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The Journal OF THE Ministry of Agriculture

FEBRUARY, 1920.

PRINCIPAL CONTENTS.

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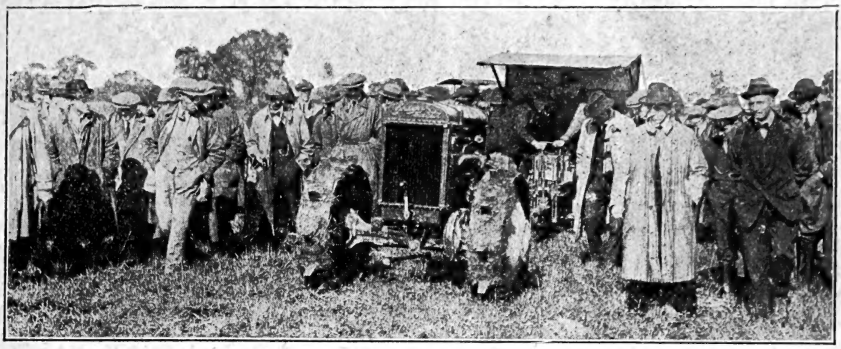

"The 'Glasgow' undergoing the dynamometer test."

The Lincoln Tractor Trials

Extract from the "COMMERCIAL MOTOR," 30/9/19.

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NEW PUBLICATIONS.

REPORT ON INSECT AND FUNGUS PESTS OF PLANTS IN 1918.

The second of a new series of Annual Reports on the distribution of insect and fungus pests of plants in England and Wales has just been published by the Ministry. It has been chiefly compiled from the records contained in Monthly Reports sent in by qualified observers stationed in different parts of the country, and it forms a comprehensive survey of the distribution and economic importance of plant pests during the year 1918. The Report is somewhat technical in character and is intended primarily for scientific workers on plant diseases and perhaps even more for those who will be engaged in this work in future. In addition to notes on the most important pests the Report gives the records in tabular form, so facilitating reference. For the convenience of readers weather charts have also been added.

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WART DISEASE OF POTATOES ORDER, 1919.

List of Growers of Immune Varieties of Potatoes in England and Wales.

The object of this list is to indicate to purchasers of seed potatoes the sources of supply in England and Wales of potatoes of varieties immune from Wart Disease. The crops of all the growers given in the list were examined in the field in 1919 by Inspectors of the Ministry of Agriculture and Fisheries, and certified as true to type and reasonably free from "rogues."

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CONTENTS.

THE JOURNAL

OF THE

MINISTRY OF AGRICULTURE

Vol. XXVI. No. 11.

FEBRUARY, 1920.

NOTES.

Agricultural Education and Research.

LORD LEE OF FAREHAM, Minister of Agriculture and Fisheries, addressing representatives of agricultural education on the 15th January last, in the Hall of the Civil Engineers' Institute, outlined proposals for the extension of agricultural education and research throughout the country.

In view of our limited area of land, the increased production of foodstuffs on which our future security depends can only be obtained by far more intensive cultivation. This involves a great increase of understanding of modern agriculture, and a far wider spread of agricultural education. In educational affairs, as in all other matters connected with agricultural progress, the motto of the Ministry is "Trust the Counties." In the main, the Ministry will confine its responsibilities to co-ordinating the efforts of the Local Authorities, giving them every assistance it can. It will become the source from which central technical advice on agricultural matters will issue. After explaining the organisation of the Intelligence Department recently set up at the Ministry under the control of Sir Daniel Hall, K.C.B., F.R.S., Lord Lee touched on the question of the local organisation for providing agricultural education and advice. The immediate question which arises out of the Ministry of Agriculture and Fisheries Act, 1919, is this: Is agricultural education to be entrusted to the Education Committee of the County Council, or transferred to the Agricultural Committee? The Act gives the option to each county to exercise its discretion, and the Ministry does not intend to use its influence on one side or the other. If agricultural education goes over to the Agricultural Committee, the Ministry is in complete agreement with the Board of Education in wishing to see an adequate representation of the main Education

(792). Wt. P. 2127—162. 12,500. 2/20. J. T & S., Ltd.

Committee on the Sub-Committee which would doubtless be set up by the Agricultural Committee to deal with agricultural education.

The Minister emphasised the importance of securing the best men for the work and of fixing salaries commensurate with the services required of them, since, however urgent the need for economy, inefficiency is dear at any price. He stated that forty-two counties had already appointed Agricultural Organisers, and he hoped that the delay in the remaining counties was due solely to the difficulty of finding the very best men for the posts.

In addition to the Organiser and the Horticultural Superintendent in such counties as possess a considerable development of horticulture, the appointment of specialist instructors in dairying and poultry-keeping is recommended, and perhaps a still larger staff will be needed, but the Ministry does not propose to hamper the Councils and will leave local conditions to decide local requirements. Farmers requiring advice should apply in the first instance to their County Agricultural Organiser, who will turn if necessary to the advisers attached to the provincial Agricultural College. If the College staff cannot deal with the question, it will be referred to the Ministry, which will call in such expert opinion as may be necessary. Farm Institutes, defined in general terms as agricultural schools, providing courses in agriculture for the sons of farmers, together with summer and other special courses for women and others, are regarded as of great importance to counties, but in view of the building difficulties Councils will be well advised to lease rather than to buy land for such Institutes and to adapt existing buildings rather than seek to erect new ones. The chief object of the Ministry is to give a general stimulus to educational effort and to ensure that the educational work is carried on in close touch with the other activities of the County Agricultural Committees, such as land settlement and the improvement of cultivation.

* * * * * *

The Improvement of Grass Land.

IN the middle of January a Conference of Agricultural Organisers and Principals of Agricultural Colleges and Research Institutions was held at the Ministry of Agriculture to consider the Ministry's scheme for the improvement of grass land. Sir Daniel Hall, K.C.B., F.R.S., in an opening address, outlined proposals and explained how enormously the produce of grass land would be increased by the aid of a little knowledge and

expenditure. He went on to say that the time was considered ripe for a wide extension of demonstration work and for a campaign of enlightenment among farmers. It is proposed to establish grass plots as far and wide as possible, preferably by the road-side. Demonstrations will so be carried on that the most casual passer can see, almost at a glance, the improvements that a little skill and care may bring about. Professor Somerville of Oxford, and Professor Stapledon of Aberystwyth, two of our greatest authorities on grass land improvement, will deliver a series of lectures in different parts of the country and will place their knowledge at the disposal not only of the Ministry, but of all Local Authorities throughout the country. The trials to be carried out will be regulated by the conditions that obtain in each county, and the work will be left in the hands of the County and College Authorities. Dr. Somerville, who followed Sir Daniel Hall in addressing the Conference, stated that after nearly thirty years' work on grass land improvement he had come to the conclusion that there was no form of experiment and expenditure likely to bring about such important results. He reminded the audience that we have in this country at present over sixteen million acres of grass land, by far the greater part of which can be very considerably improved. The plans as outlined met with general approval, a scheme of demonstration and experiment was considered, and the details have since been published (see p. 1133).

* * * * * *

The Growth of Rural Industries.

A RURAL Industries Branch has been established at the Ministry of Agriculture for the purpose of propaganda and for developing organisation in connection with the keeping of pigs, poultry, goats, rabbits and bees, and the preservation of fruit and vegetables. The Branch will also deal with schemes for the development of Rural Industries and social life in rural places and for the co-ordination of action by Local Authorities and other bodies by which such development may be effected. The establishment of this Branch, which has been placed in charge of Sir John Green, late of the Rural League, marks a definite effort on the part of the Ministry to give a measure of permanence to conditions that arose during the War, when the submarine campaign became so great a menace that it was necessary to stimulate production, not only on the large farms, but on the smallest of small holdings and allotments. In the opinion of those best qualified to judge, the agricultural labourer and other dwellers in rural areas will have better

opportunities in the future than they have enjoyed in the past for keeping live stock and developing home production. At a time when the Village Clubs Association and the Women's Institutes and other social forces are stimulating life in the countryside, the villager finds himself in the possession of a higher wage and larger leisure than he has ever known; it follows that he may be expected to take an active interest in the improvement of his own position.

* * * * * *

The World Campaign against Rats.

ONE of the most encouraging results of the National Rat Week in this country is the interest aroused abroad. Inquiries have come from the authorities in many far-away lands—from Mesopotamia, from Accra on the Gold Coast, from Shanghai, from New Zealand, and from Nigeria, India, and the West Indies. The authorities have written to the Board to inquire precisely what is being done to abate the rat menace, asking for literature and for the results of experiments with various poisons, stating the special needs of their own country and asking how these can best be met. Inasmuch as the rat menace is universal in its scope, and is most deadly in some of those parts of the world that are under British control, it is indeed encouraging to find that the handling of the problem in the Mother Country has stimulated so much interest and inquiry elsewhere. It is unnecessary, perhaps, to say that all possible information has been sent and that a careful record of all experiments that are possible under the existing conditions is being kept and will be published in due course. It may be mentioned that inquiries have not been limited to Africa, Asia and Australasia, Both the Swiss and the Danish authorities are keenly interested in all that is being done. These countries have been active in the past and are busy to-day in doing what they can to destroy their rats. It may be hoped that facilities for scientific inquiry will soon be provided under Government auspices in this country.

LAND SETTLEMENT IN DENMARK.*

J. G. STEWART, M.A., B.Sc.,

Superintending Inspector, Intelligence Department, Ministry of Agriculture and Fisheries.

IN so far as it is possible to judge in the course of a short visit, Denmark would appear to have satisfactorily solved the problem of settling people on the land.

As regards women in agriculture, Denmark, so far, cannot be said to offer any special object lessons. Women naturally find employment upon the land, but chiefly in side lines, gardening, poultry keeping, etc.; we saw no instances of women actually farming on their own account. Still, conditions such as prevail in Denmark seem particularly favourable for independent agricultural enterprise on the part of women.

Denmark is, pre-eminently, a country of small farmers. The question, therefore, as to how success has been achieved with small farms or holdings in that country is of prime importance to us at the present time.

