying a greater part than at present of her requirements in eggs and poultry appears to rest mainly upon the adequate development and improvement of British farm poultry-keeping. The National Farmers' Union works in friendly co-operation with the National Poultry Council, and the two bodies jointly last year organized a public conference to consider ways and means of improving existing methods of marketing British eggs and poultry, many of which pass through wholesale

marketing channels, though producers and consumers are, in comparison with the position in many other countries, relatively short distances apart.

The National Federation of Women's Institutes.—The second body is the National Federation of Women's Institutes, which is affiliated to the National Poultry Council, and has for its main purpose the provision of an organization with the object of enabling women to take an effective part in rural life and development. In order to achieve this aim, the National Federation endeavours amongst other things to make provision for the fuller education of country women, and to give instruction and training in all branches of agriculture, rural handicrafts, domestic science, hygiene and social welfare. The National Federation has established regulations for the formation of County Federations of Women's Institutes, the number of the latter at the end of 1926 being 3,507. The Institutes exercise a considerable and valuable influence on the development of the poultry industry by organizing courses of lectures, exhibitions and demonstrations, and by taking a helpful interest in the work of the County Poultry Instructors and County Poultry Schemes operated by local education authorities. In several instances, organizations have been established for marketing eggs and poultry in rural areas.

II. EXTERNAL ORGANIZATION.—The Ministry of Agriculture and Fisheries is the Government Department responsible to Parliament, amongst other things, for the proper expenditure of grants made by the State for agricultural education and research. Apart from the work conducted at its Veterinary Laboratory, which was established primarily for investigating diseases scheduled under the Diseases of Animals Acts and other diseases of live stock, the Ministry itself does not, as a rule, undertake directly either teaching or research work, but aids, by means of grants under specified conditions, institutions such as agricultural colleges and research institutions, and county education authorities. As far as the poultry industry is concerned, the Ministry maintains direct contact with it through its Poultry Commissioner, whose duty it is to advise the Ministry on all matters relating to the industry; through its staff of inspectors; and through a Poultry Advisory Committee.

Poultry Advisory Committee.—This Committee includes representatives of producers and traders nominated by the National Poultry Council; nominees of the National Farmers'

Union representing farmers; and a few nominees of the Ministry. It was originated during the war to advise the Ministry on any matter relating to the industry which might be referred to it or which any member might bring forward.

National Poultry Institute Advisory Committee.—Since the establishment of the National Poultry Institute, and at the request of the National Poultry Council, a Committee has been set up known as the National Poultry Institute Advisory Committee, which includes, in addition to members of the Poultry Advisory Committee, further members representing institutions responsible for sections of the Institute's work. This committee advises the Ministry only on Institute questions, the Poultry Advisory Committee retaining its former duties.

Northern and Southern Committees.—Two smaller Sub-Committees are respectively responsible for the experimental work of the Institute which is in operation at Wye Agricultural College and at the Cheshire School of Agriculture, Reaseheath.

Local Agricultural Education Authorities.—There are in England and Wales 63 administrative counties, which are the units for most purposes of local government, and the relative County Councils through their agricultural education committees constitute the county authorities for agricultural education. Most of these county authorities employ a staff of experts, responsible to an organizer of agricultural education, for the purpose of providing instruction and advice to farmers, horticulturists, poultry-keepers, etc., in the county. The Ministry of Agriculture contributes about two-thirds of the total approved expenditure of local authorities on this work, the remaining one-third being defrayed from local rates.

County Poultry Instructors.—Fifty-five counties employ County Poultry Instructors, who, in addition to giving itinerant instruction in the form of lectures and personal visits to poultry-keepers, are responsible for the efficient working of County Laying Trials and the Egg and Chick Distribution Scheme in those counties which operate either or both of those schemes.

County Laying Trials and Egg and Chick Distribution Scheme.—Last year, in 39 counties, there were 324 breeding centres in operation under the Egg and Chick Distribution Scheme, and 13 counties conducted County Laying Trials. Briefly, the Egg and Chick Distribution Scheme is designed to afford small poultry-keepers, such as smallholders and cottagers, an opportunity of obtaining, at reasonable prices,

eggs for hatching, and day-old chicks or ducklings, from pure-bred stock birds with laying pedigrees, or special table qualities, and which are the property of breeders at various centres in the County. These centres, together with the stock birds, are carefully selected by the County Poultry Instructor, who also pays surprise visits of inspection from time to time during the season. County Laying Trials are limited to breeders in the County; they are supervised by the County Poultry Instructor, and the results are published under the authority of the County Council concerned.

Farm Institutes.—In addition to this itinerant educational work, several county authorities, with the aid of grants from the Ministry of Agriculture, have established Farm Institutes, which are designed to provide short courses of instruction in agriculture, etc., of a less extended character than that obtainable at Agricultural Colleges. Sixteen Farm Institutes have now been established in England and Wales, and most of these possess poultry departments for the benefit of their students. Sometimes one or more counties within the area of a Farm Institute establish County Laying Trials at the Institute.

Agricultural Colleges.—Excluding Veterinary Colleges, there are 14 University Departments of Agriculture and Agricultural Colleges in England and Wales. These owe their origin and maintenance either to private, local, or State donations, or to a combination of these. The Ministry of Agriculture aids these colleges usually by means of annual grants, the amounts of which are fixed periodically according to circumstances. Most of the colleges maintain Poultry Instructors and well-equipped poultry departments.

Research Institutions.—The research institutions in England and Wales at which work is being carried on in direct connexion with poultry-keeping are few in number. Reference has already been made to the investigation of poultry diseases at the Ministry's Veterinary Laboratory, and of the genetics of poultry breeding and problems of poultry nutrition at Cambridge University. These institutions are all aided in respect of this work by the Ministry of Agriculture under the National Poultry Institute Scheme. Interesting investigations into the problems of cold storage and preservation of eggs are also being carried on at the Low Temperature Research Station at Cambridge under the Department of Scientific and Industrial Research. One or two other Institutions have worked at particular problems.

Inspectorate.—Through its staff of inspectors, the Ministry supervises the whole of the agricultural education work conducted by local authorities, colleges and institutions, and towards the cost of which it contributes. These inspectors, who include specialists in poultry, rabbit and goat-keeping, and are designated Small Live-Stock Inspectors, are located at Divisional Headquarters, of which there are six in England and Wales. The chief duty of these inspectors is to supervise that part of the work of local education authorities with which they are concerned. They from time to time attend the lectures and demonstrations given by County Poultry Instructors, inspect County Laying Trials, Egg and Chick Distribution Stations, and Stud Goat Centres; attend meetings of local authorities and collect information as required by headquarters. In fact, amongst a multiplicity of duties they act as the "guide, philosopher and friend" of County Poultry Instructors, and through their influence with county authorities (who, as a rule, are only too glad to take advantage of an inspector's knowledge and experience) they function not only as overseers of the expenditure of public money, but as active agents in the development of poultry and small animal industries.

New Markets Branch of the Ministry.—Finally, owing to the growing need for the modernization of methods of marketing English agricultural produce, including eggs and poultry, the Ministry has recently established within its organization a New Markets Branch, whose special function it is to investigate marketing methods and marketing conditions generally, with the object of effecting improvements where possible. This Branch has issued two reports dealing respectively with the marketing of eggs and of poultry in England and Wales, and with the origin and character of imported supplies. Judging from the excellent reception given to these reports by the public, and the widespread interest which they have aroused, there is good reason to believe that reform in the methods of marketing English eggs and poultry, which is generally admitted to be long overdue, will in the near future become the objective of combined effort on the part of producers and traders.

* * * * *

The Ministry desires to acknowledge the courtesy of the Department of Trade and Commerce of the Canadian Government in permitting the reproduction of the photographic views accompanying this article.

THE CONTROL OF SWINE FEVER

V. C. FISHWICK, P.A.S.I., N.D.A., N.D.D.,

Pig Research Department, South-Eastern Agricultural College, Wye.

SWINE fever is a very serious disease, which usually causes heavy losses when it breaks out in a herd. Some losses are at present unavoidable, but observation indicates that a very considerable proportion of losses might be avoided if proper methods of control were taken by owners of infected herds.

On June 25, 1926, the disease was diagnosed in the college experimental herd by one of the Ministry's Inspectors, and the disease spread rapidly. Serum treatment was not recommended in this case. Detailed experimental work on the disease was not carried out, but the following notes, founded upon careful observations made during the outbreak, may be of assistance to others who have to deal with similar cases. Although the pathology of the disease has been carefully studied,* there are numerous points of detail upon which the pig-keeper who has to deal with the disease cannot find information, for literature on the disease gives but little definite information about the treatment of it.

It is very important that every pig-keeper should be constantly on the look-out for the disease, as, if it is identified early and prompt steps are taken, there is always a chance that its spread may be prevented. The destruction of an ailing pig, and a few healthy ones that have been in contact with it, may save the herd. It may be pointed out that there are probably several strains of the organism (virus) which causes the disease, and these probably affect pigs in different ways—some causing a very acute attack of disease and others only a mild form. The latter may exist in the herd for a considerable time, and spread to a disastrous extent, before its presence is recognized. In one way and another the mild form, if it once spreads through the herd, will cause very serious losses, although comparatively few pigs may actually die from it. The notes given in this paper were made from observations upon a "mild attack" of the disease. If the disease is to be dealt with successfully, it is essential that its nature should be understood; therefore, in the next paragraph, the symptoms observed are described and an account given of the way it attacked the pigs.

* The disease is fully described in the Ministry's Leaflet No. 29.

Symptoms of Ill-health.—The following symptoms of ill-health were observed at different times, and, as post-mortem examinations made by the Ministry's Inspectors showed that a number of pigs in the herd were affected by the disease, it seems reasonable to suppose, in view of its highly contagious nature, that many, if not all, of these symptoms were caused directly or indirectly by the disease.

(1) The coat lost its bloom and invariably remained harsh and staring until the pigs began to show signs of recovery. In many cases, the hair and skin of diseased pigs had a dirty colour which could not be removed by oiling. The pigs looked as though they had been smothered by dirty water. A discoloration of this kind was very often noticed down the centre of the back for several weeks after the pigs had apparently recovered. In some cases, the hair became yellow; some pigs were yellow all over, in others the discoloration was in patches. This would, of course, only be observed in a white pig. The skin of many pigs showed a dark-coloured scaling (Fig. 1). This was particularly noticed at the root of the tail. After apparently recovering, the pigs suffered from continual irritation, evidenced by frequent rubbing. Figs. 2 and 3 show typical diseased weaners. The pig shown in Fig. 2 recovered; the one in Fig. 3 died.

(2) All the animals affected suffered with diarrhoea. In some cases, the diarrhoea was thrown off in a few days. The others became "wasters."

(3) The ears in practically all cases of young pigs showed a distinct red coloration, but, in a few bad cases, they were blue. Red spots were found upon the belly and legs in a few instances. In bad cases, there was paralysis of the limbs. A considerable number of pigs suffered from lameness, which was usually not persistent but affected different limbs in succession.

(4) Sucking pigs and stores affected by disease lost condition and became very unthrifty. It may be pointed out that before the remedial value of cod liver oil and chalk was discovered, the loss from this source (*e.g.*, loss of condition and unthriftiness) was greater than the loss from death.

(5) A number of pigs were born with scabs upon their faces. These varied in size from that of a threepenny piece to that of half a crown, and were generally situated round the mouth and under the eyes. Large litters were produced by most of the sows which farrowed after the outbreak of the disease, but the mortality amongst pigs at birth was very high, and the litters were very uneven, many containing 60 per cent. of undersized pigs. There were a number of abortions, and the proportion of barren sows was unduly high. In two instances, sows, after farrowing successfully, produced no milk.

(6) Several sows were observed to vomit.

(7) A number of sows were taken suddenly ill; some had a staggering gait; others were dull and listless; foaming at the mouth was a constant symptom with them. Several sows, whilst showing no other external sign of disease, were very restless, exhibiting a strong desire to break out of their pens. Their litters developed disease when between four and six weeks old. Other sows appeared abnormally irritable at the time of farrowing, a few biting wildly at the framework of their pens, or the farrowing rails. In a number of instances, sows could not be made to lie

in the normal position for farrowing, rather lying on their bellies or standing up. Such sows invariably produced particularly weakly litters, from which few, if any, pigs were reared.

Course of the Disease in Growing Pigs.—The disease was usually observed in the pigs when between three and six weeks old, the first indication being loss of bloom; this being followed by a white scour which was very persistent. Some piglings were so badly affected that they were destroyed, but the majority reached an apparent recovery; in nearly every case, however, diarrhoea broke out again between three and seven days after weaning. A few pigs were so badly diseased at this stage that they, also, were killed. The majority again reached an apparent recovery after one to ten days, and a few became "wasters." In the autumn of 1926, examinations were made of the bowels of over 200 pigs of 14 to 18 weeks old which had been attacked as described above, and which had, apparently, recovered. In a large number of these, although no definite evidence of swine fever was found, there was a small amount of enteritis in the cæcum, the inference being that a pig frequently does not completely recover in less than six or eight weeks after the crisis, although, to the eye, it may be perfectly healthy. It is well known that, in some cases, pigs are affected with the disease for as long as 80 days, and it would seem possible that some of these pigs may have been in an infectious condition, and further that such pigs might suffer from a relapse* if exposed to adverse conditions—such as excessive heat or a sudden chill.

Pigs that have been attacked when young and have recovered should therefore be kept carefully isolated, and on no account mixed with healthy swine. It would seem wise to give them good housing accommodation and to fatten them off as quickly as possible.

Methods of Control Tried.—These fall into two categories:—

- (a) Those designed to prevent the spread of the disease.
- (b) Those designed to strengthen the pigs' power of resistance.

Measures to Prevent the Spread of Disease.—These are best considered under five headings.

* Several cases were observed in which such a relapse appeared to occur.

Isolation.—In order to enable each lot of pigs to be properly isolated, 24 grass runs were constructed. Each run had an area of one-twentieth of an acre, and was surrounded by a path; the troughs were placed against the fence so that the pigs could be fed without the attendant entering the pen. Fig. 4 shows one of these runs, the hut being made by thatching a hurdle framework. The erection of these additional runs made it possible to empty alternate pens in the permanent buildings.

In spite of the precautions taken from the first, in the early part of September, 1926, the disease broke out simultaneously in nearly all the grass runs. The distribution of the cases in this outbreak seemed to indicate that the disease was being carried in the food, and the possibility of this happening was explored. It was found that, in spite of the precautions taken, infective material was being carried on the shoes of the attendants into the food shed, where it was mixed with the food. The shed was therefore locked up and placed in charge of a man who did not go near any pigs.

Under ordinary farming conditions this may perhaps be a common way of spreading diseases through a herd. The pig-man usually mixes the rations, and very often uses the same shovel and brush in the mixing shed that he uses for cleaning out the sties. There could be no more certain way of spreading a contagious disease like swine fever. The above occurrence and the remedy are therefore specially worthy of notice.

Disinfection.—Tubs of disinfectant were placed at convenient intervals, and the attendants were instructed to dip their feet into the disinfectant before entering and when leaving a sty. It is doubtful if this was completely effective.

Cleansing of Runs.—It is known that the organism which causes swine fever cannot live outside the pig for more than 10 days if exposed to the light. When pigs had been removed from an open-air pen, the latter was therefore kept empty for a period of 14 days. Sties were left empty for 14 days, and subsequently disinfected with Jeyes' fluid.

The Destruction of Ailing Pigs not likely to Recover.—With sucking pigs, it is a comparatively easy matter to see when the animal is so badly attacked that it is not likely to recover; but, when the disease attacks store pigs, it is very difficult, from their appearance, to form an opinion as to the chances of recovery. Many which were apparently badly attacked recovered rapidly, whilst others, which did not appear so ill,

failed to recover and became "wasters." In the early stages of the outbreak in question, several pigs, which ultimately proved to be "wasters," were kept for a considerable period in the hope that they would recover. It was eventually found that store pigs which did not show signs of recovery within 14 days of falling ill, as a rule, failed to recover. This would seem to be a useful test which might obviate unnecessary destruction of many pigs. Thus, each pig which is attacked by the disease should be given a chance for a fortnight; if it is not improving in condition at the end of that time it should be destroyed. Such pigs can rarely be fattened and the food they eat is wasted; in addition, they are a constant source of infection.

When the disease was first diagnosed, an attempt was made to stamp it out by slaughtering every pig showing signs of ill-health. This policy was continued for eight days only, during which time nine pigs were killed; on the ninth day, there were 11 ailing pigs, all in different pens. As it was probable that these pigs had already infected some of those in contact with them, it appeared useless to continue this policy unless contacts as well as diseased pigs were slaughtered. This would have meant the destruction of nearly 100 stores, and even then there would have been no certainty that the disease would be eradicated.

The Destruction of Undersized Sucking Pigs.—It was noted, under "Symptoms of Ill-health" (p. 1003), that many litters contained a number of undersized pigs. Observations made during the early part of the outbreak indicated that a large proportion of these undersized pigs ultimately became "wasters." Consequently, all weakly or undersized pigs were destroyed at or soon after birth. The more rapid growth made by the surviving pigs, owing to the more liberal supply of milk that they obtained, far outweighed the small loss occasioned by the destruction of the small and weakly pigs. Thus, if, in a litter of 12, there are six good strong pigs and six undersized or weakly ones, it pays to destroy the six unsatisfactory pigs at or shortly after birth, if there is disease in the herd.

Measures Designed to Strengthen the Pig's Power of Resistance.—It was found that acid food was injurious to diseased pigs. Before this was observed, it had been customary to soak the rations for 12 hours before feeding; afterwards the meal was mixed with water *immediately before feeding*.

In this connexion, it may be pointed out that many of the most destructive attacks of swine fever have occurred amongst pigs fed upon refuse or whey, both of which are very acid; and, in view of the above observation, it is worth while trying the effect of temporarily discontinuing the use of these and substituting a meal ration, in the event of an outbreak of swine fever. After the contact pigs have been fattened and the pens rested, a return can safely be made to the original method of feeding. It should be noted that all the pigs referred to in this article were fed on a ration containing 10 per cent. of white fish meal.

The diarrhoea from which diseased pigs suffered was checked by feeding chalk (or ground limestone). Two oz. of ground chalk per head per day, fed to sows suckling diseased litters, checked the scour in the litter. The chalk was stirred into the food just before feeding, one oz. being given in the morning, the other in the evening meal. The treatment was continued until the diarrhoea in the young pigs ceased. In some cases, this stopped in 24 hours; in others, it lasted two or three days.

In the case of stores, as previously noted, diarrhoea broke out within a week of weaning. This diarrhoea was checked by feeding one oz. of chalk per pig per day—half an oz. in both the morning and evening meals. This was continued until the diarrhoea stopped. In some cases, the diarrhoea only lasted 24 hours after treatment; in others, it persisted for several days. Feeding chalk on the free choice system was tried and found unsatisfactory, and the addition of steamed bone flour and oxide of iron to the chalk did not give any better result than the chalk alone.

The pigs in grass runs threw off the disease more rapidly than did those in the styes, both before and after weaning. In every instance, there was a noticeable improvement when a group of diseased pigs was transferred from a sty to a grass run.

Cod Liver Oil.—In an outbreak of the "mild form" of swine fever, the number of pigs of over a month old that die from the disease is usually comparatively small. A considerable number, however, become "wasters," and have to be destroyed. There is also a serious loss of condition in the pigs that eventually recover: they are unthrifty and make but little growth for several weeks. It was found that this loss of condition could be avoided largely by administering cod liver oil. In a number of cases, the oil was given to pigs which

had been attacked and had lost condition, and their recovery was very noticeable. Following this observation, the oil was administered as a precautionary measure to pigs which had been exposed to infection; in these cases, the typical diarrhoea developed at the usual times (4-6 weeks and 8-10 weeks) but was quickly thrown off when chalk was fed, the treated pigs showing very little loss of condition. Of 258 diseased pigs which received cod liver oil-chalk treatment, only three were lost. The remainder were all marketed in first-class condition.

The quantities of cod liver oil used were:—

Sucking pigs: 1 dram per head per day.

Weaned pigs, 20-50 lb. live weight: 1 oz. per head per day.

" 50-70 " " " 2 " " "

The sucking pigs were fed away from their dam. The oil was given in all cases in the food, half being given in the morning and half in the evening feed.

Whole Milk.—In one case, whole milk was used instead of cod liver oil, with equally good results.

Separate Feeding of Weaklings.—In many litters which were attacked by disease, one or two small weakly pigs did not do as well as the remainder. These pigs can be reared with their litter mates, but it was found to be a great advantage to sort them out at weaning and to give them a run to themselves. Two or three such pigs put together in a small grass run on all occasions did very well, and several pigs which, otherwise, would undoubtedly have been lost, were saved in this way.

Epsom Salts.—It has been previously noted that pigs which had apparently recovered from the disease suffered from "skin irritation." It was found that this was relieved by an occasional dose of Epsom salts. The simplest way to deal with sucking pigs is to administer the salts to the sows; 2-4 oz. of salts given to the sow will cause the pigs sucking her to purge in 24 hours.

Conclusion.—Every pig-keeper should be familiar with the symptoms of swine fever and should be constantly on the look out for them.

When the "mild form" of swine fever attacks a herd, the following method of procedure is to be recommended:—

- (1) Give all pigs a grass run.
- (2) Mix meal with water immediately before feeding, and avoid acid foods.

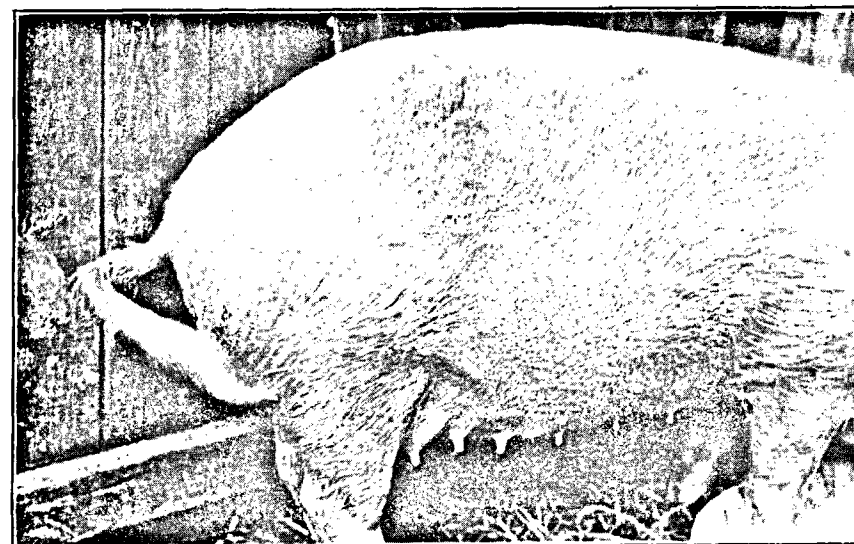


FIG. 1.—Showing dark-coloured scaling.

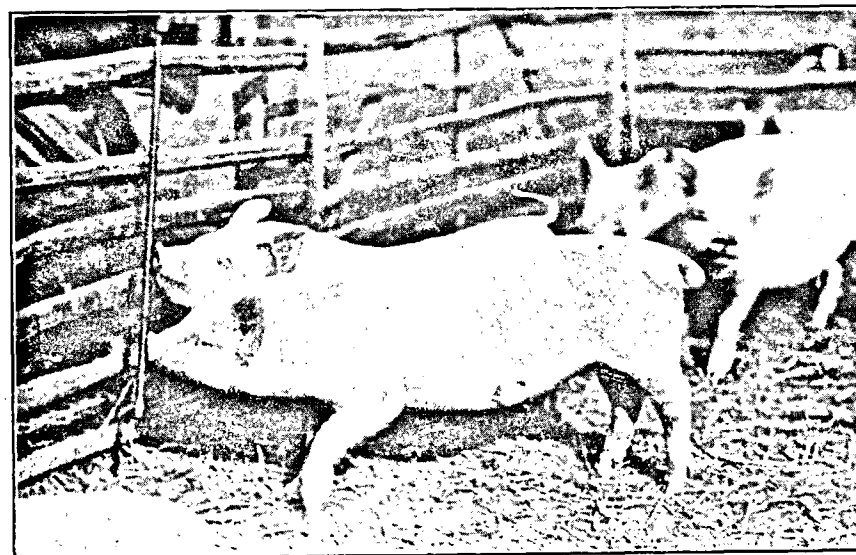


FIG. 2.—In the foreground is a typical diseased pig. Many such pigs were successfully fattened. The dirty colour of the hair, referred to in the accompanying article, is to be seen in this pig behind the ear and on the ribs and flanks.

THE CONTROL OF SWINE FEVER.

1002.4



FIG. 3.—A diseased pig: this animal proved a “waster.”

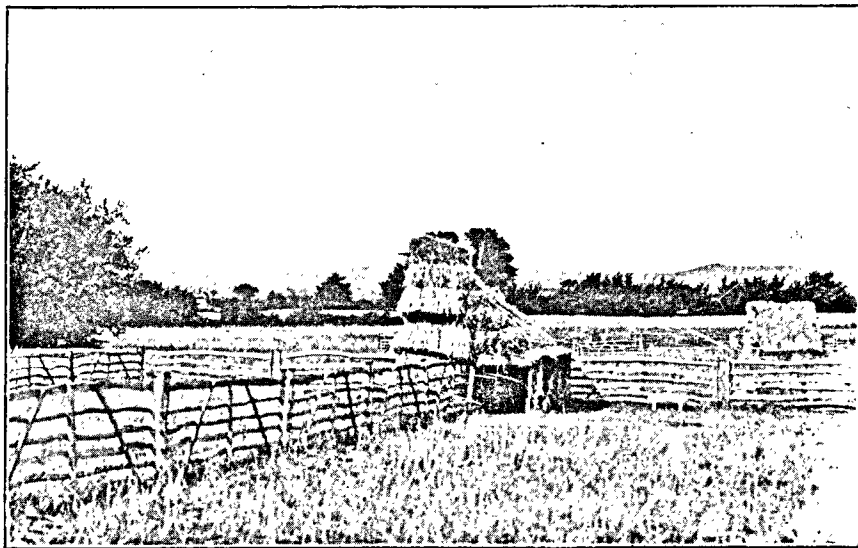


FIG. 4.—Showing a temporary grass run with its thatched shelter.

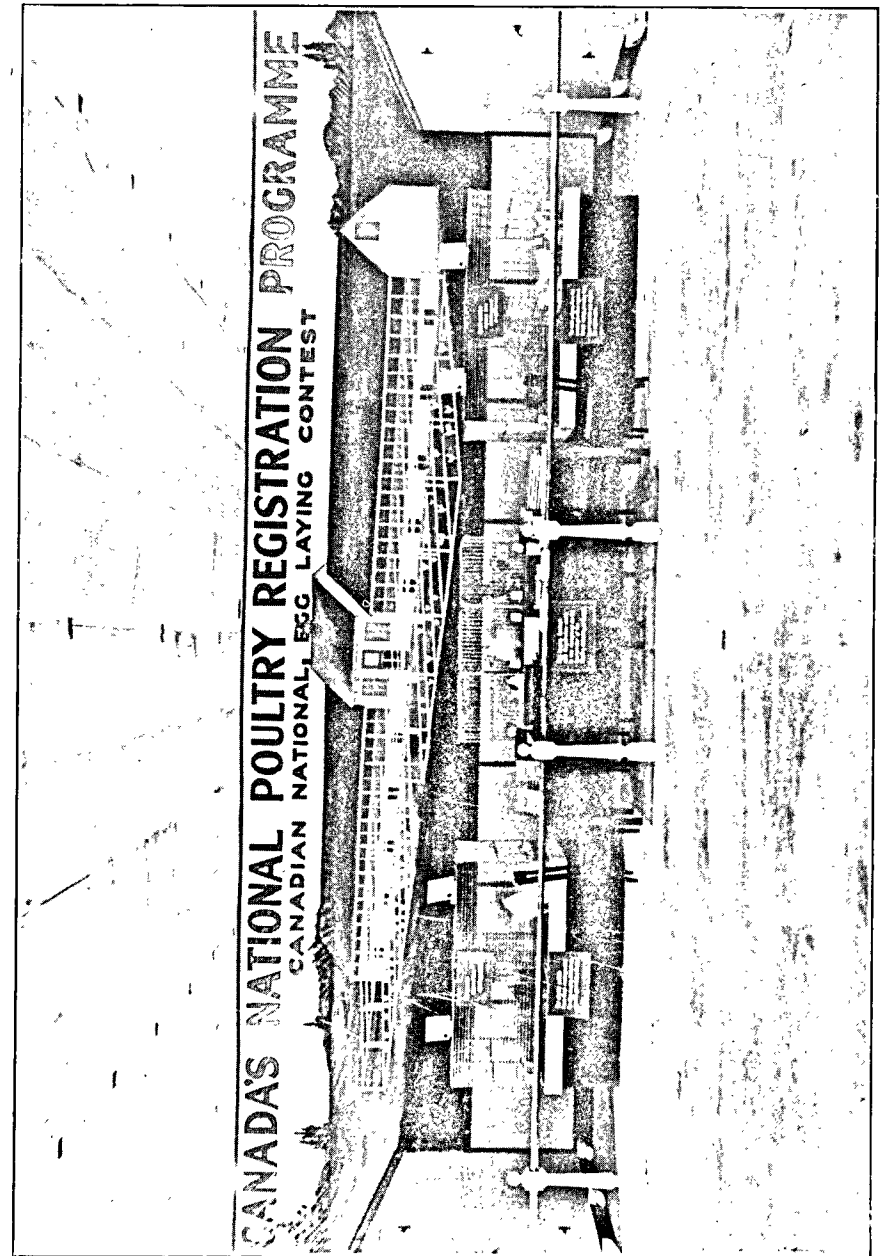


Exhibit illustrating the Canadian Poultry Registration Scheme.

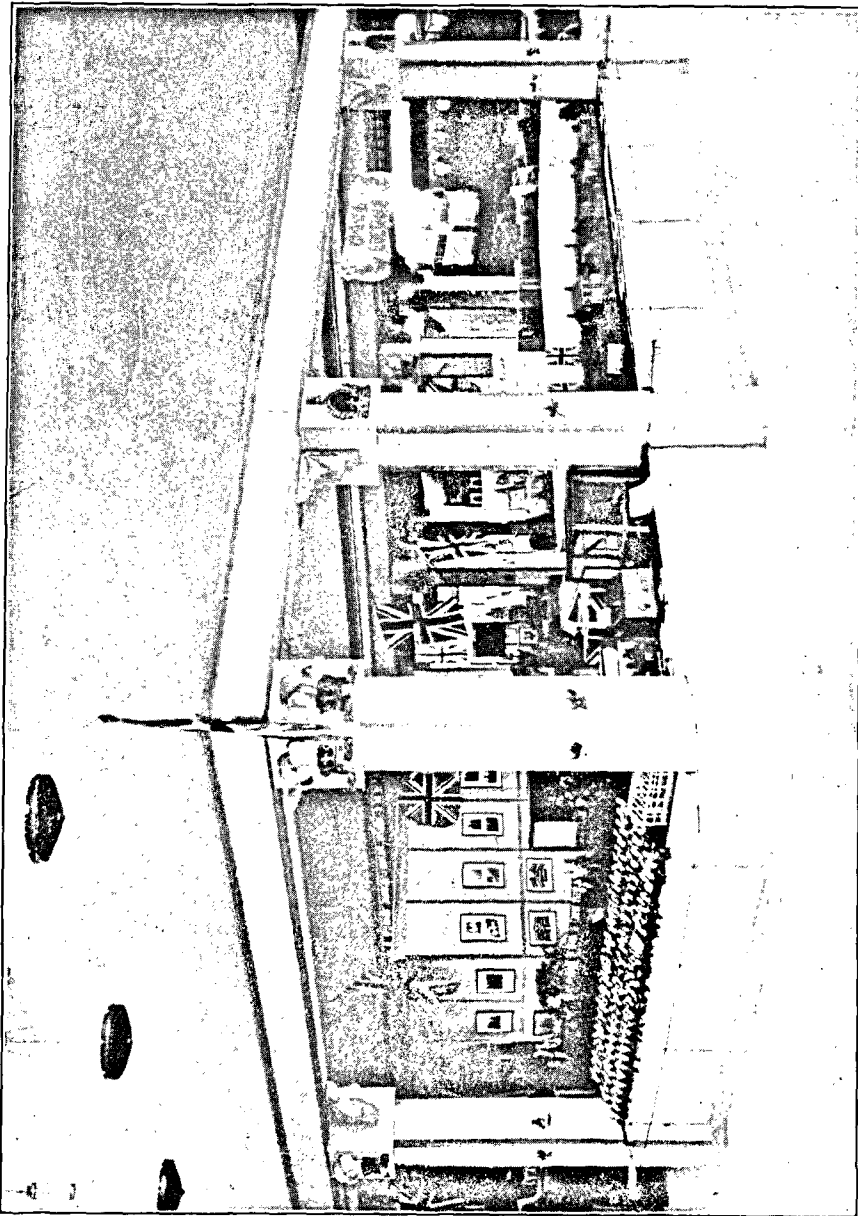
- (3) Cull litters at or shortly after birth, destroying weakly and undersized pigs.
- (4) As soon as sucking pigs will eat meal, feed them apart from the sow and add one dram of cod liver oil per head per day to their food.
- (5) If diarrhoea breaks out in sucking pigs, give the sow 1 oz. of chalk per feed (=2 oz. per day), and continue this until diarrhoea in young pigs ceases.
- (6) After weaning, feed 1 oz. of cod liver oil per head per day, $\frac{1}{2}$ oz. being added to morning and $\frac{1}{2}$ oz. to the evening feed. After pigs are 50 lb. live weight, the quantity may be increased to 2 oz. per head per day.
- (7) If diarrhoea breaks out in store pigs, feed 1 oz. of chalk per head per day, half in the morning and half in the evening feed, and continue until diarrhoea ceases.*

The disease may be readily spread by the food. The most rigid precautions should therefore be adopted to prevent infected material coming into contact with feeding stuffs.

The writer desires to acknowledge the help he has received from Mr. Willing and Mr. Gooch, the Resident Inspectors of the Diseases of Animals Branch of the Ministry. The former took a very keen interest in the outbreak and, on many occasions, gave valuable advice. Acknowledgment is also due to Professor Cave for help given, both in dealing with the disease and in preparing this article.

* The writer also recommends that $\frac{1}{2}$ oz. of cod liver oil be fed to sows which have been exposed to infection for 14 days before they are due to farrow. The same quantity to be fed after farrowing and continued until the pigglings are feeding apart from the sow. The evidence upon which this recommendation is made is, however, very slender.

* * * * *



The British Educational Exhibit.

THE THIRD WORLD'S POULTRY CONGRESS, 1927.

A DEMONSTRATION CIDER ORCHARD IN HEREFORDSHIRE

JOHN F. GOAMAN,

Ministry of Agriculture and Fisheries.

IN the winter of 1908, an experimental orchard was established on six acres of land at the Asylum Farm, Burghill, near Hereford, with the object of testing the relative merits of some of the recognized good varieties of cider apple trees grown in the county of Hereford, and of some of the best varieties grown in other districts but practically unknown to Herefordshire growers. Some of the following particulars about the situation and establishment of the orchard have been taken from a leaflet, prepared in 1909 by Mr. J. O. Peet (then Agricultural Organizer for the County) for the guidance of visitors. The orchard is now used for demonstration purposes by the Herefordshire Agricultural Education Committee.

Site.—The site adjoins the road from Hereford to Canon Pyon, and has a moderate and fairly regular slope with a northern aspect. The soil, derived from the Old Red Sandstone formation, is a good deep loam with the exception of part along the top bank, more particularly at the end next to the road, where it is somewhat stony and of only moderate depth. For several years, the land had been liberally treated. When Mr. Peet prepared his description, it was in good condition and under seeds, sown in 1907, from which a hay crop was taken in the year following.

Trees and Planting.—Twenty-five varieties were planted, 11 of each kind. Each variety occupies a single row, running from top to bottom of the slope, and equal conditions were thus secured for them. The trees were raised at the National Fruit and Cider Institute, Long Ashton, Bristol, and were presented by the Managing Committee of the Institute to the County Council, which had made annual grants to the Institute for some years. When received, the trees were, on the whole, well-grown trees with good roots; the heads were some of one and some of two years' growth.

The square arrangement of planting was adopted, with 30 ft. between the rows each way. Holes about 3½ ft. diameter were opened to a depth of 14 in., and the bottoms forked as deeply as possible, thus breaking the ground to a depth of 20 to 24 in. After the stakes were securely fixed, in holes 3 ft. deep, the turf was chopped on the forked subsoil

and made firm. The hole was then filled to within about 2 in. of the height of the surrounding soil, at which level the trees were planted. All damaged roots were carefully pruned before planting. About 4 lb. of bone meal was mixed with the remainder of the soil, the whole of which was placed about the roots. A mulch of manure was also given as a protection from frost and drought. The stakes used were 2½ in. square in section and 9 ft. long. They were creosoted under pressure before delivery, the creosote penetrating practically to the centre of the stake. The cost, delivered at Hereford, was 9d. each, but to-day's price would be about 1s. 8d.

Tree Guards.—Three types were adopted for the protection of the trees.

(1) A proprietary patent guard consisted of wire netting, 17-gauge, 1¼ in. mesh, 6 ft. high, with six vertical strands of barbed wire. One side is fastened by means of four staples to the stake which supports the tree. The other is then carried round the tree and hooked over eyelets on the fixed side, being held in position by a wire rod running through these eyelets. The makers' price, when purchased, was 2s. 6d. each.

(2) The wire netting for a second type of guard is 16-gauge, 1¼ in. mesh, 3½ ft. wide, and cut into 6 ft. lengths. It forms a cylinder round the tree 6 ft. high, and about 3 ft. in circumference, half a foot being taken up in overlapping. Eight yards of barbed wire are wound regularly round the cylinder from bottom to top to strengthen it and protect it from damage by stock. The cost of the wire netting at the date of planting was 25s. per roll of 50 yards, and of barbed wire 16s. per cwt., but present prices would exceed these.

(3) In the third type of guard, three stakes, similar and additional to that supporting the tree, were used. They were set triangularly with the tree in the centre, a rail at the top and barbed wire below being secured to the stakes, the fence being completed with a narrow cylinder of wire netting. The cost of the stakes, and digging holes for them, made the initial cost of this guard somewhat expensive.

The respective costs of the three forms of protection are given by Mr. Peet as follows, but the prices to-day would be at least 50 per cent. greater :—

Type 1						s.	d.
Guard and staples	..	..	..	..	..	2	6½
Fixing ..	..	..	..	..	..		1
						2	7½
						3 s 2	

1012. A

<i>Type 2</i>						<i>s.</i>	<i>d.</i>
Wire netting ..	..	..	..	..	..	1	0
Barbed wire ..	..	..	..	..	..		4
Fixing ..	..	..	..	..	..		1½
						1	5½
<i>Type 3</i>						<i>s.</i>	<i>d.</i>
Stakes (3) ..	..	..	..	..	..	2	3
Setting stakes ..	..	..	..	..	..		3
Slate battens (3 yd.) ..	..	..	..	..	..		5
Barbed wire (38 yd.) ..	..	..	..	..	..	1	6½
Wire netting (1 yd.) ..	..	..	..	..	..		6
						4	11½

All three tree guards have proved quite efficient, and the cheapest type described is to be desired, therefore, for such work.

Cost of Planting.—The expenses of planting per tree, apart from fencing, were as under, but it should be noted that the figures are for the costs in 1908.

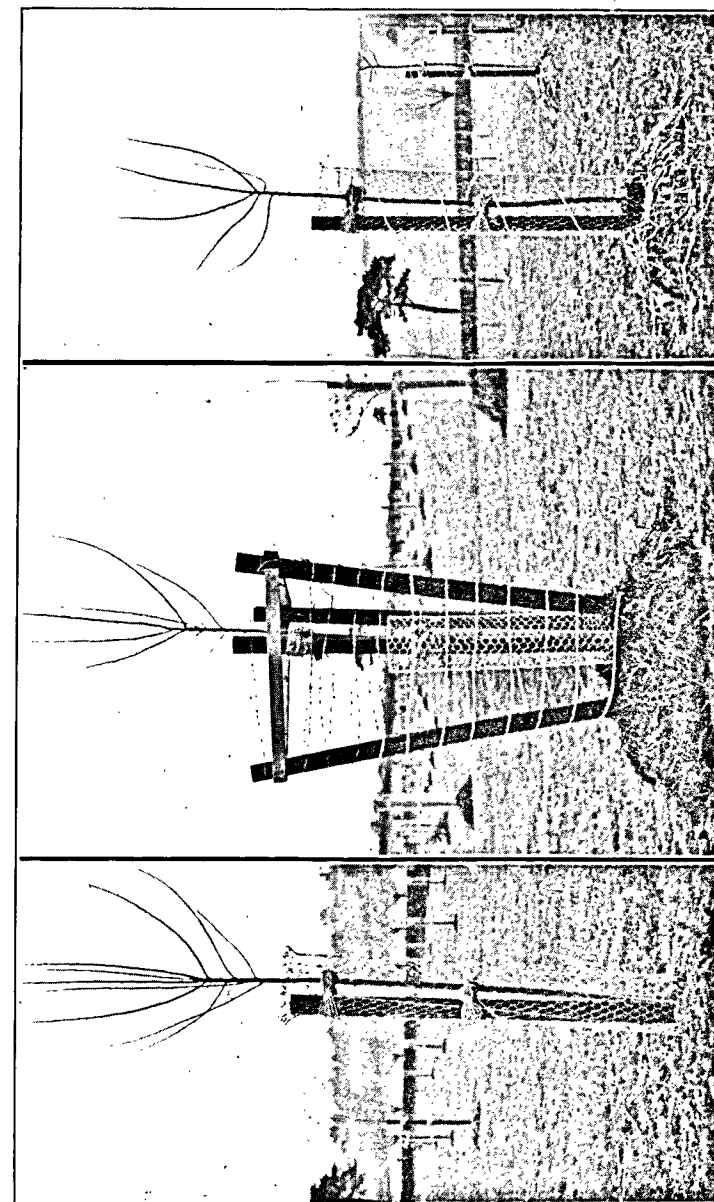
	<i>s.</i>	<i>d.</i>
Opening and filling hole, fixing stake and mulching		5
Stake ..		9
Bone meal (4 lb.) ..		2½
Planting ..		1½
	1	6

Varieties Planted.—The 25 varieties planted were as follows :—

Broad-leaved Jersey	Fair Maid of Devon	Medaille d'Or
Butleigh No. 14	Hereford Redstreak	Old Foxwhelp
Cap of Liberty	Improved Pound	Skymes Kernel
Cherry Norman	Killerton Sweet	Somerset Redstreak
Court Royal	Kingston Black	Strawberry Norman
Cowarne Red	Kingston Black	Sweet Alford
Dabinett	Improved	Sweet Coppin
Dymock Red	Knotted Kernel	Yarlington Mill
Eggleton Styre	Long Ashton No. 32	

Of the above varieties, a few rogues were found in several sorts and the Dymock Red was not true to type. The French apple, Medaille d'Or, as elsewhere, has proved a complete failure as an orchard tree. Its growth is weak ; it crops heavily and the trees break easily under the strain. This variety, therefore, has been regrafted.

For five or six years, the trees were carefully trained by Mr. A. J. Manning, Horticultural Instructor to the Hereford County Council, during which time they remained in grass.



Type 2.

Type 3.

Type 1.

Tree guards used on the Herefordshire Demonstration Cider Orchard.

The orchard was ploughed, however, and carried ordinary tillage crops during the War, and Mr. Manning observed that, as a result of this treatment, the trees made greater growth, and to this chance circumstance is attributed their present satisfactory size. It is valuable as showing that the former practice of establishing an orchard in tillage is still the best method, in certain cases, although very rarely adopted nowadays.

Present Condition.—Recent observation shows that the best trees, true to type, in the orchard are Killerton Sweet, Cherry Norman, Court Royal, Broad-leaved Jersey, Improved Pound, Fair Maid of Devon, Strawberry Norman and Knotted Kernel. The remainder are reasonably good trees with the exception of the following: Butleigh No. 14, Old Foxwhelp, Skyrmes Kernel, Cowarne Red and Medaille d'Or. Of the best trees, only Cherry Norman, Knotted Kernel and Strawberry Norman are Herefordshire varieties. Cap of Liberty, a heavy cropping variety, comes among the weaker growers on a basis of the average girth of the trees; but this average is brought down by several trees on poor ground that have cropped very heavily, but made no strong growth.

