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NOVEMBER, 1921.

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THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE

Vol. XXVIII. No. 8.

NOVEMBER, 1921.

NOTES FOR THE MONTH.

Concilation Committees in Agriculture.

Towards the end of October, the position as regards the formation of Conciliation Committees was that, although in two or three areas the preliminary meetings of the Interim Conciliation Committees had not been held, initial arrangements had been completed in all outstanding cases and the whole of England and Wales is now covered by Interim or Permanent Conciliation Committees set up under the Corn Production Acts (Repeal) Act. The total number of these Committees in October was 45, but it is anticipated that some of the present areas will decide eventually on further sub-division.

It will be remembered that these Committees, which are voluntary bodies composed of representatives of local employers and workers in agriculture, are being set up to deal with wages, hours and conditions of employment. It was hoped that each Committee would recommend rates of wages to operate immediately from 1st October, the date of the abolition of the Wages Board. With this object in mind several Committees were able to arrive at temporary agreements, which in some cases are still operative, and no doubt these Committees will in due course see their way to reach agreements of a more permanent nature. These temporary agreements, which will expire before the end of October, were made in Cheshire, Kent, Isle of Ely, Hampshire, Lancashire, Leicestershire and Rutland, Warwickshire, and the North Riding of Yorkshire.

In 11 areas (Cambridgeshire, Cornwall, Cumberland and Westmorland, Devonshire, Durham, Hertfordshire, Norfolk, Shropshire, Staffordshire, Denbigh and Flint, and the East Riding of Yorkshire) agreed recommendations for rates of wages have been made to apply during November and Decem-

(39705) P.14/35. 11,250. 10/21. M. & S. A

ber, and in some cases up to January and February, 1922. In the remaining 26 areas negotiations have reached various stages. Frequently area and constitution questions have delayed the discussion of wages, which has been deferred to later meetings. The suggestions of each side have in some cases necessitated further reference to the Executives of the Representative bodies and have thus resulted in delaying decisions. In certain of the few areas in which there has been any serious difficulty, steps have already been taken for the early resumption of negotiations between the two sides.

Although the representatives of employers are in many areas at present opposed to agreed rates being confirmed by the Ministry, they have supported the principle of confirmation in Cambridgeshire, Surrey, and Brecon and Radnor. The Cambridgeshire Committee have already submitted their agreed rates to the Ministry for confirmation. When rates of wages agreed by a Conciliation Committee have been confirmed and advertised by the Ministry, such rates become an implied term of every contract of employment for the particular class of worker concerned.

* * * * * *

Agricultural Research and Education: The Government's Policy.

IN a speech recently delivered in Northamptonshire, on the occasion of the opening of the new Farm Institute provided by the Northamptonshire County Council at Moulton Grounds Farm, the Minister of Agriculture and Fisheries outlined the Government's policy with regard to agricultural reseach and education.

Sir Arthur Griffith-Boscawen said he was much interested in the Farm Institute movement, because he was certain it was going to do great things for agriculture. The Government was often criticised for want of policy as regards agriculture, or for having too many policies, or too many contradictory policies, or for changing policy. He had come to the conclusion that they could help agriculture very little by legislation. They could do very often a great deal of harm, and they had got to walk very warily if they were going to do much good, but he was sure that by sound administration, and by promoting the application of science to the farm, by giving bigger grants and assisting in the establishment of places where research and education could be carried out, the Government would be helping British agriculture to success in the future.

The future of British agriculture depended upon knowledge, and he hoped the policy they had devised would be immutable, more like the laws of the Medes and Persians than some laws they had passed lately. He hoped their policy in the future would be one of consistent promotion of agricultural education and research with a view to the greater application of science to the farm.

In that policy there were certain stages. Research must come first. The research institution was the primary body. They had got to establish the principles upon which progress in a farm would depend. They had not to be in too great a hurry. In the past, money had been wasted on policies which had proved faulty in the long run. They had to establish their principles and make sure of their facts, and then apply them. The work that was being done at such places as Rothamsted on questions relating to the soil and to manures; at Cambridge in plant breeding, where Professor Biffen had produced some new wonderful wheats which had been so successful in many parts of the country, and in animal nutrition; at Reading, where the principles of dairying were being investigated and admirable results secured; and at Bristol, where horticulture was being scientifically examined—all those works, he was sure, would be for the permanent advantage of British agriculture.

When they had established their principles and facts and had arrived at the latest and best and most economical processes, they had to make them known. That could be done in various ways. Many agricultural colleges were doing excellent work, but the college existed largely for the more well-to-do who could afford time and money to take a long course far away from their homes. What was wanted were places where the sons of working farmers could go for short courses near their homes, and go in the winter-time when there was not so much work on the farm, and where they could be brought into touch with the best scientific knowledge, which was constantly being added to, through the work of the research institutes.

The Farm Institute was not only for the farmer and smallholder; he hoped very much to see there in increasing numbers the sons and daughters of agricultural labourers. This would involve offering free places, scholarships and maintenance allowances. All these were purposes which had been specifically mentioned in the Act of Parliament recently passed (The Corn Production Acts (Repeal) Act, 1921), which established a fund of one million pounds for agricultural development. In the

summer, there would be short courses near their homes for daughters of farmers and farm workers, who would learn all about dairying, poultry rearing, the bottling of fruit, cooking and other subjects which would prove of the greatest advantage on the farm, so that the whole family would take an intelligent and practical interest in the work of the farm.

That was the idea of the Farm Institute, which it was hoped would become the centre of agricultural intelligence for the county: a place where every kind of help could be given, where farmers could go for advice, where soils could be tested, feeding stuffs and fertilisers analysed and their value ascertained, and where information could be given on the combating of pests and diseases. He felt sure the institutes would gradually obtain the confidence of farmers and become of the greatest value to those engaged in work on the land.

Although it was as long ago as 1908 that a Departmental Committee, presided over by Lord Reay, recommended that there should be a Farm Institute in every county, or group of two or three counties, the progress in this direction had been slow, so that only four institutes had been established when the War began. Since the War twelve more institute schemes had been projected, but only six of them had got under way when the economy axe fell, and the other six had to be abandoned temporarily.

When the Repeal of Part I of the Corn Production Act was passed and the Government was compelled by financial stress to abandon the guaranteed prices, they were able to save about £1,000,000 from the wreck, and that money was to be devoted to agricultural education and research. Out of that money he hoped to restart the six institute schemes that were abandoned, and also to set on foot five or six more. In that event there would be 24 or 25 Farm Institutes scattered about the country. The results to British agriculture could not be put down in black and white, but he felt certain they would be incalculable, and that every penny spent, whether by the Government or by enlightened County Councils like that of Northamptonshire, would be money well spent, and that it would bring in a handsome return.

The session which is just commencing will see Farm Institutes at work in the following counties:—Cheshire, Cumberland and Westmorland, Essex, Hampshire, Hertfordshire, Northamptonshire, Somersetshire, Staffordshire, Suffolk, Carnarvonshire, Denbighshire and Monmouth.

Full information as to the courses of instruction and other work which will be carried on at these institutes can be obtained on application to the County Agricultural Education Authorities.

* * * * * *

International Labour Conference.

THE Third International Conference held in accordance with the Labour Clauses of the Peace Treaty assembled at Geneva on 25th October, 1921. This Conference, at which all the countries which were parties to the Peace Treaty (except the United States of America) are represented, is of special interest to agriculture owing to the fact that a number of items on the agenda relate to agricultural labour, viz. :—

Adaptation to agricultural labour of the Washington decisions concerning the regulation of the hours of work.

Adaptation to agricultural labour of the Washington decisions concerning :—

(a) Measures for the prevention of or providing against unemployment;

(b) Protection of women and children.

Special measures for the protection of agricultural workers :—

(a) Technical agricultural education;

(b) Living-in conditions of agricultural workers;

(c) Guarantee of the rights of association and combination;

(d) Protection against accident, sickness, invalidity and old age.

Each participating country is represented at the Conference by two Government Delegates, one Delegate representing the employers and one Delegate representing the workpeople.

In the case of Great Britain the Government Delegates are Sir Montague Barlow, M.P., Parliamentary Secretary to the Ministry of Labour, and Sir Daniel Hall, K.C.B., F.R.S., Chief Scientific Adviser to the Ministry of Agriculture; the Employers' Delegate is General A. C. Bayley, National Confederation of Employers' Organisations; and the Delegate representing the workpeople is Mr. E. L. Poulton, O.B.E., J.P., Vice-Chairman of the General Council of the Trade Union Congress. The Employers' Delegate will be assisted as regards agricultural questions by Mr. James Donaldson, Vice-President of the National Farmers' Union, and by Mr. Alexander Batchelor, Vice-President of the Scottish Farmers' Union; the Workers' Dele-

gate will be assisted by Mr. R. B. Walker, of the National Union of Agricultural Labourers, Mr. John Beard, of the Workers' Union, and Mr. J. F. Duncan, of the Scottish Farm Servants' Union; while the Government Delegates will be accompanied by Mr. R. J. Thompson, of the Ministry of Agriculture, and Mr. H. M. Conacher, of the Board of Agriculture for Scotland.

* * * * * *

The Monthly Agricultural Index Number.

THE Monthly Agricultural Index Number* of the prices of agricultural produce prepared by the Ministry of Agriculture shows that the prices at which farm products were sold in September were on the average 105 per cent. above the average rates in the three years 1911-13. This represents a fall of 11 points as compared with the preceding month when the average stood at 116 per cent. above the 1911-13 level. The following table shows the figures for each month since the beginning of 1919 :—

Month.	Increase per cent. on the average of the years 1911-13.		
	1919.	1920.	1921.
January	148	213	186
February	150	205	172
March	150	199	158
April	153	199	141
May	132	169	112
June	128	164	102
July	141	174	100
August	138	177	116
September	148	181	105
October	166	191	—
November	182	197	—
December	207	194	—

Wheat and oats fell during the past month, but barley showed a seasonal rise due to a larger proportion of malting barley being put on the market. All descriptions of live stock showed a decline during the month, and this was also the case with butter, cheese, poultry and eggs. On the other hand higher prices were obtained for milk, as is customary in the autumn. Potatoes were cheaper. On the whole, taking one commodity with another farmers now appear to be receiving a little more than double pre-war prices. Among the commodities purchased by farmers, maize and milling offals are distinctly cheaper, while oil cakes and some other feeding stuffs show a small decline.

* An explanatory note on the Agricultural Index Number appeared in the issue of this *Journal* for October last, p 578.

Fertilisers on the whole have not varied very much during the month.

* * * * * *

International Potato Conference.

IN the issue of this *Journal* for September reference was made to the forthcoming International Potato Conference. The Organising Committee have now practically completed their arrangements.

Official delegates have been appointed by the Governments of Belgium, Denmark, France, Greece, Germany, Holland, Hungary, Portugal, Rumania, Spain, Switzerland, India, New South Wales, Queensland, and Western Australia. Most of the principal countries which are interested in potato growing will therefore be represented. The American Government has not seen its way, so far, to nominate representatives, but two papers by officers of the United States Department of Agriculture will be read at the meeting. The Conference will be held in the Royal Horticultural Society's Offices, Vincent Square, Westminster, commencing 16th November, and will be opened at 10.30 a.m. with an address by Sir A. D. Hall, K.C.B., F.R.S., Chief Scientific Adviser to the Ministry.

The Programme of papers is as follows:—

Wednesday, November 16th.

11.20-12. Breeding, Selection and Development Work in the U.S.A. —Wm. Stuart, Department of Agriculture, Washington.

12 -12.45. Breeding, Selection and Development Work in Britain.— F. J. Chittenden, Donald McKelvie and Wm. Robb.

3 - 3.30. The Industrial and Commercial Uses of the Potato.— H. V. Taylor.

3.50- 4.20. The Early Potato Industry.—J. M. Hannah.

4.40- 5.10. Degeneration of Potatoes.—Dr. R. N. Salaman.

Thursday, November 17th.

4 - 4.40. Wart Disease of Potatoes.—V. H. Blackman and Wm. B. Brierley.

5.30- 6. Some Information on the Heredity of Wart Disease.— R. N. Salaman and J. W. Lesley.

Friday, November 18th.

10.30-11. New Work on Leaf Curl in Holland.—H. M. Quanjer.

11 -11.45. Recent Investigations on Potato Blight.-G. H. Pethybridge.

11.45-12.15. New Work on Mosaic in Ireland.—P. A. Murphy.

12.15-12.30. The Situation as regards Leaf Curl and Mosaic in Britain.—A. D. Cotton.

It will be seen that the papers cover a wide range of subjects of the greatest possible interest to all who are concerned in the growing of potatoes, and the discussions on the various papers

should provide information of considerable importance. During the progress of the Conference the Annual Show of the National Potato Society will be held in the Royal Horticultural Society's Hall, and visitors will have an opportunity of examining the great majority of British varieties of potatoes. A scientific exhibit is also being prepared showing the recent results of research into potato diseases and potato breeding.

* * * * * *

Tests of Drainage Machinery.

THE Ministry has arranged a public demonstration of drainage machinery to take place at Harmston, near Lincoln, on 7th and 8th November. The demonstration will form the conclusion of a series of tests of drainage machinery of many types which has been proceeding for a considerable time. Machinery will be at work for making field drains, clearing farm ditches, and clearing and grading subsidiary water-courses. The tests do not, however, extend to floating machinery used on main water-courses. Among the more novel devices shown will be the Nordby Ditch Digger, which has been specially imported from Norway; the Priestman Grab Ditcher specially designed, in consultation with the Ministry, to operate on narrow and soft banks; a large grab-line machine designed by Messrs. Ruston and Hornsby; force and lift pumps supplied by Messrs. Gwynnes; a mole plough designed for direct traction by Mr. F. B. Wells, of Welwyn; and two types of Revolt excavators. It is expected that other machines, including the Buckeye Tractor Ditcher,* the Fowler Scoop, and a mole plough of the usual design, will also be on the ground, and will afford an opportunity for comparison between established and newer methods. A number of tractors will be employed, including a Clayton and a Saunderson, with specially designed attachments for operating the Priestman machine, and it is hoped that an internal combustion cable set will also be at work.

A comprehensive report, including complete records of the performances of each machine, with special reference to cost, will be published in due course.

Harmston is within easy reach by rail of Lincoln and Grantham, and the trial ground at Aubourn Fen is a mile from Harmston Station.

* See this *Journal*, July, 1921, p. 306.

AGRICULTURE BEHIND THE LINES IN FRANCE.

LIEUT.-COLONEL J. H. FORRESTER ADDIE, C.B.E.,
Late Colonel, Royal Welsh Fusiliers, and late Deputy Director of Agricultural Production, G.H.Q., France, and
CAPTAIN A. T. A. DOBSON,
Late Lieut.-Colonel, Hampshire Regiment, and late Assistant Director; Assistant Secretary, Ministry of Agriculture and Fisheries.

Part I.—Up to the End of the German Offensive in 1918.

PROBABLY few people, unless familiar with the actual operations of the Army in France, have any idea of the extent to which that Army was self-supporting and of the steps that were being taken, when the War happily terminated in November, 1918, to render food production a definite part of the Army's operations.

It has been frequently observed that for every man engaged in the actual operations of fighting, there are some three or four engaged on the lines of communication and at the bases in supplying the fighting man in the trenches with food, ammunition and equipment. The Army in France contained men of all tastes and all trades, and it is not to be wondered at therefore that, at the many bases and stations on the lines of communication, such as ammunition dumps, supply dumps and so forth, there were to be found men with an agricultural training, or at all events, with a sufficient inclination and knowledge to spend their off hours in recreation of an agricultural nature.

It was for this reason that from an early date the establishment of garden plots became a regular feature of the various Army establishments of a more or less stationary nature, from the base ports up to within a reasonable distance of the fighting line. Even in Divisional areas, namely, those within, say 10 miles of the front line, agricultural operations were also prosecuted, but the constant moving of units, from one part of the front to another, naturally deprived such operations of any very great stability.

These early operations were largely, if not entirely, carried out by the enterprise of individual units and of their Commanding Officers, who realised the necessity for keeping their troops

in good heart by supplying them with healthy and interesting occupation in the hours set aside for recreation.

It soon, however, became apparent to the Authorities at G.H.Q. that this movement was one which ought also to be encouraged from the food supply point of view, and ought not to be left solely to the more or less private enterprise of individual units. Moreover, within the zone in the more immediate neighbourhood of the fighting front, the Army Authorities were constantly receiving requests from the French Authorities for assistance in harvesting the various crops to be secured in areas from which civilians had had to be withdrawn or in areas where civilians found labour difficult to procure, owing to the inroads made by the War on the male population.

It was not, however, until the middle of 1917 that the whole aspect of the question of food production began to demand the serious attention of the Quartermaster-General's staff at General Headquarters.

The submarine campaign had begun to take its toll to a menacing extent, and it began to be evident that the more independent the British Army in France could become of food supplies from home, more particularly potatoes (which absorbed a great deal of tonnage), vegetables, hay and cereals, the better for all concerned. With the conditions existing in France, a plentiful supply of fresh green vegetables was an invaluable if not essential item in the diet of the fighting soldier.

The Quartermaster-General was not unmindful of the fact that the area known as the British Army Zone comprised some of the richest agricultural land in France. Moreover, no one could be blind to the great success which had attended the systematic agricultural operations, in the form of vegetable gardens, which had been carried out by the troops of the French Army.

The first steps to be taken, therefore, were to place the whole undertaking on a properly recognised footing. Up to that time units had obtained the necessary money for the purchase of seeds from the Expeditionary Force Canteens, who were repaid as soon as the crop had been harvested and taken over by the Director of Supplies, the unit being credited with the value.

New arrangements were now made. It was decided that all money required should be advanced from the Fund, which existed at G.H.Q., known as the By-Products Fund, and the only units which were entitled to an advance from this Fund were to be the five Armies, the Lines of Communication as a

Photo, Crown Copyright.] [*Imperial War Museum.*

FIG. 1.—At work on an Army Farm.

Photo, Crown Copyright.] [*Imperial War Museum.*

FIG. 2.—An old Communication Trench.

whole, and the G.H.Q. troops area. The headquarters of each of these Formations had to ascertain the demands from the units within the area of its command, and to incorporate them in one combined application to G.H.Q. All produce harvested as a result of the scheme was to be taken over by the Director of Supplies at a flat rate of 10 centimes per lb., and at the end of the year the loan from the By-Products Fund was, so far as possible, to be repaid.

At the same time, in order that the undertaking might be extended to all available units and, above all, might be properly supervised, steps were taken to obtain particulars of all officers serving in the Army in France who possessed agricultural qualifications.

The two photographs (Fig. 1 and 2) which accompany this article show work proceeding on an Army Form. In Fig. 2 it will be seen that opportunity has been taken to plant potatoes in the bottom of a disused communication trench.

Towards the end of 1917, however, progress was made in a new direction with a view to expanding the scope of the undertaking, and after discussion with the Home Authorities and certain inspections of suitable areas by Dr. F. Keeble, of the Ministry of Agriculture and Fisheries, it was decided by G.H.Q. to establish a Central Farm for the British Expeditionary Force as a whole, as well as lesser farms in each Army area. All these farms, as well as all the other minor agricultural undertakings already discussed, were to be placed under the control and direction of a Director of Agriculture at G.H.Q., with representatives with the larger formations of the British Expeditionary Force.

It was not intended, however, that these central farms, which were more especially designed for the production of potatoes and cereals on a large scale, were to take the place of, or in any way involve the doing away with of the vegetable gardens that already existed all over the British Army area.

The question of organisation consequent upon this decision became one of great urgency. Suitable officers for service under the Directorate had to be selected and large quantities of machinery for the preparation of the soil had to be assembled. Moreover, a suitable area had to be chosen and the necessary agreement drawn up with the French Authorities. The area ultimately selected was one of about 45,000 acres in the region of Roye, which had been the scene of earlier fighting, but was at that time between 30 and 40 miles behind the British Front.

It may be wondered why existing farms were not taken over for this purpose far behind the fighting front. It must be remembered, however, that time was short, the season far advanced if any ploughing and planting were to be done in time for the harvest of 1918, and the only course to adopt, which would not give rise to endless negotiations with private French owners, was to select, in consultation with the French Authorities, an area in the *Zone Interdite*, namely, the land from which French civilians had been evacuated and to which they could not return. No vexatious questions as to ownership arose as regards the cultivation of this area, as it was controlled by the French Military Authorities, so long as it remained closed to civilian inhabitants. Moreover, the French had lost so much territory that it would not have been wise to suggest taking over farms which were actually being farmed. Naturally with so many farmers dispossessed from the devastated area, the French wanted for their own cultivation all the land they could retain.

The early months of 1918 will certainly never be forgotten by those who were engaged in equipping the Directorate with staff, with special Labour Companies for the execution of the work of cultivation, in collecting suitable men as tractor drivers, and last but not least, in the supply of agricultural machinery. The energy and rapidity shown by the War Agricultural Committee in England in the supply and despatch to France of agricultural machinery was only equalled by the speed with which the Director-General of Transportation dealt with it, as it arrived at Havre and sent it up to the railhead in the vicinity of Roye.

The appointment of the Directorate of Agricultural Production was approved by the War Office early in January and Brig.-Gen. the Earl of Radnor, who was appointed Director, proceeded to France on the 2nd of that month. By the 2nd February, 1918, no fewer than 59 tractors, 74 rollers, 40 harrows, 50 cultivators and 33 cases of tractor ploughs were actually on the site at Roye, while a further 35 tractors, 30 rollers, 17 tractor ploughs and numerous cases of spares were at Havre waiting to be put on rail.

On the same date a tractor plough turned its first furrow.

The Headquarters of the Directorate were in the first instance located at Le Touquet as it was essential that, while the necessary staff was being collected and other preliminary arrangements made, close touch should be kept with the

General Headquarters at Montreuil, a few miles distant. As soon as the area to be cultivated had been selected, the Headquarters of the Directorate were moved to Blangy Tronville, a little village west of Amiens lying just off the main Amiens-Peronne road.

Here the offices of the Directorate were within a few miles of the centre of operations and it was possible to keep close watch over, not only the arrival of stores, but almost more important, the assembling of tractors and the training as tractor drivers of men who were arriving from all parts of the Army area, as likely candidates for instruction. The provision of both skilled and unskilled labour presented a very difficult proposition. On every side there was the same story—the shortage of labour. The British Labour Corps which provided men for all purposes other than fighting in the trenches, were greatly below strength, and agricultural operations at that stage had to compete in the limited labour market with urgent services more directly connected with the military operations.

The Quartermaster-General in France in 1918, however, attached great importance to the success of the movement, and the strong personal interest which he took in the work materially helped to smooth away these difficulties.

As already stated, time was the greatest enemy to the undertaking. Every day lost meant a reduction in the number of acres ultimately to be put under the plough. As the result, however, of various Conferences at G.H.Q., six Agricultural Companies, formed according to a special establishment, composed of 1 officer and 169 other ranks, were promised by the Adjutant-General, as well as one British Labour Company, which was equivalent in strength to three Agricultural Companies. It was thus contemplated that there would be one Agricultural Company or its equivalent for each of the 9 blocks of about 5,000 acres into which the whole area was to be divided.

To obtain sanction for these companies was one thing, but to effect their assembling from all parts of the British Army area was another; and by the 27th January, 1918, only 50 men of the first Company had arrived, and even some of these were specially trained men sent out from England.

The task of manipulating the 200 tractors which were considered necessary for the cultivation of the whole area was entrusted to three specially formed Auxiliary (Petrol) Companies, Army Service Corps (Agricultural). The strength of

these Companies was 5 officers and 180 other ranks, divisible into three Sections, each of which had sufficient personnel to deal with 20 tractors. Thus each block of 5,000 acres was ultimately intended to be cultivated by means of one Agricultural Company, and one Section of the Auxiliary (Petrol) Company, with 20 tractors.

The position as regards the Petrol Companies was rather more hopeful, in that a large number of the personnel was supplied from unfit men in England, one complete company arriving by the 26th February. Practically all the personnel, however, had to be trained in a specially created school for tractor driving, but by the 8th March no fewer than 80 men were passed through the school with their training completed.

It is unnecessary at this point to present in greater detail the organisation designed for administering this large area. Suffice to say, however, that work went steadily forward from the 2nd February up to the 21st March.

On the first-mentioned date 6 acres were ploughed and on the last-mentioned date 203 acres were ploughed. The record acreage for one day was on the 17th March, when 300 acres were ploughed. By the 21st March, the ploughing of just under 5,000 acres had been completed.

The area selected was a suitable one in every way. It was advantageously situated. It was well traversed by roads and intersected by railways, one of which was the main line of supply to the British Army on that section of front. The soil varied in character from a light easy-working loam to a stiff clay. There was, however, a chalk subsoil and experience showed that the greater part of the land would work easily and well and excellent crops were looked for. Most of the land had, however, been out of cultivation for three years. Except at isolated points there were not many shell holes, but trenches and their protective belts of wire ran in all directions and were the first task for the Agricultural Companies.