In any scheme of land settlement, whether in this country or elsewhere, it is generally agreed that provision must be made to secure, on the one hand, that all persons placed on holdings shall have adequate capital (through loan facilities or otherwise), practical experience, and a sound general education; and, on the other hand, that the holdings shall be such as in size, character of soil, situation with regard to markets and facilities for co-operation, will ensure a good prospect of a comfortable living.

How are these conditions fulfilled in Denmark?

1. **Capital.**—According to the law of 1909, landed property may be purchased to the value of 6,500 kroner (£360) or, where the local values of land are exceptionally high, up to 8,000 kroner (£450), in respect of which the State will advance a loan in cash to the extent of nine-tenths of the value of the property.

A yearly interest of 3 per cent. is paid on the State loan, which is secured upon the property with its buildings, live and dead stock, etc. For the first five years the loan is free from part payments: after that period the loan has to be repaid in yearly instalments, including interest on the loan. The total loan will be liquidated in 98 years.

* This report was prepared by Mr. Stewart as a result of a visit to Denmark in 1919, with a delegation of women, who desired to study Danish conditions in relation to women's work on the land at first hand.

So long as the loan from the State amounts to more than one-half of the original lendable value of the property, no other mortgage can be raised upon it. The ordinary banks, the savings banks, and credit unions lend money on the security of land and stock.

There is no provision for compulsory purchase: the land must be bought by voluntary agreement with a willing seller. A Bill at present before the Danish Parliament seems to aim at the expropriation, on the basis of taxation value, of glebe lands, entailed estates, and the largest farms, for division among small holders. In this way it is hoped to secure about 100,000 acres, which will be parcelled out during the next 16 years. Parcelling-out societies formed to counter the activities of land speculators have been in existence for some years.

2. **Practical Experience.**—An applicant for a small holding under the Act (who may be a woman), must be a Danish subject, be over 25 and, as a rule, under 50 years of age, and must be unable, without financial assistance, to acquire a small holding. He must be of good character, sober, industrious and thrifty, and for the five years immediately preceding his application must have had practical agricultural experience.

3. **Education.**—The scheme of education for farm life in Denmark includes—

(1) Rural Elementary Schools.
(2) Folk High Schools.
(3) Agricultural Schools.
(4) Rural Schools of Household Economics.
(5) Special Schools for Small Holders.

The *Rural Elementary Schools* are very similar to the parish schools in Scotland. They are attended by children of all classes of the community. Education is compulsory from 7 to 14 years of age. There are no fees. The management is in the hands of the local communes or parish councils under State supervision. The teachers are well trained and exercise considerable local influence. The usual fundamental subjects are taught, together with nature study and a language other than Danish—usually English or German. Danish and bible history, songs and hymns, gymnastics, etc., hold high place in the school curriculum. The children are bright, healthy, courteous and less self-conscious than our rural children. The school week is a six-day one, but as a rule the older children spend more time in school in winter than do the younger ones, while the reverse is the case in summer. During the busy

seasons the older children, therefore, are free to assist in farm work.

In general, the course is primarily designed to inculcate in the minds of the pupils a love for rural life and their native land.

After leaving the free elementary schools, a few of the children enter the middle schools, which are found in the larger towns. The majority remain on the land. Evening continuation schools are available for further study, but it is not till pupils reach the age of 18 years that admittance is given, as a rule, to any of the other schools referred to. Danish thinkers contend that the years of adolescence should be devoted to physical development and to gaining experience of life rather than to class-room routine. Almost every rural community has its local gymnasium where instruction in physical exercises is given, and its assembly hall where the people meet for self-improvement.

The *Folk High Schools*, so called because their aim is "high," are attended by pupils of both sexes from 18 to 25 and upwards. They are not as a rule co-educational—they are attended by men for five months in winter and by women for three months in summer. The chief subjects are history, literature, sociology, song practice, and gymnastics, but a certain amount of time is also devoted to natural science, mathematics, physics, geography, accounting, hygiene and sanitation, and to sewing and embroidery for women. The work is mainly based on lectures, and the success of the school consequently depends largely on the ability of the teacher to hold and inspire his pupils.

It is very difficult for the uninitiated to gauge the value of the high school teaching, but that it has exerted considerable influence in the intellectual advancement of the Danish nation can scarcely be doubted. It is claimed to have contributed to the making of a broad-minded, moral citizenship, to have fostered a deep-seated love of the soil and native land, to have freed the people from class domination and shown them how to utilise their political power, and to have laid a broad, cultural foundation for the successful tackling of the diverse problems of life.

About 50 per cent. of the students attending the agricultural schools have first passed through a high school; in some agricultural schools this is insisted on as a necessary preliminary. Most of the leaders in social and political life have graduated at the high school.

Agricultural Schools.—These are attended by young men of 18 to 20 or over (occasionally by a girl or two). The requirements for admission, which, however, are not strictly enforced, are usually (1) practical knowledge of farm work; (2) completion of a course at a high school. In regard to the former a system of apprenticeship prevails whereby a youth may spend three years on three selected farms—one year on each.

The main course of instruction is one of six months in winter with an extension course of three months in summer for more advanced study. In addition a special course of one month is usually provided for older men and women of experience who desire to become control assistants.

The longer courses embrace most of the subjects taught at our own farm institutes, but are more theoretical. Laboratory equipment is almost entirely lacking.

The course for control assistants includes lectures on dairying, accounting, feeding, manuring, and the testing of soils for acidity, milk recording and the use of the Gerber tester.

Each school has its farm or small holding attached, which is run mainly on commercial lines. Dalum School Farm extends to about 100 acres and carries 35 cows; that at Lyngby is about 32 acres and carries at present 11 cows, though the normal number is 16. Both farms are extremely well managed, and more than pay their way.

The agricultural school is intended to train practical farmers. Students desirous of becoming teachers must proceed to the Royal Veterinary and Agricultural College at Copenhagen, where a more advanced course is given, extending over 2½ years.

Schools for Small Holders.—Three schools have been established for the sons and daughters of small holders, with special short courses for small holders themselves and their wives. Two such schools were visited. Both are well equipped with buildings, comprising lecture rooms, gymnasia, dormitories, kitchens, and the usual accommodation for live stock and implements. Considerable areas of land, attached to each school, are used for general farming and horticulture.

The land attached to Koerehave School comprises about 200 acres, consisting of 100 acres of farm land, of which 20 acres are rented at 54*s.* an acre, 66 acres of wood, and 33 acres of garden and orchard. With the exception of the 20 acres referred to, the whole is the private property of the Principal. One of the agricultural teachers rents a 13-acre holding from

the school at 84*s.* per acre. An instructor in horticulture, a part-time member of the staff, has purchased a holding of 27 acres from the school for close upon £100 an acre and is running it for nursery purposes, fruit and milk production. The Principal intends to cut off one more small holding, to be let to another teacher on what are conceived to be improved lines.

The school farm is relatively understocked, carrying only 11 cows, a few calves and about a score of pigs.

Fruit-growing in Denmark is still in its infancy, and, in general, receives little attention. The school orchards have been carefully planned and are full of lessons for future growers. Most of the better known varieties of apples, pears and plums grown in England are represented, but only in respect of pears have the imported kinds attained any appreciable success. Even in pears the Danish " Greve A. V. Moltke " is much the most reliable and the most prolific cropper. This pear should be worth a trial in England if not already grown here ; it is sold to the French as King Christian of Denmark.

Apple culture, so far, is not a success : most of the varieties are badly cankered.

Of the bush fruits, red currants are the best ; gooseberries are badly affected with the American mildew.

The woods, which are the special care of the Principal, have been laid out with much taste and originality. The scheme includes shady walks, secluded open-air theatres and sports grounds. Here visitors congregate on high days and holidays to hear the leaders of Danish thought discourse on history, literature, art and sociology.

The Odense School Farm is 85 acres in area, and cost £4,500 six years ago (about £53 per acre, including buildings). The farm is let to the lecturer on agriculture at a rental of 84*s.* 4*d.* per acre, and consists, for the most part, of poor, light, black sand overlying an equally light subsoil. The cropping is as follows : one-third roots and potatoes, one-third lucerne and grass (two years), one-third corn and peas. The cows number 12, about half the normal head, and there are 14 head of other stock.

The courses of instruction at both places are similar in character. They comprise, winter and summer, five- or six-month courses in agriculture and horticulture for men, and corresponding courses in household economics for women. In addition, several short courses of eleven days each are held throughout the year for older men and women.

The longer winter courses are similar in scope to those given at the agricultural schools. The summer course provides for a class of pupil who works on the school land and who, in addition to free tuition, board and lodging, receives pay from the State. The special 11-day courses are devoted to lectures, visits to farms, factories, etc., recreation, song and social enjoyment. Such a course affords rest and change from the routine work and isolation of a small holding and provides the benefits which arise from contact with fresh people and fresh problems.

These schools are of comparatively recent origin and were intended to devote special attention to side-lines, such as poultry-keeping, bee-keeping, and rabbit-breeding; but except for some useful poultry and poultry-houses at one centre nothing of note was seen in this connection.

The Danes are out for *Education* rather than *Technical Instruction.*

As compared with our institutions, the instruction given at the higher educational centres in Denmark is, in general, more elementary, more theoretical, and takes the form mainly of lectures. The "living word," without embellishment in the form of illustrations or lantern slides, is the chief instructional means employed. On the other hand, the students, as a rule, are better versed than ours in practical farm work before they enter the schools. There is, however, just a danger of the Danes becoming, as one educationist expressed it, a nation of listeners rather than thinkers.

The schools in Denmark are practically all residential, and at some of them, *e.g.*, the Small Holders' Schools, men and women attend together to their mutual advantage. More attention is also paid in Denmark to the "humanities," recreation and social life.

In contrast with Britain, most of the agricultural educational institutions in Denmark are privately owned, either by the Principal or by groups of farmers or small holders. The farms are utilised chiefly as a means of supplying produce to, and helping to finance, the school: they play little, if any, part in the teaching.