Although no crop records have been kept, Mr Manning observes that the order of cropping may be taken to be as follows: Fair Maid of Devon, Cap of Liberty, Improved Pound, Sweet Coppin, Strawberry Norman, Yarlington Mill, Knotted Kernel, Killerton Sweet. It should be noted that the trees are only recently adult. The Somerset and Devon apples show up well compared with the Herefordshire sorts. Cap of Liberty is planted in Herefordshire in places, while Strawberry Norman is commonly met with and Knotted Kernel is fairly common.

The following varieties, from observations made, appear to be fairly resistant to Winter Moth: Cherry Norman, Yarlington Mill, Somerset Redstreak, Dabinett, Knotted Kernel, Strawberry Norman, Improved Pound and Broad-leaved Jersey. While others have, at times, been noted as "clean," occasionally they have had severe caterpillar attacks. As Winter Moth can be controlled, the point is, perhaps, of minor importance.

The three important qualities, from the growers' point of view, are vigour, good cropping and good vintage quality. The varieties, so far as this orchard is concerned, that most nearly fill all these requirements are: Killerton Sweet, Yarlington Mill, Knotted Kernel, Cap of Liberty and Norman. Of these,

only Knotted Kernel and Strawberry Norman are typically Herefordshire apples, although Cap of Liberty is not uncommon in the county.

The orchard, now planted 19 years, is a very valuable object lesson to Herefordshire farmers, and it is to be hoped that more use will be made of the information to be gained from it.

* * * * *

SALAD VEGETABLES

THE production of salad vegetables on a commercial scale forms a valuable adjunct to market gardening. It is not proposed here to deal with the system of intensive cultivation known as "French gardening," which demands large capital outlay, technical knowledge and experience, but rather to indicate the general practical methods of production applicable to the market gardener, and, in many respects, to the private gardener and allotment holder, to whom some of these crops are invaluable. In fact, the private gardener is usually in a favourable position to grow them; with the greater attention to detail which he can give, a long succession of salads in their best condition can be secured. The allotment holder can utilize spare space between such growing crops as require some time before they need the full room allotted them in normal practice. Most of the salad vegetables are particularly suitable for use in intercropping, as, generally speaking, to be grown rightly they must be grown *rapidly*. From but small areas of land, therefore, a considerable supply of wholesome salads can be obtained.

In order to raise choice crops, the plants need, in practically every case, to be grown quickly and without check, and for this purpose a warm, well-drained soil in "good heart" is necessary, and an unlimited supply of water desirable. In such conditions, and with a certain amount of artificial protection available, salad vegetables may be procured throughout the year. Although they are in greatest demand, and most readily produced, during the summer months, nevertheless, they are sought after and often realize good prices at other periods, when, with a little extra trouble and care, they can be satisfactorily grown.

The plants usually cultivated for salad purposes in this country are:—beet, celery, chicory, corn salad, dandelion, endive, lettuce, mustard and cress, radish, spring onion, and watercress, and also cucumbers and tomatoes. Information on the cultivation of watercress will be found in the Ministry's

Leaflet No. 17, while cucumbers are dealt with in Leaflet No. 123, and tomatoes in Leaflet No. 393.

Beet.—The area of beet under cultivation is not usually large and might be increased with advantage to the grower. The consumption of beet as a salad seems to be somewhat dependent upon the weather conditions of late summer and early autumn. In dull, cheerless periods but little is eaten, whereas in seasons of bright or dry weather, the demand is good. As beet can be suitably stored, the grower can generally avoid forced sales at unremunerative prices and hold the crop in readiness for marketing at a time when economic returns are attainable.

Soil and Manuring.—The most suitable soil for beet growing is a fairly deep, well drained, friable loam, which should be thoroughly worked before planting. It is usual for this crop to follow one that has been well manured, as no fresh farmyard manure should be applied directly to it. A dressing of kainit, at the rate of 4 cwt. per acre, is beneficial.

Seed Sowing, Cultivation, and Storage.—The end of April or the beginning of May is the best time for sowing the seed. Occasionally a small area is put in early in April, but this is only advantageous when it is intended to raise and market an early crop. Plants from early sowings, if allowed to remain till the normal period of lifting, have a tendency either to bolt or to become too large for ordinary purposes. Drills should be made 1½ in. deep and 15 in. apart. This distance between the rows will serve for all except the small type of beet, for which 12 in. is adequate. Sowing should be made as evenly and thinly as is possible without leaving any gaps. As soon as the seedlings are through the soil, the first thinning should be made by striking out redundant plants with the hoe. The second thinning, or singling, must be done by hand at a time when it is certain that suitable plants can be selected to form the crop; these should be left at a distance of 9 in. apart in the row.

If the soil is subsequently hoed frequently in order to produce a surface mulch and prevent the growth of weed seeds, little, if any, further attention is needed. When ready, the crops should be lifted with care, avoiding injury to roots and consequent loss of colour in boiling.

Where storage is desired, a clamp or pit, similar to that used for mangolds, is suitable. The leaves should be carefully trimmed off to within about three inches of the crown before storage. Too close trimming may, however, cause bleeding and inevitable deterioration in the market value of the produce.

Varieties.—For early use, the red turnip-rooted variety should be grown. Main crop sorts are the old Cheltenham Green Top and Nutting's Dwarf, which are still held in favour in many districts. In recent years, the globe variety has been grown extensively. Dell's Crimson and Blood Red are also suitable varieties to grow.

Marketing.—Selected roots are sometimes packed in flats, with other salad vegetables, but the more usual method is to sell by weight or the dozen. In any case, roots should be washed clean of soil and graded into sizes and not sold "as grown." Attractive packs can be made in three grades, each consisting of large, medium or small roots. Where roots are sent by rail, judicious use of hay in packing prevents injury and resultant loss through bleeding.

Diseases.—The beet is occasionally attacked by Crown Gall and by a form of Scab similar to that occurring in potatoes. Both troubles are contracted from organisms in the soil and neither can yet be cured. The crop should not, therefore, be grown in soil liable to carry these diseases. The leaves are sometimes affected with "Rust" for which, again, there is no known cure, but lack of potassic manures is said to favour the incidence of this disease. Stored beets sometimes suffer from "heart" or "dry" rot, said by some to be due to the attacks of the fungus *Phoma betae*. In making clamps or pits, care should be taken to exclude roots that are affected, and attention should be paid to drainage and ventilation so as to avoid "heating" and yet run no risk of frost.

Celery.—Celery is in general demand during the autumn and winter months. Whilst, admittedly, good-quality produce is costly to grow, it has been proved, by the remunerative prices realized for it, that such expenditure is justified. Poor-quality celery, on the other hand, is seldom a paying proposition. It has been found possible, however, in recent years, by selecting a suitable soil and aspect for the crop, to eliminate some of the labour items, such as watering, which were formerly deemed to be essential points in its cultivation.

Soil and Situation.—Celery is best grown in an open position. The soil should preferably be a deep, rich, medium loam. A heavier type of soil is not unsuitable, provided it is rich in organic matter and has an adequate supply of moisture in movement. Certain soils in the Fen districts of Lincoln

and Cambridge are admirable for the purpose of celery growing.

Sowing the Seed and Treatment of the Seedlings.—To obtain early crops, thin sowings, in shallow boxes of prepared soil, should be made in mid-January. The soil used must be porous, finely sifted, and pressed firmly in the boxes. For this early sowing, any available heating resources of the grower should be employed to supply the necessary warmth, a heated greenhouse being most suitable. When the seedlings are large enough to handle, they should be pricked out in boxes containing equal parts of loam and leaf mould, made porous by the addition of sand. The seedlings should be planted diagonally at a distance of $1\frac{1}{2}$ in. Such plants, after pricking off, should be placed near to the glass in order that sturdy growth may be promoted and the production of spindly, drawn-out plants prevented. If carefully attended to, these plants will require further transplanting in a short period, and the best site will be a frame which has been made up on a slightly heated hot-bed. The surface of the soil in the frame should be within 8 in. of the glass, and the plants should be given $2\frac{1}{2}$ in. of space each way. Attention to watering and ventilation is essential; after the plants have become established, the lights may be lifted off, except during cold nights—the object being to harden the plants and obtain sturdy growth before planting them out in the open in rows or beds about the second week in May.

For later batches, sowings may be made in February and March on hot-beds protected by frames. These will provide plants for final bedding at intervals during June and July. Less attention will be needed in the pricking off than for the January seedlings—they may be planted direct from the boxes to frames and set out at a distance of 2 in. apart.

Cultivation.—Celery may be planted in rows or beds, although the latter method is not generally adopted on account, possibly, of the large amount of spade work involved. If it be decided to plant out in single rows, trenches 1 ft. wide and 1 ft. deep should be made. The distance between the rows should be 4 ft. Manure should be spread in the trenches to a depth of 6 in. and covered with soil which, when made firm, should be 3 in. deep. For double rows the trench should be 2 ft. wide, with the same depth and manner of filling as for the single row. In single rows, the plants are set 9 in. apart, whilst for double rows, 9 in. from plant to plant

They must be kept absolutely dark and in an even temperature of about 55° to 65° F., and be stacked close together, or packed in boxes, surrounded with sand or very light soil, which should be kept sufficiently damp to promote action of the root fibres. The heads are ready for marketing when about 6 in. high. This state will be reached in a period varying from two to four weeks from the time they are placed in the forcing pit, according to the temperature maintained.

Varieties.—Two of the best known varieties are Christmas Salad and Witloof.

Marketing.—It is usual for chicory to be bunched and sold by weight, the bunches being held together by two ties of raffia. Selected heads are, however, often sold in deep punnets. The aim of the grower should be to market as attractively as possible, and to this end, he may find it profitable to grade the leaves into sizes and mark the best, even lots, as "specials."

Corn Salad.—In this country, corn salad (*Valerianella*) is very little grown, nevertheless it forms a useful ingredient of a "salad."

Any well-worked soil, which has been enriched by the application of manures to the preceding crop, will serve for the growing of corn salad, but it is preferable that the soil should be of somewhat light nature and that a dry open situation be chosen.

Seed is usually sown in August in shallow drills from 6 to 8 in. apart. Thinning may be made to 6 to 8 in. in the rows. Often, in small areas, the most advanced plants are removed as required and the younger allowed to come in for use in succession without otherwise thinning. On a commercial scale, however, successional sowings are made during August and September, for the plants to mature in autumn and winter, when they are usually most in demand.

Dandelion.—The green leaves of dandelions are sometimes used in salads and also the blanched heads as with chicory.

Seed may be sown in May, and the seedlings thinned to 9 in. apart; otherwise, the culture and subsequent treatment is the same as for chicory.

Endive.—The uses and general cultivation of this plant are similar to those of lettuce. A light, rich soil, which has been deeply worked, is needed, and a warm aspect should be chosen; the plants will not thrive under drought conditions.

As a succulent, crisp plant is to be produced, the plants must be encouraged to grow quickly.

Time of Sowing.—For commercial purposes, seed is occasionally sown under glass in February or March, but the usual practice is to sow during late April on a warm border, or in May in the open ground, for the main crop; for the winter crop, sowings are made during August, the plants generally coming in for use after the New Year. Although transplanted seedlings give superior results, this method is not often adopted, the seed usually being sown sparingly and the plants thinned out to a distance of one foot apart in the drills.

Blanching.—The value of this crop for market purposes depends largely upon the effective blanching of the "heart." This process is said to improve the flavour. The broad-leaf sorts may be blanched by tying loosely, whilst, with the moss-leaf varieties, good hearts are secured by covering the plant with an inverted pot or pan. A flat slate placed over but not touching the heads will also produce the desired effect. Blanching should be arranged as far as possible so that no heads have to be kept long before marketing, as they soon lose condition after blanching.

Varieties.—The Broad-Leaf Endive, although good for cooking purposes and better for winter use, is apt to be too tough for salads. Perhaps the most desirable type is the White Batavian. The Moss-Leaf or Curled types are more satisfactory for use in salads. Among these are Ruffee and White Curled, and also a dwarf variety known as Moss Curled.

Marketing.—Fresh, well-blanched, clean hearts should be selected for marketing. In cutting, the stem should be cut through well below ground level to ensure that the plant shall keep in order in nice shape. A few of the outer leaves drawn up around the heart will afford protection during transit. The heads should be placed close together on their sides in "flats" or boxes holding 2½-3 dozen each. During seasons of scarcity, the plants are sold by the dozen. The number of heads in each container should be clearly marked on a label.

Lettuce.—Of all salads, lettuce is perhaps the most generally grown, and it is one with which, during summer, success may be attained under almost any conditions, provided that good cultivation is practised. Early crops, however, should be raised in fairly rich, light, porous soils, heavy land and exposed situations being avoided.

and 12 in. from row to row will be necessary. In double rows, planting is done diagonally.

For the bed system, the land is marked out 10 ft. wide. A few inches of the top soil are removed and banked up on a space 3 ft. wide outside the marked area. Thus, for a series of beds, a space of 10 ft. is allowed for each with a 3 ft. space between. The bed area is dug over, well manured, and celery planted out diagonally 9 in. apart.

In either system, the spaces between the rows can be utilized for catch crops, such as lettuce, radish, and such salads as can be readily cleared before the earthing-up of the celery is necessary.

In seasons of drought, an occasional watering may be necessary. When the plants have made one foot of growth, the first earthing-up should be done. For the early crop, which it is intended to market in mid-September, earthing will usually be effected early in August. The plough may be used for this and the second earthing, but the final one should be done with the spade. Soil must be prevented from getting into the heart of the plants and causing decay; it is therefore imperative to ensure that the stems are close together and the leaves well up. The earth should be drawn around each plant and made firm. Much care should be exercised in the final earthing-up. Upon this depends the effective blanching of the celery, and therefore the appearance and quality of the mature plants.

Varieties.—The following are suitable varieties to grow:—

White varieties: Sandringham, White Gem, and Solid White.

Red varieties: Leicester Red, A 1, and Clayworth Prize.

White varieties are usually preferred for all purposes, and exclusively for early work; for the latter, Sandringham and White Gem are favourites.

Marketing.—Celery is usually sold in bundles of eight or a dozen sticks, these being made up either in flats, known on the market as "Fans," or else in round bundles, called "Rolls." The outer leaves and roots should be removed and the stems washed, so that the fans or rolls present a clean, attractive appearance.

Pests and Diseases.—The two most serious insect or animal pests are the Celery Fly (see the Ministry's Leaflet No. 35) and various kinds of slugs (Leaflet No. 132), while occasionally the Carrot Fly (Leaflet No. 38) is troublesome. The leaflets

dealing with these pests should be consulted for detailed information, but the following are the more important points:—

CELERY FLY.—The planting-out of the infected seedlings should be avoided as it will almost certainly result in damage to the crop later. If the plants become infected when in the seed bed or in boxes, it will usually be found at planting time that the outer leaves alone are attacked, and such leaves can be pinched off and burnt. Deterrent sprayings with paraffin emulsion, or dustings with soot and lime, are chiefly of service in the case of small areas, since they are only effective if repeatedly carried out.

SLUGS.—The attempt to grow celery commercially on slug-infested land is not worth while. In the case of small garden plots, wrapping the stems in brown paper just before earthing-up will prevent much slug damage.

CARROT FLY.—If this pest becomes troublesome to those who grow celery on a commercial scale, it is advisable to avoid planting celery on or near land which has carried a carrot crop the previous season.

CELERY LEAF SPOT is important. This disease is dealt with in Leaflet No. 238. It should be emphasized here that the disease arises mainly from sowing infected seed, and special care therefore is necessary in obtaining clean seed. If this cannot be obtained, the seed should be disinfected, as indicated in the Leaflet. Subsequent spraying when necessary should be counted as the price to be paid for the folly of not securing proper seed.

Chicory.—The blanched leaves of the chicory plant (*Cichorium intybus*) are used for winter salad purposes in this country. A deeply worked loamy soil, which has been well manured for a previous crop, is desirable. It is not good practice to apply farmyard manure to soil immediately before planting.

General Cultivation.—Seed should be sown about mid-June, in drills 1 in. deep and about 1 ft. apart. When the seedlings are about 2 in. high they must be thinned, leaving the plants 9 in. apart in the row. For the remainder of the summer, it is only necessary to keep the soil stirred and free from weeds by frequent hoeing. The roots should be lifted in the autumn and the leaves *twisted* off, the roots being stored in the same manner as for beet, till they are required for forcing.

Forcing and Blanching.—The root can be forced in a variety of places, such as pits or cool greenhouses, or a warm shed.

Early Crop.—A crop can be obtained in the spring of the year by two methods, according to the facilities of the grower :

(a) Seed of a hardy variety may be sown during August or early September, the seedlings being wintered in frames or on a protected border. Drills should be drawn 4-5 in. apart, the seed sown thinly, and lightly covered with soil. The plants should be set out in their final bed 9 in. square, being transplanted to these when they are large enough to handle.

(b) Seed of a quickly maturing variety may be sown in a heated house in January. When this method is adopted, it is the practice to sow in shallow boxes, covering the seed with fine, sifted soil, care being taken to ensure thin sowing. As soon as large enough, the seedlings may be pricked out into other boxes, placing the plants about 4 in. apart in both directions, or, if more convenient, they may be planted direct into the border of an early tomato house. Some of those pricked into boxes may be gradually hardened off and others planted in cool houses or final quarters outside to provide a succeeding crop.

In the cultivation of lettuce under glass, forcing must be avoided, otherwise they will not "heart" properly. Further sowings may be made under glass for succession until the summer crop is ready, the treatment varying as the season advances.

Summer Crop.—Small sowings at regular intervals are desirable for the summer crop. The first may be made about the middle of March and others at intervals up to the end of June. The resultant seedlings should be transplanted as they become large enough to handle. A number may be allowed to mature where sown, in which case thinning to the required distance must be effected. The thinnings, if carefully lifted, can be planted elsewhere to come in as a later batch. Constant hoeing is essential, and, in a very hot season, mulching is sometimes resorted to, with beneficial results.

Winter Crop.—Seedlings of the hardy varieties, sown as for the spring crop, will, if the season be favourable, be fit for use during the winter. Such seedlings should be lifted and planted out to finish in a cold frame, where they will be protected in the hardest weather.

Manures.—Little manure need be applied to lettuce if planted on land where the previous crop was well dunged, but, failing this condition, a dressing of well-rotted stable or farmyard manure at the rate of 10 tons per acre should be given. If, however, these natural manures are scarce and the

soil is deficient in humus, or where green manuring has not been resorted to, artificials may be used. As a spring dressing, superphosphate of lime at the rate of 5 lb. per pole is advised, and sulphate of potash at the rate of 3 lb. per pole often gives good results. Sulphate of ammonia is best applied when the crop needs a little stimulating to promote "hearting." On the lighter soils around industrial centres, where continuous cropping is practised, the land is likely to be deficient in lime, and growers should therefore make sure that the soil in which a lettuce crop is to be grown is adequately supplied with it.

Varieties.—There is a large number of excellent varieties of cos and cabbage types of lettuce. The names of a few of these are given below, but growers should largely be guided by local experience in the selection of suitable kinds for their purpose :—

FOR SPRING CROP : *Cabbage.*—Golden Ball ; Stansfield Park ; Continuity ; Commodore Nut ; Tom Thumb.

Cos.—Hick's Hardy White ; Parish Green.

FOR SUMMER CROP : *Cabbage.*—Ideal ; Wonderful ; Malta.

Cos.—Parish White ; Superb White ; Mammoth White ; Covent Garden White.

FOR WINTER CROP : *Cabbage.*—Hammersmith Hardy Green ; All-the-year-round ; White Chavigne.

Cos.—Black Seeded Bath ; Winter Green.

Marketing.—Summer lettuces are usually pulled and sent to market with the roots attached ; the cos varieties should be tied before dispatch, as this prevents the outer leaves breaking during transit and preserves them in good shape and neat appearance. Winter and spring produce, especially when scarce, pays for packing in small flats ; the cos varieties should be laid on their sides and packed closely together, the cabbage sorts with hearts uppermost. In all cases, the grower should endeavour to arrange for the dispatch of his lettuces as soon as pulled, in order that they may arrive on the market in fresh condition. Attention to attractive and clean methods of packing will usually yield a profit on the trouble taken to ensure them.

Pests and Diseases.—All pests which are general feeders, such as Cutworms and Leather Jackets, attack lettuce, but, as the crop seldom justifies special treatment, it is necessary to rely for the control of these pests upon cultural measures, especially the repeated hoeing and working of the soil, which forms part of the regular routine on the soils usually preferred for a lettuce crop. Lettuce Root Aphis is sometimes

troublesome, but no control measures are known. Under glass, Aphides (green fly) on the foliage may also cause injury if allowed to persist until hearting begins. Fumigating or spraying the plants when still young should prevent this damage.

Lettuces are sometimes attacked by a Downy Mildew when grown under conditions of excessive atmospheric humidity, and precautions should be taken to avoid such conditions. The Ring-Spot disease of this crop is often very serious, both under glass and out of doors. (See article in this JOURNAL, May, 1923, p. 147.)

Mustard and Cress.—Seedlings of these plants are usually sold together for use in salads, and, their cultivation being so simple and similar, need not be treated separately.

Mustard usually germinates more rapidly than cress and should therefore be sown about three days later than cress. Although during summer the plants are hardy, it is nevertheless advisable to grow them only under cover, in partial darkness, as the seedlings are then crisper and taller and the stems white, whereas in the full light they are apt to be somewhat short and green.

Seed is best sown in boxes containing friable, sifted soil. After watering thoroughly, the seed is sown on the surface of the soil and allowed to grow to a height of $1\frac{1}{2}$ inches. Cutting should be done with a long sharp knife and the produce packed tightly in punnets, with heads uppermost.

Varieties.—White mustard is generally used for garden crops, but for commercial growing black is often sown.

For cress, the type known as "garden cress," is used.

Radishes.—Radishes are by no means difficult to grow, and, as an early crop, are generally profitable. It must, however, be borne in mind that a good sample can only be obtained when rapid growth, without a check from seed bed to maturity, is secured. One common error is the sowing of too large a batch at one time, so that, if the roots cannot be disposed of as they become fit for market, they soon get hollow, pithy and, consequently, unprofitable.

Cultivation Outdoors.—The date of the earliest sowing will depend on the soil available and the methods adopted. In a favourable season, the first sowing may be made towards the end of February. A rich, deeply dug, friable soil, containing plenty of lime, is most suitable; heavy retentive soils should be avoided. The seed bed should be moderately dry and possess a fine tilth.

Seed is often sown broadcast, but it is more economical to sow in drills 9 to 12 in. apart, and thin out the seedlings to $1\frac{1}{2}$ to 2 in. apart in the drills. If late sowings are made during hot weather, a shaded site should be selected. Throughout the summer, frequent hoeings are necessary. Each crop should be ready for pulling in a few weeks.

Where plenty of cheap straw is obtainable and conditions admit the formation of a suitable bed, sowings can also be made at intervals commencing in late December. Beds 6 ft. wide, in sheltered positions slightly raised above the level of surrounding ground, with pathways between, are generally made for this method of culture. The seed is sown in the beds, lightly covered with soil, and the area covered with straw to a depth of 6 in. During favourable spells of weather, the straw should be raked off into the alleys. After germination of the seed, the straw covering should be in place only during frost or cold spells.

Cultivation in Frame or House.—Early crops can be secured by making sowings in December and January on a gentle hot-bed, covered with about 6 in. of good soil, over which is placed a frame, so arranged that the soil is only a few inches below the glass. The seed should be sown in drills, watered with tepid warm water, and the frame kept closed till the seed germinates. After germination, the frame should be opened when the weather is favourable, and, in due time, the seedlings thinned. Another means of producing early crops is by sowing in borders in houses which are, later, to carry a tomato or other crop.

Whichever method is pursued, it is well to bear in mind that failures with this crop are often due to sowing the seeds too thickly and not thinning sufficiently after germination.

Varieties.—For early sowings, the olive-shaped types are most suitable, although Wood's Early Frame is still used in some districts.

For summer crops, the turnip-rooted varieties give the best results.

Marketing.—After pulling, the roots should be washed, and put up in bunches of 12. Even-sized and shapely radishes only should be marketed. The long rooted sorts are sometimes arranged fanwise. They are sold in units of one dozen and one score bundles.

Pests and Diseases.—Flea Beetles are troublesome in dry weather (see Leaflet No. 3).

Radishes occasionally suffer from a Downy Mildew and from White Blister, but these diseases are rarely serious enough to necessitate spraying with Bordeaux Mixture. Finger-and-Toe sometimes occurs in radishes (see Leaflet No. 77).

Spring Onions.—There is a considerable demand for “spring” or “green” onions for use in salad, and, in the past, large areas around Evesham and in other localities have been devoted to the production of this crop.

Seed is sown for preference in August. In the north, sowings are made early that month, but, in the southern counties, the end of August is a suitable time. The land should have been dunged for the preceding crop, but at this stage it is not necessary to work it deeply. A fine tilth is essential, however, and a firm seed bed desirable. The seeds should be drilled at a distance of 12 in. between the rows. Onions are often sown as a catch crop between rows of other crops. At all times the beds should be kept clean, and a frequent use of the hoe between the rows will not only prevent the growth of weeds, but will also assist the growth of the crop. It is desirable to get the produce on the market as early in the season as possible, and a light dressing of either sulphate of ammonia or nitrate of soda may be given in February, and the hoe used between the rows, provided that the soil is sufficiently workable or dry.

When a suitable size has been attained, the plants may be marketed in bundles containing one dozen onions which have been washed free of soil. In many markets, the bundles, up to 12, are generally tied together.

The thinning from spring-sown onions, where grown for “large onions,” are also marketed for salad purposes, and in some districts the trade done is considerable.

White Lisbon is usually grown for this type of work, but other suitable varieties are A 1 and Giant Rocca.

* * * * *

POULTRY ON THE GENERAL FARM

F. W. RHODES, D.S.O.,

Head of the Department of Poultry Husbandry, South-Eastern Agricultural College, Wye, Kent.

THE object of this paper is to suggest to the general farmer a method of poultry-keeping which he can conveniently and profitably carry out, with the minimum amount of initial capital outlay, and without interfering with the general conduct of his other farming operations.

The first question which the farmer will naturally ask is: “Is there room for expansion of the poultry industry in this country, or shall we, if many of us take up poultry-keeping more extensively, bring about over-production and consequent reduction in the possible profits to ourselves?” This question is completely answered by a study of the Reports* on the Marketing of Eggs and Poultry which have been issued by the Ministry of Agriculture. These reports show that approximately £20,000,000 are annually paid to foreign countries for eggs and poultry imported into this country to supply the present demand. The annual increase in imports shows that the home demand is not likely to decrease, but is much more likely to increase. No fear need, therefore, be felt as to a possible lessened demand for poultry produce in the future.

There is no doubt that the cost of production of eggs and poultry is lower in the case of the general farmer than in the case of the producer who is a poultry farmer pure and simple. In the latter's case the whole of his land is entirely stocked with the poultry, which provide his sole source of income.

The General Farmer's Advantages.—There are numerous reasons why the general farmer is in a position to produce cheaply, but the chief of them may be stated briefly as follows:—

(1) He is not bound, as is the case with the poultry farmer, to stock his land heavily with poultry with the consequent risk of the land becoming poultry sick, thereby impairing the health of his birds and making them more susceptible to diseases of a serious nature. He can use fresh ground annually for his chicken-rearing area, this in itself going a

* *Report on Egg Marketing in England and Wales*, Economic Series No. 10, price 6d., post free 9½d. *Report on the Marketing of Poultry in England and Wales*, Economic Series No. 11, price 6d., post free 9d. H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2.

long way towards the successful conduct of this branch of the poultry work.

(2) It is possible to run a certain head of poultry on grass land without detriment to the other farming stock and without decreasing the numbers of the latter which the farmer is accustomed to run per acre. This is accounted for by the fact that poultry have a small food capacity and therefore require concentrated foodstuffs. This small food capacity does not allow of their consuming any appreciable proportion of the grass which is needed for the other farm stock. The chief source of food for poultry, so far as the grassland is concerned, is the animal life which they consume in the form of worms, slugs, grubs, insects, etc., these, in many cases (*e.g.*, wireworms) being harmful to the growth of the grass itself. The foodstuffs which are hand-fed to poultry are of a highly concentrated nature, and hence the manurial value of the residue from this source is considerable, and the land over which the poultry run benefits by receiving a highly nitrogenous manure—this, in its fresh state, being at least equal in value to the highly-priced artificial manures sold in the form of guanos.

The fact that poultry can be run in addition to the ordinary farm stock means that the profit-earning capacity of the land per acre is increased without addition to the rent or rates. Virtually, the general farmer can regard poultry as living rent free on his farm.

(3) The farmer can produce a certain proportion of the foodstuffs necessary for the poultry, thus eliminating millers' profits, cartage, and other labour charges on these particular products. Wheat, oats, tail corn, straw for litter, etc., are all produced on the farm, and all can be used in part for the poultry.

(4) The land, so far as the poultry are concerned, is practically unlimited, so that it is possible to run the birds in small flocks, widely separated from one another, and no wire netting fences are required. This eliminates a considerable item of capital outlay which the poultry farmer must, of necessity, incur in order to keep his flocks within his own boundary and to prevent mixing and crowding in the houses.

(5) As poultry, on the general farm, have practically unlimited free range over grassland, they cost the general farmer less to feed than the poultry farmer, since, at certain times of the year, they will be able to obtain a large amount of natural food which does not cost anything. The fact that they are

only run on the farm in comparatively small numbers per acre gives them greater opportunities of obtaining this cheap but very valuable form of food.

(6) The general farmer is saved the cost of applying expensive heavy dressings of basic slag, lime, etc., which the poultry farmer must necessarily use in order to prevent his land from becoming poultry sick.

(7) Pullets can be run on the corn stubbles for some considerable time after harvest until the shed corn has all been picked up, after which they are drafted into the laying-houses. Cockerels for killing as table birds can also be run on the stubbles. This all helps to reduce the cost of production, and is greatly to the advantage of the farmer when compared with the poultry farmer.

As an instance of the indirect value of poultry to the farmer, the case of arable land badly infected with wireworm may be taken. Such land can be largely, if not completely, cleared of this pest by temporarily stocking the infected fields with poultry during ploughing and other tillage operations, provided not more land be ploughed at one time than the number of birds can adequately cover. As a general guide, 400 birds will do an immense amount of good if one acre a day is ploughed for them.

Number of Birds per Acre.—On grassland, the maximum number of birds should not exceed 50 per acre. Even with this number, it will be found that the same number of other farm stock can still be kept on the land. It is not suggested, however, that the farmer should attempt so large an undertaking as to carry 50 birds per acre on all of his grazing land, but rather that he should aim at a flock total which can be adequately looked after by one man, these being evenly distributed over his total grazing land. For example, a farmer having 100 acres of grazing land would run his poultry at the rate of approximately 10 birds per acre, if his total flock numbered 1,000 birds.

Size of Flocks and Houses.—The most economic unit is one of 120 to 150 birds in one house, each house having 300 sq. ft. of available floor space. For example, a house 24 ft. long by 12 ft. wide would house approximately 150 birds. The houses must never be less than 80 yards apart, or mixing and crowding of the flocks will take place. Such close proximity would be unlikely as, at this distance, the number of birds would be approximately 85 per acre.

The size of house mentioned (24 ft. × 12 ft.) allows only two square feet of floor space per bird, which is the absolute minimum area if the birds are to have the necessary scratching exercise, obtained by feeding grain in dry straw litter inside the house during bad weather. This size of house is only capable of housing 150 birds when both top and bottom ventilation is provided in such a way as to allow frequent change of air without causing draughts.

One-Man Unit.—It is suggested that the total head of adult stock should be such that it justifies the employment of a full-time poultryman. Provided certain simple labour-saving devices are used, one man can look after 1,000 head of adult stock housed in flocks of 150 birds each, and can rear 1,000 to 1,200 chicks each season. It is, however, advisable to have someone on the farm who can, at a moment's notice, take the place of the poultryman in case of illness, and so that he can have at least one half-day off duty per week.

Making a Start.—It is suggested that the poultry section of a general farm should be the particular care of one of the farmer's sons (if he have one) who has been specially trained for this work at one of the Colleges or County Institutes which provide facilities for such training. It is not suggested, however, that this trained son should immediately launch out into a 1,000-bird plant, but rather that he should start gradually, feeling his way during his first year, commencing in October, by building his chicken-rearing appliances. This would be followed by rearing some 600 to 700 chickens, and by building two laying-houses which should be ready by the end of August for the 300 pullets which he should get from the 600-700 chickens hatched. The following year he would extend by building more laying-houses and rearing more chickens. By extending gradually in this way he will gain invaluable practical experience and the confidence that will lead to success.

If hired labour has to be used, then the problem becomes rather more difficult, as the farmer himself will have to give up a certain amount of time to the supervision of the poultry branch.

Labour-Saving System.—In order to reduce labour to a minimum, the dry mash method of feeding should be adopted, each house being provided with dry mash hoppers of sufficient capacity to supply the birds for a week. In each house there

should be a metal bin which will hold a week's supply of grain, and all the houses should be fitted with rain-water gutters leading to two 40-gallon creosote barrels raised on a stand outside the house and, in turn, connected with a ball tap and drinking trough inside the house. Creosote barrels are suggested because creosote is used for the houses and therefore it is probable that some of these will be available on the farm. By this method of collecting the rain water from the roofs of the poultry-houses, the water supply is guaranteed for the greater part of the year and an immense amount of labour is saved. During a period of drought water will, of course, have to be carted round in a water-cart.

Each house should also be provided with a galvanized dust-bin, outside the house, to take the manure which is scraped daily from the dropping-boards under the perches.

A cart would visit the houses once a week to deliver dry mash, grain, grit, shell, straw for litter, etc., and at the same time would empty the manure-bins, carting the manure to a shed where it would be stored under cover to prevent loss of manurial value through exposure to rain. It is recommended, however, that this manure should be distributed as soon as possible, as, if left for long in heaps, it heats and loses much of its fertilizing value.

The above system makes it possible for the poultryman to attend to a far larger number of birds widely distributed over the farm than he could possibly attend to had he to carry by hand all water, foodstuffs, etc., several times a day. The houses need fencing round to keep other farm stock from damaging them but, other than this, no fencing is required.

Shutting Up at Night.—Under this system of free range poultry-keeping, it is of course essential that the houses be all closed up at night to prevent losses by foxes. In districts where foxes are so numerous as to cause loss by any this system cannot be carried on successfully.

The Stock.—The success of the whole scheme, of course, depends upon (1) the stock, (2) the feeding, and (3) the housing and general management. Since the main source of income will be from the eggs produced, it is essential that stock of the "bred-to-lay" type be used and not the purely exhibition type. Breeders of the "bred-to-lay" type can be found by carefully watching the monthly reports of, and by paying a visit to, the local County Egg-Laying Trials or the larger Open

Laying Trials. It is not, however, proposed that the farmer should necessarily purchase his stock from the winners of these trials, but rather that he should purchase from breeders whose birds have consistently done well over a period of years.

It is realized that, in most cases, the farmer cannot spare the time to be a pedigree breeder of poultry, since this necessitates trap-nesting, much recording and other work. The simpler method is for him to purchase either hatching eggs or day-old chicks from the pedigree breeder and rear the chickens himself. He should be able to purchase hatching eggs at £3 per 100 or day-old chicks at £6 per 100, which will give him stock capable of putting up a paying egg average. In estimating the number of eggs required for hatching it is wise to allow five eggs for every pullet required.

Culling the Flocks.—It is not profitable to keep the average layer for more than two laying seasons, therefore half the flock will have to be culled and sold as fat hens annually, and a corresponding number of pullets reared to replace them.

Capital Outlay.—The amount of capital required, per adult bird, should not exceed 20s. This capital may be apportioned approximately as follows :—

	Per bird.	Per 1,000 birds.
Stock	7s.	£350
Housing	8s.	£400
Rearing appliances	4s.	£200
Sundries	1s.	£150
Total	20s.	£1,000

Returns.—A flock consisting of 50 per cent. pullets and 50 per cent. hens, none of which are kept for more than two laying seasons, will easily produce an average of eleven dozen (132) eggs per bird per annum. These, at an average price of 1s. 10d. per dozen, will bring in a gross return of £1 0s. 2d. per bird per annum.

Expenses.—The following is an apportionment of the expenses which will have to be incurred :—

	10s. 0d. per bird	per annum
Foodstuffs	10s. 0d.	per annum
Labour	2s. 3d.	" "
Replacements (stock)	3s. 0d.	" "
Depreciation (plant)	1s. 3d.	" "
Sundries	2d.	" "
Total	16s. 8d.	" "

Net Profit.—The above figures, based upon a comparatively low egg average, show a net profit per bird per annum of 3s. 6d., or £175 on 1,000 birds, which is 17½ per cent. interest on the capital invested.

Payment of Labour.—In the event of hired labour having to be used it will be noted that, in the statement of expenses, the labour item is put at 2s. 0d. per bird per annum. This, based on the fact that a flock of 1,000 birds is a one-man job, works out at an annual wage bill of £112 10s. 0d., or approximately 43s. per week. It is, however, suggested that a fixed weekly wage of 35s. be paid, and that the remainder be made up in the form of a bonus of fourpence per hundred eggs produced. This bonus would be paid weekly, but a single annual bonus is suggested of 20s. per egg for each egg by which the average of the whole flock exceeds the 132-egg average mentioned under the heading "Returns."

Disposal of Surplus Cockerels.—The above profits do not take into consideration possible profits from the sale of surplus cockerels. For every pullet raised, there will be at least one cockerel to be disposed of. Whether there be any profit on the sale of these will depend, firstly, upon the breed kept, and, secondly, upon the method of preparing them for market. If a light breed be kept, only the earliest hatched cockerels will show a profit. On the other hand, if a heavy breed be kept there is no reason why at least sixpence per head net profit should not be obtained. If these cockerels be sold alive straight off the run, and marketed in the local auction yard, no extra labour expense will be incurred, but the price realized will not leave so much profit as would be the case if the birds were partially fattened, killed, plucked, and marketed in one of the London wholesale auction markets. Table birds, to realize the best prices on the London market, must be young and well covered with soft flesh. This can only be obtained by penning the birds in fattening cages and feeding on meal and sour separated milk mixed to the consistency of thick cream and fed in troughs. This treatment, for from seven to ten days, greatly improves the quality of the flesh and increases weight. The important point, however, is that although the increase in weight may not be considerable, the improvement in the quality of the flesh results in a better price per lb. than in the case of the birds sold straight off the run and marketed in the same way. These surplus cockerels

should be sold at from eight to eighteen weeks old, according to the market requirements. The demand for the smaller birds is greatest in the earlier part of the season, the size required increasing as the season progresses. In no case should the cockerels be kept until they become coarse and show spurs; as in this condition they always realize a poor price.

Effect of Poultry on Grassland.—The beneficial effect of keeping poultry on poor chalky grassland has been clearly demonstrated on Wye College farm. By feeding most of the grain feed in the coarse, rough patches, the coarse grass has been largely scratched out as, also, has the moss on other parts of the field. These changes have been brought about in a comparatively short period (two years) owing to fairly heavy stocking (75 birds per acre), but there is no reason why similar results should not be obtained with less heavy stocking but extending over a greater period. The writer knows of many instances where this has been the case.

Poultry in Orchards.—The scheme of poultry keeping as outlined above can be applied equally well by fruit growers in their orchards. It is very important, however, that fallen fruit should be picked up daily to prevent the poultry from eating it. When poultry eat large quantities of fruit, especially apples, bowel trouble very soon sets in and causes much trouble. This is especially so in the case of growing chickens, and therefore particular care to collect windfalls must be taken where chickens are being reared.

Considerable advantage to the fruit grower is obtained by running poultry in his orchards as a means of destroying certain kinds of pests which attack the fruit. This is in itself an indirect source of income attributable to the poultry.

* * * * *

METEOROLOGY AND AGRICULTURE

A THIRD conference arranged by the Ministry between workers engaged on the study of various aspects of the effect of weather on crop growth was held at the Meteorological Office on September 22 and 23, 1927, under the chairmanship of Sir W. Napier Shaw, F.R.S. Those present included representatives from the research institutes at Rothamsted, Cambridge (Animal Nutrition), East Malling (Fruit Growing), Aberystwyth (Plant Breeding), and Edinburgh (Animal Breeding), from the crop testing stations in England, and from several agricultural colleges and county agricultural staffs.

The following papers were read :—

"The Week as a Phenological Time Unit" (Sir W. Napier Shaw).

"Rothamsted Temperature Records" (Mr. T. N. Hoblyn, Rothamsted Experimental Station).

"The Effect of Temperature and Humidity on the Changes in Weight of Crops in Storage" (Mr. H. J. Page and Mr. G. V. Jacks, Rothamsted Experimental Station).

"Investigations into the Losses that Occur in Corn Crops During Storage in the Stack" (Mr. W. S. Gibson, East Anglian Institute of Agriculture, and Dr. W. Goodwin, South-Eastern Agricultural College).

"The Effect of Temperature on the Keeping Quality and Bacterial Count of Milk" (Captain H. Barkworth, South-Eastern Agricultural College).

"The Effect of Meteorological Conditions on the Amount and Nutritive Value of Pasture and Hay" (Professor R. G. Stapledon, Welsh Plant Breeding Station).

"The Effect of Meteorological Conditions on the Rate of Growth of Pasture Grass" (Dr. H. E. Woodman, Cambridge Animal Nutrition Institute).

"Temperature and the Food Requirements of Animals" (Professor T. B. Wood, Cambridge Animal Nutrition Institute).

"The Effect of Ultra-Violet Light on Animal Nutrition" (Dr. H. E. Magee, Rowett Research Institute).

"Meteorological Factors Affecting Sheep" (Mr. J. E. Nichols, Edinburgh Animal Breeding Research Department).

Space does not permit of a full account of these papers, some of which are in any case rather of academic than immediate practical interest, but a brief summary of each is given below. It is proposed later to issue a full report of the conference, and a limited number of copies will be available for free distribution.

The Week as a Phenological Time Unit (Sir W. Napier Shaw).—In so far as the application of meteorological data to agriculture or phenology is concerned, the week is a much more convenient unit of time than the month. The salient

events of a week, meteorological and phenological, would not be missed by anyone making a weekly round of observation, whereas the conditions at the beginning of a month may be only dimly remembered by the end of it. The common events of ordinary life also are periodic in the week and are likely to remain so as long as the "week-end" habit holds. For the practical application of meteorological statistics, therefore, the week is a natural unit. This unit was chosen for a Report of the Meteorological Office specially designed for agricultural and hygienic application. A novel feature of this weekly series of data is that warmth and cold are not dealt with by the simple process of noting temperatures but, at the suggestion of leading authorities in agricultural science, by "accumulated temperature" above or below 42° F., expressed in "day degrees."

The weekly report of the Meteorological Office affords the best material for the study of the features of climate in relation to its effect upon the sequence of events in agriculture, or the facts concerning health and disease, which are set out week by week in the tables of the Registrars-General of the three Kingdoms. The weekly records can easily be summarized to preserve in very short form for the community in general an effective memory of past weather.

Data given suggest that, for the purposes of a weekly report, it is well to commence the statistical year on January 8, to group the weeks in fours and fives, which by analogy may be called months, so arranged that the four groups of five weeks have the solstices and equinoxes in their middle weeks. The grouping makes it easy to display the quarters of the May-year and the seasons of the Farmer's year—autumn, winter, spring, and summer.

Rothamsted Temperature Records (T. N. Hoblyn).—Daily records of maximum and minimum temperature have been taken at Rothamsted for nearly 50 years, and it has been found necessary to condense the mass of data which has accumulated into a form which would be more easy to handle before an adequate consideration of the effect of temperature upon any particular agricultural or horticultural crop could be attempted. During the process of condensation, it was realized that the effect of temperature would be most evident in its variations, either from day to day in any one particular year, or in the variations of the mean for a particular month from year to year. The daily readings were, therefore, reduced

to five constants for each month. These were, firstly, the mean for each; secondly, the variation of each measure during each month; and, thirdly, the co-efficient of correlation between maximum and minimum.

The variation over a period of years can be divided into two portions, that within months and that between the same months in different years. The analysis showed that the greatest variation of the maximum temperature is found in the spring and early summer, the winter being comparatively even; the minimum temperature, on the other hand, varies greatly in the winter months, while the summer months are very even. It would appear, then, that maximum temperature is likely to have a decided influence on an annual crop during the spring and early summer, while the minimum temperature is most likely to have an influence during the winter and early spring. The variation of the mean temperature during the summer months is greatly influenced by the low variation of the minimum; the mean tends, therefore, to give a poor idea of fluctuations of temperature during this time.