Of the 45,000 acres which comprised the whole, it was proposed to set aside 12,000 acres for potatoes, of which there had been frequent shortages at certain periods in the past. If this acreage had been achieved it would have gone far to meet the total needs of the British Expeditionary Force. The remainder of the area was to be planted with oats, although it was realised that the resultant crops would have but little effect in reducing the tonnage which would be involved in keeping the British Army supplied in this respect, and it was for this reason that the more bulky crops, such as potatoes, were decided upon.

The tractors used were of five types. "Moguls" of three different horse powers, the "Emerson" and the "Allis-Chalmers." They were equipped with three-furrow self-lift ploughs of the "Oliver" and "International Harvester" types. Two drivers were allotted to each tractor, as they became trained, in order that each machine might be kept working at its maximum capacity. All tractors were filled with petrol and oil over night, so that no delay might occur in starting up next morning.

Cultivation of the land other than by ploughing was carried out with convalescent veterinary base horses which, in many cases, had been blinded by gas and were only of value for comparatively light work on the land.

It was on these lines that work went forward until 21st March, and on that date the great German offensive opened.

It is hardly within the scope of this article to discuss this offensive from the military point of view. In selecting the Roye area as the scene for agricultural operations, it had been contemplated that it was sufficiently in the rear of the battle zone to render it improbable that the agricultural operations would have been interfered with by a temporary military success on the part of the enemy. It would be idle to argue here whether such optimism was justified.

There was no time for regret and the officers of the Directorate realised that their first task was to clear the area of all the machinery that had been collected, not only to prevent it from falling into the hands of the enemy, but still more important, to prevent it from encumbering the roads behind the retreating army. The saving of practically everything intact was certainly a gilded page in the history of this short-lived enterprise.

Communication with G.H.Q. from the Directorate Headquarters was somewhat difficult as all the lines were choked with more urgent messages. One message, however, was got through from G.H.Q. on the telephone, ordering the Directorate to move. From that point onwards operations were in the hands of the Directorate.

Orders were given for all tractors and personnel north-east of Roye, viz., on the side nearest the approaching enemy, to concentrate on Roye itself. All other personnel and tractors were ordered to concentrate in the vicinity of the main Roye-Noyon road, with a view to withdrawal south and west. On the 24th March, the general withdrawal started, all tractors proceeding under their own power and all ploughs, rollers and other implements being towed behind horse transport.

The 10 miles to the first objective in the rear was completed without incident, but the news that the German advance was proceeding with rapidity necessitated a further withdrawal immediately. This was again completed without incident and all the columns converged at a point due south of Amiens.

Forced marches had been made and the pace could not be kept up indefinitely. It was therefore decided to make a dump of material other than tractors, which could proceed under their own power, at a village known as Hargicourt. This village ultimately proved the limit of the enemy's advance. It was in fact in the trench lines and was reduced to ruins. By a peculiar freak of war, however, while the whole area round the dump was pitted with shell holes, the implements within were hardly touched, except by shell splinters and were recovered almost intact five months later, when the tide turned.

The withdrawing columns finally reached Rouen after a series of marches which were effected under inevitably trying conditions, and the greatest credit was reflected upon all ranks for the endurance and high sense of discipline which they displayed. At Rouen the personnel was reorganised and sent forward to construct rear lines of defence. The Directorate returned to their old Headquarters at Le Touquet.

Of incidents there were many during the retreat. In one case, an abandoned tractor was pressed into the service of a retreating battery, who were finding it difficult to get their heavy 9-in. guns into action. In accordance with instructions, this tractor had been left with empty water tanks, but notwithstanding, it was put in motion and the engine responded to the call, and although overloaded, pulled the gun into position. The inexperience of the gunner drivers, however, proved too great a test and the tractor, after performing this last service, had to be counted among the missing.

One more incident is worthy of mention, and was not without humour. Two tractors had been loaned to one of the Armies affected by the retreat, for use on the Army Farm, and owing to a belated start, finally withdrew under their own power, practically on a level with the rear guard troops. The mornings were misty; the noise of the engines was unfamiliar; and reports reached Corps Headquarters that German "tanks" had succeeded in passing the line of outposts. Counter steps were immediately taken to deal with a situation, which was only restored when the mist lifted, and revealed two 8/16 "Moguls" making stately and steady progress towards the rear.

ABERDEEN-ANGUS CATTLE.

J. J. CRIDLAN.

Historical Notes.—The rise of this breed to its present pre-eminence is probably the most remarkable of any of our domestic bovine species. The breed is indigenous to the districts which are still its headquarters, the North Eastern Counties of Scotland, Aberdeen and Forfar (Angus) being its chief centres. The precise date at which organic changes have given us the Aberdeen-Angus polled breed remains a mystery, but there is documentary evidence to prove there were in Aberdeenshire cattle without horns more than 400 years ago. The current belief that the native cattle of Aberdeenshire have been black and hornless, time out of mind, is confirmed by a legal document in Vol. III, p. 344, of the Spalding Club Antiquities of the Shires of Aberdeen and Banff. It describes the ceremony observed in putting John Cumyng, of Culter, Aberdeen, into possession of his deceased father's property in 1523. Till 1845, when a property changed owners by death or purchase, sasine or actual possession was given by the Crown or the Superior to the new owner by delivering to him, on the ground, a handful of earth as a symbol of the soil of the property, and a stone as a symbol of the building on it. This was called giving " yird and stane." At an earlier period, when land was held by personal military service, the Crown, before accepting a new owner, claimed a money payment called " relief " from an heir and " composition " from a purchaser. This made sasine-giving a more important function than it was after the abolition of military service tenure.

In the case mentioned, sasine was given by an officer of the Sheriff of Aberdeen called the " mayor of fee," and it was effected by John Cumyng selecting and accepting " unum bovem nigrum hommyll "—a black hummel (hornless) ox—valued at 40s. 8d. Scots. It had represented a plough ox, of which there were at the time eight in the plough team, and indicated John Cumyng's right to cultivate the ground. Being a symbol, and being selected, it is plain that it was of the kind of oxen common and most esteemed in the country at the time, and also that this had been a long established custom.

That progressive Society, The Smithfield Club, did not till 1892 consider this breed to be sufficiently important to allot it a separate classification, notwithstanding the fact that Mr. William

McCombie, " the great deliverer " of Aberdeen-Angus Cattle as he has been aptly called, in 1867 brought the great Doddy Ox " Black Prince " south, and swept away all the leading championship honours from the Birmingham and Smithfield Shows, whence at Her Majesty the Queen's expressed desire, it was forwarded to Windsor for her inspection. Like Saul, William McCombie was head and shoulders above his compeers. Born at Tillyfour in 1805, he died in 1880. He carried on the work of the pioneer, Hugh Watson of Keillor: what Collings did for the Shorthorn, the latter did for the Aberdeen-Angus. In his work " Cattle and Cattle Breeders," William McCombie pays generous testimony to his excellence: " Amongst those who have distinguished themselves as breeders of Aberdeen and Angus polled cattle, the late Hugh Watson deserves to be put in the front rank. We all look upon him as the first great improver and no one will question his title to that distinction. There is no herd in the country which is not indebted to Keillor blood."

Previously to his great successes above mentioned, McCombie had in 1856, 1857 and 1862 won every first prize for Aberdeen-Angus breeding and fat cattle awarded by the French Government at its International Shows, including the Fat Stock Championship of the World. It was not, however, till 1878 that McCombie reached the zenith of his fame as a breeder and feeder, by his triumph over all breeds at the Paris International Exhibition, where a prize of £100 was offered by the French Government for the best animals for breeding purposes bred by the exhibitor in the section of animals other than French. For this trophy, there competed representatives of the Aberdeen-Angus, Shorthorn, Hereford, Devon, Sussex, Ayrshire, Highland, Norfolk, Kerry, Dutch, Flemish, Danish, Berne Fribourg, Swiss, Piedmontese and Portuguese breeds—surely the most representative groups of the breeds of the world ever gathered together. The prize was awarded to McCombie's group, with the group of Sir George McPherson Grant second: the Aberdeen-Angus thus providing the champion and reserve champion winners. More honours, however, fell to the lot of the Doddies of Aberdeenshire. The only occasion on which British and French cattle had any opportunity of testing their respective merits was in the competition for the £100 prize for the best group of beef producing animals, bred by the exhibitor. The adjudicating bench was comprised of 31 members of the various breeds, and by a majority of 24 to 7 the Aberdeenshire group triumphed. It should be noted as affording another

proof of the early maturing characteristics of the Doddies that only one of McCombie's " best beef producing group " of six, was over two years and a few months.

McCombie's ideal in breeding cattle was size, symmetry, fineness of bone, strength of constitution and adaptability to accumulate flesh evenly. Few men in his generation had greater all round experience than McCombie; he dealt largely in commercial cattle, attended the Smithfield markets with regular consignments, and there found that the demand for the Doddy by the London butchers exceeded that for any other breed, and brought more remunerative prices—a feature that impressed the most famous of all present-day Shorthorn breeders, Mr. William Duthie of Collynie, who has stated, " It is some years since I was in the habit of attending the London Christmas market, and in *those* days there was nothing I liked to own, and nothing I liked to stand behind better than a lot of good Aberdeen-Angus cattle." What an appreciation from so great an authority! In *these* days he is modelling the Shorthorn with the Doddy characteristics as nearly as human skill can command.

McCombie's deeds proved an incentive to that able veterinarian, Dr. Clement Stephenson, to carry forward the black " banner with a strange device," the Doddy. He, in 1885, 1887 and 1894, carried away from the Smithfield Club Show the Champion Plate and other trophies. Dr. Stephenson was a keen enthusiast and good judge and did sterling work in promoting the interests of the breed: he will fill a big place in its historical records. Not the least of his productions was his 1885 Champion Heifer, " Luxury," which was a model of symmetry and economical feeding; its carcass gave the minimum of offal to the maximum of prime lean flesh ever registered; the purchaser who slaughtered it testified that the carcass, when quartered, appeared to have no coarse meat at all; there was little more scrag than in a sheep and the smallness of the bone in proportion to the thickness and weight of the carcass was remarkable. The dead weight of this animal was 1,318 lb. showing a percentage of 76¾ dressed meat to live weight, only 23¼ per cent. offal. This record will be hard to beat, if it is ever beaten.

The Earl of Strathmore next entered the lists and emblazoned on the black banner further Smithfield Club Championship victories in 1896, 1898, 1901 and 1902. What a marvellous quartette were those Aberdeen-Angus heifers, " Minx," " Ju Ju," " Layia," and " Brunhilde of Glamis."

The carcass of "Minx of Glamis" was a remarkably fine one, undoubtedly the best of a grand quartette. Other Aberdeen-Angus Championship successes have been won by Earl Rosebery, The Duke of Portland, Col. McInroy, Sir Richard Cooper, J. D. Fletcher and another breeder.

The Aberdeen-Angus as a Butcher's Beast.—How far the points of excellence aimed at by the breeder are appreciated by butchers, is doubtless a question of great interest to those agriculturists who desire to produce the best types of the various breeds of cattle indigenous to Great Britain, and whose successful efforts have been rewarded by raising their country's cattle to such an eminence that its stock is sought by every country suitable for cattle breeding. The value of these efforts to the butcher continues to be exemplified abroad, especially in the United States of America, Argentina, and in recent years New Zealand and South Africa, from which sources we have been drawing huge supplies to feed our teeming millions. So far as the first country is concerned, these supplies of beef are almost a thing of the past; it is now difficult for it to feed its own increasing population. Notwithstanding its great commercial development and its millions of acres, its cattle breeding industry has not kept pace with its expanding population and national progress, and consequently it has now to resort to importations from the Argentine and elsewhere.

The estancieros of Argentina, wise in their generation, had with much foresight and unstinted outlay raised up from its Criolla (native) stock by the aid of the best British bulls, principally Shorthorn, vast herds of commercial cattle suitable for exportation. When in 1910 I was invited by its great Rural Society to judge Aberdeen-Angus cattle for the first time, I found the Shorthorn very popular and in the ascendant, the Hereford with a wealthy and important following, but the poor Doddy the despised and rejected of men. The merits of the Aberdeen-Angus were only appreciated, with one or two exceptions, by the smaller and less important section of breeders, but what a revolution of opinion and esteem has occurred in 10 brief years! One dared hardly then mention the incomparable merits of the Aberdeen-Angus before being "sat upon" by the enthusiasts of the other two breeds.

The American packing houses were, however, just opening their first great plant, and knowing so well its mode of procedure, I was very optimistic and prophesied those coming events which were casting their shadows before. The English

FIG. 1.—Champion Bull of Aberdeen-Angus Breed. Winner of 6 Gold and 9 Silver Medals.

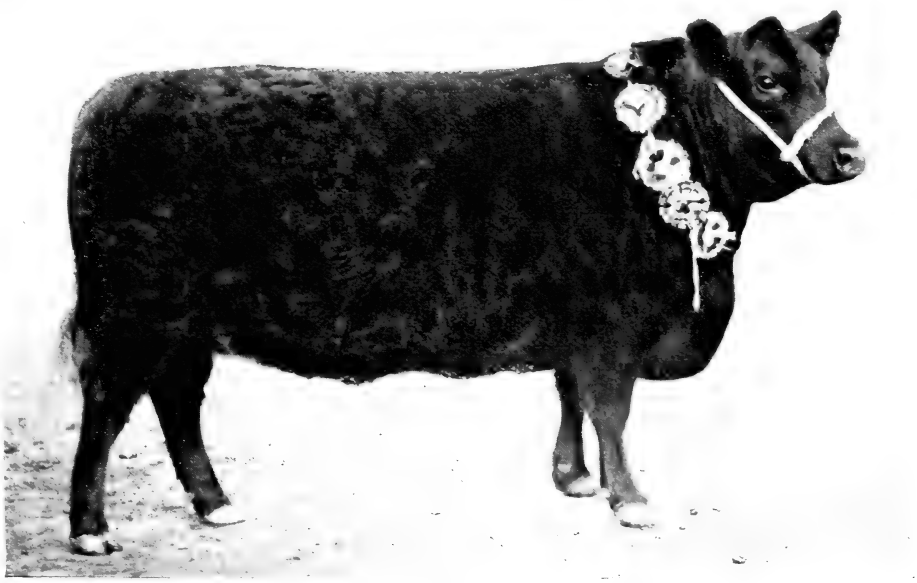

FIG. 2.—Champion Heifer of Aberdeen-Angus Breed. Winner of many Gold and Silver Medals, and Cups.

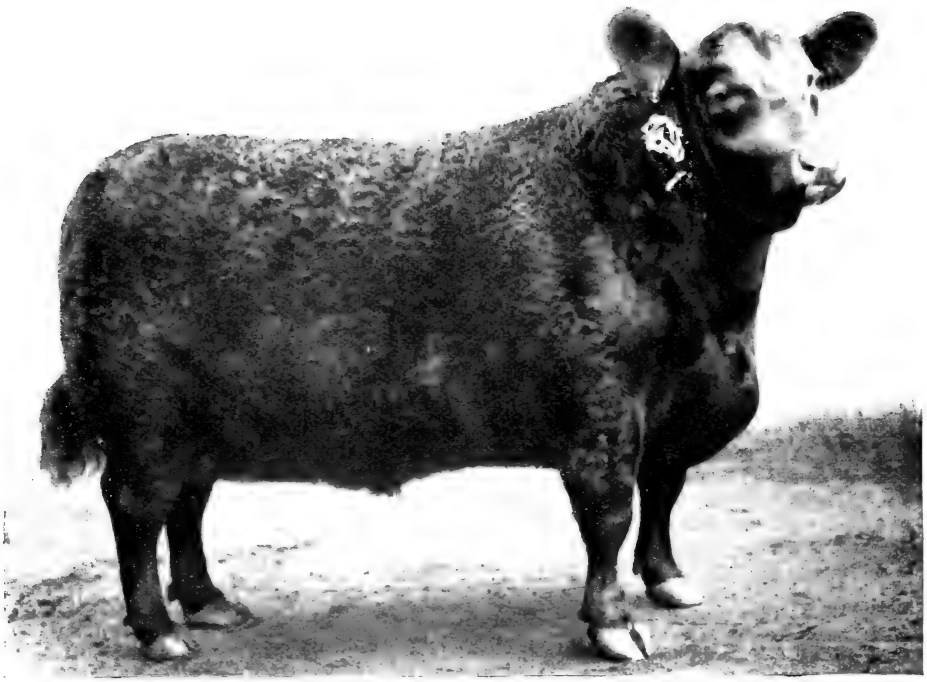

FIG. 3. —Champion Steer of Aberdeen-Angus Breed. Winner of several Prizes and Cups.

FIG. 4.—Champion Heifer, Aberdeen-Angus-Shorthorn Cross ($\frac{3}{4}$ Angus). Winner of several Prizes.

packing houses had been and were buying the cattle by the lump, if I may so term it, irrespective of quality: that was not the policy of the Yankee. Quality rules in the Smithfield market, and the aim of the American companies has always been to secure the best clientèle there, viz., the meat traders who require the best article and give the highest prices. I paid visits to nearly all the leading packing houses and leading estancias and advocated the production of baby beef, a series of two-year-old bullocks in the place of the 4, 5 and 6-year-old oxen that were so common. Experience of 30 years on the Smithfield market gave the assurance that the uplifting of the Doddy in the appreciation of this great country was on the horizon. Another feature that made assurance doubly sure was the prospective Show of Fat Cattle, the first of its kind in South America, at which I was invited to stay and judge. A new epoch was opening; the show proved a great success. There were few Doddies exhibited, and the leading honours went to the Shorthorns and Herefords, but it meant salvation to the Aberdeen-Angus, for a fat cattle show without representatives of the black and comely would be like Shakespeare's greatest play, Hamlet, without its sable-clad Prince of Denmark.

Figures published recently by the Rural Society of Argentina show that the Aberdeen-Angus is now second on the list of the pure-bred herds of the beef cattle of Argentina, the Aberdeen-Angus being more numerous than the Herefords. Pure bred Aberdeen-Angus bulls are sought after for crossing purposes, as no better steers for the butcher can be raised than its cross with the almost universal Shorthorn. The Secretary of the Argentine Angus Society—Senor Ricardo Hogg—has published the fact that in the neighbourhood of Concordia alone, there are now 300,000 black cows. Mr. James Sidey, the oldest exporter of cattle to the Argentine, told me at the Highland Society's Show that he had received from his partner in that country a cablegram advising him to sell all purchases possible at home with the exception of Angus. Such straws show which way the wind blows: the demand of the packers there is now for the animal with the maximum of meat for roasting with a minimum of coarse.

In an article some years ago* I gave particulars of specimens and measurements of our various cattle of 100 years ago, which then met the requirements of the butchers and the public; but unless one has the engravings and measurements of those

* Farmer and Stock Breeder Almanac.

monster animals before one it is difficult to realise the results attained by breeders of the 20th century, who by selection and registration have evolved the type and quality of the breeds exhibited at our present-day shows which give so much satisfaction to the butcher and the public, not the least important feature being early maturity.

Towards the end of the last century the London and country butchers began to resent the character of cattle exhibited at the Smithfield Club and other shows. The cow and ewe classes then in existence proved sources of loss, the character of the meat being so wasteful as to be useless to the customer and unprofitable to the trader. Protests were made and the Council of the Smithfield Club eventually deleted such classes from its schedule. The abolition of the cow and ewe classes did not, however, entirely meet the objections to show cattle from the butcher's point of view, and further pressure of the meat traders caused the institution of the Carcass Section by the Club, the Council of which eventually generously provided funds for handsome prizes, and the Section is now acknowledged to be very popular and highly educational. This Section is open to all breeds and is now judged by members of the meat trade, whose awards have given general satisfaction, and definitely fixed the superiority of the Angus, which either in its capacity as a pure breed or its value as a cross (principally with that other great breed, the Shorthorn) has produced the champion carcass of beef on every occasion but one, viz., in 1903, when a Welsh runt took the laurels.

The carcass competition was established in 1895, and champion prizes were first given in 1899. Since then the Angus breed has been successful on five occasions, the Angus-Shorthorn Cross on 15, the Angus-Hereford once, the Angus-Dexter once, and the Welsh once. Thus in 23 competitions, Angus and Angus crosses have been supreme on 22 occasions: a remarkable record that cannot be explained away.

A memorable date in the annals of Aberdeen-Angus Cattle was 1892, the first year distinct classes were allotted to the breed at the Smithfield Club Shows. In the main section since (26 shows) pure Angus cattle have won the Championship 14 times: Aberdeen-Angus and Shorthorn crosses twice. Such a record is so striking that it needs no adjectives to accentuate it; yet, the records created by the Angus at the Great International Show in Chicago are even more telling. Judged by the most expert members of the great packing

houses, through whose hands millions of cattle of all breeds pass every year, the following results have been attained. The Carcass Competition there was instituted in 1900, and in that year a Shorthorn cross was Champion (what kind of cross is not stated), but every year since that date the Championship has been gained by pure Aberdeen-Angus cattle or a cross therewith, all black and polled. Probably the most remarkable collection of beef animals in the wide world is the Car Load Lots of 15 exhibited there, matched to perfection like a row of peas in a pod. Shorthorn cattle were Champions in 1909; Herefords in 1901 and 1903, and Angus the other 15 years of the competition. Owing to foot-and-mouth disease Smithfield Club shows were not held in 1914 and 1915.

The Aberdeen-Angus most nearly approaches the ideal butcher's animal. As I wrote in the *Live Stock Journal Almanac*, 1910:—" Meat traders, after continued experience with all breeds of cattle are unanimous in awarding the palm to the Aberdeen-Angus; short on leg, small in the bone, deep in flesh of a fine mellow grain throughout, with well-rounded hooks and buttocks, it is undoubtedly the best type of what a beef-producing animal should be. Even its coarse parts are more valuable than those of other breeds, the flanks and briskets have greater depth of flesh and are interspersed with less wasteful fat and gristle." I have likened the Angus to a student of economy:—

" It does a bit at every bite
And makes the most of every mite."

In other words, it puts on fat so regularly and smoothly throughout that no loss is occasioned to the butcher by having to trim unnecessary fat from parts of the carcass. The butcher hates patchiness, which is an evil all breeders should avoid and use their best endeavours to eradicate. Shorthorns and Herefords are very prone to accentuate this fault, especially when fed for fat stock shows, on the tail head, the hooks, ribs, brisket and flanks. Brought up in my youth amongst these two breeds, I had a predilection for them, and the height and goal of my ambition at that time was to possess a herd of either; but later experience proved incontestably that the Angus cattle were supreme as beef producers of the choicest quality, and as " market toppers " in price could not be equalled.

This opinion is not biased or unique amongst meat traders. Mr. James Brown, chief cattle buyer for Armour and Co., who judged the car load lots at the International Live Stock

Exposition in 1909, the only occasion when the Shorthorns have won this great prize, states: "An Aberdeen-Angus steer is an ideal animal from the butcher's standpoint, the ripe Aberdeen-Angus has no superior. The average market performance of black cattle as indicated by the prize list, demonstrates their quality, the meat marbles well. They are high dressers, being short-legged and chunky, the meat is in the right place with a high percentage of choice cuts. They cut up with minimum waste, hence the popularity of beef carcasses that have been divested of black hides, with the retailer. Buyers are of necessity impartial to breeds; their mission is to get good cattle regardless of colour or history. 'Blood will tell,' and when a buyer locates a drove of well-bred finished Aberdeen-Angus, he knows he has an opportunity to buy *something*. They are smooth, the proportion of weight in loin and rib (the most valuable parts) is uniformly heavy." Henry du Plan, buyer for another large packing house, who judged car load lots in 1907, states: "No better cattle come to market than Aberdeen-Angus. A load of black bullocks of the same quality and finish as a load of any other kind, will invariably elicit a bid 10 cents higher than the buyer would feel justified in offering for others. The statement that the black is an 'honest bullock' explains this. When he starts a load of black ones towards the scales, he does it with the conviction that not only will he get a high percentage of beef, but it will be good meat. One reason the butcher is partial to them is that they are fine boned, and when an experienced retailer enters a beef cooler (refrigerator) to select material to replenish his stock, he invariably begins a patient search for the black ones, frequently surprising beef men by the certainty with which he picks them out of the mass. A black carcass is always a nice carcass, and my experience justifies me in stating that there are fewer counterfeits in this breed than in any other." Such is the universal opinion of meat experts, an opinion so recently endorsed by the sale of Canadian cattle bred and fed in Alberta and brought over at the instigation of the Honourable Duncan Marshall, Minister of Agriculture, to demonstrate the class and quality of the stock being raised in the Dominion. There were 7 Herefords, 6 Aberdeen-Angus and 2 Shorthorns, sold by auction to leading butchers, and the Angus averaged £10 per head more than the other breeds, and what is even more incisive 2d. per lb. higher in price.