The State contribution towards the annual cost is usually from 2,500 K. (£140 12*s.* 6*d.*) to 3,000 K. (£168 15*s.*). Fees (including board and lodging) are usually 75 K. (£4 4*s.* 5*d.*) per month, or 450 K. (£25 6*s.* 3*d.*) for five months (includin extras). Half of this sum may be paid by the State.

4. **Size of Holding and its Equipment.**—

Size.	*Number.*	*Total Area.*
7 acres and under	116,614	239,604 acres.
7 „ to 11¼ acres	16,988	159,832 „
11¼ „ 22½ „	28,992	473,598 „
22½ „ 33¾ „	17,723	496,962 „
33¾ „ 67½ „	35,257	1,752,121 „
67½ „ 135 „	25,615	2,346,295 „
135 „ 270 „	6,502	1,169,484 „
270 „ 540 „	1,570	574,946 „
540 „ and over	822	964,327 „
	250,083	8,177,169 acres.

Average size of holding = 30 acres (approx.)

In the old days Denmark was divided into large estates, much the same as in this country, The process of sub-division had begun in the 18th century, and the disastrous war of 1864, followed by the disappearance of profit from corn-growing, accentuated the process. At the present time over 90 per cent. of the Danish farmers own the land they farm.

Of State small holdings there appear to be about 9,000 of an average size of about 9 acres.

We were able to visit a colony of 17 State small holdings near Ringsted, in Seeland, which had been parcelled out of a farm 12 years ago. In size they vary from 5½ to 27 acres, with an average of about 12 acres.

Each holding is a separate unit with its own complete set of buildings, and the land is conveniently arranged around the buildings. Each has access to a good road.

The *Buildings* are substantial and well kept up; they are built of brick and roofed with tiles or, occasionally, thatch. The dwelling-house consists, as a rule, of two sitting-rooms, kitchen, scullery, and two bedrooms, with floor above. Water is laid on from a supply on the estate worked by a windmill, and in charge of one of the small holders. The outbuildings consist of two, sometimes three, wings situated behind the dwelling-house, and comprise cow-house, stable, piggery, barn and store. The cow-house and stable and sometimes the piggery are usually under one roof. All are provided with concrete tanks for liquid manure, and most of them with open, concrete dung-steads.

Stock.—A typical 11-acre holding possesses 3 cows (4 in normal times), 3 to 6 young stock (calves and heifers), 1 sow or 2 or 3 store pigs (before the War such a holding delivered to the bacon factory from 10 to 20 pigs annually), from 10 to 40

hens, and up to 80 chickens, and 1 or 2 horses. In some cases neighbouring holders each keep a strong, active horse and work together, usually carting milk to the factory as well, but in most cases each holder possesses 2 ponies, usually Icelanders, about the size of our pit ponies. The Iceland pony is believed to be an important factor in the successful working of a small holding. Before the War such a pony cost about £8 10s., now he is worth £42. He is very hardy, active and willing, and, it is claimed, two cost only about as much to keep as one big horse.

The main source of income is milk, which is collected at the door by the co-operative dairy. The cows—Red Danish—are smaller than our milch cows and not so shapely, but they have all the points of good milkers. No milk records, as such, are kept on the holdings in question, the returns from the co-operative dairy being considered sufficient. One holder delivered last year 14,000 lb. from 3 cows, as compared with 28,000 lb. from 4 cows before the War. Another milking 4 cows gave the yield per day at the date of our visit (3rd June), as follows:—

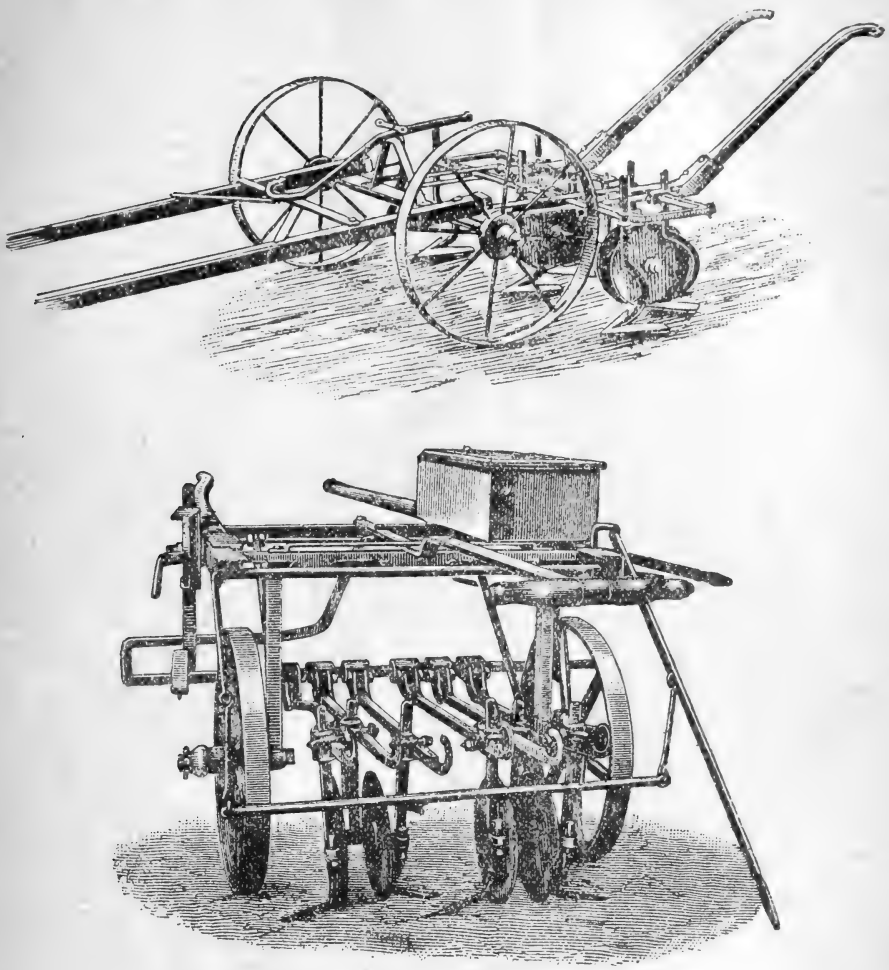
1 heifer, calved	Christmas	..	..	=	20 lb.
1 cow	,, 6 weeks ..	..	..	=	29 ,,
1 ,,	,, 2nd March	..	..	=	35 ,,
1 ,,	,, 11th ,,	..	..	=	42 ,,

About 700 gal. per cow per annum is considered a good average.

A bull is usually hired from a bigger farmer: one, owned co-operatively, died, and as he was not insured, funds were lacking wherewith to purchase another.

The pigs are of white Danish breed, very similar to our Large White Yorkshires, to which they are closely related. Boars belonging to neighbouring farmers are used; in one case the boar at the small holders' school.

Implements.—The holdings are invariably well equipped with implements of the small-holder type. A light plough of the "Oliver" pattern and a Danish horse hoe, convertible into a root drill, are perhaps the most noteworthy. The latter is adapted for cleaning roots on the flat—two rows being taken at one time: a pair of discs fixed about 3 in. apart straddles each row of plants, and flat cutting-shares operate between and at the outside. The discs protect the plants from being covered up by the working of the shares. One horse is required to pull this excellent tool. Many of the holdings have their own



Horse Hoes suitable for Cleaning Roots on the Flat.
(Maker: Christopherson, Holeby.)

threshing machine. It is a simple affair, driven by horses, and consists mainly of a drum to beat out the grain; winnowing is done afterwards. It is capable of threshing 600—700 lb. per hour, and cost (pre-war) 300 kroner (£16 17*s.* 6*d.*). Some possess chaff-cutters, root-pulpers, corn-drills and mowing machines. Co-operation in regard to implements is rare, but one or two holders may share a threshing machine.

The small holder schools are endeavouring to encourage, in combination with milk production, the growing of flowers and roots for seed, and the cultivation of fruit, but such examples as we were able to see were not very promising.

Larger Holdings.—A visit was also paid to four farms in the same locality. In size these run from 75 to 85 acres (average 80 acres) and, with one exception, are owned by the occupiers. The exception is the case of a son renting from his father: the son entered the farm before the War, and pays a pre-war rent of 33*s.* 9*d.* per acre, although it is generally acknowledged to be worth 67*s.* 6*d.* at the present time. (Not far away, and on soil of similar character, an occupant of a 10-acre holding is paying 84*s.* 4*d.* per acre rental.) Rates, in general, come to 7*s.* or 8*s.* an acre.

The land is mainly arable and is worked on a seven- or eight-course rotation. Hay is usually taken from the second year grass, and the land is subsequently dunged and half-fallowed in preparation for wheat. Crops in general were good, particularly rye and roots, though "seeds" in some cases were thin and lacking in clover.

Red Danish cows are the main class of stock kept: these are bigger and in better condition than the small holder's cows, and are probably producing more milk. A usual yield is stated to be about 800 gal. per cow per annum. Records are mostly kept, monthly weighings being made by the Control Assistant.

The cows are tethered at grass from May to the end of September, are moved several times a day, and milked thrice. Only one collection of milk is made daily by the factory, but the different milkings are kept separate, and during hot weather the milk is cooled by standing the cans in cold water.

Winter feed during the War has consisted mainly of roots, straw, and sometimes hay, with either no concentrated food in addition or from 2 to 4 lb. daily per head, according to the supplies which the farmer has himself been able to produce.

All rye and wheat were taken over by the State, and most of the oats and barley. In regard to the last-named cereals, the Government fixed a quota which it was considered the holding should be able to spare after retaining sufficient for seed purposes and for the horses. Nothing was allowed for other stock, but such quantity as might be produced in excess of the Government requirements could be disposed of by the farmer at his discretion. This provision operated greatly to the disadvantage of occupiers of the lightest soils where rye is the principal crop.

In regard to cow-carrying capacity, it was found that the average number of cows maintained was 28, approximately

one cow to three acres, about the same as in the case of small holdings. (An ordinary cow is worth about £45; a cow of special milking pedigree will make £90 or more.)