Considering now the variation between the same months in different years: whereas, in the spring and autumn months, the variation of the maximum temperature within months is high, the mean maximum temperature varies comparatively little from year to year. In the winter and summer, however, the maximum varies very considerably between years.

The minimum temperature has its greatest variation from year to year in the winter, but is extraordinarily constant in the summer months. Whether a summer be hot or cold, there will be very little difference in the minimum temperature in either case.

The mean of the maximum and minimum probably gives a fair idea of the variations in temperature from year to year in the winter months, but the mean tends to follow the maximum temperature from year to year during the summer months.

The Effect of Temperature and Humidity on the Change in Weight of Crops in Storage (Mr. G. V. Jacks).—Experiments have been carried out at Rothamsted on wheat, oats and barley with the object of ascertaining the effect of controlled conditions of relative humidity, temperature and pressure on the weight of crops during storage. Preliminary experiments on oats having indicated conclusively that variations of

pressure had no appreciable effect on the moisture capacity of the grain, the main work was confined to temperature and relative humidity.

Temperatures of 50° F., 59° F., and 68° F., and relative humidities of 60 per cent., 75 per cent., and 90 per cent., were used. It was found that the humidity changes had a much greater effect on the weight of the crops than had the changes in temperature. All three crops lost weight at 60 per cent. and 75 per cent. relative humidity, and gained weight at 90 per cent. relative humidity. The way in which temperature changes affect the moisture relationships depends on whether the crop is gaining or losing water. Where the crops have lost weight, the loss is greatest at the highest and least at the lowest temperature. Where the crops have gained weight, the gain is greatest at 68° F. and least at 50° F.

Analysis showed that the changes in weight were chiefly due to changes in the moisture content—entirely so in the case of oats, although slight respiration had taken place with barley and wheat. The amounts lost from this cause, however, were small, averaging less than 1 per cent. for barley and between 1 and 2 per cent. for wheat. Respiration was greatest by a very small amount in the high humidity series.

The increase in the moisture content is greater in passing from 75 per cent. to 90 per cent. than in passing from 60 per cent. to 75 per cent. relative humidity. In the series of 90 per cent. humidity at 68° F., the wheat and barley samples began to lose weight slightly, after increasing steadily for three and a half months. The oats, however, continued slowly to increase in weight. Storage of these samples was continued for four weeks longer, when they appeared to be reaching equilibrium. The losses in the wheat and barley were probably due to the occurrence of some biological reaction, causing counter losses of moisture, and may have indicated the commencement of deterioration of the grain. It should be noted that the oats, which behaved normally, gave no indication of appreciable respiration.

The results of these investigations show that the effect of climatic variations on the weight of stored crops is relatively small, since the greatest change observed over a period of four months was only 5 per cent. On the farm, considerably higher losses often occur in the same time. The difference may be due in part to increased respiration in the stack; the amount of respiration occurring in wheat, for example, increases enormously at 80-90° F.

An Investigation into the Losses that Occur During the Storage of Farm Crops (Mr. W. S. Gibson and Dr. W. Goodwin).

—In order to gain information as to the nature and amount of loss which takes place when wheat is left in the stack for varying lengths of time, under ordinary farming conditions, a large stack of Yeoman II wheat at Good Easter, near Chelmsford, was pulled down and built up into six equal small stacks. Care was taken to ensure that as equal an amount of grain as possible was placed in each of the small stacks, and that each should contain the same quantity of produce from the top, centre, base, outside, and inside of the large stack. Two of the stacks were thrashed within a week, on December 23, 1926, two on April 12, 1927, and the remaining two on June 10, 1927. One stack of each of the last two pairs was built on a metal vermin-proof rick stand, the remainder being built on straw laid directly on the ground. When the second two stacks (Nos. 3 and 4) were thrashed, in April, no rats were found in either stack, but mice were found in both. There appeared to be more mice in the stack built on the ground than in that which stood on the metal stand. A certain number of mice were found in both stacks Nos. 5 and 6, though there were fewer in No. 6, which was built on the rick stand. No. 5, which was built on the ground, also contained 8 adult and 16 young rats.

An examination of the weights of thrashed grain from all the stacks showed that there was no significant loss in weight in the case of stacks Nos. 4 and 6, built on the rick stands, despite the intervals during which they remained standing. Stack No. 3, built on the ground and thrashed in April, yielded a smaller quantity of grain than its companion stack No. 4, the difference, 6.53 per cent., apparently being due to damage by vermin. The difference, 9.93 per cent., between stacks Nos. 5 and 6 showed that there was a further loss sustained as a result of vermin damage between April and June.

Moisture content determinations were made from samples from each stack at thrashing. The figure for the original large stack at time of harvest was obtained from comparable data furnished by the National Institute of Agricultural Botany variety trials, and was taken at 17.50 per cent. This figure had fallen to 15.91 per cent. by December 23. The April figures showed another decrease to 13.66 per cent., and finally, in June, the figure was 11.88 per cent. On this basis, stacks Nos. 4 and 6 on the rick stands should have shown

theoretically a loss of weight since harvest from this cause, of about 3·8 per cent. and 5·6 per cent. respectively, but actually did not. The discrepancy was attributable to experimental error, due probably to the fact that it was quite impossible to ensure that an equal amount of grain was put into each of the six small stacks in December. It seems but reasonable, then, to consider that the moisture content figures give the more accurate indication of the loss in weight sustained, apart, of course, from the vermin damage.

In the experiments carried out at Wye, six bags, each containing a known weight of ears, were built into each of three stacks—Bountiful oats, Plumage Archer barley, and Yeoman II wheat, respectively. The mouth of each bag was fastened with a piece of strong rope, one end of which was left about 5 ft. long. The bags were placed well inside, about 10 ft. from the ground, the loose ends of the ropes being left hanging outside the stacks. One of the bags was withdrawn from each stack each month, and various determinations were made upon the grain.

The most striking feature of the results was the small amount of change which took place in the various kinds of grain during the six months' storage in the stack. The bushel weight, the 1,000 grains weight, and the proportion of head to tail corn remained perfectly constant. For the first three months a gradual fall in the 1,000 grains weight was noticed in the case of oats and wheat. This decrease, however, was not maintained, and the weight tended to remain constant for the following three months, except in the last sample of oats, when a marked increase occurred. The 1,000 grains weight in the case of barley was irregular throughout. The bushel weight in all cases remained remarkably constant throughout the period. The variations in the moisture content were so irregular that it was not felt permissible to draw any conclusions. They did not appear to be related to the temperature and relative humidity prevailing at the time the samples were withdrawn.

The results suggest that when grain is stored in the stack under good average conditions the loss of weight is extremely small and probably does not exceed 1 per cent. The large losses which occur in practice are mainly due to damage caused by vermin.

The Effect of Temperature on the Keeping Quality and Bacterial Count of Milk (Capt. H. Barkworth).—Temperature alone of the various weather factors has been shown to

influence the behaviour of milk. Changes in temperature have a negligible effect on the chemical constituents, but considerable chemical changes take place as the result of micro-organic activities. Lactose is changed to lactic acid, resulting in souring, and the lactic acid bacteria, which are chiefly responsible, have an optimum of 68°-71° F., while *B. Coli*, which produces gaseous fermentation as well as souring, has an optimum of 98° F. Up to this optimum, there is an increasing rate of multiplication as the temperature rises, the increase in rate being progressive in itself, so that the difference in rate of multiplication between 65° and 70° F. is many times greater than between 50° and 55° F.

Some indication of the rate of multiplication can be obtained by testing milk samples at different ages and keeping the milk at different temperatures. Capt. Barkworth tested 13 samples at milking time, and when 24 hours old, at a temperature of 70° F. Dr. Savage (Milk and Public Health) gives a table of nine samples, and used temperatures of 60° F. and 70° F. Both tables show that wide variations in multiplication occur at 70° F. The 13 tested samples averaged 2,000-fold in 24 hours at 70° F. for total bacterial count. Dr. Savage found 100-fold. Both tables point to 10,000-fold multiplication of *B. Coli* in 24 hours at 70° F. In addition, Dr. Savage indicates a 20-fold greater multiplication at 70° F. than 60° F. An American worker gives 6,000-fold in 24 hours at 70° F.

A very great increase in both total bacterial count and also in numbers of *B. Coli* is therefore to be expected in hot weather, and is reflected in a dual capacity in lowered keeping qualities of the milk, which is, in general, dependent on the total number of bacteria present, but Dr. Stenhouse Williams has shown that the life is further shortened by the presence of *B. Coli*.

In order to show the effect of temperature on the ultimate behaviour of actual milk supplies, as distinct from laboratory experiments, 186 samples received in connexion with the West Sussex Clean Milk Competition from February to August, 1925, were used. In no case were the samples less than 20 hours old on examination. Having travelled by post, they had been exposed to the general temperature conditions prevailing at the time, and were quite comparable with bulk supplies. The samples were from 31 farms, one sample being taken from each farm at six visitations during the period. The first and second series were taken and kept at

60° F., the third taken and kept at 63° F., the fourth mainly at 63° F., the fifth mainly at 69° F., and the sixth mainly at 66° F. As the temperature rose, there was a steady fall in keeping quality, and also a gradual disappearance of low counts. It was noted that when the temperature, which had risen to 69° F. with the fifth series, fell to 66° F. with the arrival of the sixth series, a recovery was at once shown both in total count and in keeping quality.

Another series of samples was taken in a competition from November, 1925—September, 1926. Twenty-three samples were taken at stated times during the period from each farm, the total number of farms varying from 29 to 31. By considering the results from five selected farms it was shown that when only a really small number of bacteria were present at temperatures of 54°-60° F., no great increase occurred until a temperature of 69° F. was reached, the samples being in all cases 22-28 hours old when examined, and the temperature being that on arrival at the laboratory by post the morning after production. Where larger numbers are present under even low temperature conditions, then high bacterial counts will occur when a temperature of 65° F. is reached.

To show the effect on milk supplies as a whole, three groups of samples were considered, approximately 90 in each group, and received at temperatures of 54°-55° F., 63°-65° F., and 67°-69° F. For the keeping quality test, all samples were adjusted on arrival to 60° F. and thereafter maintained at that temperature. A comparison of these groups shows that, as the temperature rises, it becomes increasingly difficult to conform to a fixed bacterial standard (as with "Certified," Grade "A—T.T.," and other such milks), and the increase in *B. Coli* at 65° F. and also at 69° F. is clearly seen.

The keeping quality tests gave respectively 3½ days, 2½ days, and 2 days for the three groups considered. Had the samples been kept at their arrival temperatures the first group would have had a considerably longer life, probably 4½ or even 5 days. The second group, if kept at their arrival temperature of 65° F., would have had a shorter life—probably on the average not more than 2 days. The samples at 69° F. would probably not have kept on the average more than 1½ days.

It is concluded that any lengthy exposure to a temperature of 65° F. would have a serious effect on both the bacterial count and the keeping quality of milk. Where the initial bacterial count is really low, exposure to this temperature

may be survived without any great effect, but a short period at 70° F. is usually fatal to any milk supply. The rule for milk production has always been to cool as soon and as thoroughly as possible, and to *keep* cool. The nearer we keep to this ideal, the less we shall be at the mercy of climatic variations.

(To be concluded.)

* * * * *

ARTICHOKES AS A FIELD CROP

IN 1925, the Ministry, at the request of the Department of Scientific and Industrial Research, arranged for field trials of artichokes to be carried out at four centres in England. Artichokes were grown to some extent in this country about 30 or 40 years ago, but were not found to be an economical crop. Recent research had, however, shown that the stalk contains a valuable form of cellulose, and it was considered worth while to make an experiment which should demonstrate whether the new use, to which the crop might now be put, would make it economical and remunerative to the farmer to grow it on a field scale. It may be stated, at the outset, that the experiment, carried out in 1925-26, has clearly shown that the cultivation of the crop for the production of cellulose from the stalks is not an economical proposition.

The side of the experiment dealing with the production, harvesting and use, as fodder, of the tubers has, however, brought to light some interesting facts which the Ministry, under authority of the Department of Scientific and Industrial Research, deems it desirable to make public.

Experimental plots of artichokes were grown at the following centres :—

The University Farm, Cambridge.

The University Farm, Shinfield, near Reading.

The Lord Wandsworth Agricultural College, Long Sutton, Hants.

The Kelham Estate, Newark-on-Trent.

From four to six acres were grown at each centre, the total area being about 20 acres. The University, Reading, has already published a record of the Shinfield experiments as its Bulletin XXXV, *Report on the Feeding of Jerusalem Artichokes to Pigs*, by K. W. D. Campbell, M.C., B.Sc.Agric. (Durham). No detailed report of the results at the two last-named centres was prepared. The Cambridge results have not hitherto been

The exhaustive feeding test, which was carried out at Cambridge with fattening pigs, clearly showed, however, that while artichokes are greedily eaten both boiled and unboiled, their use leads to the production of carcasses definitely inferior to those of pigs fed on boiled potatoes.

For this experiment, four pens of pigs were put up on December 12, 1925. All the pigs were pure-bred Large Whites from the University Farm herd, out of registered sows, and all by the same boar. The average age of Pens 1 and 2 was 146 days; of Pen 3, 137 days; and of Pen 4, 134 days. As the pigs in Pens 1 and 2 were distinctly older than those in Pens 3 and 4, no attempt was made to compare all four pens, but only to determine the difference between the two in each pair.

The rations were arranged so that approximately half of the dry matter was consumed as meal and half as tubers, so that the rations consisted of one part cereal mixture and four parts by weight of tubers. A standard cereal ration was used for all four pens. At the beginning, about 2 per cent. of a mixture, containing salt, chalk, iron oxide and potassium iodide, was added to the ration, but, as there is some difference in the analysis of the minerals in potatoes and artichokes, the pigs were later allowed a free choice of the more important minerals.

The tubers fed to Pens 1 and 2, at the beginning of the experiment, were boiled potatoes and boiled artichokes, and those fed to Pens 3 and 4, raw potatoes and raw artichokes, respectively. The cereal mixture consisted of

Bean meal	2 parts
Tail corn (mostly barley)	1 part
Sharps	1 part

The dry matter in the tubers was estimated during the course of the experiment with the following results:—

Potatoes, 18·07 per cent. Artichokes, 17·63 per cent.

Early in the experiment, it was found that the pigs in Pen 3 were doing so badly on raw potatoes that the ration as stated above was altered, and the potatoes for that pen were boiled before being fed. This Pen and Pen 4, however, did not thrive as well as the other two, and the experiment, so far as they were concerned, was not carried to its conclusion.

The pigs in Pens 1 and 2 were sent for slaughter on February 2, 1926, to the St. Edmundsbury Co-operative Factory. It is not proposed here to give details of the weights and comparative condition of the carcasses. The difference was very clearly marked, and, whereas the carcasses of the pigs fed

on boiled potatoes were found to be better than any previously sent to the factory from the University Farm, the carcasses of those fed on boiled artichokes were reported as being not properly finished and of very poor quality. This evidence appears to be conclusive.

Cost of the Crop.—The cost of growing the crop is high. The average cost for four centres, which incidentally represented varying types of soil conditions, amounted to something over £24 per acre. This would no doubt be reduced if the crop were grown in a subsequent season. But it does not represent the whole cost of handling the crop. The charges for carriage of seed and of the resultant crop are not included, and these in respect of the dried stalks are very high. Nor is any charge made in respect of harvesting the tubers.

Moreover, the tubers are difficult to eradicate from the land, and may so persist as to require a considerable expenditure of labour and of money to remove them in a subsequent season.

Conclusion.—The experiment has, therefore, shown that, although artichoke tubers are readily consumed by both sheep and pigs, they have a tendency to cause scouring; and that, in the case of fattening pigs, they have a detrimental effect on the bacon produced. The cost of the crop is too high to encourage the development of a market for the stalks for the production of cellulose. The conclusion which must be drawn is, therefore, that there appears to be no prospect at present of making the cultivation of artichokes profitable on a field scale.

The Ministry wishes to express its appreciation of the assistance it received in the investigation from the Authorities and staffs of the four centres where the trial fields of artichokes were cultivated.

* * * * *

FEBRUARY ON THE FARM

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

Seasonal Notes.—The name of this month is derived from that of the Roman Februarius, which in its turn was derived from Februus, one of the names of the god of fertility and the deity who protected the flocks from wolves. The festival in honour of this god was celebrated on the 15th of the month and originally it was a shepherds' anniversary; later, it became the festival of purification and expiation, having lost its original import when the Romans were no longer a nation of shepherds.

published, and, as the experiments at that centre were the most complete of all those carried out, they will be fully dealt with here. Acknowledgment must be made of the thoroughness with which the work was carried out by Mr. Arthur Amos, the Director of the University Farm, and by Mr. H. R. Davidson, of the School of Agriculture, Cambridge, who assisted him.

The Cambridge Experiments: *Cultivation and Yield of the Crop.*—Four acres were planted in a field, the soil of which varied between light gravel and gravelly loam, where a crop of thousand-headed kale had been grown and folded off with sheep.

Planting took place in May at the rate of about 10 cwt. per acre, and was carried out in the way usually adopted with potatoes. The rows were 30 in. apart, and the sets 15 in. apart in the rows. At the beginning of June, the crop received a dressing of superphosphate at the rate of 3 cwt. per acre.

The development of the plant was affected by the varying degrees of rainfall experienced during the summer months, but it is not possible definitely to assess the extent to which weather conditions affected the yield, even when comparison is made with the conditions prevailing at the other centres.

By October, the height of the stems was in most parts between seven and eight feet, and the ground was so thoroughly shaded by the leaves that annual weed growth was completely suppressed. Light frosts in October and severe frosts in early November, however, cut down the foliage prematurely, and thus limited the yield of both stalks and tubers.

The stalks were cut and roughly stripped of leaves in November and December. This operation absorbed a considerable amount of labour—50 man-days for the four acres. The resulting crop of stalks stripped of leaves and partially dried amounted to six tons. The estimated total crop of tubers was 50 tons.

Disposal of the Tubers.—The problem of how to deal with this quantity of tubers now presented itself to those in charge of the experiment. It was found that the market for the Jerusalem artichoke, as a vegetable for human consumption, was very restricted, and that, moreover, the price received barely repaid the cost of lifting and carriage, while the quantity of tubers available was in excess of what could be consumed by the stock of pigs on the farm.

A considerable quantity was lifted throughout the winter, in spite of the difficulty of digging and picking up the com-

paratively small tubers in the prevailing heavy condition of the land. These were carted to the pig buildings and fed to the whole pig stock; particular care being taken that the rations for the experimental pens of fattening pigs should be fully maintained.

With the advent of spring weather, it was decided to fold the stores and the dry sows on the artichokes. As soon as the weather and soil began to dry in March, rough pig shelters were erected in the field, and a commencement was made with the folding of the crop. One lot of 23 store pigs, averaging 12 weeks in age, were put in one field and some dry sows in another, and were fed with 2 lb. of meal and the maximum quantity of artichokes which they could consume without scouring. It was found that they ate the artichokes greedily, and that the only difficulty was the tendency of the pigs to scour if too many artichokes were fed. The difficulty was overcome by feeding a limited quantity of tubers each day. The store pigs were kept on the artichokes till April 28, when they were brought into the yards to fatten. No record was kept of their gain in weight, but they kept perfectly healthy and thrived well on the diet. The sows in like manner kept in good condition.

By a fortunate accident, it was discovered that sheep would eat artichokes. Arrangements were accordingly made for folding the ewe flock (130 head) on the tubers, and, by this means, it was possible to secure the consumption of the whole quantity in time to crop the field in 1926.

It was found that the ewes would readily consume and thrive on as much as 12 lb. of artichokes per head, daily; but that if the ration exceeded that amount they showed a tendency to scour. Lambs were found to scour when they ate the tubers.

It appears, therefore, that one conclusion to which the Cambridge experiment leads is that, for folding both to pigs and to sheep, artichokes are suitable when they have previously been dug out in dry weather and when folded on reasonably dry soil. It appears that in New Zealand a fairly common practice is to allow pigs to root the tubers out for themselves, and it is probable that they could do so in this country if artichokes are grown in very loose sandy soil.

In the Reading experiment, pigs were also found to eat the tubers readily, and 10 lb. of tubers were substituted there, with no apparently disadvantageous effect, for 1 lb. of meal in the ration. At Long Sutton, while the pigs willingly ate the tubers, they showed a tendency to scour.

It is noteworthy that in most European countries there are adages which express objections to mild or dry weather in February. We say that when gnats dance in February, the husbandman becomes a beggar. The Germans have a couplet which means lock up your corn in the bin when you see midges on the midden. Tusser, the author of *Five Hundred Points of Husbandry*, published in 1524, wrote "February fill dyke, With what thou dost like," and there are proverbs in several languages which state that full ditches in this month foretell full barns. Another of Teutonic origin favours the occurrence of north winds in this month, adding that if they do not come in February they will certainly be felt in April.

Candlemas, February 2, is a day of some agricultural importance, and in some districts this is the date for leaving and entering farms. Lancashire, Cheshire, and many districts farther south on the same side of the country have Candlemas customs. Tenancies which commence on this date are often complicated by customs of pre-entry and hold-over, whereby the new tenant receives access to the stubbles in autumn while the outgoing retains possession of the house, most of the buildings and certain grass fields until the first of May. These inconvenient customs tend to disappear with the extension of modern valuation practice. Excepting the fact that a removal at this date involves difficulties where milk is sold by contract dating from April 1, there are certain advantages in the Candlemas tenancy which a Lady Day farm lacks. At the earlier date, time is not so precious as it usually is at the end of March, and the earlier entry gives the incomer a better opportunity of arranging the cropping of his arable land according to his wishes and of carrying out the operations of ploughing and manuring necessary for that purpose.

Land and Crops.—As mentioned in last month's notes, weather conditions in the autumn prevented normal progress with the work of cleaning stubbles, wheat sowing, and ploughing. Since the middle of December, the land has been either frost-bound, covered with snow, or sodden with moisture; and to the arrears mentioned as apparent at that time have been added those of the ploughing after roots, potatoes and beet, and the breaking up of leas, as well as the accumulation of manure in yards. A farmer must have extraordinary faith in such old weather lore as is above quoted if he can this year wish for a wet February.

There is no doubt that it will be necessary in many cases to depart from the normal course of cropping in order to overtake the accumulated arrears, and to mitigate the consequences of the preceding bad season. Some parts of the arable land will not give anxiety or require special treatment; the corn stubbles seeded down last year have generally a good take of young "seeds," and, in this case, the usual harrowing and rolling may if necessary be omitted, except where yard manure has been applied or surface stones have to be pressed down. Last year's leas also will receive customary treatment, except where the ploughing has been delayed so late that it may be advisable to apply about 5 cwt. of complete mixture of artificials to compensate for the undecayed condition of the sward. The drilling of this land with oats or barley may generally be carried out fairly early, as it becomes dry and workable before land that has not been recently cropped with "seeds."

In dealing with land that carried roots and potatoes in 1927, such ploughing as may be necessary at this date should be shallow, about four inches being a suitable depth for spring corn in these circumstances. This depth of working not only allows of a wider furrow, and therefore more rapid progress, but it also facilitates the requisite drying of the seed bed for further tillage and sowing, whereas deeper work tends to delay these ends.

Less simple problems will be encountered in deciding and carrying out the treatment of unseeded stubbles. Weather conditions in 1927 encouraged the growth of grassy weeds, and there was no opportunity for stubble cleaning after harvest. Land that bore a first corn crop last season would in the ordinary course of husbandry have been cleaned, manured, and drilled in October or November with wheat or winter oats. Spring oats and barley will be drilled on such fields of this group as were not sown in autumn and winter, except in cases where, owing to the dirty condition of second-corn stubbles, a portion of this area is set aside for sugar beet and mangolds. This departure from strict five-course practice is better than attempting to cultivate the full acreage of second corn in the one case and of roots after second corn in the other, when, owing to special circumstances, the second stubbles are too weedy to be prepared for seasonable sowing with beet and mangolds.

To permit of the above plan, a portion of the land ordinarily due to be cropped with roots will have to be treated

otherwise. The potato crop, being tolerant of spring cleaning and workings, may occupy its usual place; and, if the setts are boxed so that they may be sprouting during March and, if necessary, April, the date of planting may without prejudice to the crop be delayed until cleaning has been thoroughly effected. Swedes and common turnips, and crops of the kale group, may also occupy their customary place. The area set free by the cultivation of beet and mangolds after the first corn crop, however, may be either bare-fallowed or sown with a smother crop that does not require singling and hand-weeding. Marrow-stem kale, if heavily top-dressed, will fulfil these conditions; but, probably, for most cases, the more convenient course is that of sowing a vetch and cereal mixture for hay or for silage, which may be cleared from the land in July and thus allow of summer and autumn cleaning. If this plan is decided upon, an endeavour should be made by liberal top-dressing to produce a weed-smothering crop. Beans may be included in the mixture where ensilage is the intention, and, to give them a fair chance, they should be ploughed in about four inches deep some two or three weeks before the cereals are drilled. For hay-making, peas are regarded as preferable to vetches on account of their better drying properties.

Arable Farming and Live Stock.—Correspondents have asked for further information on the statement made in last month's notes to the effect that the economic weakness of our system of arable farming is not the corn crops but the fodder crops and the live stock by which they are consumed. In ordinary four-course husbandry, there is one acre of fodder roots and one acre of clover or seeds lea to every two acres of corn crops; half of the roots and most of the seeds are fed on the land by sheep, while the other half of the roots is carted to the yards and consumed by bullocks, which at the same time convert straw into manure and incorporate therewith fertilizing residues purchased in the form of concentrated feeding stuffs. When the cost of labour, cakes and meals, and other expenses except coarse fodder, is deducted from the increase in value of the animals fattened, there remains little balance to set against the cost of producing the roots, hay and straw fed. In recent years, this balance has been less than the production costs of these crops; and whether the criticism be directed against these costs, or against the apparently unprofitable returns from the crops, or against the heavy cost of the manure made

from them by bullocks and sheep, the net result has been the same, *i.e.*, a poor profit or a net loss on the arable farming system as a whole.

In the light of the official statistics, it may appear to be an established fact that the remedy for the above state of affairs is to lay the arable land down to grass; that being what most practical farmers seem to consider the best plan. Escaping arable difficulties by grassing down is not a real solution of the main problem, unless there is likelihood of greater profit or less loss from the land when in grass than as arable; and, without a definite object for and method of utilizing the pasture when made, there is no such likelihood. In my opinion many farmers could, with advantage, intensify the treatment of some of their existing grassland and convert a part of the remainder into arable. I am here thinking mainly of dairy farms where too large a proportion of the total returns is expended on bought foods.

There are two directions in which, under suitable conditions, the typical corn-producing system can be strengthened. The first is that of reducing the proportion of fodder crops and increasing that of the cash crops. In the Lothians rotation, only one-third of the arable land is devoted to roots and seeds as compared with one-half in the English four-course and two-fifths in the five-course rotation. The introduction of sugar beet in place of mangolds and turnips needs no further explanation in connexion with arable farming, although it is not invariably sound economy on a dairy farm where heavy crops of fodder roots can be grown. Potatoes may be likened to sugar beet for the purposes of this discussion. Perhaps the above principle may be seen carried out to its utmost possibility on the large German arable farms, where the rotation followed is: potatoes, wheat, beet, barley. No seeds and no fodder roots, nothing in fact is grown specifically for consumption by live stock; but beet tops and pulp and straw are utilized for feeding purposes; and, on one farm which I recently visited, so much of the straw as could not be sold or used as litter (by the stock kept to use up the beet tops and pulp) was being made into artificial dung. Artificial manures were being liberally used, these taking the place of manurial residues of the concentrates fed in the English system; and the result of the system was not only success in the matter of fertility and large crops, but also a net profit on the working.

The second direction of modification is that of substituting cows for bullocks and sheep. This is what many of our arable farmers are doing, and many others have done. This plan depends less on soil considerations than on the possibility of marketing the milk produced. The quantities of food required to produce a gallon of milk and a pound of beef are much the same; and, while the former brings in 1s. 3d. and the latter only about 8d., there is no doubt as to which is the more remunerative. In Denmark and Germany, however, where this plan has been widely adopted, the prices of the gallon of milk and the pound of beef have tended towards the same level; but, in spite of this, the dairy cow is preferred to the fattening bullock.

* * * * *

NOTES ON MANURES FOR FEBRUARY

H. V. GARNER, M.A., B.Sc.,
Rothamsted Experimental Station.

The Need for Potash.—Under the older system of farming, in which grain and fat stock were the chief sales, and all the roots and straw were kept on the holding, the need for potash manures was not severely felt. In fact, the excellent farming of 70 years ago was carried out without any supplies of potash beyond that provided in the farmyard manure, bonfire ashes, and the small quantity occurring in purchased feeding stuffs, most of which contain less than 2 per cent. Turning to the other end of the scale, we may refer to the conditions of intensive culture of market garden crops on light soils. Here, unless great quantities of dung or seaweed are available, the need for potash is most marked, and forms a governing factor in production. The crops themselves remove much potash from the soil and the bulk of the produce is sold off the holding. The high prices, which growers farming such land were prepared to pay for potash during the scarcity arising out of the war, gave an indication of the part played by this fertilizer in their system. Between these two limits comes the ordinary arable farming of the present day, and the lighter the soil, and the greater the acreage devoted to such crops as potatoes, sugar beet, carrots and onions, the more will be the need of potash fertilizers. Even under such conditions on farms, where good dung is abundant, the effect of potash shortage does not readily show itself, but, while the crops will, probably, be fairly good, a potash dressing would improve them. In the absence of a large supply of dung, however, the

effect of potash starvation is obvious, particularly in potatoes, where the leaf takes on a dark bronzed colour, dead patches appear at the margins, and cropping is reduced to a very low level. Until recently, farmers who used mixed fertilizers were usually offered a compound which contained too little potash to correct the conditions mentioned above; this state of affairs has improved of late, and 10 per cent. of potash in a compound manure or home-made mixture is quite little enough in cases of marked need.

Nitrogen and Rainfall.—The past season has been a wet one in many districts. Heavy rain throughout the summer saturated the ground, and, although autumn and winter have not been abnormally wet, nevertheless, owing to the waterlogged conditions of the land after harvest, small falls were enough to cause the drains to run. Under these conditions, it could be expected that spring would show a deficiency of nitrates in the soil, as it is on them that by far the most serious loss by leaching falls. Fortunately, we are in a position to remedy this, for spring dressings of quick-acting nitrogenous fertilizers serve to supply what has been lost. Winter corn will need special attention in this matter from the end of February onwards, when judicious top dressings should be well justified.

Urea.—In recent years, the tendency has been towards high-grade fertilizers in order to save charges for bagging, railway carriage, and handling on the farm. No doubt, as the use of artificial manures extends to more distant and inaccessible parts of the world, these considerations will be even more cogent than they are now. The most concentrated form of nitrogen, at present available, is urea, which contains no less than 46 per cent. of nitrogen in the form which occurs in the urine of farm stock, and, as such, is well known, and perforce often neglected by, farmers as a valuable source of plant food. In the course of transformation in the soil, urea reaches the state of nitrate and is then readily taken up by crops. Urea has been produced chemically from the nitrogen of the air for some years in Germany, and will probably soon make its appearance in this country; a few of the experimental results obtained with this substance in recent seasons at Rothamsted, given in the accompanying table, may therefore be of interest.

It will be seen that each form of nitrogen has been equally effective both in the years when the response was good and in the two seasons—1923 in barley and 1921 in potatoes—when

YIELD OF BARLEY PER ACRE.

	1921		1922		1923		1924	
	Grain bush.	Straw cwt.	Grain bush.	Straw cwt.	Grain bush.	Straw cwt.	Grain bush.	Straw cwt.
No nitrogen	26.1	17.6	25.2	16.8	21.2	14.8	23.9	14.1
Sulphate of ammonia	35.0	23.5	32.3	20.3	22.8	17.9	33.8	19.7
Equivalent urea	34.0	23.4	33.4	21.8	24.7	16.1	32.8	19.6

WINTER OATS, 1926. POTATOES, 1921.

	Grain	Straw	Tons
	Bush. pr. acre	Cwt. pr. acre	Per acre
No nitrogen	61.1	34.1	2.0
Sulphate of ammonia	69.0	39.2	2.3
Equivalent urea	75.1	43.3	2.3

nitrogen showed little action. Experiments are continuing, but it can be taken that, up to the present the behaviour, of urea has been approximately the same as that of sulphate of ammonia on the Rothamsted soil.

Early Grass.—Stockowners look forward to the day when their pastures will be fit to carry stock in the spring, and relieve the pressure of indoor feeding; and it has long been known that farmyard manure used on pasture has the effect of giving that early start which is so valuable. Two causes are at work here; the shelter from cold winds provided by a dressing of long manure: and, what is probably more important, the manurial effect of the dung. No doubt, this fertilizing action is mainly associated with the nitrogenous constituents, although the potash and phosphate play some part. It is, perhaps, not so widely known that an early top dressing with some form of nitrogenous manure will produce similar effects in hastening the spring flush of grass. There are many possible forms in which this nitrogen may be given, but, at present prices, sulphate of ammonia would serve as well as any, and 1 cwt. per acre would be a normal dressing, to be applied early in the spring just as the herbage is beginning to wake up after the winter period.

Nitrogenous fertilizers can also prolong the growth of grass at the other end of the season, a fact which may be used with advantage by graziers when indoor keep is likely to be short.

It should be stated that the successful use of nitrogen on pastures, as a regular feature of management, requires periodical

dressings of phosphate potash, and, probably, lime, in order to maintain fertility and enable the nitrogen to produce its best effect.

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 January 11				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%)	..	..	11 7	11 7	14 8
Sulphate of ammonia:—					
Neutral (N. 20.6%)	..	10 11*	10 11*	10 11*	10 3
Calcium cyanamide (N. 19%)	..	8 16†	8 16†	8 16†	9 3
Kainit (Pot. 14%)	..	3 7	2 17	2 19	3 0
Potash salts (Pot. 30%)	..	5 2	..	4 17	3 3
" (Pot. 20%)	..	3 17	3 5	3 9	3 5
Muriate of potash (Pot. 50.53½%)	..	9 10	8 15	9 6	9 16
Sulphate " (Pot. 48.51½%)	..	11 10	10 15	11 10	11 17
Basic Slag (T.P. 32%)	..	3 8§	3 3§	3 3§	..
" (T.P. 30%)	..	3 6§	3 1§	3 1§	2 15
" (T.P. 28%)	..	..	2 12§	2 13§	..
" (T.P. 26%)	..	..	2 6§	2 7§	..
" (T.P. 24%)	..	2 10§	2 1§	2 2§	..
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
" (S.P. 33%)	..	..	..	3 2	..
" (S.P. 30%)	..	2 15	2 12	2 18	2 15
Bone meal (N. 3½%, T.P. 45%)	..	8 15	8 10	8 10	8 7
Steamed bone flour (N. 1½%, T.P. 60.65%)	..	5 17†	6 2†	6 5	5 17
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.

NOTES ON FEEDING STUFFS FOR FEBRUARY

H. E. WOODMAN, M.A., Ph.D., D.Sc.,
School of Agriculture, Cambridge.

The Farmer's Sheet-Anchor.—Under this title, a very interesting and suggestive review of the live stock side of agriculture has appeared, from the pen of Professor T. B. Wood, in *The Nineteenth Century* for August, 1927. The importance of this timely article cannot be overstressed. We are all, farmers and scientific men alike, concerned to find out ways and means for ameliorating the conditions of the great industry in which we are interested. It may truly be stated that Professor Wood's article constitutes a very real effort in this direction. It will not be out of place, therefore, to devote this month's space to a short summary of the article in question, especially in view of the fact that much of what Professor Wood has written bears directly on the problems of intensive production, a question which was touched on in a general manner in the Notes for last month.

Professor Wood quotes official statistics to show that the live stock industry provides by far the greater part, almost 70 per cent., of the farmer's gross takings. In this sense, therefore, live-stock truly constitutes the farmer's sheet-anchor. The economic results of the several branches of the live stock industry, however, vary very greatly. This is a fact of obvious importance, since the farmer does not live on his gross takings (or should not, as Professor Wood dryly interpolates) but on his net takings, that is to say, on the difference between his gross takings and their cost of production. Beef and mutton are almost invariably produced at a loss to the farmer; the production of pork and bacon is speculative; milk production has very generally given a fair profit; in the case of poultry and eggs, the profit has invariably been high. These facts are emphasized if a comparison be made of the value of the output of these various items for the years 1908 and 1925. Calculating value in both cases on the basis of 1925 prices, it is seen that, although the total value of the output of live stock and its products has only risen by 1 per cent. since 1908, the value of the output of meat and wool has declined by 10 per cent. and 27 per cent. respectively, whilst the value of the output of dairy produce and of poultry and eggs has increased by 16 per cent. and 36 per cent. respectively. During the same period, the number of milch cows has increased considerably, the

numbers of poultry enormously, whilst the increase in the numbers of meat-producing animals is comparatively small. The comparison brings out the further fact that the farmer is now selling for slaughter smaller, and therefore presumably younger, animals. Although beef production as a whole has been uneconomic, one aspect of it, namely, what is known as "baby beef" production, is often said to be profitable. The farmer therefore is tending to increase the number of his cows and hens, and to fatten his cattle at an earlier age.

Why, however, should milk, egg and "baby beef" production be more profitable than meat production in general? In the first place, Professor Wood points out, the profitableness of the dairy industry can only partly be explained by the circumstance that the farmer is practically secure of the home milk market. Although *fresh* milk is not imported, vast quantities of other dairy products like cheese, butter and dried milk come from abroad. The order of the events which have placed milk and egg production on a sound economic basis is: Firstly, the invention of an accurate and generally applicable measure of individual production. The data obtained by milk recording for dairy cows and by the use of trap nesting for poultry have given the breeder an exact numerical measure of the productive capacity of individuals. Secondly, this has made possible the breeding of improved productive strains and, along with this improvement, there has been corresponding progress in respect of feeding and management.

The state of affairs in the meat-producing industries is entirely different. It is usual to judge the progress of meat-producing animals by hand and eye, a method which in accuracy can scarcely compare with such methods as weighing milk or counting eggs. The ordinary farmer has no numerical measure of the rate of meat production; he cannot, therefore, accurately assess the results of his feeding and management, and, for that reason, the feeding and management of meat-producing animals lag behind the methods employed for milch cows and poultry.

Professor Wood then outlines a scheme whereby it may become possible to achieve for the pig industry what milk recording has done for the dairy industry. The essential feature of this scheme is the establishment of communication between producer and factory, with the object of securing very full information concerning the influence of varying feeding and management on the quantity and quality of the meat pro-

duced by pigs, and the length of time the animals have taken since birth in reaching factory size. Unfortunately, however, Professor Wood sees no immediate prospect of evolving similar methods to improve the conditions of beef and mutton production until the preliminary step has been taken of establishing co-operative slaughter-houses for sheep and cattle. It will also be essential, in his opinion, to undertake the proper organization on a large scale of the present transference of cattle from the breeding districts of the West Country to the feeding areas of the Midlands and East Anglia. By such detailed and collaborative organization it may become possible to devise accurate measures of the rate of meat production similar to those provided by milk and egg recording in the case of milch cows and poultry respectively.

Professor Wood next reminds his readers that if our animals are to be made more highly productive, they must be better fed. He draws the interesting conclusion that to attain an all-round standard of high productivity, such for instance as that of the 1,000-gallon cow, the 200-egg hen, the pig which is ready for the factory at six months, and the steer which makes "baby beef" at 18 months, the national bill of fare of our live stock must include concentrated foods (in which is included the dry substance of root crops) and coarse fodders in equal proportions. Going into figures, however, he shows that the annual supply of concentrated foods available for farm animals in the British Isles amounts to about 16,000,000 tons, whereas the grand total of coarse fodder is about 48,000,000 tons, that is to say, a ratio of coarse fodder to concentrated food of 3 : 1. An all-round standard of high productivity is therefore not possible under the present conditions. Further, such a state of affairs leads to a scramble for the short supply of concentrated foods, and hence prices rise to uneconomic levels. The position will not be ameliorated as the acreage of arable land declines and as sugar beet replaces other crops.

The central problem of to-day, therefore, is to bring about a material increase in the supply of concentrated foods. How is this problem to be solved? Professor Wood shows how the results of recent pasture research at Cambridge and elsewhere point the way to a simple and satisfactory solution. It is now generally recognized that the digestibility and nutritive value of the dry substance of young grass are such as are associated with good protein concentrates. Moreover, it has been demonstrated that grass, closely grazed, retains its pro-

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.		Protein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.	£ s.	s. d.	d.	%
Wheat, British.. ..	—	—	10 7	0 13	9 14	72	2 9	1.47	9.6
Barley, British feeding ..	—	—	9 5	0 10	8 15	71	2 6	1.34	6.2
" Canadian No. 3 Western ..	39 6	400	11 2	0 10	10 12	71	3 0	1.41	6.2
" American	37 6	"	10 7	0 10	9 17	71	2 9	1.47	6.2
" Persian	38 6	"	10 15	0 10	10 5	71	2 11	1.56	6.2
Oats, English, white	—	—	10 0	0 11	9 9	60	3 2	1.70	7.6
" " black and grey	—	—	9 15	0 11	9 4	60	3 1	1.65	7.6
" Irish, white	—	—	10 13	0 11	10 2	60	3 4	1.78	7.6
" " black	—	—	9 10	0 11	8 19	60	3 0	1.61	7.6
" Canadian No. 2 Western ..	34 9	320	12 3*	0 11	11 12	60	3 10	2.05	7.6
" Argentine	29 0	"	10 3	0 11	9 12	60	3 2	1.70	7.6
" Russian	29 3	"	10 5*	0 11	9 14	60	3 3	1.74	7.6
Maize, Argentine	38 9	480	9 0	0 11	8 0	81	2 1	1.12	6.8
Beans, English, winter	—	—	9 0†	1 6	7 14	66	2 4	1.25	20
Peas, English, blue	—	—	15 5†	1 3	14 2	69	4 1	2.19	18
" Japanese	—	—	24 15‡	1 3	23 12	69	6 10	3.67	18
Dari, Palestine	—	—	11 5	0 13	10 12	74	2 10	1.52	7.2
" Persian	—	—	11 0	0 13	10 7	74	2 6	1.34	7.2
Millers' offals—	—	—	—	—	—	—	—	—	—
Bran, British	—	—	8 10	1 3	7 7	42	3 6	1.87	10
" broad	—	—	9 5	1 3	8 2	42	3 10	2.05	10
Middlings, fine, imported ..	—	—	10 7	0 18	9 9	69	2 9	1.47	12
" coarse, British	—	—	8 17	0 18	7 19	58	2 9	1.47	11
Pollards, imported	—	—	8 0	1 3	6 17	60	2 3	1.20	11
Meal, barley	—	—	11 17	0 10	11 7	71	3 2	1.70	6.2
" maize	—	—	9 15	0 11	9 4	81	2 3	1.20	6.8
" " S. African	—	—	9 7	0 11	8 16	81	2 2	1.16	6.8
" " germ	—	—	9 10	0 16	8 14	85	2 1	1.12	10
" " gluten feed	—	—	9 15	1 1	8 14	76	2	1.20	19
" locust bean	—	—	8 17	0 8	8 9	71	2	1.29	3.6
" bean	—	—	12 15	1 6	11 9	66	3	1.87	20
" fish	—	—	21 0	3 10	17 10	53	6 7	3.52	48
Maize, cooked flaked	—	—	11 0	0 11	10 9	85	2 6	1.34	8.6
Linseed—	—	—	—	—	—	—	—	—	—
" cake, English 12% oil ..	—	—	12 12	1 11	11 1	74	3 0	1.61	25
" " " 10% "	—	—	12 5	1 11	10 14	74	2 11	1.56	25
" " " 9% "	—	—	11 17	1 11	10 6	74	2 9	1.47	25
Soya bean	—	—	11 10	2 4	9 8	69	2 8	1.43	30
Cottonseed cake	—	—	8 5	1 10	6 15	42	3 3	1.74	17
" " Egyptian, 5½% " ..	—	—	7 15	1 10	6 5	42	3 0	1.61	17
Decorticated cottonseed meal, 7% oil	—	—	12 0‡	2 5	9 15	74	2 8	1.43	35
Coconut cake, 6% oil	—	—	10 0	1 6	8 14	79	2 2	1.16	16
Ground-nut cake, 7% oil ..	—	—	10 7*	1 7	9 0	57	3 2	1.70	27
Decorticated ground-nut cake, 7% oil	—	—	12 15*	2 5	10 10	73	2 11	1.56	41
Palm kernel cake, 6% oil ..	—	—	9 10†	0 19	8 11	75	2 3	1.20	17
" " " meal, 6% oil ..	—	—	10 0†	0 19	9 1	75	2 5	1.29	17
" " meal 2% "	—	—	9 0†	1 0	8 0	71	2 3	1.20	17
Feeding treacle	—	—	6 10	0 9	6 1	51	2 4	1.25	2.7
Brewers' grains, Dried ale ..	—	—	8 7	1 0	7 7	49	3 0	1.61	13
" " " porter	—	—	7 17	1 0	6 17	49	2 10	1.52	13
Malt culms	—	—	6 10*	1 9	5 1	43	2 4	1.25	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 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 £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.

ductive character throughout the season. It follows, therefore, that the 34,000,000 acres of grassland in the British Isles are for the most part capable of growing fodder which is essentially productive. The conclusion is finally reached that the only economic method of increasing the ratio of concentrated foods to coarse fodders is by the better utilization, in the direction of closer grazing, of our continually expanding area of grassland. Professor Wood concludes his survey in the following words. "Much new and valuable information has been added to our knowledge of pastures. It is to be hoped that the great national agricultural organizations will step in and ensure that this new information is rapidly absorbed into improved practice."