The biggest classes at Fat Stock Shows are undoubtedly

those of the cross breeds, and here the supremacy of the Angus in conjunction with the Shorthorn is incontestable. The Angus-Shorthorn and Shorthorn-Angus crosses provide about nine-tenths of the entries, and these breeds undoubtedly "nick" more advantageously than those of any other two breeds, and produce a blue-grey or black commercial animal for beef purposes, second to none. They also carry off the great bulk of the prizes both in the main cross-bred section and carcass competitions. The butchers appreciate these crosses highly and acknowledge the grand work done in the past century by the breeders of pedigree stock in evolving breeds so suitable for their purpose to feed the epicure and the multitude.

The crucial question at the moment to the butcher and the public is: Where are we to look for our future supplies of meat? Many countries are being tested and exploited.

Brazil has huge potentialities. Henry Savage Landor in his thrilling and interesting work "Across Unknown South America" has discovered and brought to light vast grazing lands, untenanted by animal life, which are well watered and capable of sustaining very many millions of cattle.

Uruguay with its 37,500,000 acres of pasture land devoted to cattle raising.

Paraguay, where a Chicago firm recently bought 20,000,000 acres of land (and had 12,000,000 more acres in Argentina and Uruguay under offer).

Rhodesia and the Northern Territories of *Australia*, are all capable of producing and supporting vast herds. These countries are already being exploited, and numerous packing houses have been established during the past few years.

This subject is, however, too great a one to more than touch upon. Volumes of interesting matter could be written upon a matter so vital to the future well-being of our country. Very many of our pedigree cattle will, however, be required and exported to these countries before the produce are suitable, from the home butcher's point of view, and as the ultimate destination of all cattle is the block, it would be to the advantage of all breeders to keep in their mind's eye those essential points which enhance the value of all breeds to the butcher.

THE BREEDING OF GEESE:

A Profitable Addition to the General or Poultry Farm.

STANLEY STREET-PORTER.

DURING the last few years probably no industry in this country has seen a greater development than that of poultry keeping. That which in the past was regarded by most as merely a hobby is now recognised as a serious and profitable industry.

It is encouraging to note that up-to-date progressive farmers are at last alive to the fact that poultry keeping on modern lines forms one of the most profitable adjuncts to general farming.

The breeding of geese is a branch of the industry that has been greatly neglected in this country, and yet it is one of the most profitable to farmers and others possessing grazing land.

Many farmers have a deep-rooted objection to geese, under the impression that they spoil the grazing for other stock, and it is commonly stated that cattle, etc., will not graze after geese. It is quite true that a large flock of geese does consume a considerable quantity of grass, but for that matter so does a large flock of sheep; and, as a practical farmer himself, the writer can absolutely disprove the fact that cattle will not feed after geese, and has found that geese pay well for all they consume. Further, the manurial value of a flock of geese, if not run too thickly, is very great on poor grazing land.

An additional advantage is the fact that the birds do not *need* a rich pasture, but will grow and thrive on poor common land, of which there is a considerable quantity in many parts of the country. They might also be kept with advantage in smaller numbers by small-holders and cottagers with suitable grazing in the vicinity.

Given suitable grazing, there is probably no other branch of poultry keeping more profitable than the rearing of geese. Unlike fowls and ducks, which need constant feeding and care, geese will forage for their own living, and after the first few days will require practically no grain or meal ration, no expensive scratching shed, and little attention so long as adequate grazing is available. Under these conditions they will feed and look after themselves and make very rapid growth.

Before the War large quantities of geese were reared in Ireland and exported to this country to be fattened. In some

districts they were purchased in considerable quantities, run in large flocks over the stubbles after harvest, and sold as "Michaelmas" geese. To what extent this is carried on at the present time the writer is not aware.

Italy, France and Germany are also large producers of geese, and in Germany the breast of the goose is smoked and considered a delicacy.

Breeds.—Of the various breeds of geese probably the best known are the Embden and the Toulouse, while the Chinese is also well known. Another breed, which is not so well known in this country as the others, is the "Roman," which the writer considers the best "commercial" goose of all. Personally, however, he has only kept two of the above-mentioned varieties, viz. the Roman and the Toulouse. Both of these varieties undoubtedly have their good points. The Roman might be aptly compared to White Wyandottes or Rhode Island Reds and the Toulouse to Indian Game or Dorkings, since the Roman goose resembles the breeds of fowls with which I have compared them in being of moderate size and far more prolific as layers than most other breeds of geese—with the exception possibly of the "Chinese"—whilst the Toulouse is undoubtedly the best heavy-weight Christmas goose obtainable. The Toulouse are very massive and majestic in appearance and do not make the rapid growth of the Roman, but though they are slower in attaining maturity, they make fine heavy-weight geese by the end of the year. Toulouse geese usually commence laying in February, and after laying their first "clutch" of eggs, go "broody," afterwards laying a second, and as a rule smaller batch of eggs than the first. In colour the Toulouse is a dark grey with white under, and is the most handsome variety we have.

Roman geese are much smaller than either Toulouse or Embden. They have a very smart, alert carriage and are splendid foragers. In colour they are generally white, though some have grey markings on head and neck. They weigh from 12 to 14 lb. when mature, are finer in bone than the Toulouse, and carry more flesh in proportion to offal than the heavier breeds. No standard has yet been fixed for this breed in England, and consequently they are not provided for at any of our large shows and are only in the hands of a comparatively few breeders. They are probably the most prolific geese in existence, and like the breeds of "laying ducks" such as Runners, Buff Orpingtons and Khaki Campbells, they breed

quite satisfactorily without swimming water, and unfertile eggs are the exception.

As this article is written with the object of encouraging the breeding of geese for market purposes, no apology is made for drawing special attention to this particular breed, which is undoubtedly *the* " utility " goose of the future. The birds are very active foragers and extraordinarily quick growers, and if reared on grass and then run on the stubbles after harvest are very profitable to sell as " Michaelmas " geese.

Roman geese generally come into lay towards the end of January or early in February. Although they are rather addicted to broodiness, and will generally go broody four or five times during the season, if shut up at once they are easily broken of this, and the writer has frequently had them laying again in 7 or 8 days. If required to hatch their own eggs they make very reliable sitters and splendid mothers. If it is wished to break them of broodiness they should be taken the first night they remain on the nest, put in a raised coop with slatted bottom and fed liberally, when they will soon recommence laying.

The writer has little knowledge of either Embden or Chinese geese. The former are white and better layers than Toulouse, though not so large; they are frequently crossed with the Toulouse for producing market geese with good results.

Breeding and Feeding.—In making pens for the breeding season one gander may be mated with three geese. Second or third season geese are most suitably mated to a year-old gander, though good results may be obtained from first-season early-hatched geese of the Roman breed if mated to a second-season gander. It is preferable if the breeding stock can be given free range and swimming water, but the writer keeps a large number of pens of Roman geese for pedigree purposes and all are kept in confined pens during the breeding season without swimming water. In spite of this the birds are prolific as layers and their eggs are very fertile. This method, however, is not so satisfactory as regards the Toulouse breed, which, to give the best results, requires free range and water to swim in.

Through the breeding season, particularly where geese are kept in comparative confinement, the birds should be fed liberally to obtain a maximum production and the best hatching results. During this period one good feed of grain and one of soft mash are given each day.

As in the case of ducks, geese require a greater proportion of animal food in their mash than fowls. Bran, middlings, maize meal, Sussex ground oats and fish meal in equal parts make a good, serviceable mash for the breeding season, while a grain feed consisting of equal parts of sound oats and kibbled maize fed in troughs in their drinking water is recommended. Grit and oyster shell should also always be available for them in their drinking water.

For the Christmas trade geese require fattening to bring them into proper condition. For this purpose they should be shut up in an open-fronted shed and given all the food they will consume. This should be mainly a mash composed of maize meal, Sussex ground oats, barley meal, and if available some boiled potatoes may be mashed up with the meals; about 10 per cent. of fish meal or meat meal may be added with advantage. White oats of good quality, which should be steeped in cold water for some hours before feeding, also form an excellent food to produce fine quality flesh. Food may be given two or three times a day when fattening, but any food left over should be removed from the troughs after they have finished feeding; if left over until the next meal there is a danger of them going off their feed. Grit and fresh clean water should always be available, but the geese should not be allowed swimming water whilst fattening.

The shed in which they are confined should be kept well littered down with clean straw and the birds let out for a good swim before being killed, in order to cleanse their feathers.

Hatching and Rearing.—The chief trouble in hatching geese is the fact that they commence to lay freely early in the season at a time when there is usually a great dearth of broody hens. Whilst by force of circumstances the writer has had to resort to artificial methods of incubation, he cannot say that this method of hatching has even given what may be considered sufficiently satisfactory results, and does not therefore recommend hatching the eggs in incubators if broody hens are available. To overcome the difficulty the writer determined two years ago to produce broody hens for the purpose, and mated some Silkie cockerels with White Wyandotte, Rhode Island Red and Buff Orpington hens. The produce of any of these first crosses make ideal broody hens for hatching pheasants, ducks or geese. They are small but wonderful sitters and mothers, and after laying a few eggs will invariably go broody, and may rear several broods during the season.

Since following this method I have never been short of broody hens, and they have invariably given good hatching results.

If goose eggs are hatched artificially the temperature of the incubator should be 102° F. as in the case of ducks' eggs. It is advisable to sprinkle the eggs once a day with water (with the chill off) and as soon as they begin to " chip " a piece of flannel or old blanket should be well soaked in warm water and laid over them for about 10 minutes; this will help to soften the membrane of the shell and give far better results than would otherwise be obtained.

There are few prettier sights than a flock of newly-hatched goslings, and almost from the first they commence to fend for themselves and nibble at the grass. They do not need so much brooding as chickens, and a hen of ordinary size will bring up 15 or 16 if a good mother.

When artificial rearing is resorted to, the brooder should not be at as high a temperature as for chickens; the amount of heat required would vary according to the number put in, as the goslings will themselves generate a considerable amount of heat. This of course also applies to chickens and ducks, and the novice frequently suffers considerable loss from the mistake of putting a few chickens into a foster mother early in the season with insufficient heat, or again in warm weather by placing too many in a brooder, when they become overheated. If a fair number of goslings are put into a brooder very little heat is necessary after the first two or three days.

Goslings can be fed practically the same as chickens or ducklings, with a little bran, middlings, Sussex ground oats and maize meal mixed crumbly. If given a chance to range they will soon provide for themselves. After the first fortnight during mild, open weather, they need not be fed at all if given free range, unless required for early killing. If sold as " Michaelmas " geese they can be picked up for killing from the stubbles, provided there has been a sufficiency of grain to put them into good condition. It is of course, a mistake having built up the frame at a very low cost to market the geese in poor condition, and even though they have had good " shacking " on the stubbles it may be found necessary to give a little fattening meal to " finish " them. This will add to their weight and naturally give them a plumper appearance when dressed for table. Incidentally, flesh of a better flavour and quality will result.

During the next few years every farmer will need to produce everything possible from his holding (whether it be large or small) that will yield a profit, and he can no longer afford to regard poultry keeping as of no importance. Many farmers to-day, by keeping well-bred poultry on modern lines, are making a profit which goes a long way towards paying their rent, but whether they keep poultry as a serious adjunct to their business or not, there is no reason why on many farms a breeding pen of geese and some well-bred laying ducks* should not be kept. This would not entail the displacement of any other stock, and in the aggregate would add considerably to the revenue derived from the farming industry and also to the food produced in the country.

Payment of Claims under the Corn Production Acts.

IN accordance with the Corn Production Acts (Repeal) Act, 1921, payments in respect of wheat and oats of the 1921 crop are payable on 1st of January, 1922, and payment cannot in any case be made before that date.

The Ministry will, however, endeavour to issue by the end of November a letter of notification to each claimant who made a claim in the prescribed form before 18th July. This letter will only state the amount due, the actual Pay Order being issued at the end of December. The above arrangement will not, however, apply to claims made after 18th July or to claims which require fuller investigation. These will be dealt with as soon as possible after the completion of the examination of the first batch of claims, and Pay Orders will be issued without any letter of notification.

The total number of claims now received is approximately 200,000. The task of dealing with this number of claims is a very considerable one, and it is hoped that farmers will appreciate the fact that the Ministry is making every effort to ensure that payments shall be made by 1st January next.

Occupiers who have made a claim on the proper form and have received an acknowledgment are requested to refrain from writing to the Ministry on the subject as such correspondence tends to delay the work of examining and dealing with the claims.

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* See this *Journal*, April, 1921, p. 54.

IMPROVEMENT OF DAIRY CATTLE IN DENMARK.

HARALD FABER,
Danish Agricultural Commissioner in London.

The first part of this article, published in the October issue of the JOURNAL, *deals with the influence of Milk Recording on the Breeding of Dairy Cattle, the method of keeping Family and Official Herdbooks; and the Inheritance of Milk Yielding Capacity through the Bull.*

Influence of Bulls on Milk Yield.—When the milk recording societies had worked for a considerable number of years, and something like 15,000 herds including 250,000 cows, or about one-fifth of all the cows in the country, were entered in the societies, a very considerable amount of information was available annually as to the yields of individual cows and as to their sires and dams. As a result of the measures already described, many good bulls were being used in the country, chiefly in the many Cattle Breeding Societies. These bulls were mated with dams with recorded yields and the yields of the offspring were also recorded. All that was required, therefore, was *a systematic investigation of this vast material* of the milk recording societies in order to bring out in figures the influence of the different bulls on the yield of their progeny. The Law of 1912 on Breeding of Domestic Animals, therefore, made it a condition for obtaining the Government grant to milk recording societies that the societies should send annually to the Federation of Agricultural Societies of their respective Province a report with a list of all the cows controlled by the society. The report must show for each cow the name or number, day of birth, sire and dam, record of yield of milk by quantity and quality, amount of food consumed (by " food units ") and the day of calving, with information of the marking of the calf and how it has been disposed of. It was further provided that the Provincial Federations shall, as far as possible, tabulate this statistical material and publish such reports based thereon as they consider to be of interest to the cattle breeding industry. These records, properly tabulated, evidently contain the necessary material for judging the influence on the yield of the progeny of the parents and particularly of the sire.

These investigations are now carried out to a large extent in

the different Provinces by the officers of the Provincial Federations, and the Government gives a grant of £500 to help to defray the cost.* *The influence of the sire is found by comparing the yields of dams with those of their female progeny by the sire.* The character of chief interest in a butter-producing country like Denmark is the percentage of fat in the milk. In some cases, such as in Funen, the quantity of milk is also taken into account.

The following table shows the influence of five bulls of the Jutland Breed on the percentage of fat in the milk of their female progeny. It records in the case of each bull the average percentage of fat in the milk of the dams and of their progeny by the bull, the number of progeny being also stated. In the last two columns are given the calculated amounts of butter yielded by 6,000 lb. of milk, by dams as well as by their daughters by the sire in question.

Name of Bull	*Number of Progeny*	*Average Percentage of Fat in Milk of*		*Calculated yield of butter from 6,000 lb. of milk of*	
		Daughters	Dams	Daughters	Dams
				lb.	lb.
1. Assistent II	66	3·87	3·50	260	234
2. Assistent Lem	49	3·84	3·47	258	232
3. Assistent Aksel	99	3·72	3·28	250	218
4. Assistent Toftegaard	26	3·63	3·27	242	218
5. Emb Britten	46	3·71	3·36	250	224

It will be seen that these five bulls have influenced the milk of their progeny so as to raise its content of fat from 0.35 to 0.44 per cent. above the percentage of fat in the milk of their dams, so increasing the average butter production by more than 10 per cent. The bulls numbered 1, 2 and 3 are brothers, and 4 is a son of 2. These four belong to the prominent bull family "Assistent" with many members in the Herdbook of Bulls of the Jutland Cattle.

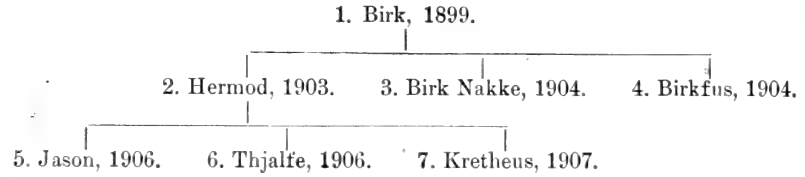
Many similar records of the influence of related bulls on the yields of their progeny can be extracted from the herd books of Danish dairy cattle. Mr. Mörkeberg has kindly sent me the

* On the Budget for the financial year 1920-21 the following amounts in aid of cattle breeding were included, according to the Law of 8th June, 1912, as amended 12th February, 1919 :—

Prizes at Agricultural Shows	£6,000
Prizes at Provincial Shows	1,500
Prizes for Bulls at State Shows	2,000
Cattle Breeding Societies	6,000
Milk Recording Societies...	6,000
Competitions for whole Herds	500
Tabulating Reports from Milk Recording Societies in order to find the influence of parents on their progeny	500

NOTE.—The two first items are for prizes for all animals, so that only part of these sums is available for prizes for cattle.

following records concerning members of a bull family of the Red Danish Dairy Cattle.* The "Birk" Bulls, with the years of their birth, are arranged in the following genealogical table :—



The following table gives for each of these bulls the number of progeny by various dams, also the average yield of milk, percentage of fat, and calculated yield of butter, for both dams and their progeny. *These averages are calculated for corresponding years*, taking the yields of the dam only for as many years, beginning with the year of first calving, as the years for which the yields of her progeny are known.

Bull	Progeny.				Dams.		
No.	Number	Yield of Milk	Fat per cent.	Yield of Butter	Yield of Milk	Fat per cent.	Yield of Butter
		lb.		lb.	lb.		lb.
1	59	8,424	3·94	372	7,962	3·70	330
2	21	9,302	4·35	453	9,731	3·81	414
3	30	9,053	3·83	387	8,639	3·38	326
4	10	9,214	3·91	403	9,000	3·46	345
5	33	9,229	4·25	440	8,884	3·73	367
6	34	8,582	3·91	374	8,793	3·56	350
7	27	9,427	4·05	427	8,534	3·65	348
Averages:		9,033	4·03	408	8,792	3·61	354

The average influence of these seven bulls on the yields of their offspring has been to increase the yield of milk slightly, by 2.7 per cent. above that of their dams, and to increase the percentage of fat in the milk by 0.42, the effect being to increase the average yield of butter of the offspring by 54 lb. per annum (or 15 per cent.) above that of their dams.

It will be noticed that while for *two* of the bulls, Nos. 2 and 6, the average *yield of milk* of the offspring was *lower* than that of their dams, the average *percentage of fat* in the milk was *increased in the case of every bull*, the increase ranging from 0.24 to 0.54 per cent.

This development of the work of the milk recording societies

* These records are from reports by J. Fr. Pedersen, Odense, 1915, and by J. Fisker, Copenhagen, 1921, to the Provincial Agricultural Federations in Funen and Sealand respectively.

—the determination by means of the milk records which bulls are able to transmit to their progeny the character of high yield of rich milk—has modified the aim of the modern breeder of dairy cattle. The line-breeding which hitherto had been the principal feature was found to restrict unduly the number of animals between which to choose sires and dams. What is now mostly desired is to find bulls with a good influence on the milk yield. Both within the Red Danish Dairy Cattle and the Jutland Breed, much of the progress during later years can be traced back to the influence of a few bulls having remarkably strong power to transmit higher milk yielding capacity to their progeny.

The use of milk records in the breeding of dairy cattle both by line-breeding and by employing bulls selected as explained above, has now been carried on by many breeders for a sufficient number of years to show definite results. The following figures are taken from the records of various herds of the three breeds, the Red Danish, the Jutland and the Shorthorn, mostly herds of moderate size, owned by peasants in various parts of the country. They give the average yields of the herds at two different periods.

RED DANISH BREED.

Year.	*Yield of Milk.* lb.	*Fat.* per cent.	*Yield of Butter.* lb.
1905–06	8,941	3·58	356
1915–16	10,041	4·11	462
1905–06	9,427	3·40	356
1915–16	11,282	4·30	546
1900–01	9,104	3·45	350
1914–15	10,366	4·19	486

JUTLAND BREED.

Year.	*Yield of Milk.* lb.	*Fat.* per cent.	*Yield of Butter.* lb.
1900–01	5,315	3·09	183
1916–17	8,175	3·87	354
1897–98	5,922	3.01	196
1913–14	8,538	3.84	367
1900–01	6,228	3·42	240
1913–14	8,844	3·90	385

SHORTHORNS.

Year.	*Yield of Milk.* lb.	*Fat.* per cent.	*Yield of Butter.* lb.
1903–04	6,349	3·30	238
1915–16	9,445	3·85	407
1901–02	6,864	3·62	277
1911–12	10,164	4·06	460

Many more instances could be given ot herds with a similarly improved yield, because these results are not obtained merely by a few eminent breeders but by many farmers, large and small.

The best cattle on the islands had already attained a fair yield of milk before the beginning of this century; they have therefore relatively gained most in respect of the richness of their milk. In Jutland, on the other hand, the greater increase has been in the quantity of milk. Averaging 18 herds of all three breeds during a period of about 14 years there has been achieved the very creditable result that the production of butter has been increased by more than fifty per cent., while the yield of milk has been increased by 26 per cent.

The influence of the progressive farmers on their neighbours has tended to raise the general standard of the dairy cattle throughout the country. Even farmers who take no part in the work of the milk recording societies reap a certain amount of benefit from these as they learn where good animals for breeding can be bought.

Grants for Prizes at Shows.—It has already been mentioned that by the Law of 1912 on Breeding of Domestic Animals the State made it a condition for giving grants to milk recording societies that they should send a report of yield and pedigree of each tested animal to their respective Provincial Agricultural Federation. The State took further steps to encourage the breeding of animals with good records, by making certain stipulations as to the grants to agricultural societies to be used to supplement prizes at shows. Section 3 of the Law of 1912 contains the following provisions :—

> "After the expiration of two years from the enactment of this Law no grant shall be given for prizes for bulls of dairy breeds unless reliable information be given of the yield of milk of their dams by quantity and by percentage of fat.
>
> "After the expiration of five years from the enactment of this Law no grant shall be given for prizes for cows of dairy breeds unless reliable information be given of their yield of milk by quantity and by percentage of fat."

It is worthy of note that, as in most similar aids to agriculture given by the Danish Government, these provisions did not introduce anything new or show the farming world a novel development, but rather confirmed and made of general application what had already been introduced by some of the agricultural societies and found to be practical and useful. At the time when the Law of 1912 was being drafted, the conditions requiring information as to yields had already been in force for years at many of the agricultural societies' shows on the islands. They had not been applied to the same extent in Jutland, although at a Jubilee Show in 1897 the Federation of Jutland Agricultural

FIG. 5.—Family group of Red Danish Dairy Cows.

Owner: Lars Jensen, Tvindelstrup.

Average yield per Cow for all Cows in one year: 10,758 lb. of Milk, 3·85 per cent. of Fat, 463 lb. of Butter.

FIG. 6.—Family group of Cows of Jutland Breed.

Owner: Sören Sörensen, Hornum.

Average yield per Cow for all Cows in one year: 9,962 lb. of Milk, 3·75 per cent. of Fat, 417 lb. of Butter.

Societies had made it a condition for competing for prizes in a class for "butter cows" that in order to be eligible the cows should have records of their yields as supplied by the milk recording societies.

At shows the records of milk yield now form an important part of the judging, but they are used somewhat differently in the different Provinces. The local agricultural societies and the provincial federations of such make their own rules for their local, provincial, or State shows—rules which naturally conform to the provisions of the Law regarding grants by the State, but which are usually considerably more stringent. It would need too much space to explain the various rules of the different societies, and it will be sufficient for the present purpose to give some of the rules for the provincial shows held by the Associated Agricultural Societies in Funen.

Cows are admitted only when reliable information is given of their milk yield, by quantity and quality, and young stock only when such information is given concerning their dams. The milk records may be obtained from the Biennial Competitions of Whole Herds, from the Laboratory of Agricultural Research at Copenhagen, or from the milk recording societies.