In addition to cows, young stock—calves and heifers—to the number of about 20 are maintained on each holding. These comprise from three to eight bull calves, worth at present from £90 to £225 each (the latter out of a cow that gave 500 lb. of butter-fat annually for four years).

Horses are invariably good and are mostly of the vanner type. A lighter-limbed horse is also used, somewhat resembling the English hackney. One of this class, a four-year-old mare that had won several prizes locally, was said to be worth about £340.

An 80-acre farm usually carries five working and three other younger horses and nags. This relatively heavy stocking is said to be due to the necessity for keeping the land constantly stirred, but a further explanation is the keen trade in horses during the War and the demand for horse-flesh for human consumption.

Pig stocks have been much reduced of late. On one farm there were 24 pigs, as compared with a pre-war figure of 200. The average number per farm at the time of the visit was about twelve of all ages.

As regards labour on these farms, about four men are employed continuously throughout the year, and two extra men for singling and lifting mangolds and beet. As a rule the foreman occupies a cottage on the farm, and his wife assists in milking. The hired men are accommodated and fed at the farm in much the same way as in Scotland. Adults (males) are paid about £56 5*s*., and women for housework about £23 12*s*. 6*d*. per annum, in addition to food and lodging.

The farm-steading is usually arranged in the form of a square the farm house occupying one detached wing, and the out-buildings three wings joined together. The steading is usually built of brick and roofed with slates or thatch, and is invariably substantial and kept in good repair. The main feature of the outbuildings is the cow-shed, usually consisting of a double row of stalls arranged tail to tail, with feeding passages in front. Connected up with this is a large concrete tank for the urine. The stalls are not washed down with water, consequently the manure is preserved pure. To obviate the passage of the solid excrement into the tank and to prevent it damming

up water in the grip, the latter is constructed with a depression at one side covered with a wooden plank, thus :—

There is ample barn accommodation—in one case the whole of the corn crop is stored under cover as it comes from the field—and a good stock of implements and food-preparing machinery.

The farm house is well furnished and scrupulously clean, and displays a degree of comfort and prosperity that one does not find as a rule in this country on farms of the same size.

The farmers' children, and in some cases the farmers themselves, have attended the high school and the agricultural school.

As compared with the small holdings it cannot be said that the crops are heavier or the land better managed ; the cattle, how ver, are bigger and in better condition, and more attention is paid to the use of better sires in breeding.

5. **Climate, Soil and Crops.**—The climate of Denmark is characterised by comparatively mild winters and cool summers. The rainfall is, on the average, about 24 in., but is very variable in the different years. The country is flat to undulating, sparsely wooded, and subject to winds.

The soil for the most part is drift, consisting mainly of fine sand or gravel with a little clay. It is light, free-working and hungry, but responds readily to good treatment and plentiful applications of farmyard manure. Over the islands the soil closely resembles the fine black sandy soil found in the neighbourhood of Ormskirk ; in the centre of Jutland it is mainly stony sand and very poor, similar to the " Bagshot " districts of England.

The character of the soil—light, free-working, yet responsive—is probably one of the main factors in the success of the Danish small holder. Light implements and light horses suffice, and the Dane has solved the problem of the cultivation of roots—the foundation of his scheme of cropping.

An eight-year rotation is almost universally adopted. On the colony previously referred to the cropping is, generally, as follows :—

Rye (or wheat),
Roots,
Barley,
Roots,
Légume and cereal mixture,
Grass,
Grass (with half fallow),
Oats (or wheat).

There is no permanent grass on this colony, and except for some low-lying meadows in the islands and the marshes of Jutland there is very little permanent grass in the country.

Very little artificial manure seems to be used by sma l holders: the roots may get some nitrate of soda and superphosphate, but in the main reliance is placed on farmyard manure. Dung is spread on the second year grass about mid ummer after once grazing or mowing ; the grass is then half-fallowed for autumn corn ; a proportion of the dung is applied, usually in early winter, for roots.

Liquid manure is used on the grass and is applied without dilution when the grass is wet, chiefly in autumn and spring.

Excellent crops of rye are grown.

Roots consist of mangolds, sometimes sugar beet or sugar mangold, swedes and turnips. The land is well worked; the use of the roller and horse hoe for conserving moisture is thoroughly understood. There is a saying in Denmark to the effect that if it is possible to walk over a root field without getting one's sabots filled with soil it is not in a proper condition of tilth.

Roots are usually sown on the flat in 18 to 20-in. rows and are thinned out 8 in. apart. Good yields are obtained: in one case a small holder's crop last year worked out at 35 tons per acre. It is a remarkable fact that throughout the whole of our tour not a single root failure was seen, even on the very light lands of Jutland—this notwithstanding the fact that the rainfall for May was only 1 mm. as compared with a 40 mm. average, and that there was practically no rain during our visit in the first half of June.

The grass crops consisted of approximately equal proportions of rye-grass, cocksfoot and tall oat grass, with lesser amounts of Timothy, red clover and alsike. Obviously a mixture of this kind cannot form a close bottom, and most of the fields which, at the time of our visit, were in full flower, were thinner than we like to see in this country. On small holdings and in the islands generally all cattle are tethered at grass. In Jutland where the holdings run larger and where there are numerous low-lying meadows the cattle often graze at large.

The system of tethering stock is prompted by the belief prevalent in Denmark, and supported, it may be remarked, by experiments in Ireland, that more feed is obtained by allowing grass in any given pasture periods, here and there, of uninterrupted growth than by grazing continually over the whole extent. It is admitted that the milk yield begins to drop when the flowering stage is reached and at the same time more of the grass is wasted. To reduce waste, small holders sometimes bring their cows in about midsummer and feed the grass in the stalls.

Where tethering is practised, the bulk of the grass becomes well established before the dry weather sets in and is thus able to hold its own even during a spell of drought. So much are the effects of drought feared that farmers hesitate to cut their hay before the drought has broken, and an aftermath is assured.

Lucerne is less grown than might be expected, and winter beans are not cultivated at all. Intensive cultivation in the form of continuous cropping is unknown, and as regards rotations, generally, it is doubtful if Denmark can teach us much.

6. **Returns.**—We were unable to examine actual balance sheets, but the small holders freely disclosed, so far as they were able, their financial condition. One holding of 11 acres cost, twelve years ago, 500 kroner per tondeland (£20 14*s.* per acre), buildings cost 4,000 kroner (£225); 6,300 kroner (£354 7*s.* 6*d.*) are still owing. In the case of a holding of 13½ acres the land cost 600 kroner per tondeland (£25 per acre), buildings cost 5,500 kroner (£309 7*s.* 6*d.*). The holder is paying interest on 6,700 kroner (£376 17*s.* 6*d.*). In another case 12,500 kroner (£703 2*s.* 6*d.*) were paid for a holding of 11 acres, five years ago. This included land, buildings and equipment. About five-sixths of this is still owing. Another paid 10,000 kroner (£562 10*s.*) for an 11-acre holding six years ago, and still owed seven-tenths of the amount.

One holder transferred in 1918 to a bigger holding (11 acres) for which the full purchase price was 22,000 kroner (£1,237 10*s.*); of this amount he paid down 13,000 kroner (£731 5*s.*). This small holder expressed the opinion that the would-be purchaser should possess not less than one-third of the total purchase price.

The general impression conveyed was that the small holders were making a comfortable living and had not much anxiety

for the future. They are content to live soberly and thriftily, they do not have to work hard, and they are content if there is a small balance left over after paying interest and household expenses. This balance naturally varies: from £28 to £56 on a holding of 13 acres is considered reasonable.

The worst conducted holding of those inspected was one of about 5½ acres, and in this case the small holder earned part of his living by working for other people (carting, etc.). In the case of another holding of the same size the small holder kept 3 cows, 1 horse, 1 pig and 1 calf (12 weeks old, just sold for 220 kroner (£12 7*s.* 6*d.*). Two of the cows were at grass on another holding; the small holder earned 800 kroner (£45) independently of his holding. The crops in this case were good. We had no further opportunities of inspecting the smallest type of holding; there appears, however, to be a general consensus of opinion that the minimum size should be big enough to provide a living in itself.

7. **Farming in Jutland.**—A visit was paid to Herning, the "Capital of the Jutland Heath," and some time was spent in exploring the country around that centre. Approaching Herning from the south one passes through an extremely poor, sandy country closely resembling our Bagshot Heaths, with this difference, that the Jutland Heath is closely settled and mostly cultivated. As seen from the central Jutland railway the land is much poorer than in the islands, the holdings are bigger and more scattered, and the cattle are not tethered to the same extent. Very little rain had fallen during the previous two months and the country as a whole was obviously suffering severely from drought. In this connection it was noticeable that where tethering was practised the grass was green and vigorous, whereas in the fenced fields where the cattle grazed at liberty the herbage was short, poor and "burned."

One was struck with the newness of the small towns or villages through which the railway passes, and the large numbers of new farmsteads along the line side. It would appear that the railway was laid through a barren heath and that gradually the stations and approaches to the railway became centres of human habitation and industry. Herning, a flourishing looking town of 7,000 inhabitants, has grown up within the last 30 years. It contains a bacon factory, two dairies, and excellent elementary, middle, high and technical schools. There are two brick factories and several large peat "banks" on the outskirts. During the War the cutting of

peat has developed into an important industry in Jutland. Herning is entirely dependent on peat for its fuel, and large quantities have been transported to the principal centres of population in Denmark, where peat fuel was unknown before the War, at a cost of 33*s.* 9*d.* to 40*s.* per ton delivered. The peat is sold on its analysis: a good sample will contain 25 per cent. of water and 2 to 3 per cent. of ash.

One typical small holding, about 1 mile from Herning, was visited. This consisted of 9 acres and cost £23 4*s.* 1*d.* per acre before the War. Buildings consisting of cow-house, stable, piggery, and dwelling-house—all in one block—cost £135. The soil is black peaty sand, deeper and richer than typical heath soil, and is cropped as follows :—

Roots,
Oats,
Grass,
Grass,
Cereal and legume mixture (ripened),
Rye.