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

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	10 14
Maize	81	6.8	9 0
Decorticated ground nut cake	73	41.0	12 15
" 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 2.57 shillings, and per unit protein equivalent, 1.72 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 2
Oats	60	7.6	8 7
Barley	71	6.2	9 13
Potatoes	18	0.6	2 7
Swedes	7	0.7	0 19
Mangolds	7	0.4	0 19
Beans	66	20.0	10 4
Good meadow hay	31	4.6	4 8
Good oat straw	17	0.9	2 5
Good clover hay	32	7.0	4 14
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

MISCELLANEOUS NOTES

A RECENT census of Young Farmers' Clubs in England (there are none in Wales) reveals that on November 1 last there were 85 clubs actually in operation,

The Young Farmers' Clubs Movement with a total active membership of 1,697 and an honorary or associate membership of 536. Of the 85 clubs, 37 are "mixed," that is, they deal with

mixed stock such as poultry and rabbits, calves and pigs, bees and so forth, or even with all these; 31 are poultry clubs, and confine their activities to egg production and the rearing of table birds; 12 are calf or baby beef clubs; while there are two rabbit and two bee clubs, and one horticulture club. The number of boy members is 1,055, and of girls 642. Of the boys, 739 are under 14 years of age, 213 are 14 to 16 years old, and 103 are 16 to 20. Of the girls, 458 are in the junior group, 133 in the intermediate, and 51 are from 16 to 20 years old.

The annual dairy cattle-judging contest for members of Young Farmers' Clubs, which was to have taken place at the Dairy Show in October, had to be postponed on account of foot-and-mouth disease, but arrangements were subsequently made, by courtesy of the Northants Education Committee, so that the competition was held at the County Farm Institute, Moulton, near Northampton, on January 26, 1928. A silver challenge cup, presented by *The Farmer and Stock-Breeder and Agricultural Gazette*, won last time by the Sussex Baby Beef Club, and silver and bronze medals, awarded by the British Dairy Farmers' Association, were the prizes competed for.

The third annual conference of leaders of Young Farmers' Clubs was held on January 27, 1928, and a representative gathering discussed the problems which confront the movement, and the best means of development.

In Cumberland, Lancashire, Northumberland, Derbyshire and Leicestershire, there are altogether 13 clubs. Of these, four are in Cumberland and five in Northumberland, and in these counties the movement appears to offer considerable scope for development, as it has behind it the strong support of the respective agricultural education authorities. The Cumberland clubs deal exclusively with poultry, and it is interesting to note that the minutes of one of the meetings of the Boltons Poultry Club were recently presented at a meeting of the Agricultural Education Sub-Committee of the Cumberland Education Authority, and were commended for their interest and lucidity.

CLOSELY connected with the question of losses of live stock on the farm is the extent to which plants of a poisonous character are present. Although the number of wild plants which are seriously poisonous is, perhaps, small compared with the total species included in the British flora, yet there are many which occur quite commonly, and which may occasionally cause serious losses of farm stock, while they may also cause illness and death to human beings, particularly children. In cases where poisonous plants occur in quantity, they may be unavoidably harvested with hay or other crops and thus later be given to stock; or they may be eaten in the green state in the open fields and along hedgerows. There are also a number of cultivated plants and trees which are poisonous and are often responsible for trouble with live stock on which they have an irritant or poisonous effect. The question as to the extent to which plants are poisonous on the farm was regarded as so important that the Ministry commissioned one of its officers, Mr. H. C. Long, to prepare the little volume* under this title. It is confidently anticipated that the book will be widely welcomed by farmers—for the reason that it is written simply, is well illustrated, and fills a definite need.

* * * * *

THE Ministry has made arrangements for post mortem examinations of poultry, agglutination tests for Bacillary White Diarrhoea, and other bacteriological

Notice to Poultry Keepers work in connexion with poultry to be carried out at its Veterinary Laboratory.

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.

In order to prevent the introduction of disease amongst healthy stock, newly purchased birds should be isolated for one month and frequently examined during this period. A memorandum showing the terms and conditions under which

* Miscellaneous Publication No. 57. Prices: cartridge covers 2s., quarter bound 2s. 6d., cloth boards 3s., post free if ordered direct from the Ministry.

these examinations are made will be sent on application to either the Ministry at 10, Whitehall Place, London, S.W. 1, or to the Ministry's Veterinary Laboratory, New Haw, Weybridge, Surrey.

* * * * *

THE annual report of this society for the twelve months ending September 6, 1927, marks a further stage in its successful progress, and serves to illustrate the possibilities of co-operative effort on a relatively small scale. The number of eggs handled during the period was 1,787,648—an increase of 81,527 over the previous year, and a record for the society.

The efficiency of the society's organization is indicated by the marketing costs, roughly 1½d. per dozen eggs; these cover transport, wages, etc., and show a saving of ½d. over last year's costs, mainly effected on transport, as indicated in the following statement:—

<i>Charges in Pence per Dozen Eggs</i>							
	1920-1	1921-2	1922-3	1923-4	1924-5	1925-6	1926-7
Transport ..	1.67	1.54	1.16	0.925	0.86	0.92	0.497
Wages ..	1.25	1.26	1.04	0.958	0.92	0.96	0.929
Other charges	0.55	0.52	0.42	0.318	0.31	0.27	0.301
Total ..	3.47	3.32	2.62	2.201	2.09	2.15	1.727

The society is favourably placed for road transport, and has taken full advantage of the situation; the distribution, as well as collection, of produce is effectively carried out by means of two motor vans at the low figure of approximately ½d. per dozen eggs for transport; it will be seen that cost of transport has shown a steady decrease over a period of seven years. Wages amount to less than 1d. per dozen, and include the cost of "candling" and grading supplies. The necessity for "candling" is demonstrated by the fact that 3,057 bad eggs were received during the year; although the position in this respect has improved, the Committee has thought it well to emphasize in their report the evils of "holding up," and of offering dirty, stale, and bad eggs for sale.

With a margin of 2½d. per dozen between the average buying and selling prices, the payment of a bonus to members of 6d. in the £ was possible during the past year, in addition to a bonus to the staff; a sum of £87 was placed to reserve and a balance of £100 carried forward.

THE prices of agricultural produce during December were on the whole slightly higher than in the preceding month, and

the general index figure shows a rise of one point to 38 per cent. above the level of the base years 1911-13. A year ago the index figure stood at 46 per cent. above pre-war.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1922 :—

				Percentage Increase compared with the Average of the corresponding month in 1911-13					
Month				1922	1923	1924	1925	1926	1927
January	..	..	..	71	67	60	71	58	49
February	..	..	..	75	63	61	69	53	45
March	..	..	..	73	59	57	66	49	43
April	..	..	..	66	54	53	59	52	43
May	..	..	..	69	54	57	57	50	42
June	..	..	..	64	49	56	53	48	41
July	..	..	..	67	50	53	49	48	42
August	..	..	..	68	52	57	54	49	42
September	..	..	..	59	52	61	55	55	43
October	..	..	..	61	50	66	53	48	40
November	..	..	..	63	51	66	54	48	37
December	..	..	..	61	55	65	54	46	38

Grain.—Wheat averaged 9s. 10d. per cwt. as against 10s. 1d. per cwt. in November, but as the fall was almost proportionate to that which occurred in December, 1911-13, the index figure was unaltered on the month at 34 per cent. above the base years. There was an appreciable decline in the price of barley, however, the average being 1s. 2d. lower at 11s. 2d. per cwt., and the index number declined 10 points to 35 per cent. above pre-war. Oats were 1d. per cwt. dearer at 9s. 2d. per cwt., and the index figure advanced by one point to 31 per cent. above the pre-war level. As compared with December, 1926, wheat was cheaper, barley was about the same price, but oats were dearer.

Live Stock.—The average price of fat cattle was raised slightly in December, owing to the holding of the Christmas sales, and second quality cattle at about 41s. 6d. per live cwt. were 16 per cent. dearer than pre-war. Fat cattle were, however, cheaper than in the corresponding period of 1926, when they averaged 46s. per live cwt. and 28 per cent. above the base years. Fat sheep continued to meet a good demand during December, and a rise of 1d. per lb. estimated dressed carcass weight to 11½d. per lb. caused the index number to advance by four points to 44 per cent. above pre-war, which is the same as the figure recorded in December last. This class of live stock

has maintained a fairly constant level during the past six months, whereas other classes, with the exception of dairy cows, have shown an appreciable fall in values. Fat pigs were a little dearer than in November, second quality bacon pigs being 2d. and porkers 3d. more, at averages of 8s. 5d. and 10s. 2d. per 14 lb. estimated dressed carcass weight, and in each case the index figure was higher: the former class of pig advanced by two points to 20 per cent. dearer than pre-war, and the latter by 4 points to 33 per cent., but both classes were very much cheaper than in December, 1926, when baconers made 63 per cent. and porkers 72 per cent. more than in 1911-13. Store cattle made similar prices to those ruling in November, and dairy cows and store sheep were slightly dearer, but as these price movements were in the same direction as, and proportionate to, those in the corresponding period of the base years, the relative index numbers were unaltered on the month at 28 per cent. above pre-war for dairy cows and 35 per cent. for store sheep. Store pigs continued to decline in price, and the index number was three points lower at 41 per cent. above the level of 1911-13.

Dairy and Poultry Produce.—The increase in butter prices customary at this season of the year was continued, and the index figure remained unaltered on the month at 47 per cent. above pre-war, while the index number of cheese also showed no change. Both commodities were, however, dearer than a year ago, when the former was 40 per cent. and the latter 28 per cent. above the 1911-13 level. Milk at 66 per cent. dearer than pre-war was about the same as in December, 1926. Egg prices fell by about 2½d. per dozen during the month under review, and at an average of 2s. 4½d. per dozen were 41 per cent. dearer than pre-war, as against 47 per cent. in November, and 46 per cent. a year ago. Poultry prices did not rise in December to the extent customary in pre-war years, and the index number for this class of stock fell by nine points to 37 per cent. above the level of the base years 1911-13. At the corresponding period of 1926 poultry realized 49 per cent. more than in 1911-13.

Other Commodities.—There was practically no alteration in potato prices during December, but as there was a slight advance in the corresponding period of the base years the index figure shows a fall of one point to 75 per cent. above pre-war. A year ago potatoes were 110 per cent. dearer than in 1911-13. Prices of hay were fairly steady at 20 per cent. above pre-war, and apples were cheaper on the month and vegetables dearer at 20 per cent. and 66 per cent. respectively above the

of fat (Gerber method) and the specific gravity; calculation of total solids; use of the Richmond scale; visits to farms, evening and morning, to weigh milk and make the necessary entries; checking of records; detection of errors and abnormal results; keeping of food records, and calculation of cost of feeding and cost of food per gallon of milk.

The tuition fee for the Course will be £3.

Board and residence are obtainable in the neighbourhood of the University, at rates varying from £1 15s. to £2 5s. per week, and addresses where such lodgings may be obtained will be sent on the applicant's request.

Applications for admission to the Course should be made not later than Saturday, February 11, 1928, to the Dean, Faculty of Agriculture and Horticulture, the University, Reading.

Students are advised to bring cycles with them if possible, as some of the work will necessitate frequent visits to the University Farm.

* * * * *

THIS Act, which received the Royal Assent on December 22, 1927, amends the earlier Acts of 1877 and 1907. The Act of

Destructive Insects and Pests Act, 1927 1877, which was passed at a time when the Colorado Beetle was sweeping across the North American continent, enabled the Privy Council to make Orders for the prevention of the introduction of the Beetle, and its spread in Great Britain. It empowered the Privy Council to require Local Authorities to carry out any Orders issued by the Council, and to pay compensation for any crops destroyed under those Orders. The Act of 1907 extended the 1877 Act to include other insect and fungus pests.

The 1927 Act enables the Ministry's officers to take the urgent action which would be necessary if a new and dangerous pest were discovered, and extends the definition of "insect" in the original Act so as to include "bacteria and other vegetable or animal organisms and any agent causative of a transmissible crop disease." This provision will enable the Ministry to take action against "Virus" diseases, such as Mosaic and Leaf Roll of potatoes, and diseases of bacterial origin. Power is given for the removal or destruction of any crop infected with a destructive insect introduced into Great Britain, and to take such steps as may be necessary to prevent the spread of the pest. Compensation may be paid by the Ministry for any crops which may be so removed or destroyed, but the amount of compensation and expenses so paid may

not exceed £2,000 in any one year without the consent of the Treasury.

The Act also enables the Ministry to charge fees for certificates given after the inspection of crops (the expression "crop" includes seeds, plants or any parts thereof).

Following the precedent established by the Seeds (Amendment) Act of 1925, the time within which proceedings may be instituted for an offence in connexion with the movement, sale and consignment or planting of potatoes is extended to twelve months from the day on which the offence was committed.

Under the previous Acts, the maximum penalty which could be imposed for offences against any Order was £10, and experience has shown that this penalty has not always been sufficient to prove a deterrent. Provision has, accordingly, been made in the new Act to increase to £50 the maximum penalty for a second or subsequent offence against an Order.

* * * * *

THE regulations and syllabus for this year's National Diploma Examinations in Agriculture and in Dairying, to be held under the auspices of the National Agricultural Examinations Board, are now available, and copies may be obtained from the Secretary, Royal Agricultural Society of England, 16, Bedford Square, London, W.C.1, or from the Secretary, Highland and Agricultural Society of Scotland, 3, George IV Bridge, Edinburgh.

The Examination for the National Diploma in Agriculture will be held at Leeds University on April 11 and following days, and applications to sit for it must be sent in not later than Monday, February 20, 1928. The Examination for the National Diploma in Dairying will be held at Reading University in September next. Full particulars about the National Diploma Examinations can be obtained from the societies named above.

* * * * *

A GRASSLAND Conference, which all interested persons are cordially invited to attend, will be held at Agricultural Buildings, Alexandra Road (nearly opposite the G.W.R. Station), Aberystwyth, on Thursday, February 23, 1928, commencing at 10.45, for 11 a.m. The Conference, which will be presided over by Mr. C. Bryner Jones, C.B.E., M.Sc., the Welsh Secretary of the

Grassland Conference at Aberystwyth

pre-war levels. Wool continued to show a slight rise in value, the index number for December being 50 per cent. above 1911-13, as compared with 46 per cent. in November and 43 per cent. in September and October.

Index numbers of different commodities during recent months and in December, 1925 and 1926, are shown below :—

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

Commodity	1925	1926	1927				
	Dec.	Dec.	Aug.	Sept.	Oct.	Nov.	Dec.
Wheat	67	61	56	48	42	34	34
Barley	29	31	64	62	62	45	35
Oats	32	17	43	35	33	30	31
Fat cattle ..	44	28	34	30	23	19	16
Fat sheep ..	47	44	45	45	41	40	44
Bacon pigs ..	86	63	36	34	22	18	20
Pork pigs ..	84	72	43	41	35	29	33
Dairy cows ..	—*	30	25	28	27	28	28
Store cattle ..	—*	21	26	24	19	13	13
Store sheep ..	—*	41	48	49	40	35	35
Store pigs ..	—*	115	70	64	56	44	41
Eggs	74	46	44	54	66	47	41
Poultry	60	49	43	37	43	46	37
Milk	74	65	55	65	57	59	66
Butter	68	40	38	41	41	47	47
Cheese	74	28	57	59	56	55	55
Potatoes	64	110	30	46	72	76	75
Hay	4	2	16	18	18	19	20
Wool	49	29	42	43	43	46	50

* Very few markets for store stock were held during December, 1925, on account of Foot-and-Mouth Disease restrictions.

* * * * *

THE fourth centenary of the birth of Emanuele Filiberto, Duke of Savoy, and the tenth anniversary of victory in the Great War, are to be celebrated at Turin this year by an International Exhibition of Agriculture, which will be held from April to October. The Exhibition, under the ægis of H.R.H. the Duke of Savoy, who is President of the Executive Committee, has the patronage of H.M. the King of Italy. It will include sections devoted to agriculture; horticulture; fruit-growing; flower culture; culture of truffles, fungi, medicinal and aromatic plants; forestry; parks; alpine plants; bee-keeping; agricultural machinery; hunting and fishing; chemical machinery, apparatus and instruments; silk weaving,

dyeing and printing, with silk machines in operation. The participation of British producers and exhibitors is desired by the Italian Government; and particulars of the Exhibition can be obtained by those interested from Il Commissario Generale, *Exposizione di Agricoltura*, Via Carlo Alberto, 24, Torino, Italy.

* * * * *

A SPECIAL Course in Milk Recording will be held at the University, Reading, from February 21 to March 10, 1928.

The chief objects of the Course are (1) to train suitable persons for the duties of a milk recorder, and (2) to extend the knowledge of persons engaged, or interested, in milk recording. Each day's

instruction will embrace :—

(a) At least two hours' theoretical teaching;

(b) Practical work in weighing, sampling, testing, and the keeping of milk records.

Applicants must be able to milk before admission to the Course, and should possess an aptitude for neat penmanship and accurate arithmetic.

At the conclusion of the Course, the authorities of the University, Reading, will notify in writing those students who have satisfied their instructors as to their industry and general ability and who have passed both the theoretical and practical examinations held during the closing days.

SYLLABUS

(a) *Lecture Course*

(1) *Milk*.—Nature and composition; causes of variation; Food and Drugs Act; regulations concerning milk.

Bacteria.—Milk as a medium for bacteria; control of bacterial growth, importance of cleanliness; use of preservatives; the Milk and Dairies Act.

Testing.—Weighing, methods of sampling; simple and composite samples; determination of the percentage of fat; and of the specific gravity; the Gerber test; the lactometer, calculation and percentage of total solids from percentage of fat and specific gravity; calculation of averages.

(2) The principles and practice of milk recording; the Ministry of Agriculture Scheme; why accuracy in detail is essential; discussion of the duties of recorders, with a study of the forms which must be kept; milk record certificates and register of dairy cows; interpretation of milk records; calculation of herd averages; breed societies, records and registers of merit; marking of cows; calf and bull marking scheme; methods of keeping food records; the use of the slide rule and calculating machines.

(b) *Practical Work*

Actual milk recording; the taking of simple and composite samples under various conditions; determination of the percentage

Ministry, is being held under the auspices of the Agricultural Department, University College of Wales, and of the Welsh Plant Breeding Station. It is hoped that farmers will attend in good number to contribute their opinions and experience to the discussions which will follow the papers to be read (at the morning session) by Professor R. G. Stapledon and Mr. T. W. Fagan, and (at the afternoon session) by Messrs. R. Lindsay Robb, S. M. Bligh, Martin G. Jones and William Davies. A general discussion will follow at 6 p.m. For the benefit of visitors to the Conference who find it necessary to arrive at Aberystwyth on the previous day (Wednesday, February 22), Professor Stapledon has arranged to give a lantern lecture at Agricultural Buildings at 8.30 on that evening dealing with "Grassland and other Lessons," derived during his recent tour in Australia and New Zealand. There will, also, be opportunities for visitors, arriving on Wednesday, to inspect the Grassland Experiments at the Welsh Plant Breeding Station. The full programme and other particulars of the Conference can be obtained on application to Professor R. G. Stapledon, M.A., at Agricultural Buildings, Alexandra Road, Aberystwyth.

* * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on December 19 at 7 Whitehall Place, S.W., Mr. W. B. Yates, C.B.E., presiding. The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying out the Committees' decisions:—

Derbyshire.—An Order continuing from December 26, 1927, until December 25, 1928, 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 8d. per hour, with overtime at 10d. per hour for Sunday work. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour, with overtime at 8d. per hour for Sunday work.

Norfolk.—(a) An Order continuing from January 1, 1928, until December 31, 1928, the operation of the existing minimum and overtime rates of wages for male and female workers. 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 the case of teamsmen, cowmen, shepherds or yardmen, an addition of 5s. 6d. per week, and in the case of sheep tenders and bullock tenders 4s. 6d. per week in respect of employment in connexion with the immediate care of animals. The overtime rates in the case of all 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.

(b) An Order fixing special minimum and overtime rates of wages for male workers employed on the corn harvest in 1928. In the case of workers of 21 years of age and over employed throughout the harvest the wage payable in respect of the harvest is an inclusive sum of £11. In the case of workers who are not employed for the full harvest period special differential rates have been fixed for overtime employment on the corn harvest, the rate in the case of workers of 21 years of age and over being 9½d. per hour.

North Riding of Yorkshire.—An Order to come into operation on December 26, 1927, and to continue in force until October 1, 1928, making certain variations in the minimum and overtime rates of wages for male and female workers. The minimum rate in the case of male workers (other than casual workers) of 21 years of age and over remains unchanged at 33s. per week of 48 hours in winter and 52½ hours in summer, overtime being payable at 10d. per hour on weekdays and 1s. per hour on Sundays. Special hourly rates are fixed for certain employment on work in connexion with the care of animals. Reductions have been made in the minimum rates for male workers under 21 years. In the case of female workers of 18 years of age and over the minimum rate remains unchanged at 6d. per hour for a week of 44 hours, with overtime at 9d. per hour.

Pembrokeshire and Cardiganshire.—An Order to come into operation on January 1 and to continue in force until September 30, 1928, varying the minimum and overtime rates of wages 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 52 hours in winter (instead of 50 hours as at present) and 54 hours in summer, with overtime at 8½d. per hour (instead of 8¼d. per hour on weekdays and 9¼d. per hour for the first three hours on Sundays and 11d. per hour for subsequent hours as at present). 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 and 6½d. per hour for the first three hours on Sundays and 7½d. 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 January 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.	
Hunts	..	Huntingdon	1	0	0	2	2	0	2	18	6	2
Dorset	..	Blandford ..	1	0	0	—			60	12	6	2
Yorks, W.R.		Rotherham..	12	0	0	4	0	0	138	0	0	6
Somerset	..	Bath ..	—			0	14	0	15	8	7	1
Flint	..	Overton-on-Dee ..	1	1	0	0	12	0	7	0	0	1
Cumberland		Wigton ..	—			2	15	0	8	0	4	2
			£15	1	0	£10	3	0	£231	19	11	14

Foot-and-Mouth Disease.—Since the report in the last month's issue of the JOURNAL, 95 outbreaks of foot-and-mouth disease have been confirmed in Great Britain. These outbreaks were in the following counties: Derby, 39; Staffordshire, 15; Lincoln (Lindsey), 11; Yorks (West Riding), 7; Nottingham, 6; Lancashire, 6; Warwickshire, 5; Leicester, 8; Glamorgan, 2; and one in each of the following counties: Northants, Worcester, Lincoln (Kesteven), Huntingdon.

The number of outbreaks confirmed since January 1 last is 44, involving 10 counties and the slaughter of 1,373 cattle, 1,107 sheep, 635 pigs and 4 goats.

During the year 1927, 141 outbreaks were confirmed, as compared with 204 in 1926 and 260 in 1925.

* * * * *

NOTICES OF BOOKS

Primer of Agricultural Economics. By Sir Henry Rew, K.C.B. Pp. 229. (London: John Murray. 1927. Price, 5s. net.)

The author of this volume approaches most of the subjects dealt with from the historical, rather than from the economic, standpoint; and while the book in the main gives an excellent and succinct summary of historical developments, it does not attempt any exact economic analysis of the factors upon which the production and distribution of agricultural commodities are based.

It is divided into three parts, dealing with the "Factors of Production," the "Costs of Production," and the "Disposal of Produce," respectively, and the chapters relating to the land, farm equipment and management, labour, farm accounts, methods of disposal of produce, markets and prices, form a useful introduction to these subjects. The chapter on "Prices" gives, for the most part, an excellent summary of the principal factors which determine agricultural prices.

The book has the merit of being very readable; it is expressed in simple, non-technical language, and, to a student unacquainted with the subject, will provide a valuable starting point for further study. This is its primary object. It contains a list of books and publications and a useful index.

Farm Soils: Their Management and Fertilization.—By Edmund L. Worthen, M.S. (The Wiley Farm Series.) Pp. x + 410. (London: Chapman and Hall, Ltd., 1927, 13s. 6d. net.)

"Farming soils" might almost have been the title of this book, for it is less a study of the soil than a guide to American agriculture. Although the elementary nature of the opening chapters indicates that the work was planned as a text-book for beginners in farm classes, it could scarcely be used in that way in England, except to demonstrate principles common to all farming, and their application to crops and soil problems (including those of sub-tropical and semi-arid regions) unknown in Britain. As a supplement to the ordinary texts, it might play the part, to some extent, of a tour of the United States.

While the book suffers from the over-simplification, re-iteration, and too-positive theorising common to elementary manuals of instruction, its production is excellent; printing and binding are good and misprints reasonably few. Almost half the pages are decorated with photographs, many of which are interesting. Others, "used only when direct quotations from the text apply to them," seem scarcely necessary.

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Vol. XXXIV. No. 12.

MARCH, 1928.

NOTES FOR THE MONTH

WHEN the Standing Committee set up under the Merchandise Marks Act, 1926, considered the question of requiring the marking of imported eggs,

Proposed Scheme of Egg Marketing Reform so as to distinguish them from British eggs, they recommended that no Order should be made until a sufficient improvement had taken place in collecting,

grading, packing, and marketing British eggs, to remove, or at least to mitigate, the danger of the "best" imported egg getting a better market in this country than the average home-produced egg. The Minister, on receiving this recommendation, referred the whole question to his Poultry Advisory Committee, which had recently been reconstituted and is now fully representative of all sections of the industry, including transportation and refrigeration. The reconstituted Committee met for the first time on December 9 last, and appointed a sub-committee to prepare a marketing scheme. This sub-committee submitted tentative recommendations to the main Committee on January 17; these proposals, after some discussion, were provisionally adopted and referred to the National Farmers' Union, the National Poultry Council, and other national bodies concerned. At the time of going to press, the scheme has been considered by the National Poultry Council, the Parliamentary Committee of the Federation of Grocers' Associations, the Council of the National Federation of Retail Fruiterers, Florists and Fishmongers, the Central Committee of the National Federation of Dairymen's Associations, the West of England Egg and Poultry Merchants' Association, and by the Directors of the Co-operative Wholesale Society. The general reaction to the scheme is in the main favourable; so also is much of the criticism that has been received from individuals.

The scheme is primarily designed to assist the industry to recover lost ground on the wholesale market. It is voluntary

in character; those who consider that they can do better for themselves by remaining outside will, of course, do so. At present, English eggs are sold, as a rule, in comparatively small consignments and parcels through regular channels to customers who know their value. If the home egg industry is to develop as it should, it must look increasingly to the wholesale markets for an outlet for its supplies. Foreign eggs reach the wholesale markets properly graded and packed, and large retail sellers of eggs in this country, the big multiple stores and so on, have experience of them according to their brands and, as a result, often take them in preference to English fresh eggs. To be able to compete with the foreign egg in these markets, the home-produced egg must be similarly graded and packed, and must be regularly available in adequate quantities.

The proposals of the Poultry Advisory Committee are of considerable importance in this connexion. It is suggested that the Minister of Agriculture and Fisheries should promote legislation empowering him to make regulations (a) defining egg grades, and making it a breach of warranty and a punishable offence for any seller of eggs to apply the grade description to eggs which failed to conform; (b) requiring (if and when a Marking Order for imported eggs has been made) the marking of cold-stored and gas-processed eggs; and (c) requiring the marking of all "preserved" eggs. At a meeting of the Council of Agriculture on January 26, in a statement on the Government's intention to assist agricultural marketing proposals, the Minister made it clear that the Government were willing to provide time for the necessary legislation during the present Session. It is further suggested that the Minister should register a national quality mark, primarily for use on packages, and appoint a National Mark Committee to control the use of the mark.

As regards action to be taken by the industry itself, it is proposed that the county branches of the National Farmers' Union, in conjunction with local poultry societies and any other local interests, should prepare a roll of "accredited country packers." To these "packers" the National Mark Committee would grant the right to use the national mark so long as they observed the undertakings given on accrediting. These undertakings would include requirements in respect of the candling, grading, and packing of eggs. As the number of "packers" in each county increased, it would facilitate administration if they formed themselves into an area

association with which the National Mark Committee could deal direct. It is proposed that these area associations should ultimately form a central federation, which would include "accredited town packers" enrolled directly by the National Mark Committee. At this stage the National Mark Committee would delegate to the central federation the control of the use of the mark as regards eggs; the industry would thus become entirely responsible for its own organization.

When the scheme is finally thrashed out and passed, it will be for the industry to make it the success which it deserves to be, and for the public to help the industry by buying home produce.

* * * * *

A REPORT,* which was published in January, is the first of an annual series dealing with the whole of the work of the Land Division of the Ministry. The

Work of the Land Division of the Ministry, 1926 Report includes, *inter alia*, sections dealing with proceedings under the following Statutes: Small Holdings and Allot-

ments Acts, 1908 to 1926; Small Holding Colonies Acts, 1916 and 1918, and the Sailors and Soldiers (Gifts for Land Settlement) Act, 1916; Improvement of Land Acts; Copyhold, Inclosure, Commons and Property Acts; Universities and College Estates Act, 1925; Glebe Lands Act, 1888; Agricultural Holdings Act, 1923, and the Ministry of Agriculture and Fisheries Act, 1919. Other miscellaneous activities of the Ministry which are reported include those connected with (a) land pests (particularly rats and mice); (b) certificates as to agricultural cottages in certain cases; and (c) the destruction of injurious weeds.

The brief section dealing with small holdings provided by county and county borough councils includes some general observations on the economic aspect of the small holdings movement; and a section of the Appendix contains interesting data showing the increased production, and the growth in population and labour employed, that result normally from the conversion of large farms into small holdings.

The section dealing with the Ministry's direct activities in connexion with land settlement shows in concise form the position of (a) the profit-sharing farms at Patrington and Amesbury, and (b) the Small Holdings Settlements still retained by the Ministry.

* The Report is obtainable, from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, and provincial branches, or through any bookseller, price 3s. 6d., post free 3s. 8d.

So far as allotments are concerned, the Report reviews the position as revealed by the statistical returns received from allotments authorities in England and Wales. The figures afford evidence that the somewhat rapid withdrawal of land brought into use for allotments during and immediately after the war has definitely slackened.

Another section of the Report deals with the Improvement of Land Acts, which enable landowners to execute various improvements of land by means of charges on their estates. This section is interesting inasmuch as no report on this subject has been issued since 1914. It includes a brief review of the various enabling Acts and a list of the authorized improvements.

A further section of the Report is devoted to the subject of the extinguishment of manorial incidents consequent upon the coming into operation on January 1, 1926, of the Property Acts, 1922 and 1924, whereby every parcel of copyhold land was enfranchised and ceased to be of copyhold or customary tenure.

The Report also includes a section dealing with the inclosure and regulation of commons, and explains the important provisions of the Law of Property Act, 1925, whereby rights of access to urban commons for air and exercise were conferred upon members of the public, and the construction of fences or other works impeding access to any common was made unlawful except with the consent of the Minister.

The latest report on the proceedings under the Universities and College Estates Acts and the Glebe Lands Act related to the year 1914, and the present Report gives particulars of the transactions effected under those Acts since that date. Reference is made to the exceptional sales of college property in some of the post-war years owing to the boom in land and property values.

The Ministry's duties under the Agricultural Holdings Act are explained, and statistics are given of the number of arbitrators appointed by the Ministry in each year since 1914.

The Report deals also with the constitution of agricultural committees established in accordance with the provisions of the Ministry of Agriculture and Fisheries Act, 1919, reference being made to the number of women members and representatives of agricultural labour on the committees.

One of the more interesting sections included under the heading of "Miscellaneous Activities" is that devoted to the subject of the destruction of rats and mice. The provisions of the Rats and Mice (Destruction) Act are explained, and

references are made to the Ministry's cinematograph films, sets of lantern slides and exhibit, which are available for loan to local authorities. An account is also given of experiments carried out on behalf of the Ministry with red squill baits, and an interesting comparison is made of the effects of this poison upon rats and fowls.

ON January 23, the Minister of Agriculture (Rt. Hon. Walter Guinness, D.S.O., M.P.) received a deputation from

State of placed before him the difficulties with
Agriculture : which the agricultural industry is at
Deputation to the present faced, and in particular referred
Minister to the high cost of labour owing to the
operation of the Agricultural Wages Act.

The members of the deputation were : Mr. Thomas Williams (Montgomeryshire), Mr. David Black (Suffolk), Mr. Sunley (Yorkshire, E. Riding), Captain Morris (Herts), Mr. Street-Porter (Cambs), Mr. H. German, Mr. Garton, Mr. Baxter, Mr. Robbins, Mr. Slade, Mr. Langford, Mr. Jenkinson, Mr. Guild (Secretary).

The deputation was introduced by Mr. Thomas Williams, the President of the Union, and the chief spokesman was Mr. David Black (Chairman of the Labour Committee of the Union), who was supported by the other speakers : Mr. Sunley, Captain Morris, Mr. Street-Porter, and Mr. German.

In replying to the deputation, Mr. Guinness stated that he was impressed by the strength of their case and the moderation with which it was put, and he promised to take an early opportunity of laying it before his colleagues in the Government.

THE following grades of milk are recognized under the Milk and Dairies (Amendment) Act, 1922 : (1) "Certified," (2)

The Recognized "Grade A Tuberculin Tested," (3)
Grades of Milk "Grade A," and (4) "Pasteurized." There

is also ordinary milk (ungraded), for which the price ruling for "milk" at the moment has to be paid. The first and most expensive class of milk is Certified Milk, which is obtained from special dairy herds which are under regular veterinary inspection, and which are found not to react to the tuberculin test. This milk must be bottled on the farm, must be sold in the raw (i.e., unpasteurized) state, and must not contain more than

30,000 bacteria to one cubic centimetre, or show the presence of *Bacillus Coli* in one-tenth cubic centimetre on delivery to the customer. It is obtainable from most milk retailers, though it can only be produced on a farm for sale as Certified Milk if a licence has first been obtained from the Ministry of Health.

The second class of milk—"Grade A Tuberculin Tested"—is produced from cows which are subject to veterinary inspection and do not react to the tuberculin test. It must also be sold in the raw state. It differs from Certified Milk in that it may be sent by rail in sealed churns to be bottled at the dealer's premises, and must not contain more than 200,000 bacteria per cubic centimetre, and *Bacillus Coli* must not be present in one-hundredth of a cubic centimetre on delivery to the consumer. A licence for its production is also obtainable from the Ministry of Health.

Plain "Grade A" milk is produced from cows which are also subject to veterinary inspection; it may be sent by rail in sealed vessels to be bottled on the dealer's premises, and may be sold either in the raw state as "Grade A" milk, or after pasteurization as "Grade A Milk Pasteurized." If it is sold in the raw state it must not contain more than 200,000 bacteria per one cubic centimetre, or show the presence of *Bacillus Coli* in one-hundredth of a cubic centimetre on delivery to the consumer. If it is sold as "Grade A Milk Pasteurized" it must be retained at a temperature of not less than 145 degrees F., and not more than 150 degrees F., for at least 30 minutes, and must then be immediately cooled to a temperature of not more than 55 degrees F. Such milk must not contain more than 30,000 bacteria per one cubic centimetre, and must not show the presence of *Bacillus Coli* in one-tenth of a cubic centimetre on delivery to the consumer. Licences for its production can be obtained from the local authority.

"Pasteurized Milk" is milk which has been pasteurized under certain specified conditions, and must contain not more than 100,000 bacteria per one cubic centimetre. The milk must not be pasteurized more than once and must not otherwise be treated by heat. Licences to produce this milk can also be obtained from the local authority.

Although the number of licences issued, during the period 1923-25, was comparatively small, there was a steady, if slow, increase in the numbers held at the end of each quarter. More recently, however, the increase has been more rapid, as is indicated by the comparative tables shown below for

producers' and dealers' licences issued in England. The total amount of milk dealt with by the licencees for Certified, Grade "A" (T.T.), and Grade "A" milk is still small compared with the total milk production of the country, but it is apparent that, if the recent rate of increase is maintained, these "graded" milks will soon have taken a position of importance in the milk supply of the nation.

The reports received from time to time show that the work carried out in connexion with County Clean Milk Competitions has a considerable bearing on the increase in the number of producers' licences issued, particularly in regard to Grade "A."

These competitions are a means of proving to producers that compliance with Grade regulations is not beyond them. This is well illustrated by reference to the fact that two out of every three samples of milk taken from the 1,062 producers during the course of last year's Clean Milk Competitions in England and Wales reached the bacteriological standard required for Grade "A" milk. It will, therefore, be understood that the number of Grade licences issued is by no means a measure of the amount of milk produced in this country that is, in fact, fulfilling the essential requirements of the Grade Regulations. As soon as the public has been educated in respect of milk, the producers will take up licences.

PRODUCERS' LICENCES—ENGLAND

	Licences issued and in force up to September 30, 1926.	Licences issued and in force up to September 30, 1927.
Certified	107	129
Grade "A" (T.T.) Bottling	12	22
Grade "A" (T.T.) Non- bottling	97	132
Grade "A"	205	328

DEALERS' LICENCES—ENGLAND

	Licences issued and in force up to September 30, 1926.	Licences issued and in force up to September 30, 1927.
Certified	758	913
Grade "A" (T.T.) Bottling Establishments ..	90	134
Grade "A" (T.T.) Shops ..	590	758
Grade "A" Bottling Establishments ..	94	156
Grade "A" Shops ..	473	710
Grade "A" (Pasteurized) Shops	—	20
Pasturized — Pasteurizing Establishments ..	94	141
Pasteurized — Shops ..	553	647

THE practical demonstration of improved methods of marketing, including packing and grading, which was an essential feature of the Ministry's programme of marketing work at agricultural shows last year, will be continued during the present year. A list of the shows at which demonstrations will be given during the coming summer, and the commodities to be dealt with at each, is appended. Proposals in regard to shows later in the year will be given in a later list, when arrangements are more fully matured.

Date	Show	Place	Sections to be demonstrated
May 11-12	Wharfedale	.. Otley, Yorks	.. Eggs and poultry
" 15-16	Wiltshire	.. Salisbury	.. Pigs
" 22-26	Bath and West and Southern Counties	.. Dorchester	.. Eggs and poultry
" 23-24	Essex County	.. Chelmsford	.. Fruit
" 30 to June 1	Devon County	.. Exeter	.. Eggs and poultry, fruit, pigs
June 7-8	Suffolk	.. Bury St. Edmund's	.. Pigs
" 8-9	Leicestershire	.. Leicester	.. Eggs and poultry
" 12	Cambridge and Isle of Ely	.. March	.. Potatoes
" 13-14	Royal Cornwall	.. Bodmin	.. Pigs
" 13-14	Staffordshire	.. West Bromwich	.. Eggs and poultry
" 27-28	Royal Norfolk	.. Norwich	.. Eggs and poultry, fruit, pigs, cattle
" 27-29	Lincolnshire	.. Scunthorpe	.. Potatoes
July 10-14	Royal	.. Nottingham	.. Eggs and poultry, fruit, pigs, potatoes, cattle
" 18-20	Great Yorkshire	.. Halifax	.. Potatoes
" 25-26	Tunbridge Wells	.. Tunbridge Wells	.. Eggs and poultry, cattle
August 2-6	Royal Lancs.	.. Oldham	.. Pigs, potatoes
" 8-9	Taunton Horticultural	.. Deane Taunton	.. Fruit
" 8-10	Royal Welsh	.. Wrexham	.. Eggs and poultry, cattle

* * * * *

SHORTLY after the Fertilizers and Feeding Stuffs Act, 1926, became law, an Advisory Committee was set up by the Minister of Agriculture and Fisheries and the Board of Agriculture for Scotland, for the purpose of preparing recommendations as to the Regulations to be made under that Act. These Regulations have now been published in draft form, and copies can be obtained from any branch of His Majesty's Stationery Office or through any bookseller, price 9d., excluding postage.

The draft Regulations deal with the manner of marking parcels, methods of sampling and analysis, forms of registers and analysts' certificates, limits of variation, and certain other matters which have to be prescribed in accordance with the Act. Any observations or suggestions with regard to them should be sent to reach the Ministry not later than March 23, 1928.

In announcing the issue of these draft Regulations, the Minister and the Board state that it is proposed to bring the Act into operation on July 1, 1928.

* * * * *

In a recently issued pamphlet* the Empire Marketing Board sets out, at length, its direct or indirect activities on behalf of the home producer. Every

The Empire Marketing Board and the Home Producer Dominion and Colony has gladly recognized that home agricultural produce has the first claim upon every buyer in this country. The Empire Marketing Board accordingly invites the public, in

its daily shopping, to demand, first, the produce of this country and, next, the produce of the Empire beyond the seas. The public is continually reminded, by Press advertisements and posters issued by the Board, as well as by displays at exhibitions and shopping weeks, that the fields and farms of home are none the less a part of the Empire because they are near and familiar.

The general publicity policy of the Board is not so much to point the merits of particular sorts of home produce, as to create a background in favour of Empire buying, against which producers and their Associations can throw into effective relief the fine qualities of the produce which they are setting before the public. Nevertheless, at the request of the Ministry, the Board has included in its advertising many direct advertisements of home produce. These have borne special reference to milk, cheese, butter, poultry, eggs, bacon, beef, mutton, pork, fruit, vegetables, and flour. The Board is now in consultation with the Ministry and with farmers' and distributors' organizations, with a view to a special joint campaign in favour of liquid milk consumption.

* *The Empire Marketing Board and the Home Producer.* Copies of this interesting pamphlet can be obtained free on application to the Empire Marketing Board, 2 Queen Anne's Gate Buildings, Dartmouth Street, S.W. 1.

The publicity side of the Board's work is constantly before the public eye, but it should be remembered that most of its activities lie behind the scenes, in (1) the improvement of marketing methods, and (2) scientific research.

In regard to (1), the marketing work, so far as England and Wales is concerned, is in the hands of the Ministry, the Board having made a grant of £40,000 per annum for five years for this purpose. Full details of the manner in which this grant is being used have appeared in this JOURNAL from time to time.

In regard to (2), scientific research is being initiated or aided by the Board in many parts of the Empire, but, since this subject is more highly developed at home than in most Empire countries, a high proportion of the grants so far sanctioned has been made to home institutions. These grants cover such diverse subjects as Animal Breeding at Cambridge and Edinburgh Universities; Pasture Research at Aberdeen and Aberystwyth; Dairy Research at Reading; Fruit Research at East Malling and Long Ashton; Cold Storage work at Cambridge and East Malling; and Entomology at Farnham Royal and Cirencester.

With the object of supplying accurate and reliable information as to marketing conditions, the Board is now issuing a series of "Weekly Fruit Intelligence Notes," which provide as complete information as possible regarding actual and prospective supplies of fruit in the United Kingdom, together with fruit crop prospects and yields in other producing countries. They also contain full information, each week, as to the imports of fruit into the principal ports, and advice regarding the probable date and port of arrival of steamers carrying fruit to this country. Arrangements have been made to extend this service to cover potatoes and tomatoes. These "Notes" are printed in the Trade Press circulating amongst home producers, and copies are supplied on application to individual growers and co-operative societies.