Red Danish cattle are shown in eight classes, the five first consisting of individual animals, the three last of collections:—

1. Bulls aged 1 to 1½ years.
2. Bulls aged 1½ to 2 years.
3. Bulls aged 2 to 3 years.
4. Cows from herds of four cows or less.
5. Heifers, aged 1 to 3 years which have not calved, from herds of four cows or less.
6. Collections of cows. From herds of 15 cows 3 must be shown, from herds of 16 to 30 cows 4 must be shown, and so on until from herds of more than 100 cows 8 must be exhibited. Each of the cows must have yielded an average of 330 lb. of butter per annum, and milk containing 3·60 per cent. of fat; a lower percentage of fat shall not disqualify a cow which has yielded an average of 385 lb. of butter. A special award can be given for a higher yield according to certain rules.
7. Families. The families may be either (1) cows descended from one dam, at least three cows being shown, descended from the cow through the female line, and only one generation may be omitted, or (2) four or more cows descended from one sire. Same conditions as to yield as in class 6.
8. Collections of heifers, aged 1 to 3 years, which have not calved.

When the judging is finished the animals or collections within each class are placed in the show yard in order of merit according

to the number of points gained from judging by appearance—size, build and other external characters.

Particular interest attaches to the rules of judging bulls in the first three classes.

The bulls are judged by appearance, and placed in order according to the points obtained, the finest bull being placed at the head of the line in each class, then the next best and so on. The judges can give up to 24 points, and no bull can be awarded a prize if it gains less than 10 points.

It is a condition without which no bull can compete for a prize at the Show that the milk yields of its dam, dam's dam, and sire's dam have been reliably recorded, and the records must be given up to the 30th September previous to the show if the animals were then alive. It is a further condition that *the dam on an average of all the recorded years shall have yielded 340 lb. of butter, and milk with not less than 3.60 per cent. of fat; or 385 lb. of butter, and milk with not less than 3.40 per cent. of fat.* If the average per cent. of fat in the milk of the dam is below 3.60 but not below 3.50 the bull shall be eligible if the average percentage of fat in the milk of the dam, dam's dam, and sire's dam is 3.60, and if these dams fulfil the requirement as to yield of butter specified for the bull's dam. This average is calculated by first calculating the average of the yields of each cow for all the recorded years and then taking the mean of these three figures. For cows which have calved the first time before the 1st January, 55 lb. of butter are added to their yields of butter for each of the two first recorded years. For cows which have calved the first time between the 1st January and the 1st May, 55 lb. of butter are added to their yield of butter for the second recorded year only.

Besides the prize for judging by appearance already mentioned, the bull can be awarded *a special recognition for descent.* The judges can give up to 24 points for the external appearance of ancestors and their ability to improve the race, as evidenced by information in herdbooks, show catalogues, personal knowledge, etc., and 24 points for the recorded yields of ancestors. This prize for descent does not influence the placing of the bull in the line. On a card suspended from the neck of the bull information is given of the points gained by the bull both for judging by external characters and for descent.

Conclusion.—It has been the writer's aim to show how the work of the milk recording societies has gradually exercised a greater and greater influence on the system of cattle breeding in

Denmark. It first helped to eliminate the wasters, cows that consumed greater money values than they yielded in milk. It then largely increased the usefulness of family herdbooks and official herdbooks by giving reliable information of actual yields where hitherto opinion of the performance of a cow rested on outward signs. It based the judging of entire herds in the biennial competitions on a firm foundation of figures, and did the same for the judging at shows, coupled, of course, with a consideration of the animals as to harmonious build, colour, size and other qualities. It proved that high milk yielding capacity is a character that can be inherited through the dam and, still more important, that it can be inherited through the sire. It thus gave rise to the recognition of "bull families," the male members of which possess the quality of improving the yields of their progeny beyond that of their respective dams. The milk recording societies have undoubtedly been a very great help to the breeding of dairy cattle for milk production; they have, in fact, gone a long way towards reducing it to something like an exact science based on definite figures of yield instead of vague ideas and outward appearances with no known relationship to yield. This influence of the milk recording societies is shown by a very material improvement in the yield. The societies have made milk production more profitable and the breeding of dairy cattle more interesting.

In a butter producing country the percentage of fat in the milk is a very important factor, and the raising of the average percentage has been the chief object of the milk recording societies in Denmark, though they have also aimed at increasing the yield of milk by quantity. When a large milk yield is desired and the richness is not of so great an importance, for instance, where milk is produced for sale and consumption as such, the object of the societies is simpler and should therefore be more easily attained: it is, in fact, a single one instead of a double one. In this connection it is worth while saying that in the opinion of Mr. Mörkeberg: "the capacity to yield much milk and the capacity to yield rich milk are two different characters, both hereditary but inherited the one independent of the other." If that be so it should be considerably easier, aided by milk records, to develop only one of these qualities instead of developing them both.

THE MINISTRY'S RESEARCH (RAT) LABORATORY.

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AT first sight it might be supposed that rat destruction is a simple matter, not offering much scope for scientific research. Such, however, is not the case, for although rat destruction has been carried out for many years by empirical methods, no considerable success has been achieved. Of late years, however, scientists and health officials all over the world have given attention to the subject, and there are gradually being accumulated facts which, it is hoped, will lead to greater success in the future.

The necessity for rat destruction cannot be questioned. Statistics show the enormous material damage, amounting to many millions of pounds sterling annually, caused by rats and mice in destroying property, especially stored and growing foodstuffs; while the danger of rats and mice as carriers of diseases which attack human beings and domestic animals is well known.

Methods of Destruction.—Four methods of rat destruction are available, namely, hunting, trapping, the use of a virus, and poisoning. The rat population is largely limited in numbers by the available food supply and shelter. Adequate rat proofing is therefore desirable wherever practicable: this alone will tend to reduce their numbers considerably.

The first two methods need not be discussed at length; both are limited in their application, and in the case of trapping there is difficulty in taking sufficient numbers to clear badly infested areas. Further, rats soon become wary of traps of all kinds and avoid them. Mention might here be made of the method of destruction known as the "Rodier" system. This depends on trapping alive, destroying all females caught, and releasing the males. It is supposed that the males, then greatly outnumbering the females, will prey on each other and on the surviving females.

The virus method, when introduced some years ago, was hailed as a great advance in scientific rat destruction, but experience has hardly justified the claims made for it. It may be well to explain the method. Some years ago, a French scientist found that the mice in a certain area were dying in unusual numbers, and on investigation the cause was traced to an intestinal germ.

After many experiments he succeeded in isolating and cultivating the germ artificially, and raising its virulence until it was strong enough to kill not only mice but also rats. It had, however, no effect on other animals. The virus method depends on feeding the rats with baits containing cultures of living germs; these infect the animals, which die in 10 or 12 days, and the disease spreads among the survivors. Several types of virus or germ rat poisons have been placed on the market. Unfortunately there are objections to this method which, in many respects, offers an ideal means of destruction. These objections are :—(1) the varying susceptibility of the rats to the disease, as some do not die when they take the germs; (2) sublethal doses tend to immunise the rats to the disease, so that a relatively immune race of rats would be evolved; and (3) there is the risk of the organism used being either initially pathogenic to other animals or developing in its passage through the rat a higher virulence which might affect other animals, and even human beings. Cases of illness in human beings have been attributed to rat virus. (4) Lastly, there is some doubt as to the extent to which the disease is transmitted from rat to rat, for as it is not a contagious disease it can only be transmitted by ingestion of the germs. For these reasons the Ministry of Agriculture and the Ministry of Health do not favour the virus method of rat destruction. Bacteriological science has not, however, said its last word on this subject, and the objections may be overcome in the future.

Poisoning is by far the most important method. With proper precautions it can be used anywhere; when suitably applied it is remarkably effective; and it therefore offers the best solution of the problem at present. Poisons are substances which, when introduced into the living organism, cause death or injury. (Strictly they include disease germs, but for the present purpose these are excluded.) Some substances, such as strychnine and morphine, are dangerous poisons, but if given in small quantities are valuable drugs. Other substances, such as bismuth or iron salts, and strong vegetable purgatives, are not ordinarily regarded as poisons, but if taken in excessive amounts may come within the above definition. There is a large field from which to choose a rat poison.

It should be noted that all methods of rat destruction should be carried out in conjunction with rat proofing, for in the end it is largely the amount of shelter and food available which determines the rat population.

Why Research is Necessary.—From the above remarks on the virus method, it is clear that there is a wide field for further work, which can only be done in properly-equipped bacteriological laboratories by a scientific staff. In the case of poisons, it might be thought that the need for research is not obvious, but poisoning is a certain and much-used method and the need is real. It is necessary to know, for instance, what is the least quantity of poison which will kill a rat of average size; what quantity to put in the bait; and how much bait to use. All these points require experimental tests, and the necessary experiments can only be carried out under a licence from the Home Secretary. Another very important question is the extent to which poisons are dangerous to other animals, and this is one of the chief directions in which research is being carried out, *i.e.*, to endeavour to find posions which, while fatal to rats, will be relatively harmless to domestic animals and human beings. The stability or keeping qualities of poisonous preparations involves much purely chemical research. Even trapping is not so simple as it seems, for experiments in India and elsewhere show that the dimensions of the trap are of great importance.

For these reasons the Ministry of Agriculture, acting on the advice of the Rat Destruction Branch, decided to equip a research laboratory for work on this subject, and further, since the Government were occupiers under the Rats and Mice (Destruction) Act, 1919, it was decided to run a small factory in conjunction with the laboratory for the purpose of supplying suitable raticides for use on Government premises. Apart from this there is an intimate relationship between the work of the Laboratory and the Factory: results obtained in the Laboratory can be checked by practical tests on a fairly large scale.

The Ministry's Laboratory.—The Research (Rat) Laboratory and Factory are situated on the top floor of one of the old blocks at Mount Pleasant Post Office, E.C., in what was once part of the Cold Bath Prison. The staff consists of the Research Chemist (who is responsible for the chemical and biological work and also for the management of the factory), one laboratory assistant, and two men and a boy for the factory work. The Laboratory is equipped, so far as funds permit, with the usual apparatus of a chemical laboratory. In the factory there are mixing machines, a dough brake and biscuit cutter for making rat poison biscuits, a large gas-fired oven for baking, a percolator for preparing Squill extract, a still for distilling water, mincing machines, and other miscellaneous appliances.

The work of the Laboratory includes the chemical examination of various proprietary raticides on the market as well as many rat poisons the formulæ of which are supposed to be secret but which usually prove to contain nothing startling. In addition, raw materials purchased for the factory, or submitted from outside sources, are examined and toxicological analyses made in cases where rat poison is suspected. A large amount of work is done at the request of firms who manufacture or are desirous of manufacturing raticides and are anxious to ensure that their preparations are toxic. A good deal of investigation has been carried out on the various poisons in use as raticides, especially Barium Carbonate, Red Squills (*Scilla maritima*), Sodium Fluoride, etc.

As an example of the problems to be solved, an account of the Red Squill referred to above may be interesting. The Red Squill is a bulb not unlike a large reddish onion and varies from ½ lb. to 2 lb. in weight. It grows in various countries on the Mediterranean littoral. Very little is known of the chemistry of this plant, and the little that has been published is scattered in various German books, making progress slow. The plant is similar to the Squill of medicine, and its poisonous properties, so far as rodents are concerned, have been known for a very long time, though the white medicinal bulbs do not appear to be poisonous to rats. In the raw state the bulb is poisonous, but baits containing chopped-up bulb do not retain their toxicity very long. If, however, the bait be cooked its keeping quality is greatly increased. The bulbs when dried and powdered are also toxic, though the powders thus made vary a good deal, and the exact conditions necessary for ensuring maximum strength are not understood. The minimum lethal dose of powdered bulb for a medium-sized rat is from 1 to 2 grains. A liquid poison can also be obtained by steeping the bulbs in water and pouring off the liquor. If kept in tightly-stoppered vessels this extract keeps toxic for a considerable time. The actual poisonous substance in these bulbs is not known, though two or three substances are said to have been isolated, but the descriptions are very conflicting. Whatever it is, it must be fairly powerful. Further, it is not known whether the toxicity of the bulb varies at different stages of its growth, though this is very likely, and it is important to know when it is most toxic. Neither is much known as to the exact quantity required to kill domestic animals, though it is certainly relatively large. A South African variety of Squill (*Urginea Burkei*) is being investigated. It appears to

be poisonous to rats. Work has also been done on possible alternative poisons to those in present use, so far, however, with inconclusive results.

Other Poisons.—It has already been indicated that the choice of a poison is very wide; the poisons actually in use, however, are comparatively few. It may be well to summarise the requirements of a practical rat poison. It must be:—

1. Relatively harmless to domestic animals.
2. Cheap and readily procurable.
3. Effective on rats and mice, that is, reasonably small doses should kill.
4. Tasteless, or, at any rate, without a repellant taste.
5. Easy and clean to handle and be readily incorporated for making the bait.
6. Capable of keeping well and retaining its toxicity.

These conditions narrow down the choice considerably, and there are not a great many substances which will satisfy them. The first condition practically eliminates all the substances popularly recognised as poisons; nevertheless a great many of the rat poisons on the market contain either arsenic, strychnine, or phosphorus, the last-named being especially popular, partly because it can be bought without the restrictions of the Pharmacy Act, which apply to the first two. Where there is little or no risk of poisoning other animals, the use of these poisons is safe enough, and they are certainly effective, though arsenic is somewhat variable in its results, while the use of phosphorus is attended by some risk of fire. Actually, strychnine is said to be cheapest, per rat killed. As a general rule, however, the indiscriminate use of these dangerous poisons is to be deprecated, and the use of alternative and less dangerous poisons should be encouraged.

Of the less dangerous poisons Barium Carbonate and Red Squill have been found most effective for killing rats. In fact, they are just as good and cheap as the more dangerous poisons, and they have the great advantage of being far less poisonous to domestic animals and human beings.

The Composition of Baits.—There is, of course, no such thing as a poison which will kill rats and mice and nothing else; what is wanted is to reduce the risk as much as possible by using poisons to which rats and mice are peculiarly susceptible. Now the success of a rat poison depends not so much on its actual toxicity as on its being presented in a form that is acceptable to and readily taken by the rodents.

Apart from mere palatability, several points require consideration, such as the size of the bait and the amount of poison in it. A bait should be small enough for a hungry rat to eat it all, and should contain enough poison to kill. If a bait will kill even if only half of it is eaten, so much the better.

Experiments carried out at the Laboratory showed that rats eat about one-tenth of their body weight per diem; hence a bait of 30 to 60 grains is suitable and represents about one-tenth of a day's food supply. Each such bait should contain a lethal dose; to obtain this the following percentages of toxic agent in the baits prepared are used:—

Arsenic 5%	Each bait being about			20	grains.
Barium Carbonate 25%	,,	,,	,,	30	,,
Squill Bulbs 20%	,,	,,	,,	50	,,
Squill Powder 20%	,,	,,	,,	25	,,

Baits should be prepared in such a way that they are ready for use; such operations as spreading on bread, etc., should be avoided. The quantity to be used should be clearly stated in common measures, such as a teaspoonful. It is, however, an advantage to prepare the bait in tablet or biscuit form, as the quantity used and the amount of poison per bait are then easily controlled. The most important point of all is that the bait should be attractive to the rodents, and this can only be decided by experiment and observation in the Laboratory followed by field trials. It is here that the close association of the Factory and Laboratory is specially valuable.

Each poison should be made up in several varieties of bait, so that if one kind is not taken a change can be made. The most frequently used bait is a mixture of oatmeal and fat, to form a hard paste; this is more useful in winter than in summer. Another very useful way is to mix the poison with flour, work up into a dough, and prepare biscuits or tablets, which are then baked. Variety of flavour can be obtained by introducing such substances as grated cheese (the older the better), minced fish or fish meal, and sugar. Baits with no natural odour are slightly flavoured with aniseed or rhodium oil. Differences of opinion exist as to the advantages of this but slight flavourings are generally favoured.

Successful rat destruction depends not only on the choice of suitable toxic agents, made with due regard to their chemical and toxic properties, but also on the adaptability of the baits to the varying tastes of the rat. In England, the rat generally prefers variety, *i.e.*, in a cheesemonger's the best bait would probably

be fish. In India, however, it is found that a bait similar to their usual diet is most successful.

The baits prepared at the Factory are supplied to the various Government Departments, and a few notes on the organisation of this side of the work may be of interest. The Office of Works have three rat officials, who were trained by the Ministry's technical staff. These men work under the direction of the chemist-in-charge, to whom complaints of infestation in the London area are sent. The building is then inspected and suitable treatment applied, the bait being drawn direct from the Factory. Cases of difficulty are referred to the Rat Destruction Branch, when arrangements are made for inspection and advice by the technical staff. Bait is also supplied on application for use at H.M. Office of Works buildings in the provinces; at Admiralty and War Office establishments at home and abroad, and at other buildings and areas occupied by Government Departments. In general the treatment has succeeded in ending the nuisance or greatly reducing it. Many of the buildings treated are in badly-infested areas and continuous efforts have to be made to effect permanent improvement, but even in the worst cases persistent efforts with varying bait, supplemented by trapping, have been successful.

PIGS FOR BACON.

SANDERS SPENCER.

Changes Leading to the Modern Type of Bacon Pig.—The changes which have taken place during the past half-century in the form, weight, quality and degree of fatness of the pigs intended for conversion into bacon, have been equally as extensive as in the pigs intended for consumption as fresh pork.* We might even go further and express the opinion that the so-called bacon curer's pig has assumed a special form and character, markedly distinct from the pork pig.

These changes have been due to various causes, one of the chief of which was the introduction some forty-five years ago of cold air chambers into the bacon factory. These enabled the bacon curer to carry on his trade with the same amount of ease and as little loss during the summer as during the winter months. This in turn made it unnecessary for the slaughtered pigs to carry so great an amount of fat as was needed when the meat had to be heavily salted to keep it sweet during the hot weather. The proportion of fat to lean was also requisite to stimulate the appetite of the consumers, who were not tempted for any length of time by the hard and very strongly salted lean portion of the old-fashioned bacon. This difficulty of the hard and heavily salted lean meat was completely removed by the adoption of the mild curing process which became possible when the necessity for preserving the meat for any considerable time ceased. A continuous supply of fresh cured bacon became available.

Among the other causes for the change in the character, size and weight of the bacon pig was the greatly increased purchasing power of the wage earning classes. With the advent of greater purchasing power came a desire for provisions of better quality, and this was accompanied by a demand for an increased quantity of food. It is quite possible that the consumption of an excessive proportion of the heavily salted old-fashioned bacon with its large amount of fat from old pigs, might have been attended with some inconvenience to the consumer, whereas the mild cured bacon, not so rich and the produce of young pigs, was much less likely to affect injuriously the health of the person dining, not wisely, but too well on it.

A change in the system of living amongst the wage earners and of the lower middle classes was taking place about the same time,

* See this *Journal*, October, 1921, p. 608.

the one or two hot dinners weekly giving place to more frequent and much smaller daily hot joints, whilst the lump of very fat bacon was giving way to the fried rasher for breakfast in the large majority of cottages and even in those mills where the employees were allowed to cook their breakfasts. This enormous increase in the demand for the middle, the hams and the better portions of the sides of bacon, placed the curers in a difficult position when the large proportion of fat pigs sent to the factories consisted of heavy-shouldered and short-sided pigs, carrying an excess of fat, such as were general in the seventh decade of last century. The heavy and coarse shoulders and the large and fat jowls, formed so large a proportion of the side of bacon, and the demand for them was proportionately so slight, that the curers were forced to start a campaign against the chubby short-sided and over-fat pigs which were so fashionable at that period, largely as a result of the demand from the United States for a pig of that character. This demand must have arisen from a desire for a pig, the complete opposite in form and character of the so-called "rail splitter," then so common on the American Continent, rather than because of the utilitarian properties of the then fashionable pig.

A vigorous campaign was commenced in the agricultural press against the thick pig with heavy head and shoulders and short back. Diagrams of the flesh of the fancy and of the bacon curers' types of pig were published showing the varying proportions of the lean meat and fat meat in their carcasses. Not content with this, one of our largest and best known firms of curers purchased pedigree boars and distributed them amongst the farmers and pig breeders who sent their bacon pigs to the factory. In deciding on the breed of boar for distribution the firm was influenced somewhat by the desire of the producers to breed only pigs dark in colour. The attempt was not an entire success, since the produce of these boars from the local sows proved to be rather heavy in the forequarters and too short-sided.

Danish and Canadian Action.—Meanwhile, the Danish Government had sent to this country one of their officials who was an exceedingly good judge of stock for the purpose of inspecting as many as possible of the English, Irish and Scotch bacon factories, the type of the pigs slaughtered therein, and the herds of most of the successful breeders. After a stay of some months this official reported to his department in Denmark in favour of a certain type of large white pig. Purchases were subsequently made from one large herd, and the pigs were distributed amongst

the principal Danish farmers who were interested in the private and in the co-operative factories. The improvement in the form of the pigs from the native race when mated with the large white boars was so great as to form one of the principal topics of conversation on the chief bacon markets in Britain. One of the largest firms of bacon curers in Canada forwarded an order to their London agent who had been engaged in the shipment of some boars to Denmark to purchase boars and gilts similar to those exported to Denmark, and thus the Canadian bacon which was becoming popular in this country was still further improved.

Improvement of Irish Bacon.—In the meantime the bacon curers in Ireland had not rested on their oars, but had jointly taken steps to improve the form and quality of their bacon, which even then had so high a position on our markets. One of their first steps was to issue a sketch of two sides of bacon showing the position, size and value per lb. of the different joints into which each side was usually divided when sold on the retail market. This gave Irish farmers a clear idea of the kind of pig which would make the highest price on the markets. They even went further, and purchased a number of thick-fleshed, short-legged large white boars of fine quality and distributed them among the pig breeders in the neighbourhood of the different bacon factories. The Dutch were also considerable purchasers of a certain type of large white boar.

Influence of the Danish Trade.—The improvement in the bacon imported from Denmark was so marked that two of the principals of one of our chief firms of bacon curers journeyed to Denmark to ascertain how it had been brought about, and to study the systems of pig feeding general in that country. On their return the firm took immediate steps to purchase nearly two hundred thick-fleshed, lengthy, large white boars of the same type as those exported to Denmark. These boars were exchanged for the old fashioned boars of those who supplied the firm with pigs, and an arrangement was made for the general use of the boars. The results were entirely satisfactory to all parties. The evolution of the present type of bacon curers' pigs has been somewhat fully considered owing to the success which has attended the efforts of pig breeders and bacon curers.

The great improvement in the form and quality, and even in the feeding of the bacon pig, has extended to well nigh all those countries which export bacon to this country. Even Russia, which had begun to send us considerable quantities of bacon, had already imported a number of English pigs for the purpose

of improving their bacon. The bacon curers in America alone appear not to have taken the necessary steps to improve their pigs so that the bacon which they export in such large quantities to this country could compete on fair terms with that which is imported from other countries. One of the principal reasons given by the packers is that it is impossible to get American breeders to pay attention to the feeding of their hogs with a view to improving the quality of the pork. They can grow corn or maize in such large quantities and can feed it to their pigs with so little expense, when labour is so costly, that they are content to produce inferior quality pork, being ignorant or careless of the fact that the production of a better article from pigs longer in the body and carrying a larger proportion of lean meat, would be far more profitable to them and more satisfactory to us as consumers.

Modern Requirements.—When the requirements of the modern bacon curer are carefully studied, they are seen to be by no means of so onerous a nature as to prevent our breeders and feeders complying with them, providing more care and attention be paid to the subject than used to be the case when the pig was of far less importance than at present. About all that is asked of the present day pig owner is that he should make a study of the wants of the consumer and then proceed to supply these wants in a business-like manner.

Most of the needs of the consumer of bacon at present are comprised in the following particulars:—The bacon must carry only a comparatively small proportion of fat to lean; it must be of fine quality, *i.e.*, the skin and the bone must be fine and the flesh free from coarseness; the joints must be of comparatively small size; and in order to conform to the two last qualifications the fat pig must be liberally fed on suitable food all its life, which must be a short one.

Length of Body.—As to the formation of the pig best suited for the manufacture of such bacon, it should be long in the body, so that as large a proportion as possible will consist of the middle which realises the highest price of any part of the side.

The hams should be long and well developed down to the hock, so that the proportion of bone to meat will be small and the ham shapely.

The flank should be thick, as this is a sure indication that the pig carries a large proportion of lean to fat meat.

The shoulders should be light, as this portion of the sides is in limited demand and realises a lower price than either the middle or hinder portion of the side.

The legs should be short and the bone of fine quality, as this is held to be

an indication of the quality of the meat, whilst a pig which is long on the leg is generally coarse in the bone and usually far from restful and contented.

The jowl should be light, as its market value is limited, whilst a large head is generally associated with a heavy and a somewhat coarse body, a long head frequently indicating the opposite, with a limited aptitude to fatten.