There is, also, a small, well-managed garden from which some produce is sold. The stock at present consists of two horses and two cows. Both crops and stock are only moderate. The land is in need of lime and will be dressed with clay marl obtainable locally (pre-war price = 1*s.* 4*d.* a load). Normally a few pigs and other stock are kept, and the holding is said to be entirely self-supporting. Latterly, however, the occupier has had to engage in carting and other outside work in order to make ends meet. For carting peat, for example, a man and two horses will earn from 50*s.* to 55*s.* a day. On poorer heath soil—farther from Herning—about 40 acres is considered necessary for a living.

West of Herning many of the holdings range between 60 and 100 acres. Except roots and rye, crops generally were poor. Some of the best crops in the district were to be seen on the Government Experiment Station at Studsgaard.

Here the soil is extremely light, black sand, on which experiments are being conducted to determine the best crops and the best varieties of such crops to grow. Rye, oats, barley, roots, potatoes, carrots, grasses, clover and miscellaneous forage plants are included in the trials. Rye and potatoes are very good; carrots also do well; and of the forage plants tall oat grass and red clover seem to be about the best. Lucerne is poor alone, but moderately good along with tall oat grass.

A usual rotation is :—

Lupins—ploughed in,
Rye,
Potatoes,
Oats,
Sugar beet,
Rye,
Grass,
Grass.

Lupins have been sown at different times, and, judging by the appearance of the succeeding rye crop, the earliest-sown lupins have answered best, due to the greater bulk of crop ploughed in.

One of the most successful experimental rotations, judging by the crop yields, is lupins followed by rye followed by potatoes. Lupins are ploughed in, and never fed to stock.

A trial is being made of pit ensilage.

In an easterly direction from Herning, towards Silkeborg and Skandeborg, the railway passes through a peat country containing wide stretches of flat, grass marshes used for grazing both dairy (Black and White Danish) and store cattle. The latter are mainly Shorthorns or Shorthorn crosses bred from English bulls. Farther on, blocks of large holdings, less well equipped with the cleaning implements seen on the islands, alternate with clusters of small holdings and some fine belts of spruce and pine. Then come treeless stretches of boggy land cultivated on 8-yd. "stitches," with intervening open ditches 2 ft. deep, and again more black sandy heath and small 10-or 12-acre holdings, with heaps of marl lying about ready for application. This so-called marl is mostly clay with about 30 per cent. of lime, and costs about 3*s*. 6*d*. a ton. So light is the soil that to prevent blocking by blown sand the railway is protected by close "sleeper" fences. The soil is still cultivated, however, even when so poor that the coarse white sand shows through the growing crops: only the flat, intractable bogs remain uncultivated and these are being worked for peat.

One then reaches the Lake District of Denmark—a poor stretch of country, little cultivated, but beautified by heath and pine. Silkeborg is the centre of the wood-pulp paper industry.

8. **Forestry in Jutland.**—A good deal of tree-planting appears to have been done in recent years: however poor the soil, small belts of spruce and pine were everywhere seen in flourishing condition; many of the fields, too, are hedged around with

pine as in the light land districts of Norfolk. The health and vigour of these conifers, even where scarcely a green blade was visible, and where the land was red with sorrel, greatly impressed the onlooker.

A visit was paid to the plantations of Hjortsballehoeje in central Jutland. On this bleak and barren stretch of light sandy moorland the Danish Heath Society started planting in 1866. The land was ploughed over roughly in furrows 12 in. wide by 6 in. deep, and left for a season. Afterwards it was knocked about and finally thrown up in 5-ft. "stitches" and planted with spruce (*Picia excelsa*). This did not flourish and trials were made with Mountain Pine (*Pinus montana*), which is more of the nature of a shrub than a tree, stooling out into four or six main stems and reaching a height of 10 ft. or so. The spruce and pine grow well in mixture, and the method now adopted is to cut out the pines at from 20 to 40 years' growth, by which time the spruce is thoroughly established. The latter remains and makes quite useful timber. The pine is used mainly for firewood and in the production of charcoal and tar. There seems little doubt that much of our own "heath" country could be similarly afforested, providing useful employment for large numbers of men or women and helping out by means of casual work the small holder located on the borders of the forest.

9. **Remarks.**—To sum up, a small holder in the Islands of Denmark is able to make a comfortable living with no great exertion from about 11 acres, provided, of course, he employs no extra labour. It was suggested to us by one of the most capable small holders we met that 16 acres would be a more economic unit and that one man would still be able to undertake all of the work. In the lighter districts of Jutland an economic unit is rather larger than in the Islands (from 20 to 30 acres or more according to the soil); in these districts the land is worked in much the same way as in the Islands, and sometimes the smaller men eke out their living by cutting and selling peat and by work in the woods. Rye and potatoes are the most reliable crops on the lightest soils, the latter being grown more extensively in Jutland than in the Islands, where a small holder rarely grows more than is sufficient for his own household.

The sale of milk, the price of which in June last was about the same as in this country, brings an assured and regular income. The cows, especially the Red Danish, are uniformly good milkers and would appear to require rather less food than ours. During the War the small holder's cow has suffered

more than that of the bigger farmer, and it is doubtful if, at present at all events, the small holding, acre for acre, produces as much milk as does the larger holding. There is less difference between the two classes of holding in regard to crop production. While the numbers of cattle (not cows in milk) have practically been maintained, pigs have fallen off during the War, from a total of about 2½ millions to half a million. The Dane had become accustomed to fatten his pigs on separated milk and barley meal or millers' offals, and when the supplies of these fell off (separated milk being used largely in cheesemaking, etc.) he seems to have been at a loss to find a satisfactory substitute.

In regard to education, the Danish small holder is perhaps slightly better equipped on the average than the small holder in this country, and he values it more highly. Whether as a result of education or temperament or some other cause difficult to define, the Danes are imbued with a spirit of helpfulness, neighbourliness, and frankness in regard to their private affairs that makes the path to co-operation easy. The progressive majority adopt it and the others have to follow suit, or fail to find a market for their produce. The chief reason, however, for the success of co-operation is, probably, the dense concentration of small holdings and small farms, all turning out the same products. This is a result of uniformity in soil conditions, the fact that agriculture is the main industry of importance, and the popular love of soil and native land. Added to this is the fact that everything possible is done by the legislature, composed largely of farmers, and by the rural councils to help the small holder in his task. Financial assistance is obtainable on easy terms; while the holdings are excellently equipped with buildings and each is a self-contained unit. There is no such thing as the sharing of buildings; there are no disjoined holdings; and the joint use of horses, implements and machinery is rare.

The same combination of circumstances in this country is seldom met with; but the wide stretches of light, free-working soil capable of improvement by liberal applications of farmyard manure, which are to be found in many districts, would seem to make likely centres for trials of small arable dairy holdings. In Denmark the milk goes to the co-operative creamery, which, on the average, has a membership of about 140 and deals with the produce of about 700 cows. The cream is used for butter-making and the bulk of the separated milk is returned to the farms for pig-feeding. In this country the milk would probably be destined for sale in the towns, and the only form of co-

operation directly called for would be the collection of the milk at the holdings for dispatch to the nearest station or depot. In the event of a surplus the additional organisation required to run a cheese factory, with the principle of co-operation already to hand, would necessarily be more easily provided.

A further reflection was suggested by the marked similarity between much of the land in Denmark with land in Norfolk and Suffolk. In these counties large tracts of light land are now devoted mainly to sheep-farming and sport. Similar land in a small country like Denmark would probably be carrying a cow to every 3 acres and contributing more largely to the wealth of the country and the re-instatement of a healthy rural population.

FARM DRAINAGE MACHINERY.

MAJOR J. G. MERRISON.

FARM drainage by mechanical means is recognised to be a subject of pressing and increasing importance to the British farmer, but little is known in the United Kingdom of the methods employed elsewhere, particularly in Canada and the United States. In those two countries high wages and a scarcity of skilled labour gave rise long ago to conditions very similar to those obtaining to-day in the United Kingdom, where manual labour is now in a great many cases so expensive as to be prohibitive. This article is not intended to explain the benefits to be derived from draining, or to discuss the methods to be followed in particular circumstances, but to describe and illustrate the various classes and types of machine successfully employed in this country and abroad.

Drainage machinery ranges from small ploughs and scoops, costing but a few pounds, to elaborate machines costing thousands. Many and widely different conditions require to be met in drainage, and machines have been designed for practically all possible conditions; but for purposes of classification it will be convenient to divide the machines into four definite groups :—

1. Ploughs and scoops.
2. Wheel excavators and endless chain excavators.
3. Steam tackle.
4. Scraper excavators.

1. **Ploughs and Scoops.**—This class includes the smallest and least expensive type of implement or machine. The main advantage of machines of this class is their low cost ; they meet the requirements of the farmer who has only a small amount of drainage work to do, which he will fit in with the general work of the farm, employing men and a team or tractor when they are not required for other operations. A heavy initial outlay on speedier and, mechanically, more efficient machines, would be clearly false economy for the farmer with only a little drainage work to perform : if such machines are to be employed for his work they will be owned by a contractor or some local authority.

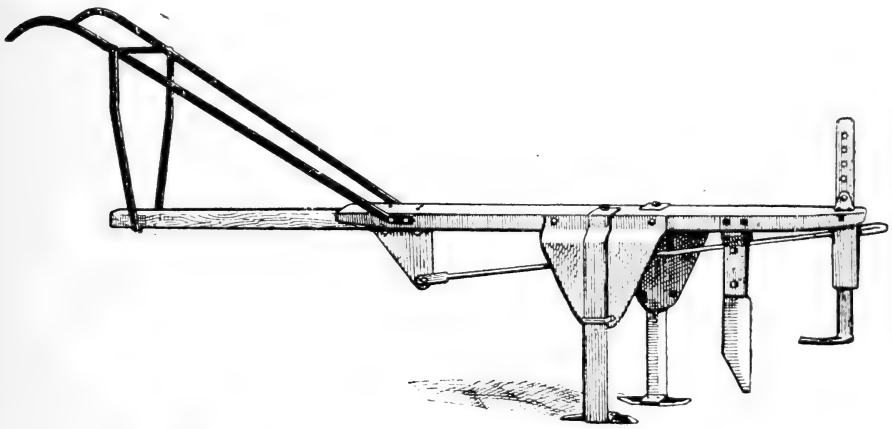


FIG. 1.—The Dawson Ditching Digger (Toronto).