Finally, the Board has made a grant to the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland for the establishment in London and Glasgow of quarantine stations through which cattle may pass, unchecked by foot-and-mouth disease restrictions, to the oversea markets of the Empire. This scheme, therefore, aims at helping, at the same time, both the home producer and the farmer in other parts of the Empire.

"THE most human of all Departments" is how Sir Francis Floud describes the Ministry of Agriculture and Fisheries in one of the latest additions to

The Ministry the "Whitehall Series" of books on Government Departments.* Sir Francis, who was Permanent Secretary to the Ministry from 1920 to 1927, has given in this volume an interesting and valuable account of the growth and manifold activities of a Department which, he points out, has functions not only in relation to matters purely agricultural and purely fishery, but is also concerned in some degree with education, research, labour, local government and health, and statistics.

It is interesting to note the origin and development of a Department which to-day covers such a wide field. The first Board of Agriculture, founded by Sir John Sinclair in 1793, was not, strictly speaking, a Government Department. It was a Society founded by Royal Charter, and its true successor is the Royal Agricultural Society of England rather than the Ministry of Agriculture. Sir Francis traces the pedigree of the Ministry itself back to the appointment in 1836 of the Tithe Commission. From that date there was a steady increase in the functions assumed by the State in relation to agriculture, and when in 1881 it was urged that a separate Agricultural Department should be constituted, it was pointed out that Cattle Diseases were under the President of the Council, Agricultural Statistics under the Board of Trade, Woods and Forests under a separate body of Commissioners, while a Bill on Agricultural Holdings had been placed in charge of the First Lord of the Admiralty. The appointment of an Agricultural Department of the Privy Council in 1883, the creation of the Board of Agriculture in 1889, the addition of Fisheries in 1903, and the change of title to the Ministry of Agriculture and Fisheries in 1919, bring the history of the Department up to date.

An insight into the working of the departmental machinery is afforded by the chapters on organization and staff, which describe the work of the seven divisions into which the Ministry is divided, the method of dealing with the immense mass of correspondence which passes through a Government Department in these days—the Ministry receives over one

* *The Ministry of Agriculture and Fisheries.* By Sir Francis Floud, K.C.B. (Putnams. 7s. 6d. net.)

and a-quarter million communications a year, and dispatches about two million—and the character of the staff, administrative, clerical and technical, which the Ministry requires to carry out its wide range of duties.

The succeeding chapters indicate how wide that range is. Sir Francis gives an account, not only of the statutory duties of the Ministry, but of the origin and purpose of the various schemes for the development of agriculture and fisheries which are administered by the Department. The functions of the Ministry in relation to the control and eradication of diseases of animals, the teaching of agriculture, agricultural research, live stock improvement, small holdings and allotments, horticulture and plant diseases, beet sugar, rural industries, agricultural economics, tithe and inclosures, agricultural labour, land drainage and commercial control are all described. There are sections on Kew Gardens and the Ordnance Survey, and Mr. H. G. Maurice, Fisheries Secretary to the Ministry, contributes a chapter on the Fisheries Department..

In the "Tribute from *Punch*," with which Sir Francis concludes his book, it is asserted that

"The Ministry of Ag. and Fish
Does everything that one could wish
To foster, guide and chaperon
Those industries it calls its own."

Perhaps it is too much to expect that this high claim should receive universal endorsement, but those in doubt are recommended to read Sir Francis Floud's book.

* * * * *

PROCEEDINGS taken by the Ministry of Agriculture and Fisheries against H. J. C. Knight, a seed merchant of Bromley, in connexion with the sale of a quantity

Clover Seed Frauds

of seed described as genuine Kentish wild white clover, but which was, in fact, seed of foreign or New Zealand origin, were completed at the Kent Assizes on February 20, when Knight was sentenced to 12 months' imprisonment in the second division, and was ordered to pay the costs of the prosecution, amounting to about £300.

THE Minister of Agriculture and Fisheries has recently issued a new Sheep Scab Order, which will come into force on April 1, 1928. It consolidates the provisions of the existing Orders, which are revoked, and makes minor amendments in the procedure for dealing with the disease.

Sheep Scab Order of 1928

The new Order continues the obligation of any person having possession or charge of sheep to report suspected cases of the disease, and also the prohibition against exposing diseased or suspected sheep for sale at a market or other public or private place, or in a lair where sheep are commonly placed before or after sale. It also continues the prohibition against diseased or suspected sheep being carried or driven by rail, road or water, or being kept on common or unenclosed land, or on the sides of a highway, road or lane.

A new feature in the Order is the provision for appeal to the Minister by a sheep owner against the diagnosis of the Veterinary Inspector of the Local Authority as to the existence of sheep scab amongst his sheep. Such an appeal must be made within three days after the date of the Veterinary Inspector's report, and must be accompanied by a certificate of a Veterinary Surgeon employed by the owner. The appeal will then be referred to the Chief Veterinary Officer of the Ministry of Agriculture and Fisheries, whose decision in the matter, after due inquiry, will be final.

In confirmed cases, the owner is required by the new Order to treat the sheep in accordance with directions to be given by the Veterinary Inspector of the Local Authority, which treatment must, however, include double dipping in an approved sheep dip. In severe cases the Veterinary Inspector may require the affected parts to be specially hand-dressed before the sheep are dipped.

The usual requirements in regard to "Movement Areas" and "Double Dipping Areas," declared by special Order of the Minister in districts where sheep scab is prevalent, are embodied in the new Order.

The powers of Local Authorities to make regulations as regards the notification and dipping of sheep brought into or moved within their district are set out, and also their powers to require the compulsory dipping of all sheep in their districts. The use of an arsenical dip for the second of the two dippings required by the Order is prohibited, and the labelling and sampling of dips is regulated.

The returns of sheep scab for the whole of Great Britain for the past year show no evidence of a reduction of the disease. It is, therefore, incumbent on all concerned to do their utmost to improve the position. This disease is one which can be cured and prevented, but only if the necessary measures are properly applied by the farmer himself. Sheep owners are, therefore, especially appealed to in their own interests, and in the interest of their brother farmers, to assist the purpose of the Order by keeping their flocks under close observation, and by carrying out the regulations conscientiously and thoroughly.

* * * * *

THE Queensland "Primary Produce Experiment Station Act," of 1927, empowers the Governor in Council to establish and equip primary produce experiment stations. The purposes of such stations are "for conducting experiments (including soil analysis) in connexion with such primary produce, for the treatment of by-products thereof, for the prevention of the spread of disease in connexion therewith, and otherwise for promoting the successful cultivation of such primary produce." Moreover, the stations may be used for experiments directed towards the improvement of the class of primary produce, the production thereof, the dissemination of information regarding their proper cultivation, and generally for the well-being of the grower and the industry concerned.

The Act establishes a "Primary Produce Experiment Stations Fund" for financing the work of the stations. Grants in aid of the Fund will be made from Consolidated Revenue at a rate not exceeding £ for £ against income from "assessments." Assessments may be levied on the grower of primary produce, calculated on produce grown for sale, in connexion with which an experiment station has been established. The Fund will be apportioned among the experiment stations as the Government may decide. A portion of the Fund may be applied for the purpose of carrying out inquiries and investigations on the control or eradication of pests and diseases.

NOTE.—At the Imperial Agricultural Research Conference, 1927, it was announced that the Government of the Australian Commonwealth was willing to undertake the responsibility of establishing in Queensland one of the links in the chain of

research stations that will ultimately engirdle the Empire. It has agreed to undertake the obligation of financing the station and providing with the Empire Marketing Board a sum of £50,000 for capital expenditure and £10,000 per annum for maintenance of the Imperial Station.

* * * * *

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 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 December 31, 1927, may prove of interest.

Publications.—Part II of the "Survey of Markets" (Midland Markets—Economic Series, No. 14) and the "Report on the Fluid Milk Market" (Economic Series, No. 16) have been published, and have met with a very favourable reception. One dairy firm alone purchased 5,000 copies of No. 16 for distribution to its suppliers. A report on "The Pork and Bacon Trades" (Economic Series, No. 17) is being prepared for the printer. The preparation of other reports is in progress.

Sales of reports in the Economic Series during the three months under review totalled 9,803 copies, bringing the total sales of the series up to December 31, 1927, to over 47,700.

Marketing Investigations.—Investigations into the marketing of cheese and vegetables continues. Field work in connexion with the marketing of cattle has been completed. The inquiries necessary in the eastern and southern counties for the purposes of a report on the markets and fairs of that area are well advanced.

Marketing Demonstrations and Displays of Empire Produce.—A considerable amount of work in both these directions was undertaken during the quarter, detailed accounts of which have already been given in this JOURNAL. An addition to the published programme of demonstrations was a fruit marketing demonstration arranged by the Ministry at Swanley, Kent, in December, as a result of which a promising scheme is now under consideration by local growers for the establishment of a packing station in that area.

Grants-in-Aid.—A grant of £530 per annum for two years has been made to the University College of Wales, Aberyst-

wyth, to enable certain investigations into marketing to be undertaken. Arrangements have been made to correlate this work with the investigations being undertaken by the Ministry's own staff.

* * * * *

THE Report of the Departmental Committee on the re-assessment of annual grants to Institutions providing higher agricultural (including veterinary) education in England and Wales has now been issued. The report has been accepted by the Ministry, and the grants which the Committee recommended have been approved by H.M. Treasury. The table below shows the grants recommended during the next three years :—

Institution	Grant recommended £
University College of Wales, Aberystwyth } ..	7,000 ¹
University College of North Wales, Bangor } ..	6,500
University of Cambridge	3,800
University of Leeds	3,500
Armstrong College, Newcastle-upon-Tyne ..	4,000
University of Oxford	4,000
University of Reading	4,000
South-Eastern Agricultural College, Wye ..	3,000
Midland Agricultural and Dairy College ..	4,000 ²
Harper Adams Agricultural College	2,500 ³
Harper Adams Agricultural College: National Institute of Poultry Husbandry, not exceeding	2,300
Seale Hayne Agricultural College	2,000 ⁴
Royal Agricultural College, Cirencester ..	1,000
Studley College	1,750
Swanley Horticultural College	900
British Dairy Institute, Reading	3,300
Royal Veterinary College	1,850 ⁵
University of Liverpool	
Total	£55,400

¹ To be allocated after discussion with the University of Wales.

² An additional grant to be payable in 1928.

³ The grant to the National Institute of Poultry Husbandry to be the subject of an annual application to the Ministry.

⁴ To be reviewed after a year.

⁵ When the Animals' Hospital is built and occupied the grant may be increased.

The Committee, in their report, make several suggestions as regards courses, extra-mural work, local conferences, etc., for the consideration of the various Colleges.

The report is published by H.M. Stationery Office, and copies can be obtained by persons interested at 1s. 6d. each, net.

ADDRESS TO THE ARGENTINE RURAL SOCIETY

By THE RT. HON. LORD BLEDISLOE, P.C., K.B.E.

This Address was delivered to the Argentine Rural Society on January 12, 1928, during a visit to Argentina made by Lord Bledisloe, then Parliamentary Secretary to the Ministry, on behalf of the British Government.

GENTLEMEN,—I am delighted to accept your generous invitation to visit your Society's handsome premises and to have this opportunity of discussing with you the object of my mission to your country on behalf of the British Government.

I venture to speak to you this evening not merely as Deputy Minister of Agriculture in the British Government, but also as a large-scale farmer and stock-owner in England who carries on the business of farming on commercial lines, and who realizes the many difficulties and handicaps in connexion with the prices of live stock and land produce, the weather, and the various diseases which afflict both our crops and our farm animals. I can only express the hope and belief in this connexion that you, as farmers, have not been passing through the period of extreme depression and financial loss which, unfortunately, has been the lot recently of most farmers in my country.

Let me in the first place express my deep appreciation of the extreme friendliness with which I have been received on all sides from the moment that I landed in Argentina, at the hands of the President of the Republic, of various members of your Government, including especially your Minister of Agriculture, and of numerous estancieros, several of whose estancias I am hoping to visit before I return to England.

My official mission to your country is, as you know, in connection with "aftosa," or, as we call it, foot-and-mouth disease, the suppression of which in both our countries is calculated to reduce the trade losses and anxieties of their respective stock-owners, and enhance the measure of friendly confidence which, more than anything else, is conducive to the development of international trade.

The announcement of my forthcoming visit to the Argentine caused, I am well aware, deep anxiety and apprehension on the part of many Argentine estancieros, who were under the impression that it might lead to an embargo being placed upon

the importation of Argentine chilled beef into Great Britain, to the serious detriment and possible ruin of the stock-owning interests of this great agricultural country. I want to assure you that you need not at present entertain any such apprehensions. The case in regard to the possible transmission of the virus of aftosa would have to be serious indeed to justify any such embargo being imposed upon one of the main sources of food supply to my country. As you are possibly not aware, Argentine meat is estimated as representing about 48 per cent., or nearly half, of the total meat consumption of our British urban populations, including that of London, as compared with 25 per cent. only derived from British farms and 20 per cent. from other parts of the British Empire. Let me take this opportunity of telling you, with the utmost frankness, that I hope and believe that the proportion of our meat supply which will come in future from within Great Britain and the British Empire will be largely increased. But even then, there is bound to be, with our large and ever-increasing population, a considerable balance which will have to be bought from other countries, and in the keen and friendly competition which is bound to take place in this as in other vital commodities, the victory will undoubtedly rest with those who are prepared to profit by the carefully ascertained results of scientific research, especially in regard to disease.

It is calculated that even in our temperate climate the losses from fungoid disease and insect pests amount to, in relation to our economic plants, from 12 to 20 per cent. of their total value, and I have little doubt that in sub-tropical areas, such as are comprised within the boundaries of your vast country, the loss from these sources is at least double that amount. You have good reason to know what such losses involve, with your unfortunate experiences in connexion, let me say, with red rust in wheat and the corn-borer in maize. What are the corresponding losses in connexion with animal diseases it is difficult to estimate. As in my own country, so to an even greater extent in yours, tuberculosis, contagious abortion, sheep-scab and hog-cholera are pests which especially reduce the trading profits of many stock-owners.

Perhaps the most insidious and inscrutable disease, and the one most difficult to control, is aftosa, or foot-and-mouth disease. The disease is caused and spread, as many of you know, by an ultra-microscopic and filtrable virus, which has not yet been separated and identified, and no effective preventive inoculation has yet become possible as the result of the

research work of our scientists. But their researches have at least made it evident that the chilling or freezing of carcasses is not effective in destroying the vitality of the disease-germ, and that it can, in fact, live in the bone-marrow of a chilled carcass for more than 60 days, and on the surface of the skin for at least four or five days, with the consequent danger of such carcasses becoming the carriers of the disease from the Argentine to distant countries like Great Britain. It is true that the disease here is endemic, and generally of a moderate or "benignant" type, and consequently not regarded with the same gravity as we regard the disease in my country. But it is quite possible for a mild type of aftosa to develop by transmission a virulent type in another country. It is this more virulent type to which we are accustomed when outbreaks of the disease occur, and in the interests of our valuable live stock industry we have found it advisable to deal with the disease in the most drastic fashion when outbreaks occur, by the process of immediate slaughter, with Government compensation, not merely of all affected animals, but of all those which may have been brought into contact with them.

This drastic policy has enabled us in the past (and I speak as one who in days gone by has sold valuable Shorthorns at good prices to Argentine estancieros) to enjoy your confidence as exporters to the Argentine of high-class pedigree stock of every description, especially cattle, guaranteed to be free from all serious infectious diseases. What we are asking now on your part is that you will be willing, through the medium of your Government, to accept such conditions as will prevent, as far as possible, animals affected with aftosa from passing from your estancias into the Frigorificos, or—if the disease can only be detected after reaching the latter—from being transported through the medium of chilled carcasses to Great Britain.

I fully recognize the difference in the conditions prevailing in this country and my own, especially in the matter of the relative sizes of farms and fields, and the long distances that live stock have to travel from the places where they are fattened to those where they are killed, and I realize that it would be unfair, and, indeed, ineffective, to attempt to apply to this country the same drastic regulations which have to be imposed under similar conditions in Great Britain. It is obvious that nothing is gained by inserting in a decree or in Government regulations stipulations which are so unreasonable or locally so impracticable as to encourage their breach or render the imposition of penalties impossible. What is far more satis-

factory, from our point of view as well as from yours, is for us to agree, as I feel sure that we shall, upon such conditions as, without being too drastic, will effect our purpose and will be accepted and enforced without hardship to any of the interests concerned. And this leads me to make an appeal to the Executive Committee of this powerful and influential organization of Argentine Estancieros.

Your kindly disposed Government can do much to help us in this matter, but *your* sympathetic co-operation is essential to the success of any action which they are prepared to take.

If the leading estancieros of Argentina, as represented by your society, will make it a matter of honour and conscience to prevent any cattle affected with aftosa passing from their estancias to the Frigorificos—in other words, “point the way” to effective compliance among all estancieros with our British requirements—it will, I am sure, render more effective the proposed Government regulations, ensure faithful adherence to them, and evoke the full confidence of the British Government and the British agricultural community.

I hear that your business of cattle raising has not lately yielded you the profits which you enjoyed a few years ago. This, no doubt, is partly due to the reduced purchasing power of the British working population consequent upon industrial depression and the coal strike of 1926. The “Meat War” in this country has also tended here, as it has (much more seriously) in England, to reduce the price of meat below the cost of its production. The prospects for the present year are in all respects more hopeful for cattle breeders, on both sides of the Atlantic, especially if your meat traders will avoid “Meat Wars,” and if we are to enjoy in Great Britain a cessation from the industrial strife which has in recent years caused or accentuated widespread industrial depression. But the producers of meat on both sides of the Atlantic have to realize, if they are to obtain the full fruition of their enterprise, that the taste of the British consumer has substantially changed in recent years. The demand now is for “baby beef” and small joints, the produce of relatively small early maturing animals. I have seen some excellent animals of this type and of all the best known beef breeds in the corales adjoining your Frigorificos. I see no reason why, if you study the changing taste of your British customers, you should not enjoy in the future the same prosperity as you have in the past. I thank you sincerely for your hospitality and kindness.

THE DOWNY MILDEW OF THE HOP IN 1927

Prof. E. S. SALMON and W. M. WARE, M.Sc.,

South-Eastern Agricultural College, Wye, Kent.

DURING the summer of 1927, a long and continuously wet period in July and August brought about very serious injury to the hop crop by Downy Mildew in certain of the hop-growing counties. Over a very large acreage, a general browning of the hop cones was caused just before or during picking time, and in some cases to such a degree that the hops were left unpicked as worthless. The probability of wet weather playing an important part in fostering a general outbreak of Downy Mildew on the cones was pointed out in 1923.¹ Further, the experience gained from the course of events during the past season has shown that the measures of control of the disease which may be sufficient in dry seasons are inadequate in wet, and need to be supplemented by spraying² with a fungicide, as has already become the practice in certain districts on the Continent.

The following article contains (1) a brief account of the course of the disease in this country in 1927; (2) a consideration of the sources of infection in connexion with the control of the disease by spraying and other measures; and (3) an estimate of the losses caused.

The Disease in 1927.—The course of events may be summarized as follows: “Spiked” shoots arising from the hill were observed in hop gardens in Kent from the beginning of April onwards. There is evidence that many growers now recognize this stage of the disease, so that in their hop gardens “spike” pulling or cutting has become a routine practice. The following is an extract from one of many letters received: “In the garden of Tutshams, which was affected during the last three seasons, exceptionally so in 1925, this year, in the spring, no more than about one spike in a hundred hills was found during training, and none at all afterwards. With us

¹ “Three New Diseases of the Hop:” E. S. Salmon and H. Wormald, this JOURNAL, August, 1923, p. 433; and “The Downy Mildew of the Hop:” E. S. Salmon and W. M. Ware, this JOURNAL, March, 1925, pp. 1145 and 1151.

² That spraying might become a necessity was pointed out in this JOURNAL, March, 1925, p. 1150. [See also paragraph 2, with footnotes 10 and 11, on p. 1097.]

this year the dry April and May appeared to check effectively the spread of Downy Mildew."

The "spike" form of the disease was received not only from many districts in Kent and Sussex, but also from Hampshire, Worcestershire, and Herefordshire. Everywhere the disease appeared to be temporarily checked during an early spell of dry weather,³ and basal and terminal "spikes" do not appear to have been so numerous in 1927 as in 1926. No great attack developed during the following months but, as a result of the very wet weather³ of July and August, cases

RAINFALL (inches)

1927	WYE (East Kent)	EAST MALLING (Mid Kent)	Normal S.E. England	Deviation from normal	
				WYE	E. MALLING
March ..	3.16	3.11	2.05	+ 1.11	+ 1.06
April ..	1.63	1.58	1.89	- 0.06	- 0.11
May ..	0.77	0.84	1.77	- 1.00	- 0.93
June ..	3.27	3.73	1.89	+ 1.38	+ 1.84
July ..	5.29	3.96	2.17	+ 3.12	+ 1.79
August ..	3.42	4.57	2.32	+ 1.10	+ 1.25
September	3.19	4.76	2.13	+ 1.06	+ 2.63

of the crop suddenly turning brown came under our observation day after day. Hundreds of acres were affected, and it is safe to say that no such sudden and widespread outbreak has been known before in this country.⁴ Among the varieties most attacked (in some cases to such an extent that they were not picked) were Bramling, Early Bird, Tolhurst, and Prolifics. Other varieties, more or less seriously attacked, were Tutsham, Cobb's, and, in some districts, Goldings. On the other hand, numerous cases have been observed which show that the variety Fuggles is practically immune from injury so far as its cones are concerned—a fact of great interest and economic importance. This resistance was sometimes exhibited under conditions imposing a severe test. Thus, where this variety was grown intermixed with a susceptible variety, the cones of

³ We are indebted to Capt. A. H. Bird and to Mr. H. C. Chapelow, Observers in connexion with the Ministry's Agricultural Meteorological Scheme at Wye and at East Malling respectively, for the figures of rainfall given in the table.

⁴ To those familiar with the history of the disease on the Continent, the state of affairs was reminiscent of that described as existing in Germany in 1926.

the latter became completely brown while those of Fuggles remained green and healthy.

Considerations of space make it impossible to give an account here of the outbreaks during 1927 on the Continent. It may, however, be mentioned that in Germany, where, for several years past, the attacks have been far more severe than in this country, Downy Mildew is being treated as a matter of national importance, and the Reichstag has voted large sums of money for further investigations and for the purchase of spraying machines.⁵ In many districts of Germany, Czecho-Slovakia and Belgium, hops were regularly sprayed during 1927 with Bordeaux mixture throughout the growing season. Good results have been reported.

Consideration of the Sources of Infection and of Control Measures.—The course of events in 1927 shows that, in a very wet season, the control measures based on the removal of "spiked" growths, the stripping of the lower leaves, etc., are insufficient to prevent, later, disastrous outbreaks of the disease on the cones. Before passing to the consideration of the practical aspect of spraying, it is important to pay particular attention to the possible sources of infection at the time when the cones are attacked. These are as follows: Spores produced (1) on the upper leaves of the vines in the hop garden; (2) on the leaves of any "wild" hops adjacent; (3) in neighbouring infested hop gardens and carried on the wind; (4) Winter-spores (*oospores*) present in infested soil.

With respect to (4), nothing is as yet known as regards the germination of the winter-spores. It appears unlikely, however, that this source is of importance in relation to the infection of the cones. With regard to (3), there is no definite knowledge as to the distance spores can be transported. There seems no doubt that, with strong winds, spores may be transported, after a period of time, from one end of a hop garden to the other, but it is not known whether spores can be carried in the air from an infected hop garden to a garden at a distance. If this does occur, it would explain why an entire crop may suddenly turn brown, such as happened in certain gardens in 1927. (2) While, undoubtedly, infected "wild" hops are a menace and should be unremittingly sought for and extirpated, they cannot be regarded as providing the

⁵ Muck, R.: Die Peronosporakrankheit (Falscher Meltau) des Hopfens. Saaz, 1927. See also *Le Petit Journal du Brasseur*, XXXV, 984, 1927.

The sudden advent of the disease on the cones before they were fully ripe, created the necessity for immediate picking in a great many cases, whereby loss in weight and condition resulted. Where the cones at picking time had turned brown, the colour of the dried hops suffered considerably, with consequent depreciation in market value, although it has yet to be determined to what extent, if any, their brewing properties have been affected. Where the cones were attacked severely, a somewhat powdery condition was reported in the dried samples, which appeared thinner and less whole than they otherwise would.¹³

Some estimate of the general loss sustained may be formed from the following accounts, amongst others, supplied to us by growers in Kent :—

(a) "As to the actual amount of damage sustained in our gardens of Goldings, Bramblings, Tutshams, etc., we estimate that our crop here was reduced by at least 25 per cent. For so unfavourable a season, we had by the middle of August a very fine show of well-grown-out hops, but owing to the severe attack of Downy Mildew, we were compelled to commence picking quite 8 to 10 days earlier than we should otherwise have done, and in consequence right through the picking we were gathering hops that were not fully ready."

(b) "Owing to the attack of Downy Mildew, picking here was commenced at least a week before the crop was mature. This quite possibly reduced the crop by 2 cwt. per acre, and I estimate loss of quality to be of the order of £2 10s. per cwt. The difference is therefore between 14 cwt. per acre at £14 (=£196 per acre) and 12 cwt. per acre at £11 10s. (=£138 per acre, showing a loss of £58 per acre."

(c) "I consider that I lost at least 33 per cent. of my weight of hops from this disease. The disease struck the hops rather early, and I consider that I lost the bulk of my weight through the under-development of the hops, as when the disease appeared in the cones they stopped growing."

(d) "Owing to severe attacks of the Downy Mildew, I left unpicked 5 acres out of 12 acres of Bramblings, and those that were picked were muck. I also had to leave, for the same reason, 3 acres of Cobb's and 3 acres of Tutshams. I lost somewhere about £1,700 worth of hops."

Summary.—1. An account is given of the incidence of Downy Mildew in 1927 in England, and of the resulting discoloration of the hop cones over a large acreage.

2. The injuries caused to the affected crop are described, and estimates given, in certain cases, of the financial losses involved.

3. In the wet season of 1927, preventive measures based on the removal of the sources of infection ("spiked" growths,

¹³ See also Waghorn, J. H.: "Hops in Kent and Sussex." *Jour. Inst. Brewing*, XXXIII, 535-6, 1927.

etc.) proved insufficient to prevent a widespread attack on the cones.

4. Spraying with Bordeaux mixture (which has proved to be satisfactory on the Continent) is recommended, and four applications are suggested tentatively.

5. As regards the cones, certain varieties, *e.g.*, Bramling and Tolhurst, have proved to be especially susceptible, while the variety Fuggles, under conditions where it was severely tested, has proved to be practically immune.

* * * * *

METEOROLOGY AND AGRICULTURE

(Concluded from p. 1043)

THE following are brief summaries of the remaining papers read at the Third Conference, arranged by the Ministry, of workers engaged on the study of various aspects of the effect of weather on crop growth, which was held on September 22 and 23, 1927. It is proposed to issue, later, a full report of the Conference, and a limited number of copies will be available for free distribution.

Meteorological Conditions and the Amount and Nutritive Value of Pasture and Hay (Prof. R. G. Stapledon).—Both yield and nutritive value of pasture or hay depend to a very large extent on the stage of growth reached by the plants composing the pasture or meadow at the time they are eaten or cut. This growth stage is determined to a far greater extent by management and by the plant's inherent capacity for growth than by the accident of weather.

Clovers are richer in nutrients than grasses, and a first harvest year pasture crop will be nutritious and bulky largely in proportion as red clover dominates the sward. Meteorological conditions influence the quantity and quality of herbage to the degree that they affect clover dominance. Obviously we cannot have clover dominance unless we have established a good take of clover, so we must go back to the weather conditions of the seeding year. Sowing in August and later is not favourable to clover dominance. For actual germination and initial establishment, mid-temperatures at over 44° F., with adequate but not excessive rain, are most advantageous. Both excessive drought and excessive rainfall appear to make for delayed germination, delayed growth and seedling casualties. Given reasonable establishment during the summer, over-autumning and over-wintering have yet to

entire source of infection for the general attack on the cones. (1) As a general rule, spores of the fungus are to be found on the leaves, often on those which occur on the branches with the hops. It is probable that the original infections of the hop cones are in many cases due to spores produced here, and also in some cases to those on the leaves of "runners" and shoots growing from the hills during the latter part of the season.

It has already been pointed out above that, in this country, it will in future be necessary to spray hops against the disease, and the sprays and methods to be used will now be described. It has been found, as the result of extensive experiments carried out on the Continent, that repeated sprayings with Bordeaux mixture result in protection of the cones.⁶ The strength of the mixture used abroad varies from one-half to one per cent., and up to 10 sprayings are commonly given. Growers in this country are advised to proceed on an experimental scale, as, although success is reported from the spraying of hops abroad, it must be remembered that the varieties sprayed were different from those grown in England, and that climatic and other conditions are also different. It is essential that the plants be not drenched, or injury due to "scorching" will result; the spray has therefore to be applied with nozzles giving a fine mist. Full reliance cannot be placed on spraying alone, and it should be carried out as a measure additional to the routine operations hitherto recommended.

The full control measures now advocated are as follows:

- (1) From April or May onwards the "spiked" shoots must be carefully searched for and removed.⁷ Stripping of the lower leaves of the bines should be carried out as soon as it is safe to do so. If shoots arise from the "stripped" bine, these should be removed. Throughout the season the hills should be kept scrupulously clean of all shoots and "runners."
- (2) All rogue, or "skew," hills which occur commonly in gardens of Tutshams, Bramlings and Fuggles, and which

⁶ Blattny, C.: *Peronospora* (Falscher Meltau) des Hopfens in *Travaux des Instituts des recherches agronomiques de la République Tchecoslovaque*, Vol. 27a, 1-274 and 297-303. Prag., 1927. Korff and Hampp: *Die Bekämpfung der Peronosporakrankheit des Hopfens. Flugblatt 50 Bayerische Landesanst. f. Pflanzenbau u. Pflanzenschutz. München. Feb., 1927.* Muck, R.: *Die Peronosporakrankheit* (Falscher Meltau) des Hopfens. Saaz, 1927.

⁷ It is a good practice to collect these in a tin of some such liquid as a weak aqueous solution of lysol or methylated spirits, which will thoroughly wet the "spikes" and prevent dispersal of the spores.

have proved to be extremely susceptible to Downy Mildew, should be grubbed up. (3) All "wild" hops in the vicinity should be grubbed up. (4) The bines should be sprayed with home-made one per cent. Bordeaux mixture⁸ (a) when they are three-quarters up the strings or poles; (b) when they have reached the top; (c) just before the plants come into "burr," and (d) immediately after the "burr" has gone.

The plants must be sprayed with a fine, mist-like spray which will cover both surfaces of the leaves with fine drops without making them drip to any extent, i.e., they must not be drenched as when "washing" against blight (*Aphis*). As regards the third application, it is particularly important that only a light spraying be given, as otherwise injury may be caused to the "pin." No spraying must be done when the hops are in "burr," as this would injure the "burr" and result in the production of very small seedless cones.⁹

In Germany, where seedless hops only are grown, spraying is carried out while the hops are in "burr" and also when the cones are formed. According to report, the brewing properties of the cones are not affected adversely by the small amount of copper which may be present as the result of spraying.¹⁰ In this country, however, in view of the statement, published recently in this JOURNAL,¹¹ that mixtures containing copper should not be used on the hop cones, as any copper found in hops would "render them entirely unsuitable for brewing purposes," it is inadvisable that Bordeaux mixture should be used at any time after the cones are formed.

The good results obtained from spraying with Bordeaux mixture are probably due to the fact that spraying protects the upper parts of the bine, so that spores are not produced on the leaves in the neighbourhood of the cones. On unsprayed bines there is likely to be a gradual upward spread of the disease until the cones are reached.¹²

An Estimate of the Losses Caused.—The severe loss caused by the outbreaks of Downy Mildew in 1927 has been two-fold.

⁸ An illustrated leaflet describing the life-history of the Downy Mildew, and giving detailed instructions for making and applying the Bordeaux mixture, can be obtained (price 6d.) from the Secretary, Research Department, South-Eastern Agricultural College, Wye, Kent.

⁹ Since fertilization of the "burr" by pollen from male hops is essential for the production of well-grown-out cones, care should be taken not to spray male hops coming into flower.

¹⁰ Dr. D. Wiegmann, in *Le Petit Journal du Brasseur*, XXXV, 743, 1927. (Translation from *Zeitschr. f. das gesamte Brauwesen*, 73, 1927).

¹¹ This JOURNAL, August, 1927, p. 481.

¹² This JOURNAL, March, 1927, p. 1119.

be considered. Young clovers are very sensitive to water-logged conditions accompanied by ground frosts, being far more readily uplifted than the grasses. The character of the weather in November when ground frosts are usually frequent, therefore, exerts a considerable controlling influence on subsequent clover dominance. It is exceptional, particularly in the case of red clover, for a heavy hay crop to follow after an exceptionally heavy autumnal development in the seeding year. Consequently, weather exceptionally favourable to growth during September, October, and early November is adverse to heavy clover production in the first harvest year. Two factors come into play: (1) the fact of the clovers having been allowed to flower and reach maturity, and (2) the killing influence of the *Gloeosporium* disease on clovers in such a stage at such a time of the year. Here, however, *management* should have entirely obliterated the response of the clovers to favourable growing conditions—grazing could and should have kept them in place.

The leaf of a grass is richer in nutrients than the stem, therefore there is a natural cycle of nutritive value which is very largely independent of weather conditions. Early in the year the percentage of leaf is much greater than that of stem, and consequently the herbage has a high nutritive value independent of weather conditions. The ratio becomes increasingly in favour of stem as heading stage approaches, and continues until maturity, the nutritive value falling accordingly, though to a slight extent counterbalanced by the flower heads until such time as the seed is shed.

Clovers and grasses attain to maximum productivity at decidedly different times of the year, and clovers require a higher mid-temperature before they start really active growth than do grasses. The precise date at which clover growth fairly starts is far more dependent on temperature than on rainfall. Excess of rain early in the year, although it will make for a measure of grass growth even if the temperature is low, will have practically no influence on clover until the mean temperature also advances considerably.

As regards protein content and mineral content, work at both Cambridge and Aberystwyth has shown that there appears to be a certain seasonal drift, even in the case of pasturage kept closely grazed, so that in this connexion it is only after prolonged study that we shall be able to gauge the influence of weather fluctuations. The available data, however, allow of certain generalizations. The percentage dry

matter in green herbage was definitely higher in dry 1921 than in wet 1923. Dried and browned herbage is, however, less rich in nutrients than green and succulent herbage. A comparison between the monthly pasture cuts of cocksfoot in dry 1921, with high mid-temperatures and excess of sunshine, and in very wet 1923, with very poor sunshine, shows that in the very wet year month-old herbage had a higher leaf to stem ratio than in the dry year, and produced a greater bulk of leaf with a higher protein content. This serves to indicate the influence of extreme weather conditions on the yield and nutritive value of pasture grass. The chief effect of a dry year is undoubtedly to make for slow growth which matures and dries off prematurely, and which will not have the same nutritive value as herbage of reasonable height produced under adequate conditions of soil moisture.

With regard to the hay crop, management rather than weather conditions influences the proportion and nutritive value of red clover in the crop. The data for 1927 are particularly interesting. The crop from a field cut on June 10 was compared with that from a field where cutting had been deferred until July 13, and it was found that the clover contribution had increased from 5 per cent. to 55 per cent. Here the influence of management was much augmented, however, by favourable weather conditions.

The influence of weather conditions on hay yields has been extensively studied in Sweden, and Witte concludes that the yield is chiefly influenced by the amount of rain falling from the time the herbage starts to make really active growth in the spring until the crop is cut—the starting date in the spring being very largely influenced by temperature. During the last seven years the heaviest hay yields at Aberystwyth were taken in those years which were the wettest during the period April to June.

Despite weather conditions, heavy aftermaths do not follow excessive hay crops, while, if weather conditions have been unfavourable to hay production and become favourable to aftermath, the aftermath will be exceptionally heavy. The weather conditions during the aftermath growing periods for late clovers in 1921 and in 1925 were almost identical, yet after the low hay yield of 1921 there was an excessive aftermath yield, while after the high yield of 1925 there was a very low aftermath yield.

Meteorological Conditions and the Rate of Growth of Pasture Grass (Dr. H. E. Woodman).—In this paper are described

the results of investigations on pasture carried out on the Cambridge University Farm in the years 1925 and 1926. The results are discussed mainly from the point of view of the effect of meteorological conditions.

In 1925, an acre plot was selected on light sandy soil (60 per cent. sand, 11 per cent. clay), and in 1926 on stiff Gault clay soil. The plots were sub-divided into seven equal sub-plots, one plot being cut every day throughout the grazing season by a 16 in. lawn mower, i.e., the whole of each plot was cut over weekly. The daily produce was weighed, sampled for chemical analysis, and digestion trials were carried out with sheep. For the last purpose the season was divided into ten periods.

The weather experienced during the two years differed equally with the soil. In 1925 the chief characteristic of the season was a drought in June. In 1926 the rainfall was more copious and was better distributed over the season; the spring was abnormally cold and wet, there was adequate rainfall during the mid-season, the autumn was fairly dry, and there were night frosts in early October.

In 1925 the pasture on the sandy soil showed signs of awakened activity in the latter part of April and in early May; this was followed by a fortnight of intense activity (May 11 to 25). During this zenith period nearly 22 per cent. of the season's yield was produced. A steady decline followed, until in mid-July productivity was at its lowest level. There was a subsequent renewal of activity, which led to a continuous improvement in the rate of production of herbage from July 20 to August 10. From the latter date until October 12 the productive capacity was fairly steady, at about one-third of that during the awakening period, and one-fifth of that during the zenith period. As October advanced, productivity fell to a low level maintained until the end of the trial.

In 1926, on the clay pasture, the rate of growth was fairly steady throughout the season. There was no zenith period, and no mid-season drop.

In 1925 the controlling meteorological factor during most of the season was rainfall, due not only to the comparatively poor water-retaining capacity of the sandy soil, but also to the mid-season drought. In 1926, on the other hand, the controlling meteorological factor over the greater part of the season was temperature; rainfall was not important, (1) because it was sufficient during the greater part of the season, and (2) because

of the superior water-retaining capacity of the soil and the higher water table.

The following details may be given:—

As regards composition and nutritive value, the grass kept short was characterized by a high protein and low fibre content in both years. If, however, conditions favoured a stemmy growth, the content of protein was decreased, and that of fibre increased with a decrease in digestibility. This happened in the mid-season drought period in 1925, but owing to the steady growth in 1926 there was no marked mid-season falling off in digestibility in that year. The light land pasture of 1925 produced nutrient matter at a high rate during the early part of the season, but during the subsequent months, especially during the dry mid-season, the rate of production fell to a very much lower level. In sharp contrast to this behaviour the rate of production of nutrient matter on the clay land pasture in 1926 was fairly uniform throughout the season. No marked peak of productivity was noted during spring, and the most pronounced rise in the rate of production of nutrients occurred towards the end of July; clay pasture at this period of the 1926 season produced starch equivalent and digestible protein at more than four times the rate at which they were produced in the herbage of the sandy pasture during the corresponding period of 1925. In 1925 the moisture content of the grass varied with the rainfall, but a surprising fact was that a higher moisture content was obtained after dew than after the heaviest rain. As regards mineral content, the maximum lime and minimum phosphate content was obtained during the droughty period.

Temperature and Food Requirements of Animals (Professor T. B. Wood).—It is commonly supposed that animals require more food in cold weather than in the summer. There are, however, very few accurate measurements. Capstick and Wood have recorded a series of accurate measurements of the heat evolution of a pig when at rest and fasting, and when exposed to temperatures varying from 10° C. to 24° C. It was found that the heat evolution was constant from 20° C. to 24° C. Below 20° C. it rose with falling temperature at the rate of approximately 4 per cent. per degree C. Measurements were not made below 10° C., but there is no reason to think that the rate of rise would not continue below this temperature. The reaction of the fasting pig to change of temperature, therefore, changes at 20° C.

The observations were made on the fasting animal. Let us

suppose that an animal is eating 5 lb. of barley meal per day, and that his "basal metabolism," *i.e.*, the heat evolution necessary to maintain his vital processes, is 2,000 calories per day. Now 1 lb. of barley meal produces in the body of the pig 1,460 calories, of which only 1,060 calories can be used for physiological purposes, the balance of 400 calories being necessarily converted into heat during the processes of digestion and absorption. There will result, therefore, from the digestion and absorption of the 5 lb. of barley meal 2,000 calories of heat which can be used for the maintenance of body temperature, but for no other purpose. Since the basal metabolism is 2,000 calories per day, and a fall of temperature of 1° C. causes a rise in basal metabolism of 4 per cent. for maintenance of body temperature, the extra demand for this purpose is 80 calories per degree C. To meet this, there are the 2,000 calories from the digestion and absorption of the food, and this will meet the demand for 25° C., and there will therefore be no need for increased oxidation, and no increase in food requirements until the temperature falls 25° C. below 20° C., *i.e.*, to -5° C. This, of course, assumes that all conditions, except temperature, are the same, which is not true, since the inside of the calorimeter used in the experiments is a much more sheltered position than the commercial pig usually occupies in winter.

The practical conclusion is that fall in temperature only does not directly increase food requirements in the case of full-fed animals under practical conditions. Fall or rise of temperature may do so indirectly by occasioning discomfort, which results in excessive muscular movement.

The Physiological Action of Ultra-Violet Light (Dr. H. E. Magee).—Sunlight has been recognized for a very long time as indispensable for the growth of most of the plants that enter into the dietaries of animals and man. Although apparently not entirely indispensable in a direct sense for animal life, there has been accumulating during the past decade a weight of evidence showing that ultra-violet light has a very important effect upon the growth and health of animals.

Sunlight is a mixture of radiations of varying wave-lengths, partly visible and partly invisible. The commonest artificial sources of ultra-violet rays for health purposes are the mercury vapour, the carbon, and the tungsten arcs.

Before radiations can affect a substance, absorption, resulting in some degree of molecular or atomic change, must take

place. Thus, chemical change in inorganic substances can be brought about and bacteria killed by ultra-violet rays, which also affect the activities of most ferments and enzymes of animal and vegetable origin.

Ultra-violet rays can only penetrate the human skin a minute distance; their physiological action must therefore be brought about by affecting the cells in the superficial layers of the skin. They are impeded by clothing, fog- and smoke-laden atmospheres, and by ordinary glass.

After a variable latent period irradiation is followed by some degree of erythema, and after repeated exposures pigmentation ensues. This is protective in function as it holds back the harmful heating rays. The general effects are perhaps the most important. The chief of these are an increase in the defensive powers of the body, and correction of disordered states of mineral metabolism, such as that found in rickets. This is a disease characterized by defective formation of bony tissue. It is very liable to develop in young animals fed on diets badly balanced in regard to calcium and phosphorus. Experiments on pigs have shown that animals fed on such diets are less liable to develop rickets if allowed access to sunshine. Other experiments showed that the absorption of these elements was improved by artificial irradiation with ultra-violet light if the pigs were fed on a ration that was not ideally balanced. The rays, however, had no significant effect on the assimilation of calcium and phosphorus, in the case of pigs fed on rations ideally balanced in regard to these elements.

Lactating animals in full milk habitually lose more calcium in urine, faeces, and milk than they absorb. Experiments have shown that irradiation with ultra-violet rays diminishes this loss by improving absorption of calcium. Repeated pregnancies and lactations, especially in heavy milking animals, induce prolonged losses of calcium from the body, of which sterility and abortion are not uncommon consequences.

The curative value of outdoor life in all forms of tuberculosis has been well recognized for generations, but only in 1893 was it realized that the ultra-violet rays of the sunlight were the chief factors in promoting healing of the tuberculosis lesions. Since that time the success obtained by direct sunlight and by irradiation with artificial ultra-violet light has been so extraordinary that such measures appear to be gradually replacing other forms of treatment.

Meteorological Factors affecting Fertility in Sheep (J. E. Nichols).—During the last century, small modifications in the domestic sheep have been encouraged, until the great number of modern distinct breeds has resulted and the sheep has been introduced into new districts. The chief factor in the distribution of breeds must be their ability to live, and the fertility of a flock or a breed in new habitats must be considered. The critical periods in the life of sheep are the rutting or tupping season, the lambing season, the first few weeks of the post-natal existence of the lambs, and, to a lesser extent, the gestation period. The lambing season is a reflection of the tupping season, and there is considerable evidence that the onset of the breeding season occurs with a falling temperature.