Hair.—As to the kind and quantity of hair which a pig suitable for the bacon curer should possess, there is a diversity of opinion. In Cumberland and certain parts of the province of Ulster a pig with comparatively little hair is preferred, whereas in most other parts of the British Isles a covering of fine silky hair is sought after, on the ground that pigs which are sparse of hair are frequently deficient of lean meat. Generally speaking, straight hair is preferred to curly hair, as pigs possessing the former are considered to furnish meat of a finer grain. This view is not held in Lincolnshire, the home of the curly-coated pig, but this may arise from the fact that the demand in Lincolnshire is for a class of bacon different from that required in most parts of the kingdom. The pig with harsh and coarse hair is not now a favourite in any part of the country, as it invariably fattens slowly and furnishes pork of an inferior quality.

Quick growth and early development are particularly necessary in the bacon pig, as bacon manufactured from young pigs is greatly preferred, and there is a great advantage to the feeder, the quantity of food consumed for the mere upkeep of the pig, body heat, locomotion, etc., being much reduced and its cost saved.

Colour.—Another point which is considered of some importance by many curers is the colour of the pig slaughtered, white sides of bacon having a nicer appearance than black ones. Some bacon curers encourage their buyers to send in white pigs for slaughter by offering sixpence per head more for white than for coloured pigs. Some few years ago the writer was at a factory in Ireland where one thousand pigs were slaughtered in one day, and after careful inspection failed to find a single coloured pig, so that on one day alone this firm would be paying about £25 in order to secure pigs of a white colour. The extra cost during the year would therefore be some thousands of pounds, showing the incorrectness of the assertion that the preference for white pigs is only fancy.

Feeding.—One other requirement on the part of the curer is that feeders should be careful to supply such food to their pigs as will produce pork of good quality which can be converted into firm bacon with lean of a nice colour. This may make a difference of several shillings per cwt. in the market value of the bacon, and the extra cost of the more suitable food may make little or no monetary difference to producer of the pigs. An excessive proportion of potatoes, of maize, or of sharps in the ration results in the production of soft and oily bacon, which wastes much in cooking; an excess of beans or bean meal makes the lean portion of the bacon hard. Some curers also complain of the use of fish meal in the feeding of pigs, on the ground that the bacon from pigs so fed is

apt to have a fishy flavour when cooked. So far as has been ascertained this unpleasant flavour is the result either of using an excessive quantity of fish meal or meal of an inferior quality, *i.e.*, meal made from other than white fish and containing too large a proportion of oil. In recent years the various kinds of food suitable for pigs have increased so greatly in number that there can be no excuse for neglect in using the few foods which are less suitable for the production of pork of fine flavour and quality.

Breeds.—The choice of pigs of different breeds which are said to be suitable for the production of bacon has enormously increased of late years. Breeders of Large Whites, Large Blacks, Essex and Wessex Saddlebacks, Gloucester Old Spots, Tamworths, Cumberlands, Ulster Whites, Lincolnshire Curly Coated, &c., all declare their belief in the exceptional suitability of their favourite pigs for the manufacture of the finest qualities of bacon. These beliefs may have the best possible foundation, but some of the breeds may not have been in existence for a period long enough to have afforded quite so great a proof of their suitability as might be desired. At the present time many thousands of pigs, which are crosses from the Large White Boar and the Large Black Sow, are slaughtered weekly by the bacon curers. This combination appears to give general satisfaction to the bacon curers and to pig breeders and feeders. The Cumberland pig has long been noted for its fine hams, whilst the good proportion of lean to fat meat furnished by the Berkshire and the Tamworth is well known, all these breeds having been before the public for many years. Pigs of the other breeds named may in due course prove their suitability for the production of bacon.

WINTER FEEDING OF LIVESTOCK WHEN ROOTS ARE SCARCE.

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STOCK feeders this year have been faced with a somewhat difficult problem, *i.e.*, how to provide for the winter feeding of their stock. The abnormal season has resulted in a general shortage of roots, and owing to the long-continued drought, green crops drilled during the summer months have either failed to come through, or have been killed after germinating. The writer is aware of one case, where white turnips have been drilled three times and have then failed to yield a crop. In addition to this, in many districts the hay crop is short, as little as 10 tons being taken off 50 acres. There are three conditions that have to be provided for this year :—

(1) Farms where both roots and hay are short.
(2) Farms where roots are short but hay and straw are moderately good.
(3) Where roots are short but straw is plentiful. This is generally the position in the Eastern Counties.

Farmers have mainly faced the difficulty by keeping less stock, and in the case of sheep flocks, by reducing their ewe flock, fattening off and marketing their ewes. The markets have lately been fairly full with 2, 3 and 4-shear ewes intended for the butcher. This is perhaps the easiest way out of a difficult position, but the farmer who chooses this course will be selling his ewes in a cheap market with the prospect of buying later at a dear rate. It may therefore be opportune to discuss the general problem involved, and to see whether, after all, it may not be possible to adopt an alternative solution.

Where both hay and roots are short (case 1), a reduction of the number of stock kept must be effected unless a certain amount of straw is available, when the conditions approximate to those of case 3, and the same general rules laid down there can be followed. Hay and straw are necessary for cattle, sheep and horses. These animals require a certain amount of bulk in their food which can only be supplied by hay or straw. In the case of cattle and horses, about 14 lb. of rough fodder per day is absolutely essential for the animals' well being; any attempt to go below this will, especially in the case of cattle, lead to discomfort and general restlessness and unthriftiness. In Germany, where

it is common for the farmers to experience a shortage of rough fodder, it is a common practice to supplement the hay and straw available with the leaves and small twigs of beech, birch and poplar, and similar broad-leaved forest trees. Leaves of trees gathered towards the end of July have a feeding value equal to that of medium meadow hay.

In the case of sheep weighing about 100 lb., 13 lb. of dry matter is required weekly to keep the animal in good condition, and in general practice, where plenty of roots are available, a part of this dry matter is supplied by roots, the average ration of hay for sheep generally being about 5 lb. a week, with roots *ad lib.*

The average requirements of farm animals for coarse fodder, (hay or straw) is therefore as follows :—

	Live weight.		*Fodder as hay or straw.*
Horses	8 cwt.	...	13 lb. per day.
	12 cwt.	...	17 lb. „
	16 cwt.	...	20 lb. „
Cows and bullocks	9 cwt.	...	14 lb. „
	12 cwt.	...	17 lb. „
Sheep	100 lb.	...	15 lb. per week.
	140 lb.	...	19 lb. „
Pigs	All weights	...	Nil.

The requirements given above are the *physiological* requirements of the animals, and although in most cases they correspond with actual practice, they are not based on the results of practice but on a study of the structure and capacity of the digestive tracts of the animals mentioned. Although the *minimum* requirements given above for horses are the same as those for cattle of equal weights, the actual capacity of cattle to deal with coarse fodder is much greater than that of horses. This is shown in practice. The amount of coarse fodder given to horses is approximately constant, but the nature of the fodder given varies according to the nature of the work the horse is required to perform. Thus with horses at rest good oat straw or oat and wheat straw is considered good enough, but when the horse is required for hard work the greater part of the straw is replaced with meadow or clover hay. In the case of the race-horse the diet consists of the finest quality meadow hay and the best oats procurable.

In the case of cattle, on the other hand, the capacity to deal with coarse fodder goes well beyond the minimum requirements given above, and the same argument applies to a lesser extent to sheep. The pig, however, owing to its comparatively simple digestive tract, cannot deal with coarse fodder to any extent and

its food therefore rarely contains much fibrous material. For this reason, too, silage is unsuitable for pigs intended for fattening, although perfectly suitable for breeding stock.

With regard to roots, these are fed normally to cattle and sheep and occasionally to horses and pigs. They are, however, chiefly used for cattle and sheep, and it is for these animals that the question of rationing in the case of a shortage becomes a serious problem. Roots are watery feeding stuffs containing sugars and starchy material chiefly, with but very little fibre.

Use of Molasses.—Sugar cane and beet molasses consist of sugar residues, amides and no fibre, and are therefore approximate to roots from the feeding standpoint, in the nature of the food material supplied. One ton of molasses is approximately equal in feeding value to 6½ tons of roots, but owing to its peculiar laxative properties cannot be fed to cattle to anything like the extent that roots can. Thus the limit for feeding molasses to farm animals is as follows:—Horses up to 3 lb., cows 2½ lb., bullocks 4 lb., and sheep ¼-½ lb. per head per day. Pigs as a general rule do not do well on molasses, and its use for them is not advocated.

The general solution of feeding problems in cases where roots are scarce resolves itself into a question of feeding more hay or straw and utilising molasses to replace part of the roots, and feeding more concentrated meals, cake and corn to make up the deficiency in the ration. It will be seen from the statement above that molasses can only be regarded as a substitute for roots to a limited extent. Molasses has the great advantage that it is laxative in effect, is a general appetiser, and is much appreciated by stock. The maximum benefit of molasses is consequently obtained by using it with straw and inferior quality hay. This enables the stock-feeder, in the case of a mixed stock farm, to reserve his best hay entirely for his horses or his ewe flock.

Method of using Molasses.—(1) When used with straw, the molasses should be dissolved in warm water, thrown over the straw, well mixed and allowed to ferment for 12 hours before feeding.

(2) The measured quantity of molasses may be mixed directly with the food, or be placed in the trough on the top of the food. Dairy cows will eat molasses given in this form quite greedily.

Objections to Molasses.—The chief objection to molasses is due to its stickiness and difficulty in handling. For this reason, proprietary foods are available for the use of farmers who may prefer to get their molasses in this form. Such foods consist of

molasses soaked up in an absorbent such as spent hops, tapioca meal, soya bean meal, sugar cane pith, apple pomace and sphagnum moss. The chief disadvantage to the use of such foods is that the absorbent used replaces a part of the straw that would otherwise be consumed. Fed in such a way, too, the molasses is more expensive to buy, and the farmer must decide for himself whether the advantage gained in ease of handling compensates him sufficiently for the extra cost.

The Jonas Method of treating Straw to make it Palatable.—An alternative method of making straw palatable to stock and so conserving hay supplies is that adopted by a Mr. Jonas some 50 or more years ago. This method consisted in chaffing the straw when the corn is threshed in the spring, and mixing with the chaff a green forage crop in the ratio of about 1 cwt. of green crop per ton of straw. At the same time salt is added. As a result of this treatment a slow fermentation process is set up, and the cattle eat with avidity such chaff when fed in the winter months.

Putting the above principles into practice the writer suggests the following rations as being suitable for root shortage conditions. It is realised that such suggestions are general and may not fit individual cases, but every effort has been made to provide for every case likely to arise in farming practice. Any reader whose particular problem still requires solution is advised to write in the first place to the Agricultural Organiser for his County or, in the case of counties still without an Agricultural Organiser, direct to the Ministry.

Sheep.—In the case of sheep, the root shortage, and failure to grow forage crops present a serious problem. Normally, sheep will eat approximately 16 lb. of roots per head per day, and will get in addition about ¾ lb. of hay and a similar quantity of corn or cake. In the case of a root shortage, the hay ration should be increased to 2¼ lb. per head per day and if hay is also scarce, oat straw may be substituted for the hay. In these circumstances a typical ration for sheep weighing 100 lb. will be :—

Per week.

A.	8 lb. hay, 7¾ lb. oat straw.	or B.	15 lb. hay.
	22 lb. swedes or kohl rabi.		22 lb. swedes.
	5 lb. cake and corn.		5 lb. cake and corn.

When the roots have failed altogether, a forage crop of some sort will generally have been drilled and either mustard, rape or white turnips will be available. In the absence of any of these fodder crops, the sheep can be comfortably wintered on hay,

straw and corn alone, their corn or cake ration containing linseed cake and crushed oats. In normal practice, the danger to the ewe flock is loss of lambs due to too heavy root feeding, and the writer is convinced that a normal crop of lambs can be produced even in the absence of roots or with a shortage of green forage. The hay and straw chaff will be more readily appreciated if a little treacle, suitably diluted, is sprinkled over it.

Horses.—Horses will not present a problem, because roots are not normally fed to these animals.

A heavy draught horse will require per day, 1½ stone of either hay or straw chaff or both, together with 7 lb. of oats for light work, 11 lb. of oats for medium work or 16 lb. of oats for heavy work. Further particulars of feeding stuffs suitable to substitute for oats are given in Miscellaneous Publication No. 32,* and the appended table giving the quantities of other feeding stuffs, which may be regarded as equivalent in feeding value for horses, is taken from that publication.

	Amount equivalent to 10 lb. oats.		*Amount equivalent to 10 lb. oats.*
Maize	7·3	Linseed cake ...	8·0
Grain	10·0	Barley	8·3
Beans	9·0	Dried brewer's grains	12·3
Palm kernel cake ...	8·0	Pollards	9·9
Gluten feed	7·9	Bran	13·2

At present prices it pays to feed oats only, but in cases where oats are short the above feeding stuffs may be utilised to replace up to one-half of the oat ration.

Cattle.—In the case of fattening cattle, and for cows of 9 cwt. yielding 1 gallon of milk per day, the following rations are suggested, bearing in mind:—

(1) Farms where silage is available.
(2) Farms where a limited amount of roots are available.
(3) Farms where neither silage nor roots are available.

A.	B.	C.
lb.	lb.	lb.
1 Treacle.	½ Treacle.	10 Seed hay.
5 Wheat chaff.	5 Wheat chaff.	5 Oat-straw chaff.
26 Silage.	26 Silage.	5 Wheat chaff.
40 Roots.	20 Roots.	5 Maize meal.
5 Hay.	5 Oat-straw chaff.	
	4 Cotton cake.	

* Obtainable from The Secretary, Ministry of Agriculture and Fisheries, Publications Branch, 10, Whitehall Place, S.W. 1, price 6d. post free.

PREVENTION OF BUNT AND SMUT.

THE year 1921 stands out as remarkable for the early ripening of wheat. Though the season suited few crops, it suited wheat, and during the month of July crops of good quality were anticipated.

In spite of this promise, however, a rude shock was experienced by unwary farmers at harvest by the discovery that Bunt or Stinking Smut was present and had ruined a large portion of the crop. It cannot be too strongly impressed upon the growers that **the bunt developed because the seed grain had not been properly pickled; if it had been dressed with Formalin as advised by the Ministry, such disappointments would not have occurred.**

Everything that is possible should be done to prevent such losses, the more so because the price of wheat is still falling. It should be clearly understood that Bunt and also the allied diseases, Loose Smut of Oats and Covered Smut of Barley, *can be thoroughly controlled.* The most wideawake farmers realise this and regularly use either the Formalin treatment or the older, but less satisfactory Copper Sulphate method. To all who are concerned in growing cereal crops the Ministry recommends the perusal of Leaflets Nos. 92 (*Bunt and Smut in Wheat*) and 328 (*Smut in Oats and Barley*), whilst for fuller details as to Bunt control the excellent article by Professor E. S. Salmon in this *Journal** should be studied.

It may be worth while to record some of the actual figures as to infected crops received by the Ministry during the past two seasons, showing the appalling loss farmers incur by the neglect of pickling.

Omitting the minor cases, such as those in which 5 per cent. of the crop is infected, which are very general, the following may be instanced:—25 per cent. in Herefordshire, 35 per cent. in Shropshire, two cases of 40 per cent. in Cambridgeshire; in a 9-acre field in Lancashire 4 acres were attacked to the extent of 40 per cent. and the remainder 20 per cent.; in another Lancashire field 55 per cent. was attacked; 40 per cent. in a 7-acre field in Gloucestershire; 40-50 per cent. in Lincolnshire; whilst in some portions of badly attacked fields 70 per cent. was the figure given. A final case just to hand may be cited. In a northern county a chance sheaf of wheat was taken from the binder and the ears counted: 525 were found affected with Bunt and 565 free, *i.e.* 48 per cent. of the wheat was infected. Many

* This *Journal*, February, 1921, p. 1013.

of the above figures were derived from actual counts of carefully selected samples, the others were from estimates made by competent persons. When it is remembered that affected ears are totally destroyed, the lamentable waste involved is obvious.

The Smuts of Barley and Oats play similar havoc with the two cereals involved, and *in this case again, careful pickling with Formalin will reduce the disease to practically nil.*

Treatment for Bunt.—The Ministry strongly recommends the use of Formalin, which can be purchased from any chemist. Careful experiments carried out at Wye showed that Formalin

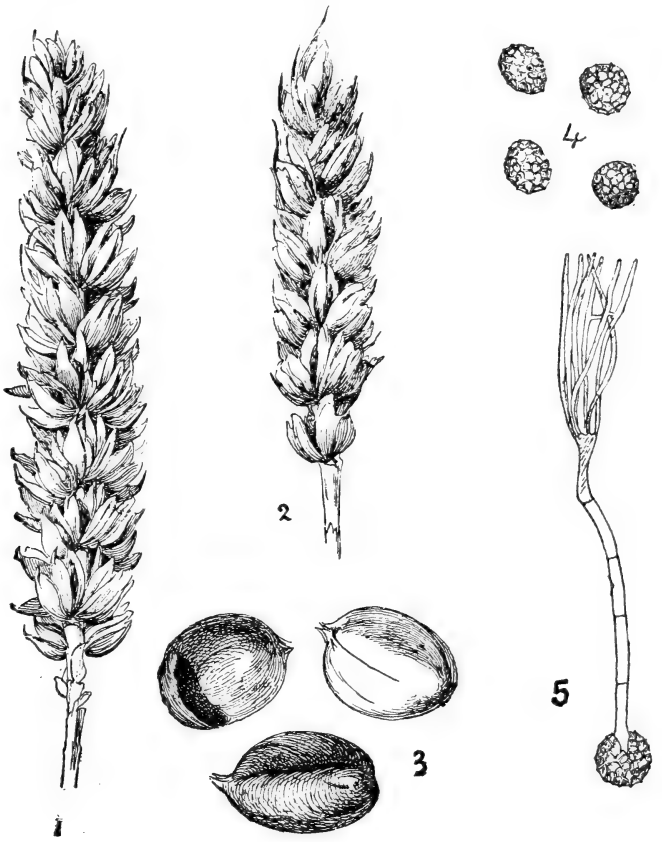

FIG. I.—Bunt.

(1 and 2) Bunted ears. (3) Spore-containing grains.
(4) Spores of Bunt *(Tilletia tritici)*. (5) Spore germinating.

was found to be superior to Copper Sulphate, as with it it was possible to obtain absolute control of Bunt with less injury to the grain.

Formalin is easy to use and gives complete control. Formalin

(a 40 per cent. solution of formaldehyde) should be used at the rate of 1 pint to 40 gallons of water ($\frac{1}{2}$ fluid ounce or one tablespoonful to the gallon), care being taken to stir well while mixing. The solution should be sprinkled over the seed and the heap repeatedly turned over till all the grains are wetted. It will probably be found that two gallons of the solution are required to wet four bushels of wheat, but in no circumstances should the solution be allowed to form pools under the heap, in which the grain might soak, or germination may be reduced. After shovelling, the grain should be placed in a heap and covered with sacking moistened with the Formalin solution and left covered for four hours. After that time it should be spread out to dry and then sown as soon as possible. Precautions should be taken that the wheat is not re-infected after pickling by being placed in sacks which have held infected corn, or on a contaminated floor in a barn.

Treatment for Barley and Oat Smuts.—To make the solution 1 pint of commercial Formalin should be poured into 20 gallons of water and mixed thoroughly.* The grain may be sprinkled with the solution, or steeped in it. For sprinkling it should be placed in a heap on the floor and the solution should be poured over it at the rate of 1 gallon to every four bushels. The heap must be turned over repeatedly so as to moisten every grain and should be covered over with sacking damped with the solution for four hours, as recommended for wheat. If the steeping method is preferred the grain should be soaked in the solution for ten minutes, stirring it thoroughly meanwhile in order to be certain that every grain is wetted. Infected grains which float to the surface should be skimmed off. It should then be placed in a heap for four hours and covered with sacking.

After four hours the treated grain should be spread out in a thin layer to dry, and then be sown as soon as possible. If it is necessary to store the grain care should be taken that it is not re-infected by being placed in smutty bags or on smutty barn floors.

* A still more dilute solution—1 pint in 30 gallons—has given excellent results in trials. See Salmon and Wormald, this *Journal*, March, 1918, p. 1388.

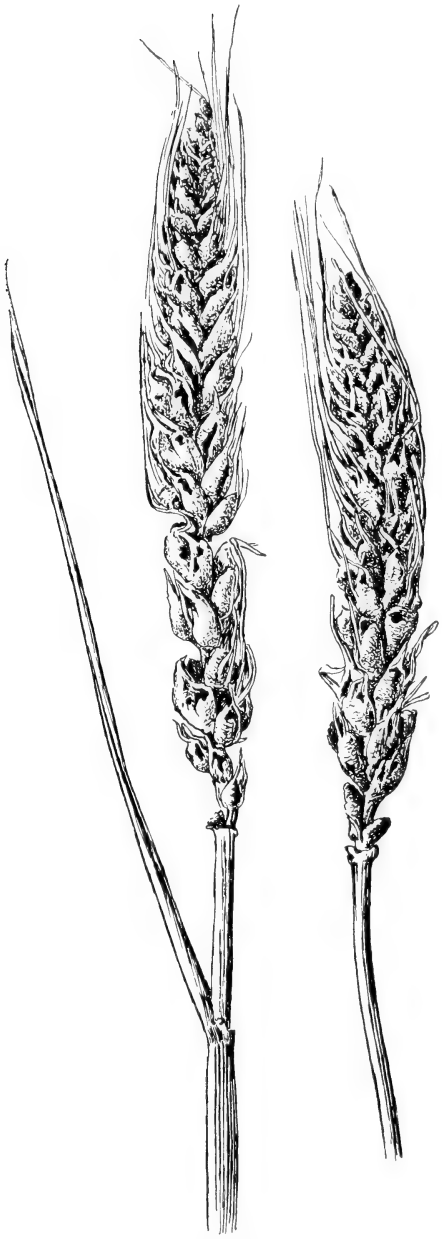

FIG. 2.—Covered Smut of Barley.

FIG. 3.—Loose Smut of Oats.

PIG AND POTATO CLUBS IN GLOUCESTERSHIRE.

G. H. HOLLINGWORTH.
Hon. Organising Secretary, Gloucester County Pig and Potato Production Committee.

IT may be observed that there is nothing new in the idea of pig clubs in Gloucestershire. They existed long before the War, chiefly on the Cotswold Hills, and stand out as notable examples of independent thrift displayed by agricultural workers in Cotswold villages, at a period when wages were low and the families of farm labourers received little fresh meat apart from the pigs they fed and killed. To lose a pig in those days was a serious matter—it almost spelt ruin in some cases—and a scheme for mutual insurance which had a great deal to commend it was therefore established by the village labourers. In other words the cottage pig-keepers formed themselves into clubs for the mutual insurance of their pigs. The small premiums were paid into a common fund which in some cases was augmented by donations from farmers and other sympathisers, and the headquarters of the club was generally the village inn. The rules of the club were few and simple, and if a member was so unfortunate as to lose an insured pig, he was fully or partly compensated, according to the rules and the financial status of the club. From the point of view of insurance business, the establishment of village pig clubs was as risky as it was primitive, and if losses occurred before a reserve fund was built up the outlook became serious. Fortunately, however, the hill-bred pigs were healthy and fatalities were not numerous. The objects of the insurance club were thrift, and to obtain that sense of security which insurance gives. Through having to pay out little for compensation, some of the older clubs have built up reserve funds amounting in some cases to hundreds of pounds. The story of Gloucestershire pig clubs in the past is one that does infinite credit to the thrift and economy of a class of workers which was poorly paid, and in this way demonstrated the value of co-operation and mutual self help.

Pig and Potato Clubs as a War Measure.—It was in the spring of 1918 that the county scheme, as at present con-

stituted, was set on foot at the instigation of Lord Bledisloe, K.B.E., for the primary object of encouraging the production of pigs and potatoes at a time when the national outlook for food, particularly meat and fats, was very critical. Lord Bledisloe contributed £500 towards a capital fund, similar amounts were provided by Lt.-Col. Sir H. Webb and Messrs. R. Thomas & Co., and with smaller contributions made up a total of over £2,500, the interest on which is used for working expenses. Lord Bledisloe can justly claim to be the founder of the scheme and Mr. Robert Gray, who is greatly interested in the welfare of rural workers, has been chairman of the county committee since its inception. It was agreed at the outset that the objects of the scheme could be best achieved by enlisting the co-operation and help of existing pig clubs, and by forming others for the following purposes:—(1) To encourage and assist as many people as possible of the cottager class to keep pigs. (2) To utilise all spare and waste produce for pig feeding and co-operate in the purchase of feeding stuffs. (3) The insurance of pig keepers against loss by payment of a small premium. (4) The co-operative purchase of Scotch seed potatoes for gardens and allotments.

The decision of the committee was followed by action, and after a few weeks' campaign of public meetings in villages, upwards of a hundred local clubs were formed and affiliated to the central committee. Most of these clubs required working capital to enable them to purchase feeding stuffs, and while in some cases this was provided out of the capital fund at a low rate of interest, in others the money was advanced by local well-wishers.