(*a*) *The Ditching Digger.*—Fig. 1 shows a very simple device used to deepen existing open ditches, and to loosen the soil preparatory to shovelling when excavating trenches for tile drains. The implement is constructed on the lines of a plough, to the beam of which are attached vertical standards with a cutting edge, and a coulter which splits the ground ahead of these cutting knives. At the end of the knives are fixed spade feet to loosen the earth at the bottom of the trench. The depth of cut is regulated by a shoe at the head. With the exception of a wooden stay the implement is constructed throughout of iron and steel, thus ensuring the maximum strength and stability. The weight of this machine is approximately 180 lb. Two men and two horses are required to work the machine, which costs about £8.

(*b*) *The Ditching Scoop.*—Fig. 2 illustrates an implement known as the ditching scoop. It consists of a heavy U-shaped

cutter which loosens the earth, and a bucket in the rear for collecting the soil. The cutter is mounted on a steel frame. The bucket is fixed to the cutter frame by steel straps. The wooden handle is hinged to the bucket and is used to keep the machine upright when entering the trench. The bucket is filled by being drawn up the sloping end of the uncompleted part of the trench. The depth of each cut is controlled by an adjustable shoe in front of the cutting knife. The bucket is $3\frac{1}{2}$ ft. long, 17 in. high, and 10 in. wide at the top, and will hold about 5 cub. ft. of soil. When charged the bucket slides out of the trench, the handle is disengaged and the bucket falls on its side. A loop on the bottom of the bucket offers a hold for turning it, and perforation in the bottom prevents the soil from being held in the bucket by suction. Two men and a team of horses are required to operate this scoop. The implement costs about £10.

(*c*) *Soil Scrapers and Scoops.*—Figs. 3 and 4 show respectively a scraper and a scoop, used for removing the soil from open ditches after it has been loosened by a plough. Fig. 3 shows the type of scraper used when the soil has to be deposited on the side; the scraper works across the ditch and deposits the soil on the edge of the bank, leaving sloping sides. Fig. 4 shows the type used when the soil has to be carried some distance. It will work either crossways or lengthways according to the size of the ditch and the nature of the soil. Two men and two horses are needed to operate these scoops, the cost of which is from £3 or £4 upwards, according to size.

(*d*) *Farm Ditcher.*—Fig. 5 shows a handy machine for making drainage ditches, grading and building roads, terracing, back-filling tile ditches and filling gulleys. As a ditcher the machine cuts a V-shaped ditch with sloping sides from 4 ft. to 6 ft. in depth, according to the nature of the soil in which it is used. The machine is built in two sizes, a 300-lb. machine equipped with a 5-ft. cutting blade and a 375-lb. machine with a 7-ft. cutting blade: the former requires two horses on light soil and four on heavier soils; the latter requires from four to eight horses, or can be used with a tractor.

(*e*) *The Swedish Excavator.*—Figs. 6 and 7 show two sizes of a Swedish machine, the "Revolt" excavator, which has been imported for use in this country. The U-shaped share serves to scoop up a layer of soil: the loosened soil enters the lower part of an inclined conveyer that carries it to the top of the machine, where a discharge chute returns it to the ground on the side of the trench. An adjustable shoe in front regulates

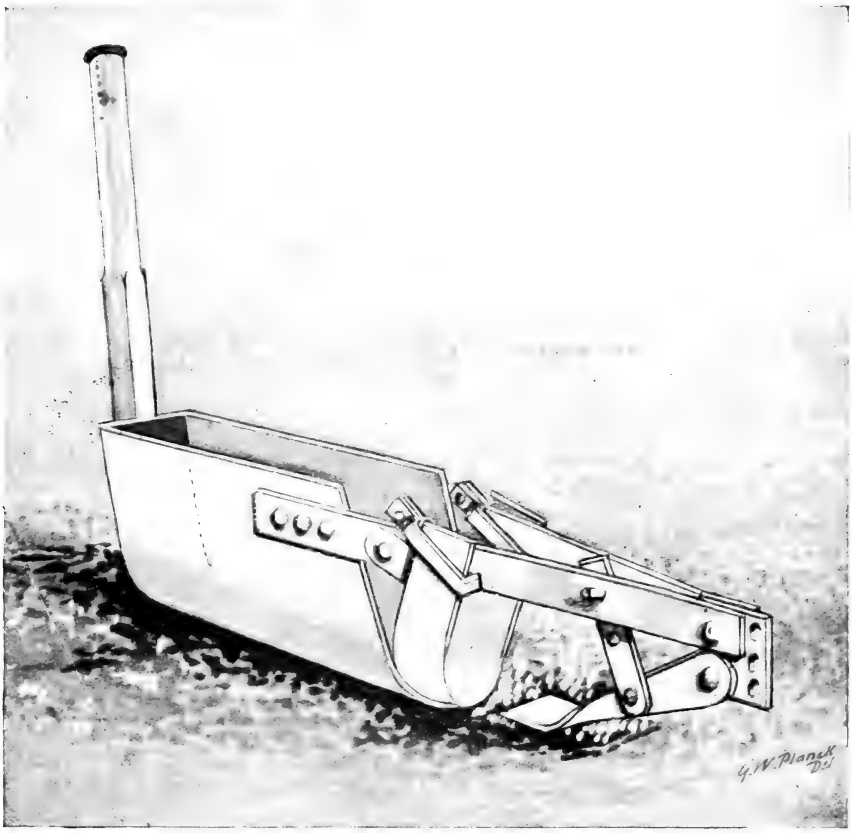


FIG. 2.—Ditching Scoop.

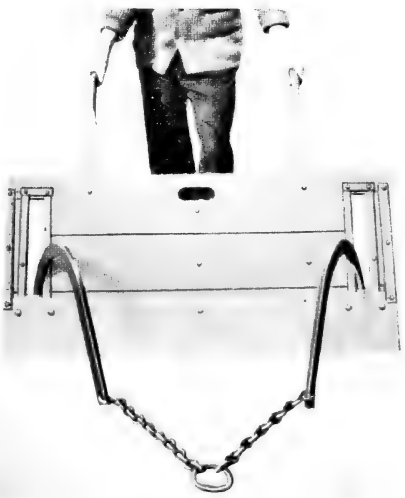


FIG. 3.—Soil Scraper.

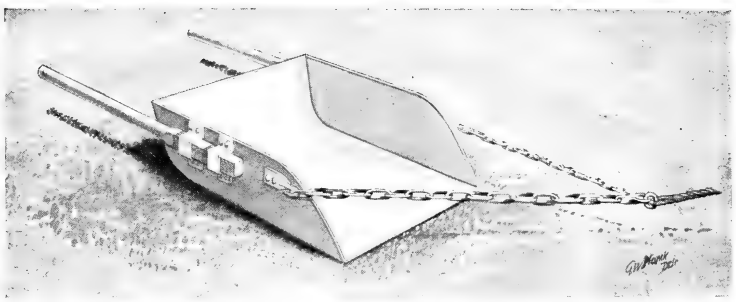


FIG. 4.—Soil Scoop.

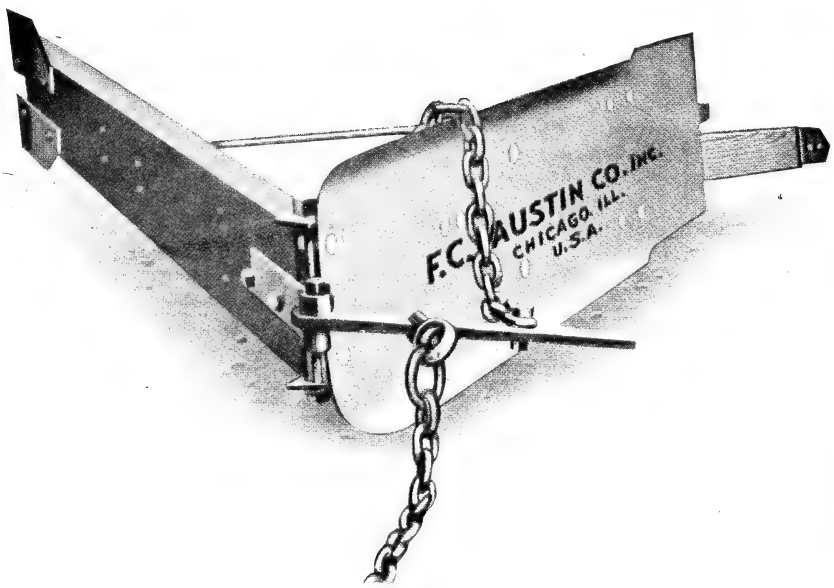


FIG. 5.—Austin Farm Ditcher, Terracer and Road Grader.

FIG. 6.—Swedish Excavator and Fordson Tractor.