Records were taken of a Cheviot and a Blackface flock, kept at the same farm for the period 1911-1924 inclusive. Each flock was pure bred and had been kept under the same conditions of pasturage, altitude, and management for the entire period. The records gave the number of ewes in the flock alive at the end of lambing time, the total number of lambs alive on May 28 each year, the number of lambs alive at castrating time three to four weeks later, and a figure for "eild" or barren ewes. The meteorological records kept were, mean monthly temperature, mean daily range of temperature, number of rainy days, and rain in inches.

The measure of fertility used was that of the number of live lambs at the end of the lambing season in proportion to the number of ewes then alive, the proportion being expressed as a percentage and termed "lambs percentage."

No definite conclusions can be drawn from the data as to the influence of meteorological conditions at the time of service on the ultimate lambs percentage, but in the case of conditions at lambing time definite associations do appear. While the mean daily temperature and the rainfall in inches during lambing time have no correlation with lambs percentage in either flock, the mean daily range of temperature and the number of rainy days do show significant correlation. High daily range of temperature is associated in both flocks with high lambs percentage. The number of rainy days at lambing time is negatively correlated with lambs percentage in both flocks and positively correlated with barrenness.

* * * * *

TAR-OIL WASH TRIALS IN THE WEST MIDLANDS, 1926-27

S. G. JARY, B.A.,

Advisory Entomologist, West Midland Province.

DURING the winters of 1924-25 and 1925-26 trials were carried out in Shropshire, Staffordshire and Warwickshire with various brands of proprietary tar-distillate washes. In 1924-25, five brands were used, and of these Carbokrimp and Mortegg proved easily the best; the other three washes were withdrawn from the market in the following year. In 1925-26, more extensive trials were carried out, using Carbokrimp and Mortegg only, in order to try the effect of different strengths of these washes. The results of these trials* led to definite conclusions regarding the strength at which the washes can safely be used and the approximate latest dates at which they may be safely applied.

Since then many new washes of similar composition have been put on the market, and, during the winter of 1926-27, two brands not previously tested (Tarolite and Battle's Wash) were introduced into the trials, Mortegg being used as the standard with which they were compared.

Research, by Messrs. Tattersfield and Gimmingham at Rothamsted Experimental Station, has shown that di-nitro-cresol and its sodium salt possess an egg-killing power very similar to that exhibited by Tar Oil Washes. The writer was asked to include in the trials two washes of this nature which are here called Wash A and Wash B.†

Wash A consists of di-nitro-cresol and a solvent, Wash B is the sodium salt of di-nitro-cresol in water, plus soft soap. The former leaves a yellow and the latter a reddish stain on the hands and clothes, which washes off with little trouble. On the other hand, both these washes mix very readily with water; their covering power seems slightly better than that of the best tar-distillate washes, and they also possess an advantage in not clogging any part of the spraying machinery.

Strength of Washes (Apples).—The tar-distillate washes were all used at 10 per cent. concentration, and the di-nitro-cresol washes were diluted to give a concentration equivalent to 0.2 per cent. of di-nitro-cresol.

Plums and Damsons.—The tar-distillate washes were all used at 6 per cent., and the di-nitro-cresol washes at the same strength as on apples.

* See this JOURNAL, November, 1928, p. 753.

† It is understood that a full account of all the field trials conducted with di-nitro-cresol washes during the past year will be published later.

Lay-out of Experiment.—At each centre, 40 trees were used, 30 of which were sprayed, the remaining 10 being kept as controls. Thus, using five different washes, six trees were sprayed with each wash. Where possible, the sprayed and control trees were arranged in chequer-board fashion to obviate, as far as possible, errors due to the uneven distribution of the insects concerned.

TABLE I.

Orchard	Key letter	Fruit	Date of spraying	Date of examination
Co-operative Wholesale Society Estate, Roden, Salop.	A	Apples (Bismarck)	February 8	May 18
		Plums (Victorias)	January 31	May 20
		Damsons	Dec. 19, 1926	May 20
Mr. Venables, Moreton, Staffs.	B	Damsons	Dec. 20, 1926	May 5
Mr. Percival, Rodbaston, Staffs.	C	Apples (mixed)	February 9	May 5
		Plums (mixed)	January 20	May 5
Mr. Blackwell Sims, Bickmarsh Hall, Bidford-on-Avon, Warwick.	D	Plums (Czar)	January 19	May 9
		Apples (Worcester)	January 19	May 9

Estimation of Results.—In estimating the effect of the washes, each tree was taken in turn, and given its mark. The figure given in Tables II and III represents the average value of the marking of all six trees sprayed with each wash. The labels on the trees carried a code letter or number, and at the time of marking the actual brand of wash referred to by any particular label was not known.

The actual system of marking is indicated by notes given below Tables II and III.

DISCUSSION OF RESULTS

Apples (*Aphides* and *Psylla*).—In none of the orchards under experiment were the control trees very heavily infested. At A, none were present; and there were very few at C, and at D. Consequently the differentiation between one wash and another was not well marked. It would seem, however, that Washes A and B did not exercise a complete control on these insects, whereas the three tar-distillate washes gave trees which were entirely free.

TABLE II.—APPLES.

Orchard	Pest	Control	Mortegg	Tarolite	Battle's	Wash A	Wash B
A	Winter Moth Caterpillar	12	6	11.6	9.3	10	14
	Capsid	17.4	9.5	18	13	15.5	18
C	Winter Moth Caterpillar	15	8	6.2	6.6	11	15
	A. pomi ..	1	—	—	—	Tr	Tr
	A. roseus ..	1	—	—	—	—	Tr
	Psylla ..	1	—	—	—	Tr	Tr
D	Winter Moth Caterpillar	7	2	2	2	2	3
	Capsid ..	24	2	1	5	7	10
	Psylla ..	3	—	—	—	2	3

SYSTEM OF MARKING.

Winter Moth Caterpillar.—The figure given is an estimate of the actual number of caterpillars per tree, and represents an average obtained from counting every individual tree.

Psylla and Aphis.—A figure of 10 is given where the attack is very heavy, and this figure falls to 1 where the attack is slight.

Tr=trace, indication that a few scattered individuals were present.

Capsid.—The figure given represents the percentage number of leaf trusses showing characteristic markings. As with Caterpillars, the figure is the average arrived at after estimating each tree.

Winter Moth Caterpillars.—It had been found, in previous trials, that the best tar-distillate washes did not appear to give a complete control of winter moth caterpillars, and, at best, only effected a partial reduction in numbers. On the other hand, it has been found that under laboratory conditions, Washes A and B will give almost 100 per cent. kill on winter moth eggs. In no case have results of this kind been obtained in the field, and one is led to seek for a reason. There may be a number of factors which account for the discrepancy.

In the first place, there is the possibility of caterpillars getting on to the trees, where they have not been hatched from eggs laid there. Some larvæ are known to be carried by the wind for considerable distances, supported either by so-called "bladder" hairs, by which they are covered, or by threads of silk, in the same way as young spiders. They may possibly arrive on the trees from outside sources in this way.

Again, although it is easy to find eggs of aphides and apple sucker, since they are laid in more or less exposed situations on the bark, it is by no means so simple to find large numbers of winter moth eggs. The female moths may lay from 100-200 eggs, and it is by no means uncommon for 50 moths to be taken on one grease band. A careful search should reveal the presence of numbers of eggs, therefore, and yet it is very difficult to find them in any great quantity. The female moth may take trouble to conceal some of her eggs in crevices and under loose bark, in which position many would escape contact with a wash, applied under field conditions, and would hatch normally.

Finally, it is by no means certain that all the winter moth eggs are laid by the time spraying is done. The March moth probably escapes in any case, but the ordinary winter moth (*C. brumata*) appears to ascend the trees over a long period, and it is quite conceivable that the caterpillars which appear to survive spraying really emerge from eggs laid after spraying is completed. Whatever the explanation, it is certain that no tar-distillate wash, used in these trials, can be relied upon regularly to give a tree clear of caterpillar.

In Orchard A, Mortegg appeared to give the best result, but in orchards C and D the other two washes, Battle's and Tarolite, came out with rather better figures. The differences, however, are small, and one cannot conclude that any of the three proprietary washes was superior to the others. The best sprayed trees, however, always had about half the number of caterpillars that were to be found on the controls. Washes A and B are again slightly less effective than the tar-distillate washes, with Wash B rather inferior to Wash A. Indeed, it may be said that, except in Orchard D, neither of these two exercised more than a very slight control.

Capsid Bug.—The results of previous trials in an orchard in South Warwickshire indicated a good control of capsid bug by 10 per cent. strength of Mortegg and Carbokrimp. Observers in other parts of the country, however, have found very little effect on this insect, and conclude that tar-distillate washes cannot be relied upon to control it. The results of trials this year seem to confirm their conclusions, for, in Orchard A, there was little difference to be seen between sprayed and unsprayed trees, except where Mortegg had been used. Examination of the control trees, however, indicated an extremely uneven distribution of the insect, and this was so pronounced that the chequer-board arrangement of the trees had not altogether

overcome it. Ten control trees gave figures which varied from 0 to 75 per cent. Capsid bug attack, varied according to their location, and a further extensive examination of the orchard, showed that the insect was very much more prevalent on one

TABLE III.—DAMSONS.

Orchard	Pest	Control	Mortegg	Tarolite	Battle's	Wash A	Wash B
A	Leaf-Curling Aphis	13 per cent.	Nil	Nil	Nil	Nil	Nil
	Winter Moth Caterpillar		No	estimation possible.			
B	Leaf-Curling Aphis	25 per cent.	1 per cent.	1 per cent.	2 per cent.	1 per cent.	2 per cent.
	Winter Moth Caterpillar		No	estimation possible.			
A	Leaf-Curling Aphis	2 per cent.	All trees	PLUMS showed less than 1 per cent.	leaves curled.		
	Winter Moth Caterpillar		No	estimation possible.			
D	Leaf-Curling Aphis	30 per cent.	All less	than 1 per cent.	showing curling of the leaves		
	Winter Moth Caterpillar	10	No	appreciable reduction in numbers.			
C	Leaf-Curling Aphis	Nil	Nil	Nil	Nil	Nil	Nil
	Winter Moth Caterpillar	30	15	20	15	10	10

SYSTEM OF MARKING.

Leaf-Curling Aphis.—The figure is again an average one, representing the percentage of curled leaves on the tree.

Winter Moth Caterpillar.—The figure given is an estimate of the actual number of caterpillars per tree, and represents an average obtained from counting every individual tree.

side than on the other. The same wash in one situation appeared to give a clean tree, whilst 20 yards away it had no apparent effect. The rest of the orchard had been sprayed with Mortegg, and the same effect could be seen.

In Orchard D, in South Warwickshire, within a few miles of the orchard where last year's experiments were conducted, all washes gave better figures than the controls, but here, as last year, the trees were arranged in rows and not chequered. The control exercised is probably, therefore, only an apparent one, due to the very uneven distribution of the insect, and, since tar-distillate washes have been used on a larger scale in commercial orchards, evidence has accumulated pointing to the fact that very little control of capsid bug is to be expected.

Plums and Damsons (*Leaf-Curling Plum Aphis*).—All washes, including A and B, seem to control this aphis quite effectively. In no case was the amount of curling appreciable on sprayed trees, and, where it did occur, appearances indicated that a small portion of the tree had not been covered by the wash.

Winter Moth Caterpillars.—The position with regard to plums and damsons is precisely the same as with apples. Since spraying is usually carried out earlier on plums and damsons, one would expect to obtain rather less control, and this seems to be the case. Large trees are very difficult to estimate in this respect, but there was no reason to think, from a careful observation, that anything more than a partial control had been exercised.

Bud Scorch.—In no case was any damage caused to the blossom buds in these experiments. All the sprayed trees carried bloom quite equal to the controls, but the subsequent crop was severely thinned by late frosts.

Acknowledgment is made to the County Horticultural Staffs for their assistance in carrying out these trials, and to the proprietors of the orchards for providing the facilities.

Conclusions.—1. Since the number of aphides and apple sucker were small on the control trees, the relative merits of the washes were difficult to determine.

2. Mortegg, Battle's Winter Wash and Tarolite all appear to control these insects quite effectively. Washes A and B were not quite so satisfactory on apples, but controlled leaf-curling plum aphis well.

3. None of the washes gave more than a partial control of winter moth caterpillars.

4. Results obtained on the control of capsid bug may be very deceptive. The distribution of this insect, even over a

small area, may be very irregular, and unless precautions are taken to allow for this, one may easily arrive at wrong conclusions as to the value of any particular wash.

5. The covering power of di-nitro-cresol washes was equal to that of any of the tar-distillate washes. Di-nitro-cresol washes leave marked stains on the clothes and skin, but do not leave a residue which clogs the spraying machinery.

6. The trees were in no way harmed by any wash, and the strengths used may be regarded as safe when applied on Plums and Damsons before the end of January, and on Apples before the end of February.

NOTE.—Permission has been given by the respective manufacturers for the publication of the names of the proprietary washes in these results.

* * * * *

IMPERIAL ECONOMIC COMMITTEE'S REPORT ON THE MARKETING OF EGGS AND POULTRY, AND OF HONEY

THE Imperial Economic Committee was appointed in March, 1925, by the Governments of the United Kingdom, the Dominions, India, the Colonies and Protectorates, to consider the possibility of improving the methods of preparing for market, and marketing, within the United Kingdom, the food products of the overseas parts of the Empire, the object being to increase the consumption of such products in the United Kingdom in preference to imports from foreign countries, and to promote the interests both of producers and consumers. In each of the Reports issued as the result of the Committee's investigations—of which there are now seven—the Committee particularly stress the need for standardization and grading if produce is to be handled rapidly and economically.

The inquiry of the Committee into the marketing of eggs and poultry and of honey has lately been completed, and the results and findings are issued in the form of two Reports, published in one volume.*

Marketing of Eggs and Poultry.—In the Report dealing with eggs and poultry the Committee acknowledge the assistance they have derived from the Report on Egg Marketing and the Report on the Marketing of Poultry, which were issued by the Ministry of Agriculture and Fisheries in its Economic

* Report of the Imperial Economic Committee on Marketing and Preparing for Market of Foodstuffs Produced within the Empire: Sixth Report: *Poultry and Eggs*; and Seventh Report: *Honey*. H.M. Stationery Office, 1s. net. [Cmd. 3015.]

Series in 1926†; the study of these two Reports is commended to all connected with the industry.

The Committee refer to the efforts which certain Dominions and foreign countries have made to ensure a high standard of quality and of uniformity in the eggs exported. Particulars are also given of the legislative action taken in certain cases. Although there are notable exceptions, much of our home produce reaches the market ungraded and poorly packed, and there is a pressing need for the acceptance and observance of generally recognized standards. The Committee recall that in the Report on Egg Marketing (Economic Series No. 10), it is recommended that home-produced eggs, especially those intended for the wholesale market, should be classified and graded to recognized standards and packed in standard packages; definite standards are put forward for consideration. The Committee have been assured by representatives of the National Farmers' Union and of the National Poultry Council that the general correctness of the conclusions reached in that Report is accepted. It may, therefore, be taken as recognized, fairly widely, that standardization of poultry products is an inevitable reform to which the poultry industry in Great Britain must resort sooner or later. In this connexion the Committee make the important statement that consideration should ultimately be given to the adoption of uniform standards throughout the Empire.

Attention is also called to the suggestion, put forward by the Ministry, that eggs produced in England and Wales should be marketed under a national brand or trade mark, and that, in the absence of mandatory legislation, there should be an organization to safeguard the reputation of the mark and to ensure continuous supply. These proposals, in the view of the Committee, are a logical consequence of the adoption of standardization, and cannot fail to be of substantial value. Whatever scheme of reform is adopted, the Committee stress the importance of securing the support of the majority of producers and of the more important dealers and retailers.

On the question of the exercise by the consumer of a preference for Empire products, the Committee believe that such preference would operate in the first instance in favour of the home producer, but obviously it could only become

† Economic Series, Nos. 10 and 11. H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 6d. each net, post free 9½d. and 9d. each, respectively.

effective if there were means of identifying the origin of the produce, and this necessitates adequate marking. The Standing Committee, appointed under the Merchandise Marks Act, 1926, have, however, recently advised against such marking of eggs until, *inter alia*, improvement has been effected in the preparation for market and in the marketing of home-produced eggs. The Imperial Economic Committee interpret this decision as merely postponing the issue of such an Order until certain conditions are fulfilled, and they express the hope that it may be possible, within a relatively short period, to ask the Standing Committee to review the position in the light of any fresh evidence that may be produced, and to take into account the effect of a Marking Order on supplies from the Empire, both home and overseas.

In dealing with the marketing of poultry, the Committee point out that several countries have established a good reputation for the quality and reliability of the poultry they send to the British market. The birds are well-finished, uniformly-sorted, carefully-packed, and consequently easily inspected for trade purposes. This is the result of production, throughout considerable areas, of fowls of one general type, which are "finished" to similar standards, and then sorted and packed on a uniform plan. The Committee emphasize the important part played by establishments that specialize in commercial fattening and finishing, and they refer, in this connexion, to the fact that the Ministry of Agriculture and Fisheries has already, in the Poultry Marketing Report (Economic Series No. 11), drawn attention to the rough and unfinished condition of much of the home-produced poultry sent to market, and that the Ministry, after consultation with producers and traders, has drawn up definite standards for finishing, grading, and packing which have been the subject of public demonstration. The Committee express the view that a condition precedent to the general application of commercial finishing stations must be the establishment of greater uniformity in type of birds throughout considerable areas.

The Report is comprehensive, dealing as it does, *inter alia*, with such questions as production, imports, consumption, price variations, packing, grading, and preservation. The last chapter summarizes the main conclusions of the Committee, and, in an Appendix, a note is included on State-aided efforts in some parts of the Empire to improve poultry stocks and the methods of poultry keeping. In other Appendices are given tables showing the imports of eggs

over a number of years, diagrams showing variations in prices of eggs, and statistical data relating to the trade in poultry.

Marketing of Honey.—The Report on the Marketing of Honey stresses the importance of bee-keeping to agriculture; its economic value to the fruit and general farmer is not restricted to the value of the honey produced, but is reflected in more copious crops of fruit and pasture. An increase in the demand for Empire honey, therefore, does not merely mean an increased demand for a pleasant food, but also increased fruit crops and better pastures.

Production in the United Kingdom is steadily recovering from the severe set-back received a few years ago through the general loss of bees from widespread disease; all home-produced honey finds a ready sale without appearing on the wholesale markets which are supplied by imports. Nearly half of these imports is produced within the Empire, notably Jamaica, New Zealand, and Canada; of foreign countries, the U.S.A., the West Indies, and Chile are the chief suppliers. Strict control has established for New Zealand honey a high reputation for quality and reliability; the control consists chiefly in centralized marketing, with its incidental standardization of grades and of containers, and the prohibition of the export of any honey below a specified standard of quality. Other Dominions have adopted similar methods of control, or are about to do so. Once again, the need is emphasized for defining and maintaining standards of quality in order to enable full advantage to be taken of the methods and needs of modern commercial practice.

•THE COUNCIL OF AGRICULTURE FOR ENGLAND

THE twenty-sixth meeting of the Council of Agriculture for England was held at the Middlesex Guildhall, Westminster, on January 26, Mr. W. R. SMITH in the Chair.

Electricity in Rural Areas.—Mr. DENTON WOODHEAD, the Vice-Chairman of the Standing Committee of the Council, moved the adoption of the Standing Committee's Interim Report on Electricity in Rural Areas. Its purport was that the Conference called by the Electricity Commissioners in November last had appointed two sub-committees to report on certain technical and administrative questions. It was expected that their reports would be received in March next, and the Standing Committee considered that it would be better that full consideration of the matter should be delayed until the reports were to hand. Mr. WEARMOUTH (Durham) supported the Report. He thought it might be possible to get electricity applied to agriculture first of all in those mining areas in which sub-stations already existed. Sir DOUGLAS NEWTON, M.P. (Cambs.), referred to the high standard which was insisted on in the erection of transmission lines in this country, requiring an outlay at present of from £600 to £800 a mile. Before electricity for country districts was practicable, that cost would have to be reduced to something like £150 to £250 a mile, the cost per unit being brought down to 1d. or 1½d. The Report was adopted by the Council.

Fluid Milk Marketing.—Mr. A. W. ASHBY, on behalf of the Standing Committee, moved the adoption of their Report on the Ministry's Report on Fluid Milk Marketing (Economic Series, No. 16). It recommended the volume to members of the Council and to the agricultural community generally, as it dealt very thoroughly with the production, wholesale sale, transport, and retail sale of milk in England and Wales, giving special attention to a definition of the areas of milk production and consumption, the annual and seasonal variations in production, and the movement of milk towards the centres of consumption. The questions of the grading of milk, and the demand and prices for the grades, were also dealt with as matters of special interest to milk producers. The great difference between the average daily consumption of milk in this country ($\frac{1}{2}$ pint) and that in other countries on the Continent (from 1 to 2 pints) was noted, and the need stressed for greater publicity for milk as a good cheap food both for

young and old. The Report quoted the Ministry's Report as follows :—

The road to increased demand lies through emphasis upon quality and guarantees of safety, and specially in raising the status and standing of ordinary milk. . . . Given this basis of confidence, methods of publicity should be widely employed, and in view of the great public interest involved in securing adequate supplies of good milk for all young people, the support of public authorities should be actively accorded.

Mr. Ashby said that the milk industry was the one branch which British farmers could expand very rapidly. The demand for milk was increasing, and the Standing Committee's Report suggested that the Public Health Authorities should take a greater share in publicity for increased consumption. Mr. HAMILTON (Lancs.) considered that it was not fair to the industry for Medical Officers to recommend the use of dried milk in preference to liquid milk. Mr. WOODHEAD called attention to the fact that in the North of England an experiment was being made with slot machines for supplying milk in populous areas. Mr. GIBBONS (Glos.) called attention to the great difficulty in rural areas for many people to get milk ; it would certainly raise the consumption over the country if they could be enabled to do so. The Report was adopted.

Better Marketing.—The Right Hon. Sir FRANCIS ACLAND Bart., Chairman of the Standing Committee of the Council, moved the adoption of the Standing Committee's Report on the Improvement of Marketing of Agricultural Produce. He pointed out that the Standing Committee had worked hard on this Report since the last meeting of the Council in October, when the Council commissioned them to prepare it. He, personally, through a chapter of accidents, had not been able to be present except at the first and last of the meetings. He considered that the Report, as presented, gave, in a useful form, a summary of the present position as regards all the main commodities, together with a reference to the sources of information. The Ministry's orange books were very excellent and interesting and should be more widely read. Considering the marketing of milk, Sir Francis suggested that the milk distributing combine might consider making a freewill offering to the industry in the form of a contribution to the campaign. At present, the retailer got quite a considerable margin for the services rendered. It was possible that the retail price might be reduced, and publicity directed to the general improvement in the quality of milk. Both would then lead to increased consumption, which would tend to reduce the present

bugbear of surplus milk. On the general question, he was not sure that the National Farmers' Union had been on sound lines in advising their branches to go into the question of improvement of marketing as a local matter and to get into touch with the agricultural organizations in their counties. Agriculture as a science was one matter, and agriculture as a business was another, and advisers who were best qualified to help on the scientific side might not be sound on the business side. The present Report endeavoured to show the way forward. It was too much to expect that individual farmers would, at the present time, sit down and plan better business organization. It would have to be a national movement, and the Government would have to help.

Mr. WOODHEAD referred to the circumstances under which the Report had been produced. The farmer, as producer, ran all the risks of production, and the middleman, as a rule, came in and took the bulk of the profits. He would say to the industry, "Whatever anybody does for you, the success or otherwise of your undertaking will depend absolutely upon what you do for yourself." It was no use trusting to Governments or politicians. Running through the whole of the Report would be found the suggestion that organizations should be set up to deal with the combined sale of farm produce. Farmers would have to make contracts with these organizations and stick to them. It would not do for them to go afterwards to someone who offered 1d. a lb. more with a view—as a rule—to breaking the co-operation. Another point was that, in combining produce, the man who produced the best goods should have the best price. Then there was the question of packing and grading. These should be done under expert direction. As regards transport, railway companies should be approached reasonably and logically as suggested in the Report. The industry had a right to cheap transport if it was to produce cheap food. There was no possibility that the agricultural worker could be paid less than at the present time, so that cheapness could not be looked for from a reduction of wages.

Mr. CHARLES ROBERTS (Cumbs.) expressed gratitude to the Standing Committee for having brought into one short Report a general conspectus of the whole subject as set forth in the Ministry's Economic Series. His criticism was that the Report did not exactly bring to a point what the farmer should do and what the Government should do. He hoped the Minister would to-day tell the Council what the Government was

prepared to do, and what the farmer was expected to do. He was not sure whether the suggestion was for farmers to deal piecemeal with the question, or otherwise. He hoped it was not piecemeal. He wanted the Government to continue its propaganda by way of public reports and marketing demonstrations, to define, by statute, grades and standards for different classes of produce, and to supply more capital where capital was needed.

Mr. WALTER GUINNESS, *Minister of Agriculture*, said he welcomed the Standing Committee's most valuable Report. He had not intended to discuss it this morning, being rather anxious to hear the views of the Council upon it. Mr. Roberts, however, had asked for the Government's proposals, and he would say that, in the marketing of each commodity, Government action fell into three stages. First, a stage of investigation and demonstration; then a stage of consultation with the industry; and lastly, the enactment of statutory powers to enable better organization within the industry. One commodity only had reached the last stage, viz., eggs. Fruit and pigs had reached the second stage. The Minister discussed the question of better grading and sale of eggs, and said that he hoped the scheme which had been produced by the Poultry Advisory Committee would be adopted by the industry within a week or two.

A Bill would then be introduced to enable the Ministry to define the grades under which eggs coming under a voluntary scheme could be sold, probably with a National Mark. Preserved eggs would have to be identified from fresh eggs, and the marking of them could only be imposed in combination with an Order for the marking of imported eggs. The Bill for defining grades, therefore, clearly would not be able to come into effect until an Order had been made for the marking of imported eggs. The Government had undertaken to find time to pass the necessary legislation this Session. The Government might, in the Bill, take power to make regulations for the grading of other forms of agricultural produce.

Mr. WEARMOUTH considered that, under the Short Term Credits Scheme, Agricultural Committees should be enabled to give approved farmers credit on their stocks of wheat at harvest time and before it is sold. Mr. R. G. PATTERSON (Staffs.) said that no problem was of more vital importance to the farmer to-day than that of proper marketing. It had been stated in the Press that meat could be purchased in London at 8d. and 8½d. a lb., and the choice parts of it sold

at prices ranging up to 2s. 8d. If a butcher sold half a carcass at 2s. a lb. he could afford to give the other half away. The farmer was at the mercy of the middleman on the one side and the manufacturer and merchant on the other. The Report, in his view, indicated a need for two things. First, that farmers should endeavour to gain control of the means of distribution; that was a very large and difficult question, and probably impossible to-day. The other was a kind of Government control in the interests of the industry. It was for farmers to make up their minds whether a remedy was to be found in combination and co-operation coupled with assistance from the Government, or whether Government control would be quicker and more effective.

Mr. W. B. TAYLOR (Norfolk) said he had somewhat hastily scanned the 14 pages of the Report, and was wondering what the average working farmer and smallholder would think of it as a practical means of solving the problems which faced him to-day. There did not appear to him to be one practical proposal that was courageously put forward by the Report for the benefit of the industry. He had heard politicians of an irresponsible character talking about pooling the goods of the nation, and, when a practical Committee brought proposals of this kind before the Council, he would suggest that Mr. Patterson's proposal for control was of a far more practical character. It was clear that the industry was unable by itself to weather the storm. Alderman DAVIS (Durham) said he was somewhat nervous of the paragraph which suggested Government assistance in warehousing the wheat crop. He also thought the pooling of wheat idea a very dangerous one in connexion with grain produced in this country.

Mr. GEORGE EDWARDS thanked the Standing Committee for the serious consideration given to this important subject. He would like to have seen more practical suggestions, especially in relation to the marketing of wheat. He thought that, sooner or later, the Government would have to deal with the subject of marketing wheat and other cereals. The Committee might have made practical suggestions for the stabilization of prices. The actual assistance required from the Government to improve marketing should be definitely set forth. The suggestions made in the Report would involve a vast organization and a great deal of capital. If farmers would use their great organization, the National Farmers' Union, to initiate this new marketing process, they would be performing a great service to the industry. He did not care who did the work,

provided the industry was helped to put its goods on the market, so that there was not so great a gulf between the producer and consumer. What was to be done, should be done speedily. The smallholder had been hit very hard, and attempts were being made to bring the agricultural labourer's wage down much lower, to a starvation wage.

At this point, the CHAIRMAN said he would like the Council to keep in mind, in discussing the Report, that it was just three months since the resolution was passed referring the subject for consideration to the Standing Committee. It had reported on 11 subjects, and it was impossible to expect complete and definite recommendations to be made on any one of them, having regard to the particular circumstances. If the Council now wished the matters pursued further, if they wanted any particular subject examined in detail, with a view to concrete proposals being made, that could only be done by means of a body appointed for the purpose which would have proper time to go into the problems.

Mr. F. T. K. CROSS (Berks.) suggested that the Report should be treated as an Interim Report, to be amplified after a fuller examination of some of the subjects. More definite recommendations could then be placed before the Council. He suggested that co-operation and the question of what should be the unit of management for marketing might be further considered and reported upon. Mr. CHRISTOPHER TURNOR said that the Report was a valuable contribution on the present agricultural situation. As regards the control of prices suggested by Mr. Patterson, it was important to know whether the control was to be imposed by the Government or would be the result of organization within the industry. He thought the latter the better form, but in these times the Government would probably have to do more than would be welcome in ordinary times. Agriculturists should keep in mind control, not only of prices, but of the industry, by the industry itself. The Report placed the Council in a position to inquire in each county what could be done. It would be extremely unwise to attempt to create organized marketing over a wide range of commodities at once. In the last 20 or 30 years failure to bring about sound development had ensued through trying to do too much at headquarters, leaving local initiative out. It was necessary now to get down to localities.

Mr. GEORGE DALLAS, speaking as a member of the Standing Committee, welcomed the suggestions by previous speakers:

Some of the members of the Committee had felt strongly that their investigations should be continued. In his judgment, agriculture was on the eve of one of the greatest changes for generations. It was becoming plain that the British farmer would have to standardize his goods; he was confident that the farmer would readily respond. Major S. V. HOTCHKIN (Lindsey) also welcomed the Report, which, in his view, contained practical recommendations on sound lines. They hinged on co-operation by farmers in the business of marketing their produce. All big industries were organized nowadays. The longer the period of depression the more difficult it would be to organize, because the farmer would get shorter and shorter of capital, and would be forced more into the hands of the local corn merchants, dealers, and tradesmen. If they went to these men for help in bad times, they would stick to them afterwards. Some form of temporary control seemed necessary at once to save the farmer who could not go on producing food and paying labourers at a loss. Mr. R. C. GREY (Hunts.) said he had been much struck by Mr. Patterson's suggestion that the farmer should either get in close touch with the consumer, or have some form of Government control. He did not understand why the consumer should be content to pay the price he did for meat, knowing the wholesale prices. He suggested that since the War the industry had been off economic lines. Mr. OWEN WEBB (Cambs.) said he agreed with Mr. George Edwards and Mr. Dallas that the Report should deal more closely with wheat. The policy of the plough was the only policy that could save agriculture.

Mr. A. W. ASHBY said that, on the whole, the Standing Committee might, he thought, be satisfied with the work they had done. The Report contained suggestions and recommendations which, as a composite body, it could wholly and fully agree to put before the Council. Those who led farming opinion could now go off to their local areas with the Report as one that was adopted by the Council. He referred then especially to the question of grades and standards for eggs, hoping that legislation would speedily be possible. He thought, however, that the machinery at present suggested might result in riveting the present merchandising system of eggs on the backs of egg-producers. That system should rather be developed and extended as the Standing Committee's Report suggested. There should be a string of producers' collecting depots working under a central system, running such pooling arrangements in their own areas as might be necessary, and

so organizing supplies for the wholesale markets. The existing marketing system gave too little information to the farmer about what the ultimate consumers' markets wanted. Every farmer who was going to be concerned in a grading system would have to realize that its merits went back to the very foundation of his business. A very large part of his produce would have to get into the first grade, and it was there that the nation as a whole became concerned in the problem. The home industry had to recover the good-will of the woman who carried the basket. The danger at the moment was that farmers would put off practical action too long.

Sir FRANCIS ACLAND, in concluding the debate, said that the Standing Committee would certainly give careful consideration to the suggestions which had been made. It had already stated in the Report that it would go further into the question of the buying of wheat under national control. They would probably also consider the indication of the parts which the farmer and the State should play in working towards a proper marketing system. He would like every farmer to remember this simple story: "There were people living on two sides of a stream who wished to be more closely united. When the torrent was strong, they always said, 'We cannot build a bridge'; when the flood died down they always said, 'There is no need for a bridge.' They were rather a foolish people. Let us do better." Mr. WOODHEAD suggested that the Report might be printed and circulated among the Agricultural Committees of the counties. On the CHAIRMAN'S suggestion, the consideration of the printing of the Report was left to the Standing Committee. The Report was then put to the meeting and adopted.

Re-election of Standing Committee.—It was proposed by Sir GEORGE COURTHORPE, seconded by Mr. F. T. K. CROSS, and carried, that the Standing Committee be re-elected *en bloc*.

Milk Publicity.—Mr. DALLAS moved:—

That this Council considers that, in view of the fact that the conditions of the production of milk in this country have so much improved in recent years, all possible steps should be taken to bring to the notice of the people of this country the food value of milk with the object of increasing its consumption. Such action would be not only in the interests of agriculturists but also of public health. The Council urges that the educational work in the schools and amongst the public which is now going forward in this matter should be developed to the very fullest extent.

He said that on this subject the Press of the country could do a great deal to help Agriculture. Some years ago people

were alarmed when Medical Officers of Health made damaging statements as to the quality and condition of the milk they had examined. These reports were rarely in evidence nowadays. He gave two instances in which the Medical Officers' reports had in a few years improved enormously. In 1927, in London, no tubercle at all had been found in milk samples, although there was 25 per cent. in 1921 and 2.5 per cent. in 1926. In Godalming, the Medical Officer said that, of 26 samples taken in 1926, 12 were up to the standard required by the Ministry of Health for certified milk, and in no case was tubercle discovered. It could not be too strongly emphasized how bad it must be for children to be brought up on tinned, condensed, skimmed milk. He then referred to a scheme set up in the schools, very largely by the aid of retailers, whereby children were sold bottles of milk, at a very low cost, for consumption in school hours. This scheme should be extended, to the great improvement of the health of the people. Mr. HAMILTON seconded the motion.

The MINISTER said he would like to endorse what Mr. Dallas had said as to the need of bringing home to the consumer the very considerable improvement which had taken place in the milk supply. The Government were alive to the need for publicity concerning the improved position, and the Empire Marketing Board were in negotiation with the industry with a view to launching a great campaign to encourage people to drink milk. The Board expected to get support from the industry, and were ready to spend within the next two years a total of £100,000 on the work. The Ministry most strongly welcomed Mr. Dallas's resolution, and would continue to do all it could by influencing those who control public education to see that children are taught in the schools the value of milk as an article of diet. Mr. GEORGE NICHOLLS (Soke of Peterborough) put in a plea for the small cow-owners, some of whom were having to dispose of their cows as they were unable to meet the regulations under the Milk and Dairies Order. The villages, in consequence, were being forced to take the condensed skimmed milk. Mr. C. B. FISHER (Northants) also spoke in support of the resolution, though he said he would like to add words referring to the inferiority of tinned, skimmed milk. He gave particulars of an analysis of this article which showed it to be very much over-priced. He hoped that the Ministry of Health would have information collected from schools where milk is being given, so that results of improvement in physique could be recorded and appreciated. He

would like to emphasize the resolution he brought forward at the last meeting of the Council on the subject of the alteration of the Food Council. It should have a fairer representation of producers and consumers, so that questions such as the retail price of fresh milk and tinned, condensed milk could be properly gone into.

Sir DOUGLAS NEWTON said that the matter divided itself under two heads: one, propaganda, and the other, salesmanship. If the officers of the Ministry of Health and the Medical Officers of Health could agree that good milk was now being produced it would be a considerable benefit. As regards salesmanship, a start might be made in connexion with the supply of milk at the schools. Capt. E. T. MORRIS (Herts.) gave figures of imports of machine-skimmed, condensed milk. He agreed with Sir Douglas Newton that there should be more co-operation between the Ministries of Health and Agriculture. We were spending large sums on the health of children, and it was directly against the public interest that these large supplies of machine-skimmed, condensed milk came into the country. Mr. WM. McCracken (Cheshire) referred to the value of county milk competitions, the result of which was to show that propaganda on the value of milk could be carried forward without any doubt or fear. Mr. H. W. THOMAS (Hants.) suggested that the motion should be amended to ask for the prohibition of the importation of skimmed, condensed milk. The CHAIRMAN, however, referred to the fact that the resolution came from the Standing Committee, whose views on tinned, condensed milk were definitely stated in the Marketing Report which had been already adopted by the Council. The motion was put to the meeting and carried.

Report in this Journal.—The Rt. Hon. Lord STRACHIE (Somerset) moved:—

That attention be called to the inaccurate report of the proceedings of the Council of Agriculture for England on October 20, 1927, which appears in the December issue of the JOURNAL OF THE MINISTRY OF AGRICULTURE.

He said that while a mis-statement of the Minister of Agriculture with reference to his (Lord Strachie's) attitude to the Agricultural Rates Bill, 1896, had been included in the report in question, his reply on that point had been omitted. He wished to make it clear that while he had voted for one particular amendment during the second reading debate on the Bill, he had afterwards supported the Bill, and had ever since been a strong supporter of the Act. The MINISTER replied that extraneous and party questions which had been

raised during the debate had been purposely omitted from the summary published in the JOURNAL. The CHAIRMAN decided that there could be no discussion on the subject, and proceeded to the next business.

Foot-and-Mouth Disease.—Col. Sir GEO. COURTHOPE, M.P. (East Sussex), moved:—

That this Council, in view of the serious increase of Foot-and-Mouth Disease, and of the evidence that the virus reaches this country in active form in the bone marrow of imported chilled meat and bacon, urges the Minister of Agriculture to issue an Order prohibiting the distribution within the United Kingdom of any meat or bacon imported from countries where Foot-and-Mouth Disease exists, unless all bone has been removed from such meat or bacon prior to its importation.

He said that, in the second Progress Report of the Foot-and-Mouth Disease Research Committee, published about a year ago, there were statements that the Committee had discovered evidences of active virus of Foot-and-Mouth Disease in the bone marrow of meat, after very long periods, in spite of chilling, freezing, or salting. The incidents quoted in the Report were not actually in imported carcasses, but he understood that evidence had accumulated since to the effect that a large number of sides of bacon and carcasses did contain infected marrow. This made a sufficient case for him to ask the Minister to take administrative action to prevent the distribution through the country of infected bone with the meat. The value of imported beef and bacon from Foot-and-Mouth Disease countries was about 50 million sterling a year. Boned bacon and ham were already coming to the country from North America; meat could be similarly treated. This country had quickly increased its production of pig products to meet the deficit through the embargo on the importation of pork and fresh pig carcasses from Europe. Nothing would benefit the arable farmers more to-day than that there should be a substantial increase in the animal population. Very little reliance could be placed upon inspection and notification of disease in the Argentine. The Minister had powers to take the action proposed, and he thought it provided him with a great opportunity to convince agriculturists that he had their interests truly at heart. Mr. JAMES DONALDSON (Oxford) seconded the motion. It was, he said, the duty of the Minister to use every means in his power to-day, Argentina was reeking with the disease, and it was clear that the meat was capable of bringing that disease to this country. The flocks and herds of the country should be protected.

The MINISTER, in reply, assured the Council that everything was being done that could be done at present to stop the introduction of infection. Two of the Veterinary Staff of the Ministry were now in South America, and the Government there had fully accepted the conditions of the Ministry which gave effective prevention of the introduction of infected animals into the slaughterhouses and freezing plants in Argentina. He thought that Sir George Courthope might have misunderstood the position somewhat. There was no evidence that infection had been brought in from the Argentine. The facts to which he had referred were in laboratory experiments showing that, theoretically, infection might be brought. He could not proceed to deal with the trade unless he had such definite evidence as he had in the case of the Dutch and Belgian pork carcasses 18 months ago. Bone marrow was a danger, but was nothing like the danger of the serum from the fresh, unfrozen carcasses the Ministry was now keeping out from Europe. If there were evidence that disease was brought in the bone of beef, he thought it would have to be dealt with by embargo, and not by boning. He was informed that it would be impossible to import boned, chilled meat from the Argentine.

Sir FRANCIS ACLAND gave an instance in which suspicion as to the cause of an outbreak in North Somerset was attached to bones on a rubbish dump, these having come from imported meat carcasses. The motion was then put to the meeting and carried.

Credit for Land Drainage.—Mr. G. G. REA, C.B.E. (Northumberland), moved :—

That this Council respectfully urges His Majesty's Government when considering the conditions of their Long Term Credit Scheme to include provision for granting loans on favourable terms to individual landowners for the purpose of enabling them to drain, or re-drain, their agricultural land.

Mr. REA said that the question of land drainage was very serious at the present moment. The Government had taken steps to bring forward drainage measures and to encourage land drainage in many ways. Their schemes were, however, limited rather to large areas. He proposed that individual landowners should be helped with loans at favourable rates to enable them to drain, or in some cases re-drain, agricultural land. Many thousands of acres of land at present derelict owing to lack of drainage. The rates of interest charged by the Lands Improvement Company were more than the landlord could pay. Rents could not be raised to recoup

expenditure. Much grazing land was also in a waterlogged condition, of very little value without drainage, producing liver fluke in sheep. The Government had a large amount of money deposited with it on which it paid a very low rate of interest, and he suggested that this might, through the instrumentality of legislation or other means, be used for the purpose. Mr. MCCracken seconded the resolution, and called attention to the large amount of old, inefficient land drainage work that existed in the country. It was in the national interest that steps of the kind proposed should be taken. Mr. GIBBONS thanked the Minister for one of the most useful Acts of Parliament ever passed, viz., the recent Land Drainage Act. Heavy clay land which he owned and farmed was drained under the old system referred to by Mr. McCracken, which was still acting most efficiently. The MINISTER said that all the Government could do was to offer for field drainage the lowest rates that would be available in the way of capital for any improvements. He referred to the good work that was being done by the Lands Improvement Company in the direction indicated. The motion was put to the meeting and agreed.

Meat Prices.—Mr. C. B. FISHER, C.B.E. (Northants), moved :

That an inquiry should be instituted into the cause of the difference in value of Scotch and English beef on the Smithfield Market, and that the Ministry of Agriculture and Fisheries be asked to appoint forthwith a Committee for that purpose consisting, amongst others, of one Grazier, one Feeder in yards or otherwise, and one Butcher.

Mr. Fisher said that English longsides of beef were quoted day after day at 48/-, and Scottish longsides up to 60/-, being in some cases a difference of about £10 a head. The least the Council should ask the Ministry in connexion with its Meat Report, which was under consideration, was to appoint a practical Committee to assist in it. He thought that breeding for milk had been carried too far. It was time that breeding for beef received greater encouragement, and the question of a smaller class of animal to meet the requirements of the trade had to be considered. Mr. J. O. ADAMS (Northants) seconded the motion. The MINISTER replied that he fully agreed as to the importance of the question. There did not, however, seem to be any object in setting up a special Committee at the present time, because two inquiries were going on. First, the inquiry, now nearing completion, in connexion with the preparation of a further number of the Economic Series, and the later inquiry by the Livestock Sub-

Committee and the National Farmers' Union. He did not think it would advance the solution of the problem to set up a third body as suggested. The resolution was put to the meeting and lost.

Relief for Eastern Counties.—Mr. CLEMENT SMITH (East Suffolk) moved :—

That the attention of the Ministry of Agriculture and Fisheries be called to the critical position of Agriculture in the Eastern Counties—and the need for some immediate relief.