Club Rules.—A set of model rules for the use of affiliated clubs was drawn up by the county committee, which is composed mostly of representatives of local clubs, and though the latter are under no obligation to adopt the model rules in their entirety most of them have done so. Outstanding clauses in the rules are, first, the objects of the club, namely (a) to afford means by which members may, upon strictly mutual principles, insure against loss of their pigs through disease, accident or other cause, (b) to secure for members' pigs the best conditions for their health and profitable keeping, (c) to purchase pigs and feeding stuffs on co-operative lines, (d) to encourage the cultivation of potatoes and other crops for human and pig consumption. Each local club defines its own area, appoints its own committee and officers, becomes responsible for its

own finances, and pays to the county committee an annual affiliation fee of 2d. per member with a minimum of 2s. 6d.

Insurance Premiums and Compensation.—A large amount of the business of local clubs is connected with insurance. The rules provide for the appointment of two or more inspectors whose duty it is to inspect and approve all pigs before they are accepted for insurance. The inspectors have also to inspect and report on pigs in cases of illness or death within 48 hours after receiving notice. In the case of a sick pig the inspectors may also decide whether the pig shall be killed or treated by a veterinary surgeon. Two classes of pigs are accepted for insurance under the rules:—Class A—Store pigs, the premium payable on these being 2s. 6d. per head from 8 weeks old until they are killed or sold, up to a value of £15. Class B—Breeding sows and boars, the premium for which is 10s. per head per annum up to a value of £20. The secretaries of affiliated clubs must send at the end of each month to the secretary of the Gloucestershire Pig and Potato Production Committee, a list of the pigs insured during the month, together with half the amount of the premiums, in return for which the county committee becomes responsible for two-thirds of the amount of the compensation payable in the case of a loss, the compensation payable to the owner of the pig being at the rate of four-fifths of the assessed value or 16s. in the £. When an insured pig dies or has to be slaughtered, the inspectors report the matter to the club committee, who examine the facts with a view to assessing the amount of the compensation, which is based on the value which the pig would have realised in the market before its death. In the event of the carcass or part of it being sold for any purpose, the amount realised is deducted from the sum payable in compensation. It will be observed from this that the insurance scheme is mutual in two ways. In the first place members of local clubs contribute one-third of the compensation which the club has to find in the case of a loss, and secondly, clubs help each other in providing through the county committee two-thirds of the compensation for which this body is responsible. Since the scheme was established in 1918, and down to 31st March, 1921, over 11,000 pigs belonging almost entirely to cottagers have been insured, and the share of the compensation paid out by the county committee in respect of pigs that have died amounts to nearly £500. This represents the loss that would have been suffered by the owners of the pigs if no insurance scheme had been in existence.

Some of the Results.—Prompted by motives of patriotism and self-preservation many people started pig-keeping in 1918 who had not hitherto done so, and while it was unfortunate that in consequence of the War the position as regards animal feeding stuffs became very serious, it is safe to say that the co-operative organisation provided by pig clubs was the means of preventing many pigs from being slaughtered prematurely. Further, through the pig club movement during the War, the county played a creditable part in the production of food at a time when it was badly needed. It was inevitable that when peace was restored some of the clubs which were started and run largely as War measures by patriotic people would cease their operations, and the movement has been checked somewhat by the high cost of store pigs and the prohibitive price of material for building pigs' cots. Nevertheless, the efforts of the county committee to continue their operations on a peace-time basis are fully justified, and at the end of the financial year, 31st March, 1921, there were 63 local clubs affiliated to the county committee. During the year 3,214 pigs were insured, of which 56 died, and the amount of compensation paid out of the committee's fund was £206 17s. 5d. The Cotswold Hills remain true to their traditions in the matter of pig clubs. The older clubs are still vigorous and progressive, many new ones have been started and they are mostly run as pig clubs should be, by the benefitting members, *i.e.*, the cottage pig-keepers, without outside help or patronage, and it is only in this way that any real spirit of co-operation can be maintained. It is hopefully anticipated that, with a return to more normal conditions in the value of pigs and building materials, pig-keeping will be increased amongst cottagers and the sphere of good work accomplished by the village clubs developed. This is all the more desirable in view of the general increase of allotments, the supply of animal manure for which is one of the problems that has now to be faced. The allotment holder who has one or two pigs on his plot solves the problem for himself, for while the pigs provide him and his family with wholesome food, they also maintain a supply of manure for the benefit of the vegetable crops grown on the allotment. To realise this one has only to inspect the plot of a pig-keeping allotment holder.

Local Competitions and Challenge Cups.—In a number of cases prizes are offered by local clubs for pigs kept by the members, and in 1920 Lord Bledisloe kindly presented two

silver challenge cups for competition amongst affiliated clubs; the trophy to be held for the year by the club which provided evidence of having best furthered the objects of the scheme in the following directions :—

1. Membership of the club for the year concerned.
2. Approximate population of the district served by the club, if obtainable.
3. Total number of pigs insured under the county scheme for the year.
4. Particulars of arrangements made by the club for supplying members with feeding stuffs on co-operative lines. Methods adopted of growing food for pigs should also be described.
5. Efforts the club has made to encourage the breeding of pigs.
6. Particulars of any effort made to purchase seed potatoes on co-operative lines for members.
7. A general account should be given of the operations of the club, *including any special features of interest;* also a statement of accounts which will enable the judges to form an opinion as to the financial position of the club and the methods of keeping accounts and general management.

Down to the present the challenge cups have been won by the Sherborne and Windrush Pig Club, the Maisemore Pig Club, and Messrs. Price, Walker & Co.'s Employees' Pig Club, Gloucester. In the case of the last-named club and also the Gloucester Carriage & Wagon Works Employees' Pig Club, the pigs are kept collectively, shares in the club being held by the members, among whom the pigs are divided as they become fit for slaughter.

Co-operative Purchase of Scotch Seed Potatoes.—Since its inception the movement has done much to increase the production of potatoes on allotments and in cottage gardens, as it provides a means by which small growers can obtain genuine Scotch seed potatoes on the same terms as farmers and large cultivators. The method of procedure is as follows. Seed potatoes of selected varieties are bought in Scotland by the county committee on the most favourable terms, and the secretaries of affiliated clubs are furnished with a list of varieties and prices. Members of the clubs are invited to place their orders, which are bulked, and a small amount is added to the quoted price to cover the expenses of distribution. The benefits of this scheme to individual members of clubs are two-fold. Firstly, by planting fresh Scotch seed the grower greatly increases his crop of potatoes without any addition to his outlay for manure and labour. Secondly, he buys his seed potatoes at wholesale rates, plus a small amount to cover working expenses: this is a great consideration when the figures are compared with retail prices. It

may be mentioned incidentally that since the scheme was inaugurated, about 250 tons of Scotch seed potatoes have been distributed by the Committee amongst cottagers and allotment-holders in the county. In several cases artificial manure has been supplied in the same way, and there is scope for considerable development in this direction.

Except for clerical assistance at headquarters, the movement is entirely a voluntary one, and great credit is due to the affiliated club secretaries who willingly give their services. At a moment when increased production is a matter of prime importance, and also bearing in mind the enormous area of land now under allotments, the advantages of organising pig and potato clubs on the lines adopted in Gloucestershire are obvious to those who realise the benefits of co-operation and mutual self-help.

INSPECTION AND CERTIFICATION OF GROWING CROPS OF POTATOES IMMUNE TO WART DISEASE.

IN pursuance of the policy which the Ministry has adopted for the control of Wart Disease of potatoes, arrangements were instituted in the summer of 1918 for the inspection and certification as true to type, of growing crops of potatoes immune to wart disease. The object is to secure for growers having land infected with the disease an adequate supply of " seed " potatoes of immune varieties, reasonably free from rogues. The importance of securing seed which is true to type and free from rogues for planting in infected land is obvious, since the planting of susceptible " rogues " is bound to lead to the reappearance of the disease, with a resultant loss of crop, and may possibly tend to weaken the faith of the growers in the immunity of the varieties recommended by the Ministry. Reports relating to the inspections for 1918 and the following seasons have appeared in previous issues of this *Journal*. The following notes show briefly the extent of the work and the results obtained during the season of 1921.

The inspections are carried out by a specially trained staff selected from the ranks of the Ministry's Inspectorate. Each officer authorised to inspect and certify a crop is first of all selected on account of his intimate knowledge of potato growing, and this corps of selected inspectors is taken to the Ministry's Trial Grounds at Ormskirk in July each year for a " Refresher " course. At the trial grounds, plots of all the immune varieties, new and old, are seen growing, and after two or three days spent in studying the newer varieties and refreshing their knowledge of the older ones, the Inspectors are required to undergo a very severe test of their knowledge. They are called upon to examine and identify no fewer than 24 varieties of potatoes, and to indicate what " rogues," if any, are present. No Inspector is allowed to undertake the work of certification unless he attains a very high standard in this test, and a few of those who attain full marks are appointed to act as " umpires " when occasion arises. The need for " umpires " will be realised by those acquainted with the varying characteristics of the potato crop. Cases arise, moreover, in which the grower is not satisfied with the decision of the Inspector who is instructed not to grant any certificates for

crops that do not reach the high standard of 99.5 per cent. purity, and in such cases the crop is inspected by the umpire. The Ministry is confident that a study of this scheme will show that every reliance may be placed on the value of the certificates issued, and hopes that traders will restrict their dealings in immune seed potatoes to these certified crops.

Prior to 1921 the inspections were carried out free of charge to the grower. The straitened conditions of the national finances, however, caused the Treasury to issue an instruction to the Ministry that all services such as this should only be carried out on a self-supporting basis, and the Ministry was compelled to intimate to growers that a charge would be made in respect of all crops inspected this year. This charge was fixed at the low figure of 2s. 6d. per acre, with a minimum charge of 10s. It is satisfactory to relate, bearing in mind the slump in the potato trade, that applications were received for the inspection of no fewer than 6,170 acres, which is practically the same as the area inspected in 1919, though it is, of course, much below the figure for the " boom " year of 1920.

Judging from the applications for inspection, the most popular of the immune varieties are the following:—Kerr's Pink, Great Scot, Majestic, Ally, Arran Comrade, and King George. The complete list of varieties inspected is shown in the following table:—

Variety.	Acreage Certified.	Variety.	Acreage Certified.	Variety.	Acreage Certified.
Abundance and Abundance Types ...	22½	Dominion ...	¼	Langworthy ...	7½
Adirondack ...	½	Early Market...	6½	Leinster Wonder	¼
Ally	375½	Early Pink Champion ..	¾	Lochar ...	144¾
America ...	6	Edzell Blue ...	12¼	Majestic ...	475¼
Arran Comrade	341	Flourball ..	5¾	Mr. Bresse ...	½
„ Rose ...	20	Golden Wonder	19¾	Nithsdale ...	5
„ Victory ...	43¼	Great Scot ...	1,378	Rector	½
Ashleaf (Sutton's)	7¾	Heather Bountiful	3	Rhoderick Dhu	8½
Bishop	28½	Irish Chieftain	12½	Schoolmaster ...	¼
Burnhouse Beauty ...	1¼	Irish Queen ...	2¾	Shamrock ...	¾
Capt. Cook ...	½	Jersey Royal ...	3	Snowdrop ...	43¼
Climax	½	K. of K. ...	2½	St. Malo ...	¼
Crusader ...	3½	Katie Glover ...	½	Templar ...	121½
Dargill Early ...	68½	Kerr's Pink ...	1,582	Tinwald Perfection ...	166¾
		King George ...	286½	White City ...	2

The exact figures are not yet available, but at the time of writing, over 5,000 acres have been found to reach the very

high standard of purity demanded by the Ministry, and certificates have been definitely refused for only 400 acres.

The Inspectors' reports show that in some varieties (Ally, Great Scot, and Majestic) many crops are still badly mixed, the chief rogues found being Up-to-Date in Abundance crops, and Arran Chief and British Queen in Ally, whilst King Edward frequently appears in the Majestic crops. More trouble is, however, caused by the distribution of wrong stocks, somewhat resembling the variety whose name it bears. There has been distributed under the name of Kerr's Pink a stock bearing considerable resemblance to that variety. The stock differs from Kerr's Pink, however, in that it is susceptible to Wart Disease. Its proper name is not known, and it may be an un-named seedling. There are also two stocks of K. of K. in circulation, though one only is correct.

A register is being compiled of the growers with certificated crops, which it is hoped to publish early in November.

THE WORLD'S POULTRY CONGRESS.

THROUGH the enterprise of the Dutch Government the first World's Poultry Congress was held at The Hague from the 4th to 15th September. The conception of the World's Poultry Congress originated from the International Association of Poultry Instructors, an Association created by Mr. Edward Brown, F.L.S., who is its first President. This Association is intended for those who are teachers or investigators in poultry keeping or who are otherwise doing work for the development of the poultry industry.

Arrangements for the holding of a Poultry Congress had made considerable progress at the time of the outbreak of War in 1914, but naturally had then to be postponed. Subsequent to the Armistice Mr. Brown got into touch with the Dutch Authorities, who decided to hold the first Congress at The Hague and to issue official invitations to other nations to send delegates. National Committees were set up in many countries, including Great Britain and Ireland, America, France, Belgium, Spain, Denmark, Italy and Norway. The National Committee for Great Britain and Ireland proceeded to make arrangements for finance, contribution of papers, and a display of poultry, while guarantees of financial support were obtained from private individuals and contributions to the general expenses of the Committee were made by the Ministry of Agriculture and Fisheries, the Board of Agriculture for Scotland and the Irish Department of Agriculture and Technical Instruction.

The Committee decided to invite tenders from British and Irish breeders for the privilege of exhibiting a pen of their birds at The Hague Exhibition. There was a good response to this invitation and some 75 pens of birds, including all the principal breeds, were accepted. Some 11 papers were also contributed by British representatives.

It was hoped that educational exhibits illustrating the educational work done and the general development of the poultry industry in the United Kingdom might have been made, but owing to lack of money neither England nor Scotland was able to prepare an exhibit of this character. The Irish Department of Agriculture, however, organised an admirable educational exhibit showing the progress of the Department's work in connection with poultry keeping during the past 20 years.

and setting forth the great expansion of poultry keeping in Ireland during that period.

The organisation of the British display and the necessary arrangements for the British party involved much heavy work, which fell almost entirely upon Mr. T. R. Robinson, the Honorary Secretary, who was greatly helped by Mrs. Rawson and others of the staff of the National Utility Poultry Society. The Great Eastern Railway Company provided cheap tickets and special facilities for the British party, which numbered nearly 150. At Scheveningen special accommodation had been reserved by the Dutch Committee for the Congress visitors, and the papers were read and the discussions held in the Kurhaus Hotel. The display of birds and other exhibits was held in the Zoological Gardens situated nearly midway between The Hague and Scheveningen. The Exhibition was officially opened in the presence of H.M. Queen Wilhelmina by H.R.H. the Prince Consort. The royal party then proceeded to the Kurhaus Hotel where the Congress was officially opened by the Minister of Agriculture. Addresses were given by Dr. Lovink, Director of Food Supplies for the Netherlands and also first President of the Congress, the Portuguese Minister, and Mr. Edward Brown, second President of the Congress. Some 20 countries were represented by about 50 delegates.

Meetings were held each day from Tuesday until Friday from 9 a.m. to 5 p.m. Owing to the fact that some 80 papers on various aspects of the poultry industry were presented, the Congress was divided into four sections, which met simultaneously. On Saturday the final meeting of the Congress was held, when the resolutions passed by the various sections were discussed and adopted. Among these resolutions were recommendations—(1) As to the importance of placing at the disposal of scientists means for the study of Mendelian laws and their application especially in regard to poultry. (2) The desirability of continuing egg laying trials for 56 weeks so that more valuable conclusions may be drawn regarding the inheritance of laying qualities. (3) That it is advisable that all eggs exported from any country should be marked with the name of the country of origin, and that uniform rules of control should be adopted for the international and national egg trade, and that such regulations should be fixed by international convention and made applicable to all countries. (4) That consideration should be given to the advisability of taking official

measures regarding infectious diseases of poultry, and that research should be undertaken in poultry diseases, their prevention and treatment, especially those involving the use of vaccine and serums, and also that in every country where poultry keeping is of economic importance instruction on poultry diseases should be properly organised. (5) That the question of the international and national standards of poultry breeds be definitely settled by the next Congress.

With regard to the Exhibition, exhibits of birds and appliances were received from 14 countries. Altogether there were 563 pens of poultry and pigeons numbering 1,606 birds. There were on view 75 pens of birds from Great Britain and Ireland, and these received general admiration and a number of sales were effected. The total sales of birds at the Exhibition was of an estimated value of some £1,300. It is estimated that 30,000 people visited the Exhibition.

The Congress was the means of collecting the latest information on the various aspects of the poultry industry, and provided a channel for the dissemination of this knowledge among various countries. It will no doubt also stimulate the export of stock poultry from various countries.

A book entitled "Transactions of the First World's Poultry Congress," which contains all the papers read at the Congress, may be obtained from M. C. S. Th. Van Gink, Office of Secretary-General, 30 Bezuidenhoutschewez, The Hague, Holland.

An illustrated "Handbook and Souvenir" of the British Section of the World's Poultry Congress may be obtained on application to the offices of "The Feathered World," 9, Arundel Street, Strand, London, W.C., or to The National Utility Poultry Society, 3, Vincent Square, Westminster, S.W.1, Price 1s.

HORTICULTURE IN THE PENZANCE AREA OF CORNWALL.

G. P. BERRY,

Ministry of Agriculture.

THE Penzance district may be generally described as devoted to early potato and broccoli culture. Although a certain amount of general vegetable and fruit growing is carried on it is not sufficient even to supply the local needs in the summer months during the visitors' season, and the bulk of the early vegetables other than potatoes and broccoli, comes from other districts.

Early Potatoes and Broccoli.—These are mainly confined to the neighbourhood of Penzance, embracing the townships of Marazion, Gulval, Newlyn, Paul, Mousehole, Ludgvan and Hea Moor. The holdings are small and consist of a series of fields or small enclosures surrounded by stone walls or hedges; for the most part they are situated on the slopes facing south, and the cropping is carried on from sea-level up to about 300 feet. Wind is the disturbing factor in the climate, and without shelter it is impossible to get good results with any crop which the small holder may grow. Occasionally frost is sufficiently severe to check the early potatoes, and in the last week of April, 1921, some damage was done in the low-lying places. The annual rainfall is about 40 inches, and in 1920 it was 46.84 inches. Extremes of drought are experienced in some seasons, and the early potato crop has been known to be planted and lifted without the benefit of a good soaking rain.

Considerable difficulty is experienced in obtaining a suitable hedge plant which will both grow quickly and resist the spray. At one time Elder (*Sambucus nigra*) was largely used, but recently this shrub has been replaced to a considerable extent by *Euonymus* sp. There are indications also that the New Zealand shrub *Pittosporum crassifolium* will grow well and withstand the sea breezes. It is during the winter and early spring that shelter is so essential, for the high temperature then prevailing enables crops to make growth when in the south generally they are dormant.

Soils.—There is considerable variation in the Cornish soils, but potato and broccoli culture is carried out on sandy loams, varying from highly sandy soils in some places to soils of more body in others, the stronger soils resembling the Lincolnshire silts. The depth varies from about 9 inches on the shallower to

18 inches and over on the deeper soils. The physical condition of the soils is ideal as regards drainage and friability, there are few stones, and the temperature rises rapidly under the influence of the sun in spring. The subsoil is for the most part sand and gravel, although soils overlying the basalt rock have been brought into cultivation. Lime is deficient over a large area, and a general shortage of phosphates is indicated.

System of Cropping.—Over a large area the sole rotation is early *potatoes* and *broccoli*. The early potato crop is lifted during the first three weeks of May, and the broccoli plants are put out as soon after as the land and climatic conditions admit. Early and late protecting varieties of broccoli are grown and most of the seed is saved locally. This practice leads to the production of a great variety of types, many of which are coarse, loose, of bad colour, and apparently not to be compared with some of the strains of broccoli in other parts of the country having a more vigorous climate. The county authorities are endeavouring to help the growers in the matter of suitable strains, and crosses are being made at Gulval. A considerable amount of early cabbage is grown and despatched in nets to the Midland markets.

The varieties of early potatoes at present grown are May Queen, Duke of York, Sharpe's Express and Advance. At one time May Queen was the most popular variety, but it has been superseded by Sharpe's Express. Next in importance are Duke of York and Advance, the latter being Dargill Early under another name. Express and Advance are not as early as May Queen or Duke of York, but the Cornish grower finds that it is better to be a week later in lifting provided a much larger crop is obtained. On the very early soils both May Queen and Duke of York are said to be losing their vitality. Seed used to be obtained direct from Scotland, but in recent years once-grown from Lincolnshire is used. The tubers are planted at the rate of from 2 to 2½ tons per acre, in rows 9 in. to 12 in. apart and 4 to 6 in. between the sets. The seed is cut severely to reduce the cost of seeding, and the crop is grown entirely on the flat through the season of growth. The ground is thoroughly worked with the spade or cultivator according to the size of the field, and the potatoes are ploughed in with a single-furrow plough or planted with the Cornish spade. Lifting is always done with the spade, and the crop is placed in bushel hampers, sieves or half-barrels and despatched to the south, midland, and northern markets. The crop usually

averages from three to four tons per acre, but in a dry season it is considerably less.

Bulbs form an important crop on most of the small holdings: in some cases these are well cultivated and kept clean, but in others the bulb areas are allowed to become over-grown with weeds and rank grass. Sometimes the bulbs are grazed by horses or the areas mown and made into hay: these practices, however, cannot tend to the general welfare of the bulbs. The best growers apply top dressings of mellowed seaweed and other decayed vegetable matter as well as chemicals, and periodically lift and replant their bulb areas. Growers who force early potatoes and bulbs under glass take a crop of tomatoes in the houses during the summer. The forcing of Arum Lilies (*Calla Ethiopica*) is also very profitable, as the flowers have made high prices for the last four years; they bloom naturally in the open in April, but under glass they flower at Christmas and onward.

Fruit Trees.—In the valleys a considerable amount of orchard fruit, mainly apples, is grown. The trees receive practically no attention in the way of pruning, spraying or manuring, and they are old, stunted and lichen-covered. The varieties of apples are out of date on the majority of the holdings, Keswick Codlin and local seedlings predominating. It must not be assumed, however, that the district is unsuitable for fruit growing. Several young plantations which were examined, proved that modern varieties of apple and pear, bush trees on paradise and quince stocks, will grow and fruit satisfactorily when given proper attention. All classes of small fruit can also be successfully grown, particularly raspberries and gooseberries. Wind is again the factor which has to be guarded against, and unless shelter can be obtained, it is little use attempting top fruit.

Manuring the Potato Crop.—The supply of plant food to the soil forms a very important part of the cultivation, especially where a crop has to make rapid growth in a short growing season. The greatest attention is paid to this operation, but in the absence of experimental data there is room for doubt as to whether the system of manuring generally adopted is on sound lines. The usual custom is to accumulate a stock of natural manure which consists of seaweed, leaves, town manure, fish offal and any other decaying matter. If live stock of any description is kept, the manure made by them is incorporated. The whole mass is made into a compost heap (midden) at some convenient spot on the holding. In the construction of the

dung heap layers of sea sand are introduced at intervals, and the top of the heap is also covered with sand and soil. The sea sand in the Penzance area contains a high percentage of lime derived from shells and other calcareous matter, and as much as 5 per cent. is quite common. This sand aids in the decomposition of the seaweed and fish offal, and will ultimately benefit the land which is naturally deficient in lime; how far it tends to liberate feeding material from the manure into the air does not seem to have been definitely ascertained. This heterogeneous mass is applied to the soil in winter or early spring at the rate of 80-120 loads and upwards per acre. Assuming that a load is only 13 cwt. owing to the inaccessibility of many of the small fields, the quantity represents a very heavy dressing. In addition to this, chemicals are applied in apparently excessive quantities. Nitrate of soda and sulphate of ammonia are applied as top dressings, usually in equal proportions, from 10-14 cwt. per acre being used. In some cases sulphate of ammonia alone is applied at the rate of 8-10 cwt. per acre. Superphosphate is also applied, seldom less than 10 cwt. per acre. It is generally assumed that sufficient potash is applied in the dressing of seaweed and dung, but there are no experimental data to prove this. Some of the growers consider that an adequate return is not obtained for this heavy outlay on chemicals, and several have been experimenting by leaving a portion undressed. In the Isles of Scilly very little nitrogenous fertiliser is used, although the soils are very similar to those of the mainland. Seaweed, fish offal, &c., are principally used, but when a heavy dressing of " green " seaweed is applied very poor results are obtained. The crop is considerably retarded and stunted by the undecomposed seaweed and does not wholly recover during the season. This points to the necessity of having the material decomposed and mellowed by the atmosphere before application to the soil. No spraying is done, even in a bad year. The usual course is to lift the crop as speedily as possible when disease appears on the foliage and before the spores have had time to fall and enter the tubers.