FIG. 6A.—Swedish Excavator and Fordson Tractor, Rear View.

the depth of the cut. The conveyer is driven direct by a combined cog and carrying wheel that runs along the bottom of the ditch. It is claimed that the smaller machine (Fig. 6) with two men and two horses will dig 300 to 400 yards of ditch per day (7 in. wide, 3 ft. 7 in. to 4 ft. deep); and the larger machine (Fig. 7) with four horses and three men, 400 to 600 yards per day (12 in. wide, 4 ft. deep). The smaller machine has been tried very successfully in England, both under easy conditions and in stiff clay. It is understood that near Boston, Lincs, working in light, loamy soil with a sandy bottom, the machine with two horses cut a trench 130 yards long and 3 ft. 6 in. deep in 1½ hours, and with a Fordson tractor cut 100 yards 3 ft. deep in

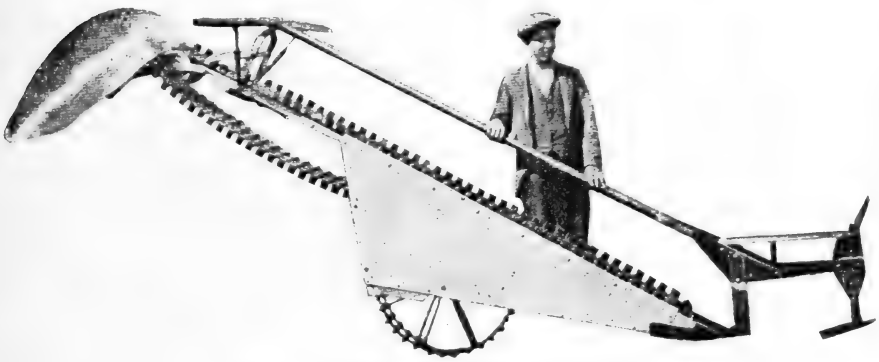


FIG. 7.—Swedish Excavator (large size).

half an hour. The present price of the smaller machine in this country is about £40.

2. **Wheel and Endless Chain Excavators.**—These machines are used by contractors and persons having a large amount of farm tile-drainage to do. To meet successfully varying soil and other conditions and to avoid breakage and loss of time, machines must be capable of digging exactly to a determined gradient, be free from mechanical trouble and resistant to heavy overload. The machines consist of a strong, rigid frame and platform carrying the engine and gears, and are so designed as to be self-propelling. Internal combustion engines are generally used, though steam engines and boilers are often preferred. The digging attachments are so mounted and hinged to the moving platform that they may be raised or lowered by the operator in securing the depth desired. Levers are so arranged that the depth of excavation can be accurately controlled by the person operating the machine. An arm or gauge is attached to the digging frame in order

that the operator can sight across it to targets set along the line of trench at a known height above the desired bottom, and the machines thus cut true to a given gradient. Manufacturers now fit these machines, especially the heavier ones, with multipedal or caterpillar tracks, although some of the lighter machines are still mounted on four wheels. The machines are moved by applying the power directly to turn the wheels or tracks. The speed at which the machine moves forward can be regulated by the traction gears, which may be changed at will. Shields are fitted to the machine to prevent the sides of the trenches from caving in when ditching in very soft soil. The shields are usually about 8 ft. long, or sufficient to permit the tiles being laid properly. The machines vary in size and weight—from a machine capable of digging trenches 10 in. wide by $4\frac{1}{2}$ ft. deep and weighing 7 tons, to machines that will dig trenches 36 in. wide by $7\frac{1}{2}$ ft. deep, and weighing about 22 tons.

(*a*) *Wheel Excavator.*—Fig. 8 illustrates a machine used extensively by contractors for tile drainage on the farms of Ontario and Eastern Canada. The machine weighs about 7 tons; its length over all is 25 ft., and its width over all is 8 ft. 6 in. The power is supplied by an internal combustion 14-h.p. single-cylinder engine. The digging is done by buckets on the rim of a wheel which is revolved in the trench: as each bucket reaches the top of the circle, the soil falls upon a conveyer belt: the belt can be adjusted to deposit on either side of the trench. Cleaning devices are furnished to remove sticky earth from the buckets. Digging wheels are supplied to take buckets in sizes from $11\frac{1}{2}$ to 14 in. wide and to dig $4\frac{1}{2}$ to $5\frac{1}{2}$ ft. deep. Two men are required to operate the machine and to lay and blind* the tile. The fuel required for ordinary tile drains averaging 3 ft. deep and 12 in. wide is 5 to 8 gal. of petrol per 10-hour day. Upon this class of work the machine will do 80 to 200 rods a day, depending principally upon the nature of the soil. The cost of this machine is about £750.

(*b*) *Endless Chain Excavator.*—Fig. 9 shows a machine of the endless chain elevator class. Machines of this kind are built in a greater range of sizes, so far as chain and buckets are concerned, than wheel excavators of the same weight. They also seem to be better adapted for work where there is need of 14 in. and larger tiles, and generally where there is a heavier task to perform. The digging apparatus (Fig. 10) is operated

* *i.e.* to fill in sufficient earth to hold the tile in place.

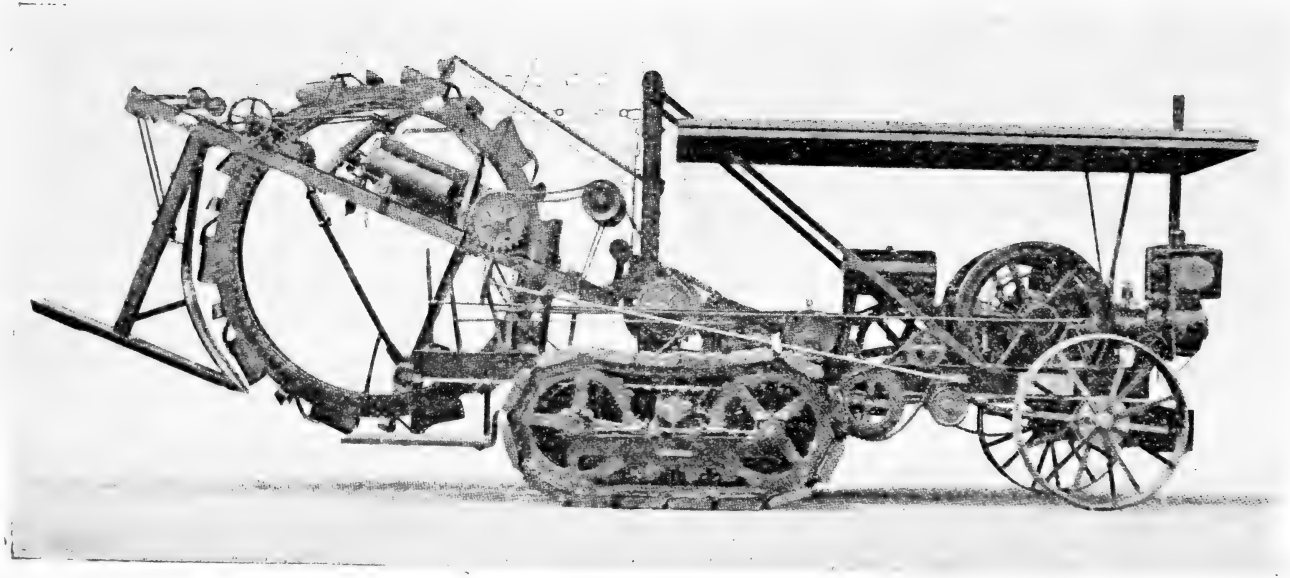


FIG. 8.—Buckeye No. 1 Wheel Excavator.

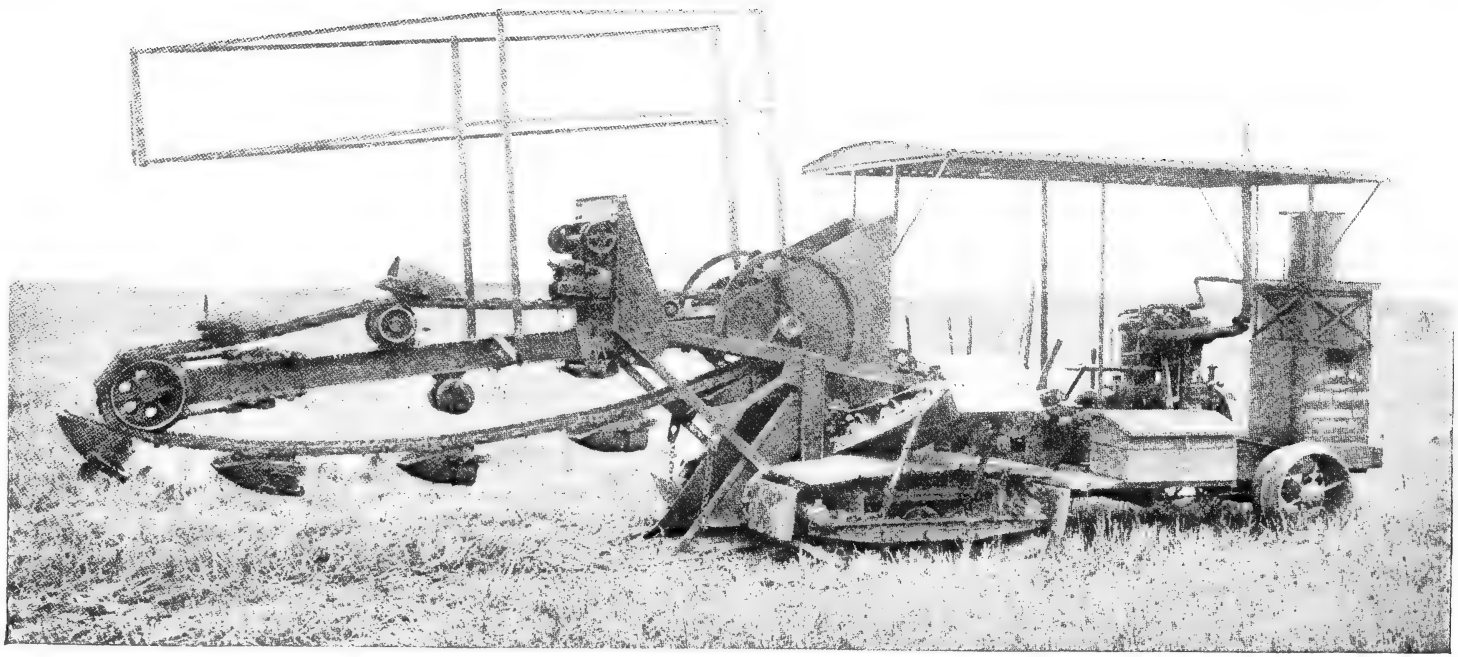


FIG. 9.—Austin Farm Tile Trenching Machine.