He said he wished to underline two words—"critical" and "immediate." He had never known the position of farming so difficult. Up to the last two years, he had been able to farm successfully to a certain extent, and to receive a moderate interest on his capital, but last year had altered the position. There was a debit balance on three farms of over £1,000, with no allowance for personal services or for interest on a capital of between £10,000 and £12,000. There were many cases worse than this, but he thought it might be regarded as a typical one in the Eastern Counties. Hundreds of farmers were simply hanging on a thread which could be cut at any time by bankers or traders. Land was going back, drainage, hedges, ditches, and buildings neglected, and landlords unable to help. Mr. W. B. TAYLOR seconded the resolution, saying that it might be made to apply generally over the country. One of the largest agricultural auctioneers in Norfolk had upwards of 80 farm sales for next Michaelmas already booked, and was unable to accept more. Barley, the staple cereal of Norfolk, had proved most disappointing through the failure of brewers to "buy British." They were making extraordinary profits with beer at aeroplane price and submarine quality. He would like to suggest that the Government should bring in a Pure Beer Bill and so secure a fair chance for British barley. The relief might be given by making the Education and Highway rates national charges, as they ought to be.

The MINISTER said that he thought the Eastern Counties were harder hit than any other part of the country. The Government fully realized the position and had extended a special measure of relief in the form of the Sugar Beet Subsidy. Norfolk and Suffolk were growing 87,000 acres of beet, which would mean at least £2,000,000 in subsidy. He would not repeat what was said by Mr. Lloyd George as to the impossibility of protection or subsidies, or what was subsequently said by Mr. Noel Buxton in the same sense. Other proposals had been considered by the Government, for instance, those concerning

malting barley, and he would ask Mr. Taylor to read the debates on previous Pure Beer Bills. It was pointed out by experts that, under a Pure Beer Bill, there would be grave danger of less British barley being used than now, because the brewer used sugar or foreign barley with a high content of starch for conversion into sugar, to enable him to counteract the excessive nitrogenous proportions in a good deal of lower-grade British barley. He had not the time now to develop the point. The particular debate he would refer to was in 1902. Other proposals had been brought forward which the Government had anxiously considered, but he did not hear that any of these partial remedies were within the Government control. They were examining the possibility of further lightening the farmer's burdens, either by basic grants from the Road Fund, or more relief of rates, or some method of that kind. He was unable, however, at the present stage to make any promise as to what it might be found possible to do.

After further discussion as to the desirability of making the resolution more general, the CHAIRMAN suggested that the word "specially" should be inserted after "Agriculture" in the second line. The mover and seconder accepted this, and the resolution was passed as follows :—

That the attention of the Ministry of Agriculture and Fisheries be called to the critical position of Agriculture, specially in the Eastern Counties—and the need for some immediate relief.

The meeting of the Council then terminated.

APPENDIX

REPORT FROM STANDING COMMITTEE ON IMPROVEMENT OF MARKETING OF AGRICULTURAL PRODUCE.

At the Meeting of the Council of Agriculture held on October 20, 1927, a Report was adopted as follows :—

- (1) That it is of urgent importance that the agricultural industry should consider the better marketing of agricultural produce in the light of the material now available, with a view to securing for the producer greater control over his product than he has at present.
- (2) That among the primary objects to be aimed at are closer touch with the consumer and better standardization both in the quality and quantity of supplies; and that the services which might be rendered in these ways would entitle the producer to receive a larger share of the price which the consumer pays.
- (3) That, though the assistance of the State would be necessary in setting up the marketing organization and machinery required for different classes of products, the movement must be primarily that of the producers, success being impossible without a guarantee of supplies.
- (4) That in order that producers should be willing to undertake the responsibility for initiating, setting up and seeing through new

marketing systems, they must be certain in advance that the profits accruing shall be secured to the industry.

- (5) That the question of benefiting the agricultural community by placing the purchase of wheat and meat, whether home-produced or imported, under national control deserves careful consideration.
- (6) That the Council of Agriculture for England may take a useful part in the movement for better marketing by preparing a report covering the scope of the above resolutions and indicating the practical steps which would be required, and that to this end the Standing Committee be instructed to act as they may think best, with a view to presenting a draft report at the next meeting of the Council.

The Standing Committee in response to this instruction, and bearing in mind that a Report was required for the next meeting of the Council normally to be held in December, decided to make a rapid survey of the field of agricultural marketing, taking into consideration the evidence of the Reports of the Economic Series issued by the Ministry and of certain selected institutions and individuals who had given special study to particular aspects of the matter, and to make a Report stating the views to which it had arrived after consideration of the facts and ideas so reviewed.

The Report, therefore, does not pretend to go in great detail into the subject, or to be more than what the Council requested, *viz.*, an indication of the practical steps which seem to be required to obtain an improvement of the present position. It will be noted that the question referred to in paragraph 5 above, *viz.*, the purchase under national control of wheat and meat, has not been dealt with. The Committee agrees that it deserves careful consideration, but the exhaustive inquiry necessary to enable a useful opinion to be formed on the subject would take more time than the Committee had at its disposal. It proposes to give separate consideration to the matter at a later date.

The principal agricultural products concerned are dealt with individually in the following paragraphs, and notes on the subject of Transport and Co-operation follow. The Committee is indebted for memoranda on some of the reviewed subjects to the Ministry of Agriculture, the Horace Plunkett Foundation, the Agricultural Economics Research Institute at Oxford, the Agricultural Economics Department at Aberystwyth, the School of Agriculture, Cambridge University, and the other authorities mentioned in the Report.

It should be added that when it became apparent to the Standing Committee that conditions in Wales would be considered in connexion with the Report, the Committee decided to invite the co-operation of the Council of Agriculture for Wales. This was done, and it was accorded by the meeting of the Council for Wales on December 16, two members of that Council (Mr. Wm. Edwards, of Hologwyn, Llanddaniel, Gaerwen, Anglesey, and Mr. W. A. Howell, of Lletai, Pencoeed, Bridgend, Glam.) being deputed to act with the Committee in its work.

Cattle, Sheep and Meat.—The marketing of cattle and sheep and the wholesale marketing of their meat are dealt with together. The Ministry's publications are Report No. 6 of the Economic Series, on the Foreign Meat Trade, and Reports Nos. 13 and 14, on the Markets and Fairs of England and Wales. It is understood that a Report on home-produced supplies, dealing with the Marketing of Store and Fat Cattle and their meat, is now in preparation, and that a Report on Sheep, Mutton and Lamb will follow later. The Committee's remarks are made subject to any fuller enlightenment which may come from those as yet unissued reports.

The Committee thinks it is not too much to say that the existing marketing methods in regard both to cattle and sheep in this country are unsatisfactory, and, as a rule, operate seriously against the interests of farmers. As regards both fat and store cattle and sheep, these are, in some parts of the country, so much in the hands of dealers and auctioneers who give credit to farmers that the full benefit of the best possible marketing of them is rarely secured to the industry. As regards fat stock, it would be better, under present conditions, if selling by weight were universal. Sales, particularly of fat stock, without weighing, lead as a rule to a definite loss to the farmer, and sales at small markets which are dominated by a few dealers should be avoided wherever possible. On this point it was represented that there were too many small markets in the country, and that better and more stable prices would be likely to be secured if business could be concentrated in larger auction marts.

The attention of farmers should be directed to the Bidding, etc., Agreements Act which recently came into force.

The questions of co-operative sale, and co-operative slaughtering, and sale of dead meat were also considered, but the Committee agreed that, although in the interests of sound marketing, such means of obtaining general improvement seemed impracticable at the moment in view of the farmers' present attitude towards co-operation. The examples of some co-operative slaughteries that had been set up showed that the farmer would send only his inferior stock to them, reserving his better stock for the fat stock markets, or for sale in other ways, in the hope of getting better prices. While this attitude remains—as it seems likely to do in the absence of any general schemes for co-operative sales or co-operative slaughtering and sale of meat—it does not appear to the Committee desirable to press the matter further. It would be different if farmers could be induced to try a large scale experiment in the direction indicated, binding themselves to send all their beasts through the one channel. Co-operative slaughteries over the country could work in close contact with each other, thus stabilizing price and output. Gluts at particular markets would not occur with such machinery working properly, as farmers would be advised to hold beasts back, or would be rationed in regard to sales, so that firm stable prices would be the general rule. The effect of such a system could be made to be somewhat similar to that in operation in the war period, when all cattle presented at the fat stock markets were graded and sold at fixed prices according to grades.

This brings the Committee to the question of quality. It appears that there is plenty of room for the further grading-up of stock. The scrub bull should be eliminated, and our prime beef should be produced only from those animals capable of being matured early, and of providing first quality meat. If it is true that the market has definite requirements, such as smaller joints and smaller cuts than formerly, then the farmer, in fattening beasts for the best beef market, should have these points kept well before him. He should breed the best possible beef for that market, and, when submitted for marketing and before he is paid for it, it should be graded as to quality, and his payment should be according to that quality. It should be possible for farmers to work out a scheme for general application throughout the country on some such lines, especially if they could be assisted by Government in laying down in writing definite standards for first, second and third-class meat, so that the classifications in all markets over the country would be as near as possible alike. Cold storage might possibly be found to be of great use in holding surplus meat supplies off the market and in bringing them into right condition for consumption. Action in this direction

would undoubtedly improve the position of home supplies on the market, as compared with imported supplies.

The Committee considers that progress along these lines, if made on a general and national basis, would be likely to improve prices to the feeders of cattle in this country, and that piecemeal and local efforts at improvement would be of little, if any, avail.

The Committee is aware of farmers' discontent with the low prices of meat, especially beef, and of their conviction that the margins between the producers' and consumers' prices are unjustifiably wide, and that these margins have tended to increase in recent times. As far as its knowledge extends, the Committee shares the opinions of the farming community, and it recommends that the attention of the Ministry of Agriculture and the Food Council should again be directed to the position.

Pigs and Pig Products.—The Ministry has issued Report No. 12 of the Economic Series on the Marketing of Pigs. Pig products are to be dealt with in Report No. 17, now in preparation.

It is understood that a Pig Industry Advisory Committee is being set up by the Ministry "to consider the circumstances affecting pig production in England and Wales, with special reference to methods of marketing, and to make recommendations with the object of increasing the home supply both of pork and bacon." This Advisory Committee will no doubt have all the information available in both Reports, and otherwise, placed at its disposal. It is hoped that the Committee will be able to make concrete recommendations on this important subject before very long.

We venture to express this hope in view of the serious set-back which the pig industry has recently encountered through the drop in the price of pigs and pig meat in this country. Apart from this, however, there is, in the Committee's view, extensive scope for improvement in the organization of the industry itself. Under present conditions, it suffers severely from considerable fluctuations in prices of both pork and bacon, and of pig-feeding stuffs. The wide extent of these fluctuations could be diminished by improvements in market information and better organization within the industry itself. It should be possible to supply forecasts of probable supplies from foreign markets for a period of six months ahead, so that pig producers might be advised—bearing in mind the average consumption of pig meat and bacon at the usual prices—what quantities they have to furnish to make up the total of normal requirements. From this information they could deduce whether it was or was not a fair business risk to increase their individual stockings of pigs. Information of the kind issued by the Ministry of Agriculture, with duly expressed safeguards as to the use of it, could not fail to be of great assistance to the industry.

It goes without saying, that the industry must continue its efforts in the production of more of the best grade pigs suitable, respectively, for the bacon and pork markets. Generally, farmers should breed and feed pigs definitely for one or the other, and should take care to acquaint themselves with the precise requirements of each, and aim always at producing them. A supply of more of the best quality pigs might do something to keep the markets from falling too rapidly or too low in bad times, since there would be more pigs grown suitable for bacon factories, which could then be kept at full pressure during such times.

Cereals.—With regard to cereals, we were provided by the Ministry with a note indicating its views and those of the Royal Commission on Food Prices, 1925, as to the great practical difficulty in the way of stabilizing prices of wheat (and meat) by means of State control of imports. As explained in an earlier paragraph, however, we did not

see our way to explore this subject in connexion with this Report. The Ministry's Report on the *Marketing of Cereals in England and Wales* is still in preparation, so that our conclusions have been reached without the advantage of considering it. They are, therefore, liable to review in the light of the Report (No. 18, Economic Series) when issued.

The Committee does not propose to follow in detail the existing methods of marketing cereals in this country. The Committee will deal, moreover, only with wheat in its remarks, this being the chief cereal, and the one whose improved marketing, if it can be obtained, will give the lead to improving the marketing of the others. At present, the trade buys wheat on sample, usually conditioning it for milling, where necessary, after purchase, and uses it for mixing with the harder wheats from abroad in breadmaking, or for making biscuits, or for stock and poultry feeding, or for seed purposes.

Putting aside the consideration of improvement of price by tariff restrictions, or any possible statutory regulation of the proportion of overseas flour used in breadmaking, it seems that one way of improving prices to the farmer is by improving the methods of dealing with the crop and marketing it.

Experience in our Dominions, where the crop is dealt with on lines generally admitted to be better than our own, shows that through the system of immediate warehousing of the crop the best financial returns are obtainable. In Australia, voluntary wheat pools for the individual States are the general rule, and in Canada the three big wheat pools account for the bulk of the crop. All provide for the taking over of the wheat in bulk directly after harvesting, grading it, and storing it in grain elevators until sold and exported. It is an essential part of the pooling plan that farmers are able to obtain substantial cash advances on their crops as soon as they are graded and sent into store.

The grain trade in this country is so different from that of the big exporting countries that it does not seem possible to adopt an exactly similar plan here. There are such special considerations as the function of local mills, and the useful part they play in supplying the farmer with the excellent offals that come from the milling of his own wheat; there is the question of the considerable loss of weight of the British wheat crop, especially in a wet year like the present, on its conditioning and storage. These and other complications have to be considered. None the less, it appears to us that if the Government could see its way to provide storage accommodation, by renting it in existing elevators at the chief ports, or helping in the erection of it at suitable points in the country, the grain trade could be relied upon to assist in the economic handling of the crop. There seems little doubt that some of the largest buyers of wheat would in normal seasons be willing to buy far more home-grown wheat if they could buy it in bulk and properly graded.

There seems to be no doubt that the efficient conditioning and storage of the crop immediately after harvest would be an advantage over the present system, both from the national point of view and from that of the farmer.

More of the crop would be harvested and kept on hand, and the farmer should get a better return for it than he does under the present haphazard method of selling. If he keeps his crop in the stack there is bound to be a certain wastage through the winter by vermin and other causes—a moderate estimate puts loss in an average year at about 10 per cent. By a system of proper storage that definite loss of grain would, of course, be avoided. On the other hand, there would be the loss of weight in the grain through its drying out and its subsequent conditioning, which would make the bulk the farmer has to sell at the higher prices of the following year much less than it would have been had he sold at harvest-time. Conditioning and storage at convenient

points not too far away from the centres of his trade would none the less appear to be of undoubted advantage. As an alternative, or as a supplementary measure, it might be possible to erect local drying and storage plants in connexion with local mills in the country. If that could be done it would save cost of transport where the wheat would eventually be required for local milling.

The whole subject, however, bristles with difficulty, and the Standing Committee does not at present propose to go further than to recommend that the question should be examined by experts, who should be asked to endeavour to prepare a scheme within such limits as the Government might be prepared to go in assisting the industry in this direction. In our view, an essential effect of the scheme should be to make cash available to the farmer immediately after harvest and storage, on the security of the crop delivered.

Liquid Milk.—The Committee had before it Reports Nos. 1 and 16 of the Ministry's Economic Series, dealing respectively with *Co-operative Marketing of Agricultural Produce*, and the *Fluid Milk Market* (Mr. Forrester's Report), and also memoranda from the Agricultural Economics Research Institute at Oxford, from Mr. A. W. Ashby on marketing of milk in Wales, and a note by Dr. Ruston, of Leeds University.

On the broad facts of the industry, the Committee is agreed that there has been a considerable increase in the quantities of liquid milk marketed in recent years, and that with the unfortunate experience in corn-growing in these same years, more land is likely in the near future to be laid down to grass for dairy purposes. The production of liquid milk will, therefore, respond readily to the call of the markets for more milk. The Committee is convinced also that there has been improvement in the quality of the milk marketed, and that this is the main reason for the greater confidence placed in it, which is reflected in its increased consumption. If it could now be reduced in price to the public, whilst the farmer retains a fair return for his expenditure and labour as the producer, the consumption would still further increase, and the use of imported condensed milks, some of which are totally unfit for feeding infants and growing children, would be at least proportionately discontinued.

Although in some cases the wholesale marketing of milk in this country appears to us to be conducted economically, the farmer does not often get the benefit of this. He would if pooling supplies and co-operative marketing were resorted to. From the farmer's point of view the only really satisfactory method of marketing milk is the co-operative method. At present the price is fixed for him by bargaining between the National Farmers' Union and the representatives of the distributing trade, although separate contracts are made between the chief distributing companies and individual farmers which may not be so good as the agreed average price would lead one to expect. These contracts have regard to local conditions as well as to the fixed seasonal prices. If the farmers were prepared to combine for the purpose of sending their milk to co-operatively owned depôts or to town selling centres for the depôt, there seems no reason why it could not be dealt with quite as economically as it now is by the distributing trade. The financial returns from the production of it ought certainly to be much increased. As a development of such a system, if it could be started, the farmer might be paid by his co-operative society according to the quality, as well as quantity, of the milk he delivers.

The co-operative societies would also be in a position to deal directly with the supplies of milk which were surplus to immediate requirements. At present, many milk producers find themselves at a disadvantage in

spring and summer, when their cows are in the flush of milk, in having to dispose of surplus milk at a much reduced price. Obviously, the position of the farmer in regard to this milk should be improved. It can satisfactorily be done only if he himself or his co-operative society undertakes the manufacture of such milk into cheese or butter, or possibly into tinned condensed whole milk, or finds an outlet for it as fresh milk.

In the absence of a scheme for co-operative selling and manufacture, the Committee agrees that the present system of collective bargaining with the distributors—which in itself indicates a start in the understanding of co-operation—is the best that can be adopted, and it would follow the lead of Mr. Forrester's fluid milk report, and recommend collective bargaining in each of the six chief markets of England and Wales, as likely to lead to closer and more detailed organization of producers. The Committee understands that the market in South Wales is very weak in its power of combination, and suggests that special attention be given to milk marketing in that area. It would be an advantage also if the nomenclature of the grades of milk (Certified Grade "A," T.T., etc.) were abolished, as the same Report suggests, and "Standard," "Super-standard" and "Special Standard," or other clearly understood terms, substituted in their place.

A good deal has been said and written recently on the iniquity of the large and growing importations of tinned skimmed milk. With much of this the Committee agrees, as it is clearly bad national management if skimmed condensed milk from abroad is allowed to take the place of whole milk produced at home in the feeding of infants by poor and ignorant parents. At the same time, the Committee considers that the practicable way to the remedy is not through the prohibition of the importation of skimmed condensed milk, but rather by assisting a wide publicity which will bring home to all classes the cheapness and value of home-produced fresh milk as a food.

Cheese and Butter.—The Committee does not propose to go more closely into the marketing of the milk products, cheese and butter, but to offer a few general observations only on them. The manufacture of butter in England and Wales is more or less localized in districts which have not ready access for the sale of their milk to the big consuming centres. As a rule, butter from these districts finds a good sale at fair prices in whatever quantities it is marketed. It is likely, however, that its marketing is capable of improvement when it is considered how varied must be the qualities of consignments, and how unequal the supply, the industry being, as a rule, quite unorganized.

As regards cheese, grading schemes have already been put into operation by certain groups of makers of Cheshire and Cheddar cheeses respectively, acting in concert, at the suggestion of the Ministry. The idea of both schemes is centred in a trade-mark which can be used by makers whose cheeses are judged to reach a certain standard. The responsibility of judgment rests with a specially appointed "grader." Both schemes were started only last year, and are understood to be giving encouraging results.

In the case of the Cheshire Cheese Federation, the makers' premises and equipment have to be inspected and passed by the grader in the first instance. In the case of the Cheddar Cheese Federation, endeavours have been made to market trade-marked cheese direct to the retail trade. Otherwise, the arrangements of both Federations are much the same. The schemes are financed by a levy of 2d. per cwt. on cheeses sold thereunder and by a small annual subscription by each member. The Ministry has made a grant in aid of the first year's working of each scheme, out of the funds placed at its disposal by the Empire Marketing Board.

The Committee considers that in the case of other produce, as well as fruit, the use of national marks as a guarantee of quality to the consumer should be widely employed, and their credit jealously guarded by associated producers. The wide adoption of the use of cheap non-returnable packages, which could be made of standard sizes in large quantities, would also help considerably to simplify and benefit the industry.

Potatoes.—The Committee has had before it the Ministry's *Report on the Marketing of Potatoes in England and Wales* (No. 9, Economic Series). It appears that the outstanding defect of the marketing of potatoes to-day is, again, the lack of adequate sorting and grading by the grower. He frequently sends to the wholesaler consignments of potatoes of all sizes, which may contain diseased and damaged tubers as well as a fair amount of earth; more rarely two or more varieties may be mixed together. The wholesaler naturally pays less for a consignment of this quality, or indeed for any unsorted crop, than he would for a sorted crop in sound condition. The Ministry of Agriculture recommends the grading of potatoes into firsts, seconds, and thirds, over and above the sorting of good from bad, and "chats" from "ware." In our view, the whole question is worth the careful consideration of representatives of growers, wholesalers and retailers. If they agree as to standards for grades, then a regular system of marketing, commencing with proper sorting by the grower or his representatives, could be started, to the certain benefit of the producer and to the simplification of the trade. Such a Committee might also consider the best means for disposal of surplus crops. It has been suggested that beet sugar factories should slice and dry surplus potatoes at a time when the factories are not being used for sugar beet, so that a trade could be built up for utilizing surpluses. The Committee has no information as to whether the preservation of potatoes in this way, or their utilization in some other way as foodstuffs for home consumption, is preferable to developing again an export trade in seasons of plenty, but it also deserves careful examination.

The Ministry's demonstrations of grading, packing, marketing, and cooking, which have been given at various Shows in the past year, with the object of improving the marketing and also the home consumption of potatoes, are, the Committee thinks, much to be commended.

Transport.—The question of improving facilities for the transport of agricultural produce to its destined markets or to the centres of consumption is a general one which seriously affects practically all agricultural commodities. The Committee understands that rates for the same weight of the same produce differ over the same distances in different directions—that with some goods the rates are out of proportion to the value of the produce—and this in some cases acts as a strong deterrent to their continued production. All kinds of anomalies are alleged, and it is widely considered that unsuitable railway rates and charges constitute a considerable drag on agricultural prosperity.

There are undoubtedly cases where complaints of high freightage and delays are justified, but there is also machinery, somewhat cumbrous perhaps, for obtaining improvements and redress. Considering the immense volume of goods traffic entrusted to the railroad, complaints do not seem to be proportionately numerous. In our view, it were better if farmers tackled the question from the positive side of better organization of supplies rather than from the negative side of complaining of the operation of principles which the railway companies consider necessary to keep in operation if the railroads are to pay their way.

If farmers produce schemes for pooling their produce, and take to a railway company a proposition for bulked traffic with a request for favourable rates in respect of it, they will, in our view, be proceeding on sound lines. It appears that the peculiar requirements of the strawberry traffic from Hampshire, and the fruit traffic from Wisbech, and those in other cases which could be named, can be adequately and economically met by the railway companies, and there seems no reason why other special traffic should not be similarly dealt with.

The position of the railway companies in dealing with farm produce would no doubt be improved if they had power to run motors over the roads in the areas which they cover, with a view to a properly co-ordinated transport service.

So far as complaints of existing traffic rates, etc., are concerned, the Committee understands that it is the duty of the Ministry of Transport and the Railway Rates Commission to deal with them. The Committee considers that it should be the business of the Ministry of Agriculture, as the special guardian of agricultural interests, actively to take up cases with those authorities where inquiry seems justified. The Ministry would, at least, become fully acquainted at first hand with the anomalies which exist and with the ground for any general changes that seem necessary, and would then be in a position effectively to advocate them.

Agricultural Co-operation.—The Ministry has issued three Reports on this subject in its Economic Series, namely, No. 1, *Co-operative Marketing of Agricultural Produce in England and Wales*; No. 4, *Large-Scale Co-operative Marketing in the United States*; and No. 5, *Co-operative Purchase of Agricultural Requisites in England and Wales*. In a recent year the total sales of produce by Agricultural Co-operative Societies—apart from sales of cereals by joint trading societies—amounted to less than five million pounds, or about 3½ per cent. of the total value of home-grown agricultural produce marketed in England and Wales. This figure gives some indication of the present size of the co-operative movement as regards sales, and how much ground there is still to cover before the principle of co-operation can be said to have a real hold of the agricultural industry.

In several of the previous sections of this Report, it has been suggested that improvement in marketing can best be achieved by farmers combining to form societies for various purposes according to their needs. The Committee desires to convey its conviction that marketing has become so important an item in farm economy that the best skill should be used in it; the farmer's primary business is to farm, and selling has a special technique of its own, and in fact is best performed as a separate business. If the farmer is dissatisfied with the prices he at present obtains for ungraded produce, as compared with the prices paid by the consumer for graded produce, perhaps the best way of improving the position is by setting up an agricultural co-operative society, which can condition, grade, pack, and market his goods.

So far several agricultural co-operative societies, set up for different purposes, have undoubtedly turned out successful; others have been failures. It may be useful to summarize the chief principles, the observance of which make for success, as follows:—

- (1) Care should be taken to see that a society has sufficient business promised at the start to justify its establishment. There is a minimum of overhead charges which has to be met in a business of any kind, and to be successful, the business must be so organized as to bring in a net return at least greater than this.

If these schemes continue to be successful, and achieve the object of obtaining better prices for the associated producers' wares than would otherwise be obtained, they must in the natural course be followed by other groups of producers whose cheeses come into competition with trade-marked cheeses in the market. The producers of Stilton and other local cheeses would probably find it an advantage to follow these pioneer steps in co-operative marketing.

Eggs and Poultry.—The Committee consulted the Ministry's Report on the *Marketing of Eggs and Poultry* (No. 10, Economic Series), and the special leaflets on the production of eggs and poultry and their subsequent marketing, which have been issued by the Ministry in connection with its demonstrations at the principal Agricultural Shows in 1927.

In the case of eggs, for their more efficient sale in this country, two chief requirements appear to be necessary. Firstly, that definite standards should be laid down for first, second and third qualities, and secondly, that the wholesale sale of eggs should be made according to those standards. These requirements have already been adopted in Northern Ireland and the Irish Free State to the considerable advantage of the trade. There is no question that the sale of eggs by weight in place of sale by number is more just and satisfactory from both buyers' and sellers' points of view. The Committee understand that the Minister of Agriculture has recently received advice on these subjects from the Poultry Advisory Committee, and that the bodies chiefly concerned are being consulted. Presumably, the receipt of such advice will be followed by legislation governing sale according to the standards recommended.

If events travel in the direction foreshadowed above, improvement in the selling organization of egg producers will be necessary. This, in the view of the Committee, might be obtained by :—

- (a) An extension of the system of central collecting, packing and grading depôts, and
- (b) The extension of cold storage facilities for eggs.

The Government might assist by arranging facilities both in regard to (a) and (b), providing producers showed the requisite initiative and desire to use such stations and storage.

It is clear as regards (a) that the collecting, etc., stations would be essential for the proper out-turn of the standardized produce. Such stations might also be used for poultry conditioning, killing, and treatment for market.

As regards (b), the question of the greater utilization of cold storage to carry over surplus supplies from the months of plenty to the autumn and winter times of scarcity is one of undoubted importance. Cold storage, or a modification of it, according to the best knowledge of the science of preservation at low temperatures, would appear to be effective for the economic preservation of eggs, if it could be used on a large enough scale. Many producers preserve in water-glass and by other means but the quantities are comparatively small. If the large cold stores over the country, which the Committee understands are far from fully utilized at present, could be used in connexion with the storage and preservation of large quantities of eggs, it would undoubtedly be a boon to the industry, if only for the stabilization of prices which would ensue from a more even distribution of supplies of eggs throughout the year.

The Committee understands that the question of the marking of imported eggs has also been considered by the Poultry Advisory Committee, so that it does not propose to express an opinion on this matter at present, except to say that it is desirable, as soon as possible, to safeguard the credit of English fresh eggs by making impossible the mixture with them and fraudulent retail sale as English eggs of cheaper foreign eggs.

Wool.—The Committee had before it the Ministry's Report on *Wool Marketing in England and Wales* (Economic Series, No. 7), and also a memorandum giving information as to the position in regard to the improvement of wool breeding in the country through the work of the Wool Breeding Council, and in other ways.

Already improvement in the marketing of wool by farmers' organizations is becoming evident. In the case of the most recently formed co-operative society, viz., that for the Eastern Counties, no less than 40,000 fleeces were dealt with last season, all graded by the Society's grader, and sold on the London Wool Exchange. There is little doubt that if farmers will combine for this purpose, and place clean wool, properly graded, on the London Wool Exchange, a substantial improvement over the prices given at local auctions will be obtained. Fewer and bigger wool auctions in the country than at present would undoubtedly be a distinct improvement from the farmers' point of view, whether co-operative action is secured or not.

Fruit.—In the case of fruit, English produce comes into closer and more obvious comparison with imported produce than is the case of any other home-grown foodstuff. Imported fruit, particularly apples, has for a long time been put upon the home market well packed and graded, and there is no doubt that there has been a definite improvement in recent years in the manner in which the better classes of home-grown fruit have been marketed. It is likely that this improvement is due in some considerable measure to the competition from overseas.

There is, however, still much room for greater advance, and the Committee thinks that improvement would be more quickly and generally made, and better returns secured for producers, if co-operative fruit-packing stations were set up at suitable centres over the country. The initiative in the matter should come from the fruit growers themselves, although it would help very considerably if the Government could see its way to assist a scheme on national lines. The Committee recommends the fruit-packing station because it is the sure way to obtain, as far as possible, uniformity of output when dealing with the produce of a large number of farms, and uniformity and reliability are the chief requirements of the wholesale fruit markets. At present, the market returns on sales of fruit are often very small in proportion to the high returns from retail sale. There may be good reasons for this in some cases under present conditions, but the disparity appears to the producer as a rule to be wholly unreasonable and unjustified. A third substantial reason why fruit-packing stations should be established is that they provide a ready means of dealing with gluts of particular crops in different seasons. It would be part of the business of at least some of the stations to make jams and preserves on a factory scale, and thus the produce of each fruit farm connected with the co-operative or other society which runs the station would be certain to be used to the full, and in the most paying way possible.

The Committee also recommends that a system of national marks should be employed on the packages of fruit sent out from the stations, and that they should refer to fruit of the same standard, so that the market would have confidence in grade and quality. It is possible also that national marks might be used by individual growers, who for some reason worked independently from fruit-packing stations; these would be members of an association empowered to use the marks, and it would be a condition of membership that their produce should come up to certain standards prescribed. If the mark were used on goods below standard, then the right to use it would be forfeited.

- (2) There must also be enough capital in the business to provide sufficient liquid assets for its purposes.
- (3) A society, for whatever purpose for which it may be formed, should be under efficient management. If the services of a first-class man cannot be obtained, failure is almost certain.
- (4) It is essential that members should pass all, or a stated part of their produce, through their society, and be bound by what is known as "suppliers' contracts." Only with the definite undertaking to supply a known amount of produce is a society in a position to employ its machinery adequately and to develop suitable markets. Until the system of suppliers' contracts is general and has been enforced it will always be difficult, and frequently impossible, for a co-operative marketing society to obtain the necessary regularity and volume of supplies. Farmers must therefore be willing where they desire to co-operate to sign suppliers' contracts which will pledge them to stand by their society.
- (5) Prospective members of agricultural co-operative societies must be assured that their liability as members would be strictly limited to the shares they have taken up.

In some recent cases the share liabilities of members have been increased without their individually expressed consent. The share liabilities of members are fixed by the Rules of each society, as made under the Industrial and Provident Societies Act and registered by the Registrar of Friendly Societies. Hitherto, it has been possible to change the share liability of individual members by securing an alteration of Rules; and such change could be secured without the express consent of any member if the resolution for the alteration of rules were passed in the manner prescribed in the rules of each society concerned. Action by this method in the case of the Farmers' Central Trading Board and the Agricultural Wholesale Society, Ltd., has caused grave trouble to the local societies which were constituent members of that society (but this did not increase the liabilities of persons who were individual members of these local societies). In other cases similar actions by local societies have caused trouble to the individual persons amongst members who were not fully aware of, or did not agree with, the action taken by the Society to which they belonged.

It is now necessary, therefore, that members (or shareholders) in agricultural co-operative societies should take steps to safeguard their position as regards the fixing of share liabilities. The position might be generally safeguarded by an amendment of the Industrial and Provident Societies Acts. It is, however, possible for each society to secure the position of each of its members in this respect without any alteration in the present law. Some societies have registered rules to this effect.

"The society shall have no power to increase the nominal value of the shares without the consent in writing of each member." One such rule reads as follows:—

"Rule 6.—*Shares*: Shares shall be transferable but not withdrawable. They shall be of the nominal value of £1, payable in full on application, and the Society shall have no power to increase the nominal value of shares without the consent in writing of each member."

In the rules of this Society this Rule is followed by another:—

"*Mode of Amending Rules*: All the rules with the exception of Rule 6 may be amended by resolution of a three-fourths majority at a Special General Meeting. No amendment of Rules is valid until registered."

Thus the members of this Society have fixed their liabilities on share capital to the amounts for which they have personally applied, and further liabilities cannot be imposed upon individual members without the express consent of each.

The possibility of making such Rules or securing amendment of existing Rules to this effect should be known by all agricultural co-operators; and the desirability of securing such provision in the rules of existing societies should be considered.

On the question of assisting general development of co-operation, the Committee understands that the National Farmers' Union has now for some time accepted the responsibility for directly fathering co-operation in this country, whilst the Welsh Agricultural Organization Society continues its works in Wales. There is without doubt much that can be done, and is being done, by the Farmers' Union and the Welsh Agricultural Organization Society, and the Committee very much hopes that their efforts will prove increasingly successful. The matter is, however, so important that the Committee suggests that the Government should consider whether it is possible to assist agricultural organization, at any rate where it is concerned with the marketing of agricultural produce, with additional special help and advice. Any expenses incurred in this matter might suitably be defrayed from the grant set apart for the development of Empire Marketing. Whether this can be done or not, however, the Committee would urge that the Ministry of Agriculture should in no way relax its own efforts in proving that co-operative action is essential to prosperity in Agriculture by the practical demonstrations in organized better marketing which it gives at agricultural shows and other centres up and down the country.

The attention of Committees of County Councils and the authorities of Agricultural Colleges who are in charge of extension work in Agricultural Education should also be drawn to the importance of education in relation to marketing problems and methods, as it is clear that their present and previous work in assisting farm production can only be made effective when marketing methods are adjusted to present circumstances.

In presenting this Report, the Committee wishes to express its appreciation of the valuable services rendered in its preparation by its Secretary, who is also the Secretary of the Council.

January 19, 1928.

* * * * *

MARCH ON THE FARM

J. R. BOND, M.B.E., M.Sc., N.D.A. (Hons.),

Agricultural Organizer for Derbyshire.

Seasonal Notes.—March, the month of many weathers, derives its name from Mars, the god who was worshipped most widely among the ancient Italian tribes. As the god of manliness and creative power, Mars came to be best known as the War-god, but he was originally the patron of the husbandmen. As Mars Gradivus he was the god of growth; he received the first fruits of the year; to him the farmer prayed that his flocks and herds might prosper. The bright season of spring—earlier, of course, in Italy than in Britain—was sacred to him. The first month of the Roman calendar was important as a time for the opening of both agricultural and military campaigns; and perhaps the ascendancy of the latter interest

may be inferred from the association of the word "martial" with warfare rather than with farming operations.

March 25, Lady Day, is an important term day in agricultural tenancies. Why so many farm tenancies begin and end on this particular day must be explained by historical reasons; indeed, it would be difficult to justify the adoption of this date on the grounds of farm management. In the twelfth century, the Anglican Church began the year on Annunciation, March 25, which was also the beginning of the ancient Jewish year and the traditional date of Adam's creation. This practice was shortly afterwards adopted in secular affairs, and continued until the reformation of the calendar in 1752. By this time, farm leases, elaborately prepared by lawyers, had become common, and the retention of the Lady Day Term is an example of the conservation of English customs. In this particular matter, however, it is of interest to note that the Government financial year has not followed the reformation of the calendar.

March is usually a dry month, and, after the rain performance during January and up to the time of writing (the middle of last month), this feature in its reputation will be awaited and critically observed by all farmers. Not only are the arrears of work which accrued in November and December still outstanding, but the land is generally waterlogged, floods are common, and some of the fields sown late with wheat or winter oats will probably require re-sowing. Even after a normal autumn and winter, however, a prolonged dry period in March is proverbially beneficial. "A peck of March dust is worth a king's ransom," recalls the time when our ancestors valued the lives of men in terms of money, that of a churl being £10 and that of a king £60. This year it will certainly be possible to test the saying that March either empties the full ditches or fills empty ones. The objection to a wet March needs no emphasis, but apparently tradition is even more strongly opposed to warm, growing weather at this period: the quotation in full is "March many weathers rained and blowed but March grass never did good." This, of course, may not meet with the approval of the protagonists of "the early bite of grass"; but mild weather in March is often followed by a chilly April, during which the forward growth of early potatoes, raspberries and other market garden crops is liable to be cut back.

The possible influence of wireless telephony is frequently discussed in farming circles, and there are many beside the

considerable minority of farmers who believe that there is some connexion between the spread of wireless broadcasting and the heavy rainfall of the past seven months. It will be remembered that the bombardments in France during the wet weather of 1918 were similarly blamed. There is no known reason to believe that the course of atmospheric depressions and anti-cyclones is influenced in any way by wireless emissions, and there is still less apparent connexion between those phenomena and wireless reception, which, even more than broadcasting, has increased in this country since the wet cycle set in.

Grassland.—On farms where little arable cultivation is practised, sufficient yard manure is available for the meadows to allow of their receiving an application every second year or thereabouts, according to the number of cattle wintered and the rate of dressing. On typical grass holdings, however, little litter is used; the arrangements for conserving the manure made are commonly poor; and, after a wet winter, which prevents the manure being carted on to the land, the quality of the dung available for application in March is decidedly low. In this case, and especially in late districts, a supplementary top-dressing of artificial fertilizers may be necessary to ensure a satisfactory and early mow.

Where a fair proportion of arable land is cultivated, the exigencies of the present season may not permit of the employment of men and horses in manuring meadows during March, when soil conditions allow of necessary arable land operations. Moreover, where good use can be made of all the yard manure for arable crops, it is sound practice to apply it to the ploughland rather than the grass, as the latter does not require the aid of added organic matter to the same extent as arable soil. Continuous manuring of meadows with artificial fertilizers only has been amply demonstrated to be practicable, provided that a complete mixture is used and that precautions against the development of sourness are observed.

Winter Corn.—The effect of the constant wetness has been to puddle the surface of the soil and restrict aeration. Consequently, on the medium and heavier classes of land, the plant has become thin, and there is likelihood that it will be slow to move forward. Under these conditions, nitrogenous stimulation is advisable, and the loosening effect of the harrows is beneficial. Many farmers roll their wheat and other winter corn as early as the land will bear the team and implement, but frequently the roller does considerable harm, and the foot-

prints of the team persist as bare patches. Rolling has its uses, but the compression of soil that is damp underneath is not one of them.

Spring Corn.—There is ample evidence of the general excellence of the oat varieties, Victory, Golden Rain and Crown, which have been tested repeatedly in experiments and in practice since about 1911. All do well on good land; while under conditions which are locally thought to be suitable only for oats of the Black Tartarian type, these newer varieties always excel the Tartarians in yield when compared in properly conducted experiments. The preference for the Black Tartarian oat in upland and wet districts is difficult to justify on economic grounds, and the only plausible explanations obtainable are the questionable ones that Black Tartarians are less liable to sprout in the sheaf and have straw of better feeding quality than the newer varieties above mentioned. Certainly the straw is longer and weaker; but this is attended with greater liability to lodging; and if Golden Rain, for example, is more liable to sprout in the sheaf, this is due mainly to its earlier ripening habit, which is as often as not an advantage for cultivation in late and upland districts.

Strength of straw is not infrequently an important factor in the selection of oat varieties. Under certain conditions, Victory and Golden Rain do not stand sufficiently well; this may be the case where oats follow well-manured roots on good, moist land, or where oats follow a three or four years' lea containing abundance of wild white clover which has been grazed during the last two or three years of the period. There are, indeed, no varieties that may be relied upon to stand well under all weathers after a rich clover lea, but Record and Yields may be mentioned as among the best for this purpose. Marvellous, a white winter oat, is a stiff-strawed sort, and succeeds very well when sown in March.

The advisability of sowing liberally when putting in oats of the modern large-grained type has been emphasized in previous notes. This year, an additional reason for liberality in seed allowance will occur on many farms where the quality of the seed available is definitely below the average of previous years; indeed, really good samples of seed oats are not very common this season.

Where spring corn is sown on lea ground, it is advisable to keep a look-out for the leather jacket grub, which may be expected to be a common pest after the wet summer and autumn of 1927.

Live Stock.—March is a busy month with young animals of all kinds. It is the principal lambing month; the "spring" litters of pigs arrive, or have already arrived; foals appear; and, on the average, more calves are dropped in March than in any other month of the year. The suitability of March as a month for the hatching of chickens intended for winter egg production needs no emphasis to progressive poultry-keepers. The feeding of sows for growth of the young pigs has in recent years been much improved by the use of fish meal, or substitutes for the protein and mineral constituents which fish meal contains. The same principles, however, have not generally entered into the management of ewes and mares with offspring. Hay and oats are still too commonly the ration of the mare suckling a foal during the indoors period, and the addition of bran, while it is an improvement, is not a sufficient enrichment in protein to enable the dam to produce a liberal flow of milk. In the case of ewes and lambs, a different supplement of concentrates is needed during the month of March, when little green food is available, from that which is suitable when the flush of spring grass has arrived. Cereal foods—oats, barley, maize—may be quite satisfactory as an addition to spring grass; but, when the basal ration of the ewes is roots and long fodder, the concentrated supplement should be more on the lines of the cakes and meals fed to cows in milk.

* * * * *

NOTES ON MANURES FOR MARCH

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

Rothamsted Experimental Station, Harpenden, Herts.

Manuring of Sugar Beet.—The results of experiments on the cultivation and manuring of sugar beet carried out in East Suffolk have recently been published.* Some of the points brought out with regard to the effect of manuring may usefully be mentioned. The addition of 10 tons of farmyard manure to a complete and generous dressing of artificials (consisting of 4 cwt. basic superphosphate, 6 cwt. kainit, and 3 cwt. nitrate of soda per acre) increased the yield from 9 tons to 12·7 tons per acre, and had no appreciable effect on the sugar content. Experiments with increasing quantities of a fertilizer mixture, used in the absence of farmyard manure, showed good increases for 6 cwt. of artificials amounting on the average to 27 cwt. of beet; a double application of the same mixture only produced

* East Suffolk Education Committee, Report on the Results of Sugar Beet Trials, 1927.

a further 15 cwt. of roots. It was pointed out that better results were obtained on land in high condition than could be produced by heavy doses of artificials used in impoverished soil. The effect of nitrogenous dressings without dung, but in presence of a suitable addition of phosphate and potash, was to give 39 cwt. of beet per acre for the application of 2 cwt. of sulphate of ammonia in the seed bed, a further 22 cwt. of roots was obtained by a top dressing of 1 cwt. of nitrate of soda; while an additional top dressing of 1 cwt. of nitrate applied separately from the foregoing produced only 6 cwt. more.

The only sign of a depression of sugar content occurred in the final case, where 2 cwt. of sulphate were used in the seed bed and 2 cwt. of nitrate were applied on top. The heavy dose of nitrogen, by forcing a great leaf growth, made the crops look better than they actually were, an observation which was made at several experimental centres last season.

The time of application of nitrogenous dressings seemed to make little difference either to the yield or sugar content: in some cases all was given before drilling; in others, part was given at singling time, and the remainder three weeks later. A small series was set out to test the effect of varying quantities of potash. The soils were light or medium and had received dung or potash in 1926 or 1927. Under these conditions, potash was not very effective. There was no advantage in increasing the dressing of muriate of potash from $1\frac{1}{2}$ to 3 cwt. per acre.