Potato Diseases.—Considerable patches were affected with black leg (*Bacillus atrosepticus*), which was most apparent in May Queen and Duke of York. Sharpe's Express appeared to be very little affected.

Mosaic disease was very prevalent, principally in May Queen and Duke of York. Growers are of the opinion that these two varieties are becoming " played out " in the Penzance area,

and that loss of constitution goes hand in hand with Mosaic disease.

The whole industry in the Penzance district requires the help of the scientist. Experiments should be carried out both with varieties and manures, especially the latter, and be clearly demonstrated by experimental plots on the grower's premises. The economic rate of application of nitrate of soda and sulphate of ammonia should be ascertained, as also whether a combination of the two is better than a standard dressing of each alone.

The question of transport is causing anxiety to the growers, as that provided is of the most primitive kind. At the siding where the broccoli and cabbage for the North are loaded there is no covering. The trucks are of the type used to carry coal and manure, and the journey to the markets often occupies 48 hours. At times whole trainloads of broccoli in crates and cabbages in coir nets can be seen along the line drying in the sun and wind. The condition of the vegetables on finally reaching the consumer, may be easily imagined after passing through the market and the retailer.

RESEARCH IN BREWING.

BREWING and farming are interdependent. The brewer obtains his raw material from the farmer, and the farmer relies on the brewer for one of his principal markets; the condition of the one industry cannot therefore fail to be a matter of concern to the other. Any progress, too, achieved in either industry as a result of research must be of benefit to the other. Research into questions relating to hops and malting barley is ground common to the two industries, and growers of these products cannot afford to be ignorant of the research work recently initiated by the brewing industry. Moreover, an account of the organisation and finances of this work is not without value to those engaged in the development of research work on purely agricultural subjects.

Initiation of the Scheme.—The history of the brewing research scheme is a short one. In 1918 funds were allocated to the Department for Scientific and Industrial Research, and thereafter research associations began to be formed by most of the leading manufacturing industries. It was quickly realised that the fermentation industries could not do otherwise than fall into line with the general movement. The Institute of Brewing, after consultation with representative brewing firms and with the Brewers' Society, was encouraged to proceed with a scheme for research work, it being decided from the outset to work on independent lines without any assistance by way of Government grants.

Finance.—To obtain funds for the work a new class of members (Research Fund Members) of the Institute was established. This new form of membership is open to corporate bodies and firms or partnerships (as such) and individuals carrying on business as brewers of beer or vinegar, maltsters, distillers, manufacturers of cider and wine, and barley and hop growers. These members were invited to pay such subscriptions as might appear to them to be appropriate to their capital interests (with a minimum annual subscription of ten guineas), the subscription being credited to a special research fund account and used for scientific investigation and research for the benefit of the fermentation industries generally.

By the end of 1919 the Research Fund membership was 136 with an annual subscription list of £4,357; by 31st December, 1920, these had been brought to a total of 197 members with an annual subscription list of £5,046.

The following accounts show the financial position of the Research Fund on 31st December, 1920:—

EXPENDITURE AND INCOME ACCOUNT.
1ST JANUARY TO 31ST DECEMBER, 1920.

Dr. *Expenditure.*	£	*s.*	*d.*	*Cr.* *Income.*	£	*s.*	*d.*
To Preliminary Expenses ...	351	1	3	By Members' Subscriptions	5342	17	0
„ Hop Investigations at Wye	125	0	0	„ Donations to the Fund	61	15	0
„ Hop Investigations at Manchester	196	5	0	„ Deposit Interest...	216	8	4
„ Timber Investigations, London	187	10	0				
„ Stationery and Printing ...	64	14	11				
„ Postage	37	13	9				
„ Sundry Expenses		19	6				
„ Institute Establishment Charges (Proportioned)...	413	14	0				
„ Balance carried forward...	4244	1	11				
	£5621	0	4		£5621	0	4

BALANCE SHEET.—31ST DECEMBER, 1920.

Dr. *Liabilities.*	£	*s.*	*d.*	*Cr.* *Assets.*	£	*s.*	*d.*
To Subscriptions received in advance	102	10	0	By Subscriptions in arrear for 1920...	128	15	0
„ Sundry Creditors	30	15	2	„ Cash at Bank on Current Account	248	12	1
„ Balance in favour of Fund	4244	1	11	„ Cash at Bank on Deposit Account	4000	0	0
	£4377	7	1		£4377	7	1

Organisation.—A Research Fund Committee was set up consisting half of Research Fund members and half of representatives of universities, colleges, experimental stations, companies, firms and individuals willing to provide facilities for scientific investigation and research. It is a principle of the scheme that the investigations shall be carried out for the benefit of the fermentation industries as a whole and not for a single firm or group of firms. The Committee will not assist in the commercial exploitation of patented inventions, but in specific cases where funds are needed for working out on a large scale a process or device already patented, the Committee will consider the question of making a grant for this purpose.

The Research Fund Committee has made provision for the appointment of Advisory Sub-Committees for specific branches of research, *e.g.*, hops, timber and barley. These Advisory Sub-Committees initiate researches into their respective subjects, and consider applications from *individual* workers for grants from the fund. Provision has also been made in the scheme for a survey of existing researches by means of which it is hoped that any serious overlapping will be avoided.

The Committee further aims at preventing successful research workers from being unfairly exploited, and where the means for research has been found from the Research Fund, the Committee will ensure, so far as in them lies, that the discoverer or inventor shall not go unrewarded. Lastly, the scheme makes provision for the appointment by the Research Fund Committee of Advisory Officers to act in liaison between the various sub-committees and the investigators.

Research Work.—Work has so far proceeded in three main directions, viz., hops, timber and barley.

The timber research does not, perhaps, at the moment concern the agricultural industry very closely. On the other hand the barley research opens out such a vast field of enquiry that, before a specific programme of work can be embarked upon, the particular line of research showing most promise of direct value to the Brewing Industry has to be ascertained. To this end a summary of the published literature dealing with the evaluation of barley from the nitrogen standpoint has been prepared, and is now under consideration.

Hop Investigations.—The work on hops has already made progress, and may be given in some detail as indicating the lines on which research in general may be expected to proceed. Work on hops is divided into five main sections:—(1) the breeding of new varieties; (2) manuring; (3) drying; (4) testing for brewing value; and (5) chemical investigations.

For the work on the breeding of new varieties the Brewing Research Fund Committee has made use of the research organisation already set up by the Ministry of Agriculture. This research is carried on at the South-Eastern Agricultural College, Wye, and at the East Malling Research Station. The aim is to breed new varieties which will produce a heavy yield of hops resistant to disease, and at the same time contain the highest amount possible of resins and other desirable brewing qualities. The newly raised seedlings are planted out in the College Experimental Hop Garden which now contains over 4,000 seedlings, and those varieties showing most promise as heavy croppers of good quality are transferred to the hop garden at the East Malling Research Station where tests are carried out on a larger scale.*

* The Committee has decided for the time being to contribute to the College the sum of £500 per annum to cover the cost of (1) the part maintenance of the Hop Nursery and raising seedlings, (2) the chemical analyses of the hops grown at East Malling Research Station, and (3) the salary of a part time investigator.

As regards manuring, two Kentish growers have each placed one acre of land at the disposal of the Committee for the purpose for the next ten years. The main object is to find out whether the manurial elements in common use, viz. nitrogen, phosphorus and potassium, have any effect on the composition, *i.e.* brewing value, of the hop strobiles. The experiments will show whether the composition of the hop is influenced by purely inorganic manures. Plots will also be obtained elsewhere.

Four experimental kilns have been erected at Beltring, near Paddock Wood, for research work on the principles of hop drying, the object being to determine the ideal conditions of drying, the subsequent step being the designing of a kiln on practical lines which will most nearly reproduce those conditions. The following problems are being studied:— (1) the effect of varying temperatures with constant air current; (2) varying air current with constant temperature; (3) the influence of moisture content of the hops; (4) the effect of burning varying amounts of sulphur; (5) the effect of products of combustion of open fires; (6) the use of dried air; (7) variation of height of air above fire; and (8) the influence of the weather.

Comparative brewing trials of certain varieties of the hop are being made under the auspices of the Committee by a well-known London firm of brewers in order to test the respective brewing values of these varieties.

The chemical investigations are designed to determine those constituents of the hop which are most useful to the brewing industry, the methods of evaluation so far employed being purely empirical. The problem now being investigated is the isolation and identification of the constituent, or constituents, on which the preservative or antiseptic properties of the hop depend. This investigation is under the direction of Dr. F. L. Pyman at the Municipal School of Technology, Manchester, which possesses special facilities for this work. The results of past researches point to the probability of the constituents containing the antiseptic or preservative qualities being found in the soft resins of the hop. In order to obtain material for investigation, the investigators have extracted the soft resins from a large quantity of sulphured and unsulphured hops and the extracts are now being examined. It is estimated that these chemical investigations will cost about £600 per annum.

DEMONSTRATION OF FLAX-PULLING MACHINES.

PUBLIC trials of flax-pulling machines were arranged by the Irish Department of Agriculture and Technical Instruction to take place at Ballyveasey, Carnmoney, Belfast, on 26th July, 1921. Only two machines took part in these trials :—

(*a*) The Crawford-Bennett Machine made by the York Street Flax Spinning Co., Belfast.

(*b*) The Fibre Corporation Machine made by Messrs. Marshall, Sons & Co., Ltd., of Gainsborough.

The Crawford-Bennett Machine is self-propelled, and consists essentially of a polygonal drum of about 5 ft. in diameter hung at the back of a motor chassis so that its lowest portion is about 6 or 8 inches above the ground. At intervals of about 45 degrees, rows of teeth extend across the width of the drum and project about 5 inches beyond its circumference. When the car is driven on its reverse gear the drum is rotated by suitable gearing in the opposite direction to the ground wheels and caused to advance towards the flax to be pulled at a slow speed. The pulling is effected by the projecting combs referred to, which pass up the flax stems until they encounter the seed heads, when the upward movement of the combs causes the plant roots to give way. The flax is carried over the circumference of the drum and delivered at the top, where it is forced from the teeth by a longitudinal metal lath, operated by a cam, which presses upwards from the base of the teeth. When at the top of the drum and freed from the uplifting teeth, the pulled flax is engaged by a further set of combs mounted on endless chains, which bring the flax forward and deliver it on to a travelling canvas, which carries it in a sideways direction for delivery on to the ground clear of the path of the machine, either in loose bundles, or in bundles automatically tied.

The Fibre Corporation Machine is built to attach to a motor tractor and consists of endless chains passing over fore and aft cogs carrying a number of combs at equal intervals. This mechanism is mounted on a suitable carriage which is attached to a tractor and made to travel in the same direction as the ground wheels. A similar action is employed for pulling as in the Crawford-Bennett Machine, combs being caused to engage the heads of the standing flax, but, in this case, the combs are caused to enter the crop from above in advance of the travelling machine. The engaged flax is drawn underneath the pulling mechanism at the slow rate of the difference

FIG. 1.—The Crawford-Bennett Flax Pulling Machine.

FIG. 2.—The Fibre Corporation Flax Pulling Machine.

between the speed of the advancing ground wheels and the backward speed of the revolving combs. This feature is a very important one as it enables the ground speed of the machine to be greater than the pulling speed of the combs. The pulled flax is delivered on the ground at the rear of the machine, being freed from the engaging pulling combs on the underside of the machine. In this case the pulled flax is left in the track of the machine, in swathes which have to be tied up and removed before the machine returns.

No injury to the flax stems could be detected after pulling by these machines, but it was noticed in each case, although more particularly with the Fibre Corporation Machine, that the flax heads were very much tangled, a fact which must render "rippling" difficult if not impossible. In both cases the heads were brought evenly together so that, depending upon the evenness in length of the straw pulled, the root ends were left at various distances in the bundle, and owing to the tangled condition of the heads it was difficult to even-up the root ends when making up into bundles.

While the trials were in progress the Crawford-Bennett Machine, by virtue of the elevation to which the pulled flax is brought, allowed the pulled straws to be tossed about in the breeze a good deal, causing a confusion of the straws in the bundle of pulled flax ultimately discharged. On the other hand, although not affected by wind disturbance, the Fibre Corporation Machine was found to be depositing the swathes of pulled straws upon flax which had not been pulled by the combs, making it difficult to lift and tie up the pulled swathes.

Generally, with the exception of the unpulled flax beneath the swathes of pulled flax already referred to in the case of the performance of the Fibre Corporation Machine, the quantity of flax left unpulled by these machines under the ideal condition of the trial was scarcely significant, being for the most part, short stems which usually fail to survive the operations culminating in scutched fibre. It is doubtful whether either machine would be able to deal with any crop if "laid" at all.

In the performance of these two machines there appears to be a very big advance towards solving the flax pulling problem, and with the prospect of further improvements before next season, one may reasonably hope that the machine pulling of flax crops will be commercially possible at no distant date.

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NOTES ON MANURES FOR NOVEMBER.

E. J. RUSSELL, D.Sc., F.R.S.,
Rothamsted Experimental Station.

Ashpit Refuse from Towns.—In view of the shortage of stable manure in cities, as a result of the increase in motor traction, it has become necessary to inquire whether, and to what extent, ashpit refuse from towns can serve as a fertiliser. In some cases a useful manure is obtainable and some of the heavy land farms near London have used it with good results. In spite of its smell, however, it is not rich in fertilising constituents, and in its raw state it is too coarse to be of much value except on heavy land where it has a lightening effect. Attempts are now being made by some Councils to grind the material and otherwise improve it, and a truck load as sent out from London by the contractors, Messrs. Cloke of West Hampstead, is being tested at Rothamsted. Analyses of some of the samples from Bermondsey and Southwark are as follows:—

	Per cent.
Organic matter	31·20
Lime	2·86
Phosphoric Acid (P_2O_5)	0·53
Potash (K_2O)	0·47

There is an element of risk in using refuse material of this nature on land where potatoes are to be grown, inasmuch as it may contain diseased potato peelings which may infect the land for a subsequent crop. On the other hand, mangolds, cabbages and other farm crops are not likely to suffer. This material is worth trial on heavy soil so long as the cost does not become too great.

Time to apply Basic Slag on Clover Leys.—There are two possibilities in the way of using basic slag on clover leys: it may be applied to the corn crop in which the clover is sown, or to the young plants after the corn has been cut and carted. The choice between these two ways turns on the vigour with which the clover grows. In some parts of the west country clover starts so well in the corn that if it is treated with slag it develops to an inconvenient extent; in such cases the addition of slag should be delayed till after the corn has been cut; it could, for instance, go on now. In the eastern counties such vigorous growth in the corn would be exceptional, and the slag

can therefore go on before the clover is sown so as to allow ample time for the full effect to be produced.

The Cockle Park experiments show that the clover ley constitutes the most convenient and profitable place in the rotation for the introduction of basic slag.

Professor Gilchrist's Method of using Waste Lime.—The writer recently had an opportunity of seeing Professor Gilchrist's method of using waste lime on arable land in the north of England. The material, known as "Chance Mud," or "Lime Mud," containing about 60-70 per cent. calcium carbonate and free from injurious constituents, is cheap, and while not in dry powder condition is in such state that it can be spread on the land from farm carts. It is put on the "Hay Stubble" at the rate of 4½ tons per acre, then ploughed in. Oats are then sown and after this crop is removed the land is ploughed for roots. This ploughing of course brings the waste lime up to the surface again when it dries and falls to a fine powder. The method is sound because the oats stand in no need of lime and therefore suffer no inconvenience from having the material buried; the roots on the other hand require it, and therefore benefit from having it brought up to the surface.

Injury to Root Crops from use of Superphosphate.—Instances have come to the writer's notice from the north of England of damage done to root crops by superphosphate this season, presumably through encouraging finger-and-toe. It is desirable to have the exact cause of the trouble determined if possible, and farmers who have suffered are requested to communicate with the Rothamsted Experimental Station stating whether finger-and-toe was common or not.

Use of Gas Liquor as Substitute for Sulphate of Ammonia.—A correspondent writes to say that he is offered gas liquor at a cheap rate and asks if and how he can use it as fertiliser. The direct use of this material is not to be recommended: the proper course is for the gasworks to convert it into sulphate of ammonia. If this is entirely ruled out, however, then the gas liquor can be used provided:—

1. Sulphides, sulphocyanides and cyanides are absent, or occur in traces only.
2. Frequent determinations of the ammonia content are made.

The liquor in question was of the so-called 12 oz. strength, *i.e.*, 12 oz. of pure sulphuric acid were needed to neutralise 1 gallon. This is about 10 times as strong as ordinary liquid manure

and must therefore be diluted to this extent and then further diluted just as if it were liquid manure. It can be put on grass land and on land intended for roots, but this should be done in winter or in early spring to avoid any risk of possible harmful effects on the young plants.

Should Farmyard Manure be ploughed in at once or can it be left on the Surface?—Several inquiries have been made as to whether farmyard manure should be ploughed in directly it is applied to the land or whether it can be safely left exposed on the surface after it has been spread. It is common in some districts, *e.g.*, east Suffolk, to spread farmyard manure on bare fallows in June and plough it in at some later date; also to spread the manure on clover stubble early in September and leave it till the ground is soft enough for ploughing, which might be several weeks. Unfortunately no exact information is available, but from what is known it seems probable that the best course is to plough in the manure directly it is spread, and if necessary to delay spreading until ploughing is possible. Naturally this recommendation must be tempered by the necessity for distributing labour as evenly as possible over the season, and it may in the end prove more economical to save labour even at the expense of some wastage in manure.

Spread Farmyard Manure Evenly.—The necessity for spreading artificial manures evenly is well recognised, but farmers are not always able to secure as even a distribution of farmyard manure as is desirable. In the Lothians may be seen an implement, the "Dumb Tam" (so named, it is said, after its inventor), which marks off the ground into squares of 18 ft. each side, of which 134 constitute an acre all but 16 sq. yd. A heap of 2-2½ cwt. of farmyard manure is then deposited on each square and can be spread evenly.

Influence of Chalk or Limestone on Young Seeds.—The following communication from a good arable farmer in Bedfordshire affords interesting evidence as to the valuable effect of chalk on the seeds mixture, the land being brown stony clay overlying the chalk: "I dig deep drains 4 to 11 ft. deep to get the spring water out and spread the chalk as widely as possible each side of the drains and the effect is as you say and have said. The ground is more tilthy, more dry and more damp*; for instance, I have sown a variety of seeds over these chalked places and the seeds are nearly all alive and look comparatively well, but where there is no chalk seeds have practically disappeared, so that if I could have chalked all the

* *i.e.*, more dry in wet weather and more damp in dry periods.

pieces thus sown with seeds, it must have gone a long way towards paying in this great drought in one crop. But in one place last year the chalk had a wonderful effect on winter oats, there being a tremendous crop as far as the chalk went, but a great falling off on the rest. This piece was winter oats again this year and there was again twice as big a crop, but much less than last year."

It is noticed, however, that all chalk is not equally effective: it will probably be found that the softer chalk is the more useful as it will more quickly come into action than the harder deposits.

Nitrogen Starvation on Water-logged Soil.—A very interesting point is raised by a farmer who writes: "I noticed if one has a piece of water-logged land the crops have the appearance of starvation of nitrogen, but if a drain is dug across this piece of land to any depth, say 10 ft., and no care is taken how the soil is returned the crops that follow are in most cases many times larger just over where the drain is dug, but no wider, while it seems that the rain must have a better chance of washing nitrogen out of the soil over the drain than elsewhere; yet 2 cwt. sulphate of ammonia per acre would not make the crops at the side equal to those immediately over the drain." The explanation is that nitrogen starvation has occurred on the undrained soil, but it is caused not by washing out of nitrates from the soil but by the decomposition of nitrates which sets in as soon as air is excluded. A number of soil organisms have the power of decomposing nitrates in absence of air, and they do it with so much rapidity that the plant suffers. The remedy is to let in air, when the loss is completely and automatically stopped; this can best be done by arranging for drainage.

Non-fertilising Constituents of Manures.—A farmer writes to ask what amounts of substances are present in the ordinary artificial manures besides the nitrogen, phosphate and potash shown in the analysis. The constituents in three common cases are as follows:—

Nitrate of soda:—Plant food in 1 cwt.: Nitrogen, 17 lb., the same amount as is present in 106 lb. of albuminoid or protein; Soda, sufficient to form in the soil 188 lb. of ordinary carbonate of soda or 1 cwt. of bicarbonate of soda. This soda has some effect as manure, but is apt to injure the texture of a heavy soil.

Sulphate of ammonia:—Plant food in 1 cwt.: Nitrogen, 22 lb., equal to the amount present in 137 lb. of albuminoid or protein; Sulphuric acid, sufficient to consume 85 lb. of calcium carbonate or about 100 lb. of ordinary good grade limestone.

Superphosphate:—Plant food in 1 cwt. of 26 per cent. grade: 29 lb. pure tricalcic phosphate; about 56 lb. dry gypsum (or 62 lb. ordinary gypsum) which has some fertiliser effect.

The Cultivation of Sage and Thyme.

SAGE (*Salvia officinalis*) has long been under cultivation in market, private and cottage gardens. The plant is a native of southern Europe. The leaves have been used for flavourings and stuffings for centuries, and at one time an infusion was made from the leaves, known as sage tea, which was said to have certain medicinal properties. There is always a certain demand for the crop on large markets, but this demand fluctuates greatly and can be easily overdone. It is therefore not by any means a safe crop to cultivate on a large scale and the same may be said of Thyme. At one time very considerable quantities of sage were grown in the Mitcham district of Surrey, and the Evesham market gardeners made a special line of the crop, but the time came when the supply very much exceeded the demand and growers consequently gave up its culture. Leading market gardeners in Middlesex still grow small quantities according to the demand.

The plant succeeds best on light, warm and dry soils and can be raised from seed sown in frames or on a warm spot in spring. The plants when well established and hardened off can be lifted carefully with good balls of soil and placed in permanent position 1 foot apart and 18-24 inches between the rows.

By far the most common method of propagation, however, is by slips and cuttings or by pieces of the young growth well ripened and broken off with a slight "heel." These slips are inserted in a shady border or cold frame in April, May or June, and occasionally watered until rooted, when they can be planted in the open and at the distances already mentioned. There has been a general tendency in recent years to plant wider, so as to admit more easily of horse labour. Three feet between the rows and 2 feet between the plants has been a common distance. The ground is kept in good tilth and clear of weeds, and the extremities of the leading shoots are pinched to produce bushy plants by the encouragement of lateral growth.

For winter use it is bunched and dried. The side and main growing shoots are cut and dried in a dark, cool, airy shed, and then tied into bunches, or they may be tied in bunches immediately after cutting and suspended from the roof of a cool shed to dry.

Thyme.—There are two varieties of this herb, the large green-leaved (*Thymus vulgaris*) and the shorter variety known as Lemon Thyme (*Thymus citriodorus*). The former is most exten-

sively used as a flavouring for soups and stuffing. It thrives best on a light warm soil.

The plants are usually raised from seed sown in April in shallow drills 8-12 in. apart. They should be thinned out in June and July to 4 inches apart and the thinnings used for planting up fresh ground at the same distances apart in the rows and between the plants as already indicated. This herb may be also bunched and dried for winter use. Cuttings can also be taken, but seedlings are the usual method of propagation.

Where only a small quantity is required a single drill may be sown at the margin of a border and left unthinned, when it will form a good edging.

At the present time there is a rather good demand for English herbs, and English sage has been commanding a price of about 150s. per cwt. as compared with 30s. per cwt. for Dalmation, French and Greek produce. English Thyme has been commanding about 178s. per cwt. as against 50s. per cwt. for the imported article. It is generally recognised that the English article is very much superior to the imported. The annual home consumption has been computed at about 200 tons of sage and 50 tons of thyme. It will therefore be apparent that although at present the demand is good, the area necessary to produce it does not amount to a very large acreage, even taking the low estimate of 1 ton per acre.

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Grants for Agricultural Research.

THE Ministry, with the approval of the Development Commissioners and the Treasury, has awarded the following special research grants for work in connection with agricultural problems during the academic year October 1921 to September 1922. These grants are in addition to the annual grants-in-aid made to Universities and Research Institutes for the maintenance of agricultural research departments.

	Institution.	*Investigation.*	*Amount.*
1.	University College, Aberystwyth.	Life History of Moniezia (tape worm).	£300
2.	Armstrong College, Newcastle.	Composition of Oat Straw -	250
3.	School of Agriculture, Cambridge.	Silver Leaf Disease - -	400
4.	School of Agriculture, Cambridge.	Soil Moisture - - -	100

	Institution.	*Investigation.*	*Amount.*
5.	Zoological Department, Cambridge University.	Soil Bionomics	£300
6.	East Anglian Institute, Chelmsford.	Insect Fauna of Soil	200
7.	Imperial College of Science, London.	Change of Seed (Potatoes)	75
8.	Imperial College of Science, London.	Wart Disease of Potatoes	230
9.	Imperial College of Science, London.	Disease of Hops	35
10.	Royal Horticultural Society.	Green Manuring	200
11.	South Eastern Agricultural College, Wye.	Insect Pests of Turnips	120
12.	South Eastern Agricultural College, Wye.	White Clover Investigations.	205
13.	South Eastern Agricultural College, Wye.	Crown Gall Disease of Fruit Trees.	205

* * * * * *

Acarine Disease of Bees.

IT will be interesting to bee-keepers to learn that, at the apiary of a recognised expert in Norfolk, the fact appears to have been definitely established that Italian queen bees provide distinct powers of high resistance against Acarine disease in those hives in which they are introduced. As is well known, the Ministry has during the last few years supported a scheme to supply bee-keepers with healthy queen bees from the best apiaries in the North of Italy. It is satisfactory to find that as far back as 1912 the Norfolk expert referred to introduced Italian queen bees into his apiary, which was at that time seriously attacked by Acarine disease (also known as Isle of Wight Disease) and that the "crawling" stage, usually a sign that the disease is becoming far advanced, was gradually overcome. Since that time, his apiary has been built up until there are 26 stocks in which there is not a sign of Acarine disease. This expert has recommended others in the county to adopt the course which he himself successfully pursued. It is stated that they have done so with wholly satisfactory results.

Rabies.—No case of Rabies has occurred in any part of Great Britain since the 7th June last. The whole of the restrictions imposed by the Berkshire and District (Muzzling and Control of Dogs) Orders of 1920 and 1921 were withdrawn as from 1st October, no case of Rabies having occurred in that area since the 1st February. This area included portions of Berkshire, Buckinghamshire, Oxfordshire and the northern part of Hampshire. There is now only one area remaining subject to restrictions on account of Rabies, viz., an area comprising small parts of Hampshire and Wiltshire surrounding Salisbury, Winchester and Southampton. All dogs in this area must still be muzzled, and no dog can be moved out of the area without a licence from the Ministry.

West Surrey Goat Club.—The attention of the Ministry has been called by Mr. T. W. Palmer, hon. secretary to the British Goat Society, to the note on the West Surrey Goat Club which was published in the September issue of the *Journal* (p. 565), in which it was stated that one of the goats "had given on the day of the show over 8lb. of milk." This appears to be an understatement, as Mr. Palmer points out that the goat referred to "gave 8lb. of milk at one milking, and during the 24 hours gave 12lb. 12oz. Other records during the 24 hours were as follows:—10lb. 14oz., 10lb. 4oz., and 10lb. respectively, while there were seven goats which yielded more than 9lb. but less than 10lb. each."

Leaflets issued by the Ministry.—Since the date of the list given on page 670 of the October issue of the *Journal*, two new leaflets have been issued:—

No. 372.—Pig Feeding.
„ 378.—Beeswax.

The following leaflets have been re-written:—

No. 73.—The Cultivation of Maize for Fodder.
„ 89.—Fluke, or Liver Rot in Sheep.

The following leaflets have been revised:—

No. 58.—The Nematode or Round Worm Disease of Poultry.
„ 78.—Tuberculosis of Poultry.
„ 87.—The Die-back Disease of Fruit Trees.
„ 93.—Farmyard Manure.
„ 120.—Peach Leaf-Curl.
„ 148.—Planning and Planting a Fruit Plantation.
„ 153.—Storing of Mangolds and Turnips.
„ 173.—Potato Growing.
„ 204.—Apple Mildew.
„ 207.—Strawberry Cultivation.
„ 228.—Prevention of Cruelty to Animals.
„ 240.—Farm Book-keeping.
„ 275.—Improvement of Poor Hill Pasture.
„ 286.—Narcissus Flies.
„ 322.—Winter Pruning Bush and Half Standard Apple Trees.

The following leaflets have been withdrawn:—

No. 181.—The Cleansing of Water Courses.
„ 220.—Agricultural Holdings Act, 1913.
F.P. 15.—The Use of Sulphate of Ammonia as Manure.
F.P. 44.—Co-operation and the Supply of Farm Implements.
F.P. 45.—Skim Milk Cheese.
Sp. 75.—The Manufacture of Cheese in Co-operative Dairies.

NOTICES OF BOOKS.

Raspberry Growing in Scotland.—By J. N. Hodge. (Edinburgh: The Scottish Smallholders' Organisation, Ltd., 1921.)—In this little book Mr. J. N. Hodge traces the history of the growth of the raspberry industry in so far as the district around Blairgowrie, in Scotland, is concerned. The writer appears to have been connected with a company which, at the early stages, purchased blocks of land for re-sale to small holders for fruit-growing purposes, and he gives figures showing clearly the cost of the land to the holders, and the return they secured during several years' work. He states that the industry was started over 20 years ago at Blairgowrie, when a farm of 30 acres was purchased and split up into small holdings. From that date the history of the industry is traced, and details are given of one or two large holdings, such as that at Essendy, a holding of 400 acres, and that at Aberuthven. The writer concludes from the figures that it was possible for a business organisation to acquire agricultural land for the purpose of small holdings for fruit culture, with results favourable both to the company and to the small holders. By so doing, he says, the capital value of the land has been considerably increased, being sufficient to employ an increasing number of workers and bringing greater prosperity to the rural population. Ultimately the prosperity is shared by the railway companies which transport the goods from the district, and by the tax collector, who increases his assessment of the land, which is now used for market garden purposes.

Not the least interesting portion of the book is the chapter dealing with the gathering of the crop. Before the War the work was done principally by tramps, who came into the district at stated seasons and did the work moderately well without requiring the grower of the fruit to make any provision for his reception; for he slept, as was his custom, on the roadside or in the woods. In the first year of the War, however, the tramp failed to return; other provision had to be made, and the task proved unduly heavy. A big organisation had to be placed on foot to secure workers from every possible source, taking women and children from the slums of large cities, boys from Industrial Schools, and other war workers of any class or sex who were willing to do the work; even German prisoners were engaged to help. Having secured the supply it was a big task to arrange for the sleeping and feeding of such a large number of people, drawn from different parts of the country, of various classes, and of both sexes. Mr. Hodge's story of this is well worth reading, and he says: "We worried on through these years, grateful to those who had helped us, willing to take back those who wanted to come, but always looking forward with a great longing to the end of the War and the return of the tramp."

Those who are interested in statistics—yield of the crops per acre from year to year, and the price realised for the fruits—will find much information in this little book. Further, there is food for thought in the chapter dealing with the limitations of the industry, for it appears from the Blairgowrie experience that where a block of land is planted to any one crop continuously the yield is influenced both by soil limitations and ravages of insect pests. The yields per acre at Blairgowrie have steadily declined; areas that in 1909 were yielding a crop of 2,600 tons produced only 1,500 tons in 1919, and between those years the decline was persistent and gradual.—H.V.T.

Lawes Agricultural Trust, Rothamsted Experimental Station, Harpenden. Report 1918-20. With the "Guide to the Experimental Plots."—(D. J. Jeffery, Vaughan Road, Harpenden. Price 2s. 6d. Foreign postage extra.) The Rothamsted Experimental Station, famous the world over, was founded in 1843 by Sir J. B. Lawes, with whom was associated Sir J. H. Gilbert for a period of nearly 60 years. Sir A. D. Hall (now Chief Scientific Adviser to the Ministry of Agriculture) was Director from 1902 till 1912, when Dr. E. J. Russell succeeded him. The period reviewed in the present Report completes the reconstruction which began in 1913. The laboratories have been entirely rebuilt; a library of some 15,000 volumes dealing with agriculture and cognate sciences has been collected; the equipment of the farm has been completed, and cultivations and cleanings necessarily neglected during the War have been carried out.

Rothamsted Methods.—The most important part of the reconstruction, however, has been the reorganising of the work of the Station to bring it more into touch with modern conditions of agriculture on the one hand and with science on the other. The purpose of Rothamsted is, as stated in the Report, to acquire precise knowledge of soils, fertilisers, and the growing plant in health and disease. The work falls into two divisions :—(1) The soil and the healthy plant; and (2) the insects, fungi, and other agencies disturbing the healthy relationships between the soil and the plant, causing disease. The opinion is held at Rothamsted that if farmers are ever to avoid the very serious losses they now suffer from plant diseases and pests, it will be by prevention rather than by cure. The method adopted at the Station is to start from the farm and work to the laboratory, or *vice versa*. There are four divisions in the laboratory—biological, chemical, physical, and statistical. The method differs, however, from that of an ordinary scientific laboratory, where the problem under investigation is usually narrowed down so closely that only one factor is concerned. On a farm such narrowing-down is impossible, and in place, therefore, of the ordinary single-factor method, liberal use is made of statistical methods, which allow investigation where several factors vary simultaneously. For instance, in crop investigations a large number of field observations are made; these are then treated statistically to ascertain the varying degrees to which they are related to other factors, such as rainfall, temperature, etc., and to indicate the probable nature of their relationship. Thus a complex problem is reduced to a number of simpler ones susceptible of laboratory investigation. It is confidently anticipated that this method will prove effective in bringing the full help of science to bear on the farmers' problems.

Fertiliser and Soil Problems.—The War has profoundly modified the artificial fertiliser position. Extensive factories now manufacture nitrogenous fertilisers from the air. Of these, nitrate of lime, nitrate and muriate of ammonia, and nitrolim have been or are under investigation at Rothamsted. A further important source of organic nitrogenous manure is sewage, and a new method of dealing with sewage, which has been devised by Dr. Fowler at Manchester, has been tested at Rothamsted, and it is found that a general adoption of the method would add considerably to our supplies of organic manures. Rothamsted is also investigating basic slag. A grazing experiment with sheep, and a set of hay experiments on permanent and on temporary

grass-land, have been started to ascertain the value of modern slags and of mineral phosphates. In addition, an elaborate series of pot experiments is in hand to determine whether any constituent besides the phosphate is of value.

Manures not only increase the crops; they bring about other changes, and these are being examined by the botanical staff of Rothamsted. The effects of manures and cultivations on crop yields are by no means simple or straightforward. Every farmer knows the variations due to season and weather conditions; and although weather may never be controllable, foreknowledge of its probable effects on crops would be very valuable. In order to study these effects, a Statistical Department has been set up to carry out an analysis of the meteorological conditions at Rothamsted in conjunction with the crop records since 1852.

However skilfully artificial manures are applied, it is essential on ordinary farms to add organic matter to the soil. Four ways of doing this have been investigated at Rothamsted. Experiments in the production of artificial farmyard manure have also been made and are being continued. Laboratory work has shown that the breaking-down of the material of straw is brought about by organisms. One of these organisms had eluded all previous investigators, but the Rothamsted workers succeeded in obtaining it in pure culture, studying it freely, and determining the conditions it requires to act.*

Experiments at Rothamsted have shown how clover—one of the most difficult crops to grow—can be improved. In another direction, no fewer than 10 workers are engaged on a survey of soil population—those soil organisms, invisible to the naked eye, yet present in vast numbers and in extraordinary variety, without which organic manure would be not only quite useless but in some cases harmful. The ultimate aim of the agriculturist is to control this soil population in much the same way that the animal breeder has controlled and developed the original wild animals. Control, however, is not possible without full knowledge of what the organisms are, what they do, and how they live: and it is this knowledge which the Rothamsted scientific workers are endeavouring to acquire.

Rothamsted's War Work.—The most important War work performed at Rothamsted was begun in 1916, when the food situation was causing great anxiety. This country was producing only one-half of our total food. Worse still, the food produced included more of the luxuries than of the necessaries—for instance, all the highest-quality meat but only one-fifth of the bread. Farmers were therefore called upon to perform a double task: they had to produce more food, and different food: to give us three or four loaves out of every five loaves required, instead of only one out of every five as hitherto; and to do this without causing too-great shortage of milk or meat. The situation presented many difficult administrative, financial and technical problems. How Rothamsted helped to solve the problems involving soils and fertilisers is told in this Report, which should be in the hands of every farmer who is interested in learning what Science is attempting to do for Agriculture.

* See this *Journal*, Vol. XXVIII, p. 398.

Agricultural Returns, 1921: Produce of Hops.

THE following preliminary statement shows the estimated total production of hops in the years 1921 and 1920, with the acreage and estimated average yield per statute acre in each county of England in which hops are grown; and the average yield per acre of the ten years 1911–1920.

COUNTIES, &c.	Estimated Total Produce.		Average returned on 4th June.		Estimated Average Yield per Acre.		Average of the ten years 1911–20.
	1921.	1920.	1921.	1920.	1921.	1920.	
	Cwt.	Cwt.	Acres.	Acres.	Cwt.	Cwt.	Cwt.
KENT East ...	39,000	49,000	4,005	3,258	9·6	15·2	11·5
KENT Mid ...	52,000	72,000	5,414	4,520	9·7	15·9	12·2
KENT Weald ...	52,000	85,000	6,634	5,710	7·9	14·8	11·1
KENT Total Kent	143,000	206,000	16,053	13,488	8·9	15·3	11·6
HANTS	9,000	10,000	1,043	838	8·4	11·8	10·1
SURREY	1,500	2,000	196	172	7·4	12·7	8·3
SUSSEX	13,000	26,000	2,269	1,788	5·7	14·6	10·4
HEREFORD ...	33,000	23,000	3,522	2,993	9·5	7·7	7·7
WORCESTER ...	24,000	14,000	1,963	1,667	12·1	8·3	8·2
OTHER COUNTIES*	760	120	87	56	8·7	2·1	6·3
TOTAL ...	224,000	281,000	25,133	21,002	8·9	13·4	10·5

* Salop, Gloucester, and Berkshire.

Note.—The estimated total production of 224,000 cwt. this year is 57,000 cwt. below that of 1920, when the area was 4,000 acres less, and, excluding the years 1917-19, in which the area was compulsorily reduced to a very low figure, is the lowest recorded since 1909. The total area of 25,133 acres this year includes about 8,000 acres planted after September, 1919, so that nearly a third of the total consisted of young hops not yet in full bearing. The average yield per acre of 8·9 cwt. is 4·5 cwt. less than last year, and 1·6 cwt. below the average of the ten years 1911-20. Good crops were obtained in the western counties, Hereford showing a yield nearly 2 cwt. and Worcester a yield nearly 4 cwt. above the average, but crops were unsatisfactory in the south-eastern counties, notably in the weald of Kent and in Sussex.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous.

Smith, J. W.—Agricultural Meteorology: The Effect of Weather on Crops. (304 pp.) (Rural Text Book Series.) New York: The Macmillan Co., 1920, 13s. [551.5.]

Harris, F. S.—Soil Alkali: Its Origin, Nature and Treatment. (258 pp.) New York: J. Wiley & Sons; London: Chapman and Hall, 1920, 13s. 6d. net. [63.11(02); 63.12.]

Plant Diseases.

Curtis, K. M.—Life History and Cytology of *Synchytrium Endobioticum (Schilb.), Perc.*, the Cause of Wart Disease in Potato. (pp. 409-478.) Proceedings of the Royal Society, Series B, Vol. 210, B380. London: Harrison & Sons, 1921, 10s. 6d. [63.24.]

Brierley, W. B.—On a Form of *Botrytis cinerea*, with Colourless Sclerotia. (pp. 83-114.) Proceedings of the Royal Society, Series B, Vol. 210, B374. London: Harrison & Sons, 1920, 4s. [63.24.]

Horticulture.

Ellis, E. T. (Edit.).—Black's Gardening Dictionary. (1,237 pp.) London: A. & C. Black, 1921, 15s. [63.5(03).]

National Institute of Agricultural Botany.—Report of the Potato Synonym Committee, 1920, and Resolutions of the Potato Industry Conference. (18 pp.) Cambridge, 1921, 1s. [63.512(04).]

U.S. Department of Agriculture.—Farmers' Bull. 1190 :—How to Grow an Acre of Potatoes. (28 pp.) Washington, 1921. [63.512(04).]

Sutton & Sons, Reading.—The Culture of Vegetables and Flowers from Seeds and Roots. (16th Edition.) (461 pp.) London: Simpkin, Marshall, Hamilton, Kent & Co., 1921, 10s. 6d. [63.51; 63.52.]

Live Stock.

"*Matheson, Darley.*"—Cattle and Sheep. A Practical Manual about Breeds and Breeding, Foods and Feeding and General Management. (202 pp.) London: Pearson, 1921, 5s. [63.62(.02); 63.63(.02).]

West of Scotland Agricultural College.—Bull. 97 :—Reports on Cattle-feeding Experiments. (pp. 94-113.) Edinburgh, 1921. [63.625.]

Ministry of Agriculture and Fisheries.—Report on the Condition of Horses Shipped to the Continent. (4 pp.) London: H.M. Stationery Office, [Cmd. 1249], 1921, 1d. [614.96.]

Dairying and Food, General.

Guthrie, E. S.—The Book of Butter: Nature, Manufacture and Marketing of the Product. (270 pp.) New York: The Macmillan Co., 1920, 12s. [63.72(02); 63.724.]

Walker-Tisdale, C. W.—Practical Butter-Making. (143 pp..) London: Swarthmore Press, 1921, 5s. 6d. net. [63.72(02).]

New South Wales Department of Agriculture.—Science Bull. 20 :—Dairy Factory Premises and Manufacturing Processes. Application of Scientific Methods to their Examination. (40 pp.) Sydney, 1921. [576-8 : 7; 63.70(04); 63.718.]

Canada Department of Agriculture.—Bull. 325 :—Dairy Barns. (34 pp.) sioners' Series. Bull. 57 :—Simple Methods for the Storage of Ice. (8 pp.) Ottawa, 1920. [664.8.]

Engineering.

Wisconsin Department of Agriculture.—Bull. 325 :—Dairy Barns. (34 pp.) Madison, 1921. [69(04).]

Royal Agricultural Society of England.—Report by the Judges on the Trials of Agricultural Motors at Aisthorpe, Lincoln, September-October, 1920. (48 pp.) London: R.A.S.E. Offices, 1921, 7s. 6d. [63.17.]

Binnie, Sir A. R.—Rainfall Reservoirs and Water Supply. (157 pp.) London: Constable, 1913, 9s. [628.7.]

U.S. Department of Agriculture.—Bull. 906 :—Use of Concrete Pipe in Irrigation. (54 pp.) Washington, 1921. [63.13; 698.]

Birds, Poultry and Bees.

Hooley, W.—Winter Egg Production. (32 pp.) London: "Country Life" Offices, 1920, 9d. [63.651(04).]

U.S. Department of Agriculture.—Farmers' Bull. 1109 :—Preserving Eggs. (7 pp.) Washington, 1920. [63.742.]

Economics.

Boyle, J. E.—Agricultural Economics. (448 pp.) Philadelphia and London: J. B. Lippincott Co., 1921, 12s. 6d. [338.1.]

Green, F. E.—A New Agricultural Policy. (169 pp.) London: L. Parsons, 1921, 4s. 6d. net. [338.1.]

Pearl, R.—The Nation's Food. A Statistical Study of a Physiological and Social Problem. (274 pp.) Philadelphia and London: W. B. Saunders Co., 1920. [31(73); 63(73).]

Board of Agriculture for Scotland.—Farm Workers in Scotland in 1919-1920. (78 pp.) By *Sir James Wilson.* Edinburgh and London: H.M. Stationery Office, 1921, 7s. [331.]

U.S. Department of Agriculture.—Bull. 912 :—Hail Insurance on Farm Crops in the United States. (32 pp.) Washington, 1920. [368.5.]

U.S. Department of Agriculture.—Bull. 943 :—Cost of Producing Wheat. (62 pp.) Washington, 1921. [63.311 : 31.]

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By Metchim & Son, Princes Street, Westminster, S.W.1.

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DENNY, E. H. M., STAPLEFIELD PLACE, STAPLEFIELD, SUSSEX.—Large White Yorkshire Pedigree Pigs. Station: Haywards Heath. Telegrams: Handcross.

GREENALL, SIR GILBERT, BART., C.V.O., WALTON HALL, WARRINGTON. The Walton and Worsley Herd of Pedigree Large White Pigs. Selections of all ages for sale at moderate prices. Apply to the Manager, The Office, Bridge House, Higher-Walton, Warrington. Station: Warrington. Trains met by appointment.

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The Rural Information Weekly Service (issues August 27th to Oct. 8th) contains the REPRINTS FROM HANSARD *re* NAURU PHOSPHATES, and also affords considerable enlightenment to farmers upon other agricultural topics. Complete set price 1s. 9d. post free.—LANCASTER SMITH, Sidmouth.

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HOW I MAKE BIG MONEY OUT OF UNMANAGEABLE HORSES.

By J. A. BUTLER.

ABOUT two years ago, when I was in America, I witnessed up in New York State an exhibition of horse-training that opened my eyes. A man by the name of Mackley took a devil of a mean, vicious mare that hadn't been harnessed for seven months, and in a few days had her gentle enough for a schoolgirl to drive. Mackley had taken the mare off the owner's hands for £10, and just ten days after sold her for £35. A clear profit of £25 in ten days!

That started me investigating. I learned that Mackley had simply used the methods introduced by the famous horse trainer, Jesse Beery. Beery, I learned, used to go about the country giving wonderful exhibitions in colt-breaking and horse-training; but realising that he could accomplish more by teaching his methods by post, had given up his exhibition work to spread his horse-training secrets by postal instruction. Mackley had studied Beery's Course in his spare time, and in a few months was able to accomplish magical results with unbroken colts and horses with bad habits.

OTHER SUCCESSES.

Mackley's work showed me a way to make some big money, and I determined to take Prof. Beery's Course in horse-training—but before doing so I made further inquiries. Here are what a few of Beery's students said. I'll let them tell of their success in their own words.

Mr. S. L. Arrant writes:—Just to test Beery's methods, I bought the worst balky, kicking, fighting horse I could find. Paid £13 for him. After handling him only a few hours according to Beery's system I sold him for £27.

Mr. Dell Nicholson, Portland, writes:—I have trained a four-year-old mare that was given up by everybody. Bought her for £7, and now have her so gentle, my little boy handles her. Wouldn't take £40 for her.

Dean L. Smith, Findley, writes:—By following Beery's instructions have changed a worthless, dangerous balker into a horse worth £45.

Everett McBlock writes:—Have just broken a pony to drive and taught it some tricks. Owner bought it for £3 10s. Paid me £8 to train it. He just sold it to a show company for £30.

HOW I WORK.

The big source of my income is in buying up unmanageable colts and horses at bargain prices, and, after training the animals, selling them at a good profit. However, I also pick up good money handling colts and training horses for others on a fee basis. For instance, a farmer had a beautiful driving bay that had the bad habit of shying. A piece of paper blowing across the road would set the horse crazy. The owner thought a great deal of the animal, but couldn't take chances on the shying habit. A friend of his for whom I had done some work put this man in touch with me, and in a few hours I had the horse completely cured of the habit—for which job I received £10.

CURING BAD HABITS.

You can see from this that my work consists not only in breaking colts and "gentling" vicious horses, but in curing the various bad habits a horse can have—such as shying, balking, fear of motor cars, etc., pulling at hitching strap, pawing in the stall, etc., etc.—Beery's methods of colt breaking are particularly amazing. Under the old way of handling raw colts one usually had to half kill the horse as well as himself to accomplish anything—and then the colt was usually spoiled or hurt in some way or another. But when you apply Beery's principles there is no hard, long work or injury to the colt.

No one should have a biting, kicking, or balky horse when it is so easy to cure these vicious habits. No one should attempt to break in a colt the old-fashioned way when Beery's methods make the task so easy. To every horse-owner, to every lover of horseflesh my advice is to get acquainted with the Beery principles. You can not only make money for yourself, but you can do a world of good, particularly at this day when war-demands have placed a premium on horses.

WONDERFUL BOOK FREE.

I have been requested to state that Prof. Jesse Beery will send his remarkable booklet, "How to Break and Train Horses," free to those interested. It is a booklet well worth having, as it reveals some startling information on horse-training. I have heard men who considered themselves expert horsemen say that the booklet was a revelation to them. There is no use in my going into details on the booklet when you can get it free for the asking.

Just drop a line to Prof. Jesse Beery, Dept. 14211, Pleasant Hill, Ohio, U.S.A., and the booklet will be sent free by return of post. A postcard (1½d. stamp) will do as well as a letter.