Green Manuring.—Farmers are agreed on the great part played by organic matter in their arable land. There are only two ways in which this most important constituent is restored in quantity to cultivated soils. These are (1) the application of farmyard manure, and (2) green manuring. The almost universal use of dung, and the relative rareness with which green manuring is found as a regular feature of farming in this country, is more a measure of their suitability to existing practice than of their effectiveness as a means of restoring fertility to the land. In any case, a dressing of dung is more beneficial than an equal weight of green manure, but the fertilizing effect of a successful green manuring crop can be quite considerable, especially if a leguminous crop is grown with the help of a good supply of phosphate, potash and lime. Some of the conditions which make for the success of green manuring are: (1) The production of a large bulk of green stuff to be turned in before it has become too woody. (2) As high a nitrogen content as possible in the green material, this

helping the decomposition in the soil and providing nitrogen for the following crop. The best way to secure this is to use a leguminous plant. (3) The mass should be ploughed in shallow enough to enable free aeration to take place, and the presence of a good supply of chalk in the soil is an advantage. Under these three conditions the land is enriched in organic matter and bacterial activity is increased. This results in the liberation of plant nutrients and an improvement in physical conditions. A green manuring practice which might receive consideration at this time of the year is the under-sowing of cereal crops with clovers, with a view to turning in the clover sod in autumn for potatoes or sugar beet. The advantage of this plan is that the operations are merely those which are regularly undertaken to secure a seeds ley, and call for no special deviations from usual farming practice. The risks are, as with leys, that in a dry spring the under-sown crop may fail, or in a wet growing season the clover may give trouble in the butts of the sheaves at harvest. As a rule, however, a satisfactory plant is obtained which can be ploughed in with good effect for roots, or, if keep is short, may be used for live stock.

Fertilizers for Gardens.—Vegetable growers have in the past relied chiefly on bulky organic manures, and their more concentrated materials were those used by farmers before the introduction of chemical fertilizers. Farmyard manure, lime, bone meal, guanos, wood ashes and soot are still the chief sources of fertility in many gardens. The tendency is, however, for the supplies of some of these materials to decrease, or at least fail to keep pace with expanding requirements. On the other hand, commercial artificial fertilizers are being produced in greater quantity and variety each year, and their use is gradually finding favour among gardeners and allotment holders. Even with a plentiful supply of the older materials there would still be a place for chemical fertilizers, in particular for nitrates, where rapid leaf development is essential, as for spring cabbages, and for potash salts to aid the growth of root crops on light soils. Where dung and organic nitrogenous materials are scarce, growers must fall back on other sources of plant food, and this will chiefly be supplied in the form of artificial manures. It is to be noted, however, that of all cultivators, gardeners have the greatest esteem for organic matter, and this is not directly supplied in the concentrated manures, consequently every effort should be made to make the existing quantity of dung go as far as possible and to help

it out by turning under vegetable residues or green manuring crops specially sown for the purpose. For general work a complete fertilizer is wanted, that is to say, one which contains all three fertilizing ingredients. A mixture as applied for potatoes in farming practice is quite suited for ordinary garden use. It might be made up of—

- 2 parts sulphate of ammonia, or equivalent quantity of nitrate of soda or of cyanamide.
- 2 parts sulphate of potash, or equivalent quantities of muriate of potash or of Kainit.
- 3 parts superphosphate.
- 1 part steamed bone flour.

Since the matter of expense is not so urgent in small-scale operations as it is on the farm, some of the nitrogen might be supplied in the organic form as rape cake, fish guano or meat meal, thereby improving the condition of the mixture and providing a slightly more lasting form of nitrogen. Growers would be advised, where possible, to purchase the ingredients co-operatively in bag lots put up by the makers, as considerable saving in price is secured by buying in quantity.

Garden culture produces bigger crops than are ordinarily obtained on farms, with consequent greater drain on the soil; somewhat heavier dressings of manures are therefore in place, and 3 oz. per sq. yd. of such a mixture would not be too much for garden crops. When using artificials in this quantity even distribution should be aimed at, or injury to germinating seeds may result. The fertilizer mixture may be diluted with an equal bulk of sand or ashes before application, and should be well worked into the surface soil.

Those who do not wish to take the special care necessary to succeed with chemical fertilizers can manage quite well with such substances as high-grade guano, meat meal, or fish meal; but on light soils these materials may need to be supplemented with potash salts from time to time. The organic manures have the advantage of simplicity and safety, but if the mineral fertilizers are rightly used no damage to crops need be feared from dressings on the scale mentioned above.

Manuring and Quality.—Attention has recently turned to the effects of manuring on the quality of crops. This applies to sugar beet, barley, potatoes, and to an increasing extent to wheat. A further aspect of manuring which is now receiving study is the possibility that varieties of the same crop may differ in their responses to fertilizer treatment. We may have

our varieties classified not only according to their suitability for high farming or the reverse, but also in relation to their needs for lime, potash and so forth. The investigation of these problems is complicated by the fact that the nature of the soil and the type of season each affects the result, and this, no doubt, accounts for the lack of agreement found in the conclusions of different workers.

An investigation recently carried out in Germany† is of interest because the effect of 10 different manurings was studied on six varieties of spring wheat under pot-culture conditions. Five of the wheats were local varieties or selections from them. They had the reputation of being early, hardy, and of rather low but certain yielding power. The sixth variety differed in being more suited to high farming conditions, it was later, and produced a more starchy grain than the others.

The soil was deficient in potash, and without added potash, nitrogen was ineffective. There was no marked response to phosphate. The results brought out clearly the opposite effects of potash and nitrogen under the above conditions. In the absence of potash, germination was delayed, growth was soft, and the plants suffered badly from mildew and aphids. Addition of potash corrected these effects, while it also—

- (1) Improved the straw;
- (2) Increased the proportion of grain to straw;
- (3) Increased the percentage of head corn;
- (4) Raised the 1,000-corn weight and the starch content.

The action of nitrogenous manure was, in general, in the opposite sense, although complete manuring gave the best result when both yield and quality were taken into account. Phosphate had little effect on yield, but increased the 1,000-corn weight in all varieties. The nature of the grain, whether rich in protein or in starch, was a varietal characteristic, the late variety being more starchy under any one treatment than any of the others. The composition of the grain was affected by manuring in all varieties: nitrogen increased the protein, potash increased the starch.

The intensive variety differed from the rest in its reaction to manures, being the only one which could respond to nitrogen and phosphate in the absence of potash. It was pointed out that, in the field, other factors were important which did not operate in pot-culture; for example, the variety

† Dr. K. Weller. *Der Einfluss d. Düngung auf den Ertrag Güte und sonstige Wertigenschaften, etc.* (The Influence of Manuring on the Yield, Quality, and other Properties of six varieties of Spring Wheat). Published by Dr. F. P. Datterer & Cie, Freising (Munich), 1927.

which did best under all treatments in the pots were so damaged by gout fly in the field, owing to its late habit, that it was outyielded by the others.

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 February 8					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 7	11 7	14 8	
" lime (N. 13%)	..	..	..	11 7	17 6	
Sulphate of ammonia :—						
Neutral (N. 20·6%)	10 13*	10 13*	10 13*	10 13*	10 4	
Calcium cyanamide (N. 19%)	8 18†	8 18†	8 18†	8 18†	9 4	
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	8 15	9 9	10 0	3 9	
Sulphate " " (Pot. 48·51½%)	11 10	10 15	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. 3½%, 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 44,400 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.

NOTES ON FEEDING STUFFS FOR MARCH

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

School of Agriculture, Cambridge.

The Fibre in the Ration.—Fibre has been referred to as the "fill-belly" of the ruminant. It is something more than that, however, as will presently be seen. Its functions in the plant are two-fold. Firstly, it is the material from which is constructed the wall or envelope of each tiny plant cell. Secondly, it serves the plant in the later stages of growth in much the same way as the skeletal structure is of service to the animal, in that it confers a certain rigidity on the grown-up plant, enabling a stout resistance to be offered to the onslaught of wind and storm. Curiously enough, although fibre is abundantly consumed by animals, it does not enter into the composition of the animal body. Fibre is an essential part of the structure of the plant cell, but not of the animal cell.

The isolation of fibre from feeding stuffs by chemical means is a simple matter, involving the boiling up of the food first with dilute sulphuric acid and then with dilute soda. This treatment dissolves out the protein, oil, starchy matter ("soluble carbohydrates") and soluble ash, the undissolved residue being therefore composed of fibre mixed with a little sand. It was at one time thought that this residue was a measure of the amount of indigestible material in the food. This, however, is now known to be by no means the case.

What is the chemical nature of the fibre so obtained? To answer this question it will be necessary to inquire first of all into the nature of the changes which occur in the plant as it grows and develops in the direction of maturity. In the young plant, the cell walls are extremely thin and tender and are composed entirely of a substance called cellulose. This substance belongs to the class of insoluble carbohydrates, and in chemical nature is related to starch. It is encountered in a fairly pure form in good samples of blotting paper. It will be shown later that the ruminant animal is able to digest this form of fibre almost as readily and efficiently as it is able to digest starch. As the plant advances in maturity, the cell walls undergo thickening, a process commonly referred to as lignification. The originally thin cell walls of cellulose become surrounded and intimately admixed with sand and highly carbonaceous forms of fibre known as ligno-celluloses. These so-called "incrusting substances" are entirely indigestible. The greater the proportion of ligno-cellulose in the plant, the more nearly does the fibre approach the nature of wood.

It is clear, therefore, that one of the characteristic changes in the growing plant is a gradual diminution in the digestibility of its fibrous constituent. Obviously, the plant is catering primarily for its own requirements rather than for those of animals. Thus, it has been shown at Cambridge that the fibre in young pasture grass is digested by ruminants to the extent of more than 80 per cent., a degree of digestibility comparing favourably with that associated with the soluble carbohydrates. The much woodier fibre of hay, on the other hand, is digested only to the extent of about 50 per cent.

This, however, does not comprise the whole story. Unless the fibrous envelope of the plant cells is capable of being easily dissolved away during digestion, it may be that the food nutrients like oil, protein and carbohydrate contained within the cells will not be readily accessible to the digestive ferments during the passage of the food along the alimentary canal. Under such conditions, the nutrients of the food may only be utilized to a poor extent by the animal. Thus, although there is no reason to suppose that the protein constituents of young pasture grass and of hay are intrinsically different in chemical nature, it has been shown that the protein of young pasture herbage is more than 80 per cent. digestible (*i.e.*, as digestible as the protein of linseed cake), whereas the protein in hay, on account of the less digestible character of the fibrous cell walls, is only utilized to the extent of about 55 per cent.

The foregoing considerations afford a basis for understanding the principles underlying the process which has been patented recently on the Continent for "pulping out" the nutrient food from the cells of green crops like grass and lucerne, and separating it from the fibrous cell-wall material. The fibre-free "plasma-pulp" is then moulded into cakes and dried for use in winter feeding. Obviously, however, such an expensive process could be dispensed with in the case of young grass, or any other immature green crop, since the fibre in such fodders is easily and almost wholly digestible in the ruminant organism, and cannot therefore hinder the ready digestion and assimilation of the other food nutrients present in the cells. In the case of the pig, however, which cannot deal with fibre so efficiently as the ruminant, the "Ereky" process undoubtedly offers attractive possibilities.

Straw is one of our most lignified feeding stuffs. Its cellulose constituent is rendered in a large measure unavailable to the animal by being embedded in large amounts of silica and ligno-cellulose. During the war, the German scientist turned

his attention to the problem of discovering a simple method whereby the cellulose of the straw could be liberated from the incrusting materials and thereby be rendered available as a food nutrient to the ruminant animal. This was found possible by treatment of the straw, under quite simple conditions, with dilute solutions of caustic soda, washing soda or quicklime. By such methods, the digestibility and nutritive value of the straw could be enhanced very considerably. With the passing of war-time conditions, however, the results of these striking Continental investigations appear to have aroused but small interest in this country.

The question arises as to the value which must be assigned to the digestible portion of the fibre of a food in the nutrition of the ruminant animal. This question has been answered by Kellner, who, in the series of investigations which led to the formulation of his system of starch equivalents, tested the value, in the rations of fattening oxen, of a feeding stuff rich in digestible fibre (namely, rye straw which had been boiled under pressure with an alkaline solution to free the cellulose from incrusting substances). He demonstrated that 1 lb. of digestible fibre is equal to the same weight of starch for purposes of fattening. This discovery is given practical recognition in his well-known expression for calculating the production starch equivalent of a feeding stuff.

By what means is the farm animal able to digest and utilize the very stable cellulose constituent? Digestion of food is usually associated with the action of enzymes or ferments secreted into the alimentary tract in the various digestive juices. Up to the present, however, investigation has failed to reveal the presence of any cellulose-digesting ferment in the digestive tract of the higher animals, although such a ferment of great activity is known to occur in the intestinal secretion of the snail. The digestion of cellulose in the ruminant animal is brought about by the intervention of certain micro-organisms known as cellulose-splitting bacteria, which have their chief seat of activity in the first stomach of the animal. These micro-organisms can be isolated in pure culture and made to work in artificial media. Laboratory investigations have shown that they split up filter paper and other forms of cellulose into organic acids like acetic and butyric acids, together with gases like hydrogen, carbon dioxide and marsh gas. Such cultures of bacteria are now employed for the production of marsh gas on a commercial scale from fibrous products like cotton waste.

The text-book theory of cellulose digestion assumes, therefore, that the digestible fibre in the animal's ration is digested by being broken down by bacteria in the rumen to organic acids of the acetic and butyric acid type, and to gases like marsh gas and carbon dioxide. Such a theory, however, comes into direct conflict with Kellner's experimentally demonstrated fact that digestible fibre and starch possess equal values for fattening in the ruminant, since manifestly the digestion products of cellulose, if this theory be correct, cannot have the same value to the animal as the glucose sugar derived from the digestion of starch. Indeed, the gaseous products, marsh gas and carbon dioxide, are excreted as waste products from the body of the animal.

The writer's attention was directed to this discrepancy between experiment and theory when he was considering the significance of the high digestion co-efficients which were being obtained for the fibre in young pasture grass during the carrying out of the Cambridge grass land investigations. He was led thereby to make a critical study of the evidence on which the text-book theory of cellulose digestion is based. It would, however, require too much space to summarize the various points which were considered, and the reader who may be interested in this subject is referred to the original paper dealing with the question.* Evidence was adduced in this paper to show that the bacterial digestion of a given weight of digestible fibre in the ruminant tract gives rise to as much glucose sugar as is formed by the enzymic digestion of an equal weight of starch. In the form of glucose, therefore, both starch and cellulose are ultimately absorbed into the blood stream of the animal, a view which is in entire harmony with Kellner's finding as to the value of digestible fibre in the diet of the ruminant animal.

* * * * *

* H. E. Woodman: "The Mechanism of Cellulose Digestion in the Ruminant Organism," *Jour. Agric. Sci.*, Vol. XVII, 1927.

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.		Protein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.	100 lb.	s. d.	d.	%
Wheat, British ..	—	—	10 5	0 13	9 12	72	2 8	1.43	9.6
Barley, British feeding ..	—	—	10 0	0 10	9 10	71	2 8	1.43	6.2
" Canadian No. 3 Western ..	40 0	400	11 3	0 10	10 13	71	3 0	1.61	6.2
" American ..	39 6	"	11 2*	0 10	10 12	71	3 0	1.61	6.2
" Persian ..	38 0	"	10 13	0 10	10 3	71	2 10	1.52	6.2
" Russian ..	39 6	"	11 2	0 10	10 12	71	3 0	1.61	6.2
Oats, English, white ..	—	—	10 13	0 11	10 2	60	3 4	1.78	7.6
" " black and grey ..	—	—	10 7	0 11	9 16	60	3 3	1.74	7.6
" Irish, white ..	—	—	11 0	0 11	10 9	60	3 6	1.87	7.6
" " black ..	—	—	10 0	0 11	9 9	60	3 2	1.70	7.6
" Canadian No. 2 Western ..	36 3	320	12 13*	0 11	12 2	60	4 0	2.14	7.6
" Argentine ..	28 9	"	10 2	0 11	9 11	60	3 2	1.70	7.6
" Russian ..	31 6	"	11 0†	0 11	10 9	60	3 6	1.87	7.6
Maize, Argentine ..	42 0	480	9 17	0 11	9 6	81	2 4	1.25	6.8
Beans, English, winter ..	—	—	9 2†	1 0	7 10	66	2 4	1.25	20
Peas, English, blue ..	—	—	15 15†	1 3	14 12	69	4 3	2.28	18
" Japanese ..	—	—	23 5†	1 3	22 2	69	6 5	3.44	18
" " ..	—	—	11 5	0 13	10 12	74	2 10	1.52	7.2
Dari, Palestine ..	—	—	10 10	0 13	9 17	74	2 8	1.43	7.2
Millers' offals—									
Bran, British ..	—	—	8 12	1 3	7 9	42	3 7	1.92	10
" broad ..	—	—	9 15	1 3	8 12	42	4 3	2.28	10
Middlings, fine, imported ..	—	—	10 15	0 18	9 17	69	2 10	1.52	12
" coarse, British ..	—	—	9 0	0 18	8 2	58	2 10	1.52	11
Pollards, imported ..	—	—	8 7	1 3	7 4	60	2 5	1.29	11
Meal, barley ..	—	—	12 2	0 10	11 12	71	3 3	1.74	6.2
" maize ..	—	—	10 7	0 11	9 16	81	2 5	1.29	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 7	1 1	9 6	76	2 5	1.29	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	18 0	53	6 10	3.67	48
Maize, cooked flaked ..	—	—	12 0	0 11	11 9	85	2 8	1.43	8.6
Linseed—									
" cake, English 12% oil ..	—	—	13 0	1 11	11 9	74	3 1	1.65	25
" " " 10% oil ..	—	—	12 10	1 11	10 19	74	3 0	1.61	25
" " " 9% oil ..	—	—	12 5	1 11	10 14	74	2 11	1.56	25
Soya bean, " 6% oil ..	—	—	11 10	2 4	9 6	69	2 8	1.43	36
Cottonseed cake, " 5½% oil ..	—	—	8 12	1 10	7 2	42	3 5	1.83	17
" " Egyptian, 5½% oil ..	—	—	8 5	1 10	6 15	42	3 3	1.74	17
Decorticated cottonseed meal, 7% oil ..	—	—	12 10§	2 5	10 5	74	2 9	1.47	35
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 ..	—	—	8 12§	0 19	7 13	75	2 0	1.07	17
" " meal, 6% oil ..	—	—	10 5†	0 19	9 6	75	2 6	1.34	17
" " meal 2% oil ..	—	—	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 15	1 0	7 15	49	3 2	1.70	13
" " " porter ..	—	—	8 5	1 0	7 5	49	3 0	1.61	13
" " wet ale ..	—	—	1 15	0 7	1 8	15	1 10	0.98	4.8
" " " porter ..	—	—	1 0	0 7	0 13	15	0 10	0.45	4.8
Malt culms ..	—	—	8 10§	1 9	7 1	43	3 3	1.74	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 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 £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 calculation 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 follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6.2	11 0
Maize	81	6.8	9 17
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 2.74 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 12
Oats	60	7.6	8 16
Barley	71	6.2	10 4
Potatoes	18	0.6	2 10
Swedes	7	0.7	1 0
Mangolds	7	0.4	1 0
Beans	66	20.0	10 12
Good meadow hay	31	4.6	4 12
Good oat straw	17	0.9	2 8
Good clover hay	32	7.0	4 18
Vetch and oat silage	13	1.6	1 18
Barley straw	19	0.7	2 13
Wheat straw	11	0.1	1 10
Bean straw	19	1.7	2 15

* * * * *

MISCELLANEOUS NOTES

IN Denmark a considerable part of the cultivated farming area—about one-fifth—is devoted to the cultivation of root

crops, and the whole of this area is weeded by means of beet hoes. The result has been that a number of new patterns have been introduced for the cleaning of root crops. Some of these

implements have already been subjected to trials and experiments, but, at the desire of several agricultural organizations, the State Commission for Experiments with Farming Implements has decided to conduct comparative experiments with hoes during the spring and summer of 1928. The trial may comprise both Danish and foreign beet hoes for one, two, or more rows. It is to be carried out on both light and heavy soils, and the implements tested will be for the weeding of sugar beet, turnips, etc.

Further particulars as to these trials may be obtained on application to the Office of the State Commission for Experiments with Farming Implements, 40 Bülowsvej, Copenhagen V, Denmark.

* * * * *

THE Annual Dairy Cattle-Judging Competition for members of Young Farmers' Clubs in England and Wales, postponed owing to Foot-and-Mouth Disease from

the Dairy Show last October, took place by courtesy of the Northants Education Committee at the County Farm Institute, Moulton, Northants, and neighbouring farms on January 26, 1928. Keen interest

was shown in the contest.

A Silver Challenge Cup, presented by the *Farmer and Stock-Breeder and Agricultural Gazette*, for the champion team, and silver and bronze medals awarded by the British Dairy Farmers' Association for the three individual competitors obtaining the highest marks, were competed for, and a further stimulus was that the winners of this contest would meet the champion cattle-judging team from the 4-H (or Young Farmers') Clubs of America in the Annual International Contest to be held in this country next summer.

The classes of cattle judged comprised Friesian, Short-horn and Jersey Dairy Cows with four animals in each class. Each

team consisted of three "young farmers," and four clubs entered teams. The competitors were allowed 12 minutes in which to decide the correct order of placing the animals in each group, points up to a maximum of 50 being awarded to each competitor for "placing." A further 50 points were obtainable for giving reasons in support of the order of placing.

The Sussex Baby Beef Club, the winners last year and the year before, were again successful in holding the Cup by a margin of 12 points over the second team, the Bletchley Calf Club. The Buckingham Royal Latin School Calf Club took third place, and the Buckland Calf Club were a good fourth. The scores were as follows (maximum 900):—

Sussex Baby Beef Club	670
Bletchley Calf Club	658
Buckingham Royal Latin School Calf Club ..	562
Buckland Calf Club	552

It is notable that the first four places in the individual scoring were occupied by girls, the names and scores being as follows:—

Edith Harriott (Sussex Baby Beef Club)	243	(Silver Medal)
Constance North (Bletchley Calf Club)	241	(Bronze Medal)
Mary Beavington (Bletchley Calf Club)	224	(Bronze Medal)
Mabel Harriott (Sussex Baby Beef Club)	223	

Edith Harriott has secured the Silver Medal of the British Dairy Farmers' Association for the third time.

The judges were Mr. J. Mackintosh, of Reading, and Mr. J. S. Shirley, of Bletchley.

* * * * *

THE general index figure for agricultural produce in January was 45 per cent. above the base years 1911-13, a rise of 7 points as compared with the figure for the previous month. The index figure was raised to some extent by the higher prices ruling for fat cattle, sheep and pigs, but normally a rise of several points occurs at this period of the year owing to the fact that prices in January, 1911-13,

were generally lower than in December, and the percentage increase above the base is, therefore, greater.

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	—
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 and barley were unaltered in price at averages of 9s. 10d. and 11s. 2d. per cwt., respectively, but oats at 9s. 6d. showed a rise of 4d. per cwt. The index figure for wheat remained at 34 per cent. above pre-war, as compared with 61 per cent. in the preceding January, and barley and oats were 5 and 8 points higher on the month at 40 and 39 per cent., respectively, against 36 and 20 per cent. a year ago.

Live Stock.—The stringent movement restrictions on account of foot-and-mouth disease which were in force during January, and the severe weather which prevailed in the early part of the month curtailed the entries of live stock, and in many cases higher prices were realized for the small supplies which were marketed. The average for second quality fat cattle advanced by about 2s. per live cwt., and fat sheep were dearer by about 3d. per lb., estimated dressed carcass weight, the index figure for the former advancing 12 points to 28 per cent. above 1911-13, and the latter by 19 points to 63 per cent. Fat pigs, both baconers and porkers, showed an increase in price, and this fact, in conjunction with the lower base prices in January, 1911-13, caused the index numbers to show a sharp rise. Store cattle, sheep and pigs were a little dearer, and in each case the relative index figure was higher, while dairy cows were cheaper at 26 per cent. above pre-war.

Dairy and Poultry Produce.—Milk prices were unaltered on the month, and the index figure was unchanged at 66 per cent. above 1911-13, and practically the same as in January, 1927;

butter also remained steady at 47 per cent. dearer than pre-war. A slight decline in cheese prices was accompanied by a lower base price, and the index number rose by 6 points to 61 per cent. above pre-war. Poultry were cheaper than in the preceding month, but as this was the customary movement in prices, and the changes were very similar to those in 1911-13, the index figure was little altered at 38 per cent. above pre-war. In the case of eggs, the slight fall in price was much less than in the period December to January, 1911-13, and the rise of 36 points to 77 per cent. above the level of the base years is due to this factor.

Other Commodities.—Hay prices were unaltered on the month, but the index number declined from 20 to 18 per cent. above pre-war owing to the effect of higher base prices, and this cause nullified also the effect of a rise in potato prices in January, potatoes averaging 74 per cent. above pre-war as against 75 per cent. in December. Wool was slightly dearer during the month under review, and the index figure 8 points higher at 58 per cent. above the base years 1911-13.

Index numbers of different commodities during recent months and in January, 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
	Jan.	Jan.	Sept.	Oct.	Nov.	Dec.	Jan.	
Wheat ..	67	61	48	42	34	34	24	
Barley ..	31	36	62	62	45	35	40	
Oats ..	35	20	35	33	30	31	39	
Fat cattle ..	52	33	30	23	19	16	28	
Fat sheep ..	63	57	45	41	40	44	63	
Bacon pigs ..	94	70	34	22	18	20	34	
Pork pigs ..	94	82	41	35	29	33	44	
Dairy cows ..	42	28	28	27	28	28	26	
Store cattle ..	33	29	24	19	13	13	24	
Store sheep ..	57	55	49	40	35	35	42	
Store pigs ..	121	135	64	56	44	41	47	
Eggs ..	70	46	54	66	47	41	77	
Poultry ..	56	38	37	43	46	37	38	
Milk ..	74	65	65	57	59	66	66	
Butter ..	53	37	41	41	47	47	47	
Cheese ..	82	38	59	56	55	55	61	
Potatoes ..	53	95	46	72	76	75	74	
Hay ..	4	-1*	18	18	19	20	18	
Wool ..	50	32	43	43	46	50	58	

* Decrease.

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland in the three months ended December, 1927, compared with the corresponding period in 1926. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	Oct. to Dec., 1927		Oct. to Dec., 1926	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina ..	46	6,570	57	6,204
Belgium ..	28	508	0	0
Brazil ..	12	1,400	30	3,692
Colombia ..	10	1,584	1	200
Cuba ..	0	0	26	865
Guatemala ..	0	0	10	335
Kenya ..	19	682	3	167
Palestine ..	0	0	4	1,500
Uruguay ..	4	750	4	235
British India ..	5	185	8	390
Canada ..	75	5,520	0	0
Irish Free State ..	756	11,905	1,321	20,060
Other countries ..	22	1,572	20	893
Total ..	977	30,676	1,484	34,541
SHEEP AND LAMBS				
Argentina ..	379	9,710	329	9,963
Brazil ..	43	1,215	40	1,210
Chile ..	47	1,670	7	1,200
Kenya ..	8	190	0	0
Russia ..	0	0	266	3,803
Uruguay ..	73	1,196	85	2,268
United States of America ..	96	1,183	0	0
Canada ..	63	1,540	0	0
Irish Free State ..	201	1,204	1,112	2,346
Other countries ..	22	257	18	292
Total ..	932	18,165	1,857	21,082
SWINE				
Argentina ..	3	46	7	260
Germany ..	4	220	5	115
Japan ..	8	428	3	113
Kenya ..	1	50	7	150
Lithuania ..	0	0	24	1,200
Poland ..	13	340	0	0
Irish Free State ..	234	387	327	1,949
Other countries ..	16	315	18	712
Total ..	279	1,786	391	4,499

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland during 1927, with comparative figures for 1926. (From *Annual Statement of Trade*, and returns supplied by H.M. Customs and Excise.)

Country to which exported	1927		1926	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	346	104,420	337	51,220
Belgium	92	2,015	0	0
Brazil	26	4,185	110	10,330
Chile	4	1,090	34	3,355
Kenya	39	1,975	18	1,204
Uruguay	62	12,186	57	10,991
Australia	46	6,343	35	6,421
Canada	209	15,820	0	0
Irish Free State ..	4,536	76,068	5,708	84,544
Union of South Africa ..	45	3,839	20	1,150
Other countries ..	146	9,110	182	9,884
Total	5,551	237,651	6,501	179,208
SHEEP AND LAMBS				
Argentina	878	21,098	629	18,011
Brazil	56	1,861	49	1,452
Chile	65	2,500	14	1,403
Peru	89	1,143	0	0
Russia	0	0	266	3,803
Uruguay	133	3,136	166	5,079
United States of America	155	2,235	0	0
Canada	389	6,730	0	0
Irish Free State ..	1,575	4,999	2,038	4,478
Other countries ..	221	3,212	99	1,764
Total	3,561	46,914	3,261	35,990
SWINE				
Argentina	19	571	23	627
France	44	686	19	425
Germany	30	941	30	843
Japan	18	1,064	3	113
Poland	21	690	5	265
Russia	0	0	180	3,646
Serb-Croat-Slovene State	0	0	40	1,250
Irish Free State ..	1,287	3,741	1,123	6,155
Other countries ..	93	1,762	110	3,570
Total	1,512	9,455	1,533	16,894

THE trials which are arranged each year by the Ministry with the object of testing new varieties of potatoes as to their immunity from Wart Disease, were again conducted in 1927 on the farm of **Trials of Potatoes for Immunity from Wart Disease, 1927** the National Institute of Agricultural Botany, Ormskirk, Lancashire. The actual field operations and the taking of records were carried out by Mr. Harold Bryan, B.Sc., and Mrs. McDermott, of the Institute, but the trials were conducted on a plan approved by the Ministry.

The weather conditions were ideal for planting, and little rain fell during the first eight weeks of growth. This dry spell was accompanied by continuous cold winds, and because of these conditions Wart Disease was late in appearing, not being observed in the field until July 8. During the greater part of the growing season, however, rain fell heavily and continuously, and after the first appearance of disease all the susceptible varieties rapidly became infected. The season was accordingly a very reliable one for test purposes, as critical examination of the whole of the control plots showed 100 per cent. infection. The wet season induced rapid rotting of the actual wart, and by the end of September it was difficult to obtain fresh specimens of the disease. It was noted that tubers infected with Wart Disease showed greater liability to rot in the ground than did uninfected tubers from the same plant.

Twenty-eight stocks were included in the second and third-year tests, and of these three proved susceptible to Wart Disease. Of the 57 entries for the first-year tests, 17 became infected; 18 proved to be synonyms of existing varieties; 4 were too mixed to judge; 2 were duplicates of another seedling; 30 were distinct varieties, and 3 foreign varieties were true to name.

The results of the trials have been considered by a small committee composed of representatives of the Ministry of Agriculture and Fisheries, the Board of Agriculture for Scotland, and the Ministry of Agriculture for Northern Ireland, and co-ordinated with the results of the trials carried out by the two latter Departments at Philpstown and Kilkeel respectively.

The Committee recommended the approval of 27 new varieties, but only nine of these have actually been added to the approved list. In the remaining cases inclusion has been postponed until such time as the raisers have intimated that the varieties have actually been, or will shortly be, introduced

into commerce. Descriptions are given below of the nine new varieties, together with those of four varieties which are already on the market and are known to be immune, and one variety which was approved as the result of the 1923 trials, but which is only now being introduced into commerce.

The findings of the Potato Synonym Committee of the National Institute of Agricultural Botany have been accepted by the Ministry where recommendations as to the classification of new varieties as synonymous with existing varieties have been made by that Committee.

Second Early Varieties :—

"Clovullin."

- Sprout .. Blue.
 Tuber .. Oval, frequently tapering towards the heel; skin white; flesh lemon; eyes shallow.
 Haulm and Foliage Open, spreading, only moderately vigorous; leaflets dark grey-green, soft appearance, dull, rather broad and short, drooping; stems numerous, pink coloration at the base only; wings straight.
 Flowers .. None observed.

"Cluny."

- Sprout .. Blue.
 Tuber .. Round; skin blue-purple; flesh white with a ring of blue; eyes shallow, open, saucer-shaped.
 Haulm and Foliage Tall, upright; stems blue-purple, wings waved at the tops; leaf open, mid-rib blue-purple, dark red at the base; leaflets medium green, large, heart-shaped at the base; top leaflets narrow, terminal leaflet sometimes tied; secondary leaflets small, fairly numerous.
 Flowers .. White, large; stalks short; buds pink-green.

"Scale's Pride."

- Sprout .. Blue.
 Tuber .. Kidney, frequently tapering at the heel; skin white; flesh white; eyes shallow.
 Haulm and Foliage Open, moderately vigorous, upright to spreading; leaflets dark green, long, broad and wrinkled; slight general pink coloration of the stems; wings straight; secondary leaflets numerous.
 Flowers .. White, borne on long stalks; anthers orange.

Late or Maincrop Varieties :—

"Early Templar."

- Sprout .. Blue.
 Tuber .. Oval to oblong; skin white; flesh white; eyes shallow and on the point, eyebrows long.
 Haulm and Foliage Tall, upright, dense; stems mottled blue-purple and having many thin branches; leaf open, broad; leaflet ashy green, dull, smooth; large pair of secondary leaflets below the terminal pair of lateral leaflets.
 Flowers .. White, frequent, anthers malformed; buds green-purple.

"Electron."

- Sprout .. Pink.
 Tuber .. Oval, frequently tapering towards the heel, irregular; skin white; flesh white; eyes shallow.
 Haulm and Foliage Tall, upright to spreading, moderately vigorous; leaflets yellowish-green, narrow, fairly short, dull appearance, erect; leaf open; stems green, numerous; wings straight; secondary leaflets small.
 Flowers .. White, small, not numerous.

"Glen Ericht."

- Sprout .. Faint pink.
 Tuber .. Oval, somewhat pointed; skin white; flesh white; eyes shallow to medium, ridged.
 Haulm and Foliage Medium height, spreading; leaf flat, open; mid-ribs of young leaves have a pink tinge; leaflets flat, ashy green, smooth, pointed.
 Flowers .. Not formed; buds pink.

"Gregor Cups."

- Sprout .. Pink.
 Tuber .. Round, dented at heel; skin pink; flesh white; eyes deep.
 Haulm and Foliage Tall, coarse, open; stem strong and branching freely, mottled red-purple; wings markedly waved; leaf rigid, short; midrib red-purple, especially in younger leaflets; leaflets medium to dark green, wrinkled, often with mosaic appearance, edges waved.
 Flowers .. White, with green tips, very rare; buds dark, dropping readily.

"Harcarse Red."

- Sprout .. Deep pink.
 Tuber .. Round; skin deep pink; flesh lemon; eyes shallow.
 Haulm and Foliage Open, upright, only moderately vigorous; leaflets grey-green, hard glossy appearance, wrinkled, narrow, short, erect, fluted; leaf open; secondary leaflets small; stems deeply bronzed, coloration extending to the mid-ribs of the leaves and leaflets.
 Flowers .. White, frequently malformed; anthers orange.

"Inverness Favourite."

- Sprout .. Purple.
 Tuber .. Oval; skin white; flesh pale lemon; eyes shallow.
 Haulm and Foliage Upright, bushy; leaflets dark grey-green, dull, medium size, involute; stems bronzed; wings much serrated.
 Flowers .. White, large, rare.

"Lord Tennyson."

- Sprout .. Blue.
 Tuber .. Round; skin blue, mottled yellow; flesh pale yellow; eyes shallow.
 Haulm and Foliage Tall and upright; stems mottled blue-purple, branching; leaf open, mid-rib blue-purple at end bases of leaf stalks, leaf short; leaflet medium green, glossy, small.

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 the 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,
Lathom, ORMSKIRK, Lancs.

Station: Ormskirk, L.M. & S. Railway.

Date of Forwarding.—Consignments should be sent so as to reach the Testing Station not later than March 31.

* * * * *

At the British Industries Fair, held at the White City from February 20 to March 2, and at the Ideal Home Exhibition, staged at Olympia from February 28

to March 24, the Empire Marketing Board arranged exhibits of Empire produce on a large scale. Very generous

allocations of space were made for home produce. The Ministry, in collaboration with the National Farmers' Union, and the other organizations who customarily assist, organized the Great Britain sections, and displays worthy of the Home Country were staged in each case.

The majority of the visitors to the Fair come from overseas, and special attention was given, therefore, to those commodities which have a potential export value, such as wool, seed potatoes, and pedigree live stock. The Board of Agriculture for Scotland arranged for a representative exhibit of wool and also of seed potatoes from that country, and these were shown side by side with fleeces and potatoes from England. The Ministry provided three "Textophote" machines, which showed, in rotation, illuminated photographs of practically every British breed of horses, cattle, sheep and pigs. For this feature, the Ministry sought the assistance of the various Breed Societies, most of whom supplied the necessary photographs. An attractive display of home-produced bacon, dairy produce, eggs, glass-house produce, beet sugar, cereal produce, vegetables and fruit—bottled, canned, and cider—was provided on the same basis as usual.

At the Ideal Home Exhibition, where the appeal is to the ordinary housewife rather than to the trade buyer, a number of new effects have been incorporated in the Great Britain section in order to attract attention to home produce. A full description, together with photographs, will appear in the next issue of this JOURNAL.

* * * * *

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 January, 1928, together with the quantity produced during the corresponding month in 1927, was:—

January, 1928	..	..	473,854 cwt.
January, 1927	..	..	606,924 „

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

1927-1928	..	..	3,789,814 cwt.
1926-1927	..	..	2,982,227 „

* * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on February 6, at 7 Whitehall Place, S.W. 1, Mr. W. B. Yates, C.B.E., presiding. The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying out the Committees' decisions:—

Northumberland.—An Order continuing from May 13, 1928, until May 13, 1929, the minimum and overtime rates of wages at present in force 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, catlemen, stockmen and shepherds who are householders 39s., and for such workers who are not householders 36s. per week of 62 hours, and for other male workers (except casual workers) 32s. per week of 48 hours in winter and 52½ hours in summer, with overtime in all cases at one and a-quarter times the general minimum time rate on weekdays, and one and a-half times the general minimum time rate on Sundays. The minimum rate for casual workers of 18 years of age and over is 7½d. per hour for all time worked. The minimum rate for female workers of 18 years of age and over, other than casual workers, is 5d. per hour with overtime at 6d. per hour, and in the case of casual workers 3d. per hour, with overtime at 4d. per hour.

Denbigh and Flint.—An Order continuing from February 16, 1928, until February 15, 1929, the minimum and overtime rates of wages at present in force for male and female workers. The minimum rates in the case of male workers of 21 years of age and over are 37s. per week of 61 hours for team-men, cattlemen, cowmen, shepherds and bailiffs, and 30s. 6d. per week of 50 hours for other male workers, with overtime in each case at 9d. per hour. The minimum rate for 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.

- Flowers .. Blue-purple, tipped white; frequent; flower stalks short; buds pink-purple.
- "Medland."*
- Sprout .. Pink.
- Tuber .. Round; skin white, flecked pink, especially in the eyes and at the rose end; flesh, lemon; eyes shallow.
- Haulm and Foliage .. Open, upright, spreading later, moderately vigorous; leaflets light grey-green, small, short, narrow, erect; secondary leaflets small and few; stems general pink coloration; wings straight.
- Flowers .. White, stigma bifid; anthers orange.
- "Sharp's Pink Seedling."*
- Sprout .. Pink.
- Tuber .. Round; skin pink; flesh white; eyes shallow.
- Haulm and Foliage .. Medium to tall; stems numerous, tinged red-purple, especially at base; leaf open, rigid, mid-rib dark red; leaflets round, distinctly pointed, medium green, dull; secondary leaflets small, but often numerous, projecting upwards.
- Flowers .. Red-purple, tipped white, profuse; buds dark; stalks long.
- "The Cherry."*
- Sprout .. Pink.
- Tuber .. Oval; skin white; flesh white; eyes shallow.
- Haulm and Foliage .. Tall, strong, upright, compact; leaflets yellowish-green, broad, roundish, wrinkled, harsh and dull appearance; secondary leaflets large and numerous; leaf close; stems green with slight coloration in axils; wings straight with occasional slight serration.
- Flowers .. White, numerous; anthers orange; berries form freely.
- "The Craigie."*
- Sprout .. Pink.
- Tuber .. Kidney; skin white; flesh white; eyes shallow.
- Haulm and Foliage .. Tall, strong, upright, compact; leaflets light grey-green, short, narrow, wrinkled, harsh appearance; secondary leaflets not numerous; leaf close; stems green; wings straight.
- Flowers .. White, small.

* * * * *

THE Ministry will continue during the coming season to test, at the Potato Testing Station of the National Institute of Agricultural Botany, Ormskirk, potatoes

Wart Disease and potato seedlings as to their immunity
Immunity Trials, from or susceptibility to wart disease on
1928 the conditions stated below.

The entry form (No. 345 H.D.), obtainable from the Ministry, must be filled up and returned to the Potato Testing Station, Lathom, Ormskirk, Lancs, with the

requisite fees. Samples must be sent to the Station so as to arrive not later than March 31, 1928.

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—50 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 Board of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland.

(e) The Ministry will furnish as early as possible a report on each stock forwarded.

(f) When the Ministry is satisfied, as a result of the trials, that a variety is immune from Wart Disease, it will formally "approve" the variety and will issue an official certificate of immunity. Such certificates will not be issued until the variety has been named, and until an assurance has been received from the sender that it has been, or is about to be, introduced into commerce. When a variety tested under a number or letter has been subsequently named and "approved," a sample of 100 tubers of the variety as named must be sent to Ormskirk for comparison with the tested stock. No certificate will be issued for any new variety until it has passed at least two consecutive years' tests without contracting the disease, and has been declared by the Synonym Committee of the National Institute of Agricultural Botany to be distinct from existing varieties.

Potatoes are accepted from foreign growers on the conditions

(a) to (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 not fewer than two tubers and not more than 10 tubers of any seedlings for growing for one season on the trial plots, and to furnish a report on the results obtained without payment of a fee. These tests, however, will not be considered as forming

Question in Parliament.—On February 16, Captain CROOKSHANK asked the Minister of Agriculture if his attention has been called to the action of certain employers of agricultural workers who have reduced the wages of their employees when they have become entitled to old age pensions on attaining the age of 65; and what action he proposes to take in the matter?

Mr. GUINNESS replied that "Certain cases have been reported to me where employers are alleged to have reduced the wages of agricultural workers on their becoming entitled to the contributory old age pension at the age of 65. The receipt of an old age pension makes no difference to the employer's obligation under the Agricultural Wages (Regulation) Act to pay a worker wages at not less than the minimum rates fixed under the Act. Exemption from the minimum rates of wages is only permissible in the case of workers in respect of whom a permit of exemption has been granted by the local Agricultural Wages Committee. Such a permit may be granted only in a case where a worker is so affected by any physical injury or mental deficiency, or any infirmity due to age or to any other cause, that he is incapable of earning the minimum rate. I would point out that the rates of wages are fixed by the County Agricultural Wages Committees, and I have no power to intervene, but I am bound to enforce the observance of the rates which they have fixed."

Enforcement of Minimum Rates of Wages.—During the month ending February 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.
Hereford ..	Bromyard	1	0 0	—	—	1 3 0	5
Dorset ..	Gillingham	1	0 0	0 10 0	—	7 17 3	1
Yorks, N.R.	Wath*	—	—	2 2 0	—	18 0 0	2
Cardiff	Llandilo*	—	—	2 4 0	—	15 0 0	1
		£2	0 0	£4 16 0	—	£41 18 3	9

* Dismissed under the Probation of Offenders Act.

Foot-and-Mouth Disease.—Since the report in the last month's issue of this JOURNAL, 31 outbreaks of foot-and-mouth disease have been confirmed in Great Britain. These outbreaks were in the following counties: Leicester, 7; Lincoln (Lindsey), 10; Nottingham, 6; Derby, 3; Yorks (West Riding), 2; Surrey, 2; and Warwickshire, 1.

The number of outbreaks confirmed since January 1 last is 75, involving 11 counties, and the slaughter of 2,247 cattle, 2,904 sheep, 1,223 pigs and 5 goats.

NOTICES OF BOOKS

Cheshunt Experimental and Research Station: Twelfth Annual Report, 1926.—The Director's Report for 1926 of the work of this Station will prove interesting and useful to all who have attempted to grow plants under glass. The year 1926 was not a good one for the tomato growers, for crops were small and prices low, so that the