FIG. 12.—Fowler Trenching Machine at Work.

FIG. 13.—Marion Model 28. Drag-line.

FIG. 14.—Austin Model 5 Drag-Line equipped with 30-ft. Boom, $\frac{3}{4}$-yard Bucket.

by a sprocket wheel at the upper end of the frame, receiving power through a drive chain from the engine. At the end of their upward movement the buckets empty their loads upon an endless belt, which conveys the soil far enough to the side, so that it will not fall back into the trench. Cutting knives or teeth on the lip of the bucket are often used in hard ground. An attachment is also manufactured that will cut open ditches with a sloping bank, having a maximum depth of 5 ft. and width of $7\frac{1}{2}$ ft. Devices for cleaning buckets are attached to the machine. The machine illustrated in Fig. 9 weighs about 13 tons: its length over all is 33 ft. plus boom 18 ft.; its width over all is 9 ft. 4 in.; and its height over all is 10 ft.

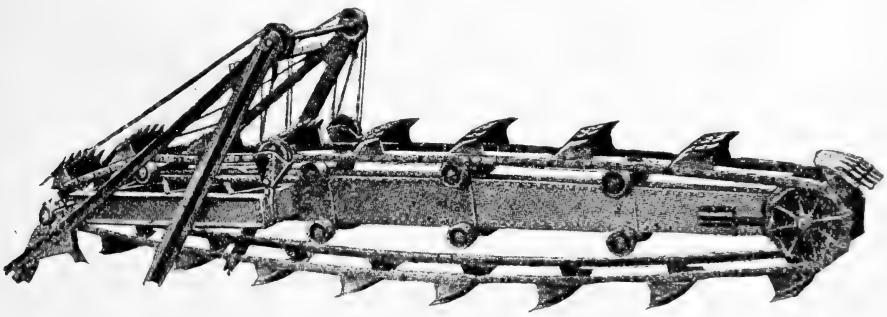


FIG. 10.—Endless Chain Excavator—Digging Apparatus (for larger machine than Fig. 9).

The power is supplied by an internal combustion 4-cylinder engine rated at 22 to 25 h.p. Two men are required to operate the machine, to lay and blind the tile. The fuel required for tile drains averaging 3 ft. deep and 12 in. wide is 20 gal. of petrol per 10-hour day: the minimum amount of work done per day is about 300 yards.

3. **Steam Tackle.**—Steam tackle is too well known to need description. Mole drainage and open ditching have been successfully practised by this system for many years, and very suitable implements are provided for that purpose.

(*a*) *Mole Draining Machines.*—Mole ploughs (Fig. 11) are used to form channels in the subsoil to drain the land. The machine forms a duct with smooth sides (similar to a mole track) into which the surface water drains and is carried away to the main drain. Stiff, clay soils are best suited to this method of drainage, since there is less likelihood of the soil filling the channels and blocking the water than in the case of loose soil. Land lying on a fair incline gives better results than flat land, as the rapid flow of the water tends to keep the

channel open. The plough consists of a steel cone carried on a coulter attached to a stout beam. The frame of the machine is mounted on two large hind wheels and one or two smaller wheels in front. Means are provided for regulating the depth of the bore to a maximum of 3 ft.

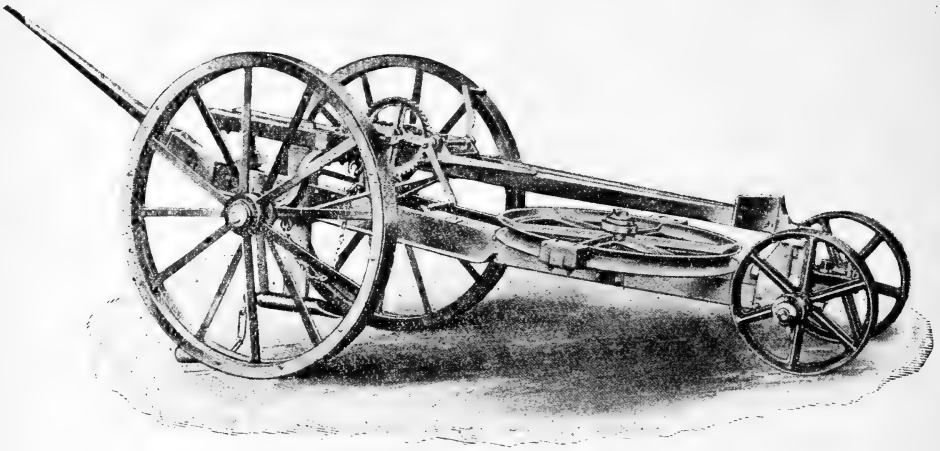


FIG. 11.—Fowler Double-frame Mole Draining Machine, fitted with Hand Lifting Gear.

(*b*) *Trench or Ditching Machines.*—Fig. 12 shows an example of a Fowler implement of a type little used in this country. It is designed for opening trench or irrigation ditches. The front of the frame is provided with a rope sheave round which a rope from one of the ploughing engines passes, the other end of the rope being fixed to the hind wheel of the same engine. The front coulter splits the mass of earth to be removed into two halves, which are conveyed upwards by suitable mould-boards and deposited on both sides of the finished ditch. The machine is manufactured in several sizes, making trenches up to 2 ft. in depth and 3 ft. in width.

4. **Scraper Excavators with Drag Lines.**—These machines are designed for open ditching work and are specially useful in digging by lateral excavation ditches not exceeding 16 ft. over the top. By substituting additional booms the machines can be converted to do four different kinds of work :—

(*a*) Drag line work.
(*b*) Digging and steam shovel work.
(*c*) Grab work with slush.
(*d*) Grading work.

The power unit of these machines may be either internal combustion or steam. The class of work undertaken by these

types is very heavy, and steam power is advocated wherever coal is procurable. The swinging boom is mounted on a bed frame and the upper end of the boom is supported by a cable. The bucket or scoop hangs on a cable from the upper end of the boom and is filled by being dragged along the ditch. The loaded bucket is raised by a cable from the boom, which then dumps it on the waste bank.

Figs. 13 and 14 show two types of drag-line machine, the first driven by steam and the second by an internal combustion engine. The first is the "Marion" Model No. 28. This is equipped with a 32-ft. boom, weighs about 21 tons, and will cut from 200 to 400 cubic yards of soil a day. The multipedal tracks are 5 ft. 8 in. by 2 ft. One ton of coal is required a day. The second is the "Austin" Combination No. 5, which has a 4-cylinder engine of 45 h.p. requiring 30 gal. of paraffin a day. It has a boom length of 30 ft., weighs 17 tons, and will cut a minimum of 300 cubic yards a day. Both machines require two men to operate them. The cost of the former is about £2,500 and the latter £2,750.

Conclusion.—It has already been indicated that only the very large farmer can afford to buy a machine other than one of those in the first class described above. There would appear to be ample scope for local authorities (such as Drainage Boards) and for contractors in carrying out by mechanical means the various classes of drainage work requiring to be done. In this connection it may be of interest to set out briefly a scheme in operation in parts of Canada where drainage machinery is largely used.

The actual work is undertaken by contractors, but the Provincial Departments of Agriculture assist farmers and contractors in the following way. Provincial Drainage Officers get the farmers together in a district which needs draining, and endeavour to secure an undertaking from them to proceed with the work, with the object of arranging for sufficient work to make it worth the while of a contractor to come into the district. Clearly a contractor cannot pay his expenses if the only work in prospect is an odd field here and there. Drainage Advisers are sent during the summer months to farmers who desire to have their farms drained, and who require technical assistance in preparing plans, etc. The Adviser surveys the farm, prepares a scheme and advises the farmers generally on the best methods to be adopted. No charge is made for the services of the Adviser, but the farmer pays his travelling expenses, defrays the carriage of his implements, boards him while at

work, and furnishes any necessary information. Loans are granted by the Provincial Government to any farmer requiring financial assistance to enable him to put in a system of tile drains. Such loans are repaid in the form of an addition to the Land Tax.

Although such a scheme may not be applicable to the conditions in England and Wales, yet it appears to the writer that there is a paramount necessity for mapping out the work to be done, and for so organising it that it will be efficiently and cheaply performed either by contractors or public authorities. At the same time it is desirable to give a word of warning: the conditions which have to be faced in any country or in any area are complex, and differ from those in other countries and other areas: the machinery suitable for a new country will not necessarily prove suitable for an old one. Careful investigation and experiment are an essential preliminary before any particular types of machines can be recommended for the various classes of work requiring to be carried out in this country.

LAND DRAINAGE.

IT is now possible to review the land drainage work which was commenced under the Defence of the Realm Regulations and is being continued under the provisions of the Land Drainage Act of 1918, with a view to increasing the food-producing capacity of the country by means of the improvement of the rivers and arterial drains. "Land drainage" must be distinguished on the one hand from "farm drainage," which, though it depends for its full effectiveness upon the efficiency of the rivers and main arteries, involves entirely different administrative and technical questions, and, on the other hand, from works of "land reclamation" which have for their object the making of agricultural land out of tidal marsh, heath, bog, or other waste areas.

Under the Defence of the Realm Regulations power was given to the Ministry of Agriculture to enforce the liability of any riparian occupier of agricultural land to clear any watercourse in or adjoining his land, in cases where his neglect to do so rendered other land liable to be damaged by flooding.

Further power was given to the Ministry to take over and exercise any drainage powers which were being ignored, or inadequately exercised, by any drainage authority. These powers were exercised by the Ministry through the Agricultural Executive Committees or counties, who dealt with the matter

on broad lines and organised comprehensive schemes for the improvement of whole rivers and large areas of land.

The cost of the work done under the Regulations was either met voluntarily by the riparian owners or occupiers themselves in the first instance, or, where the work was carried out by the Executive Committees, was advanced by the Ministry, to be recovered from the riparian occupiers on the completion of the work. To obviate the injustice of compelling a riparian occupier or owner to pay for work which benefited other land besides his own, all such work, if it could not be paid for out of the rates of a drainage authority, was done by prisoner labour, which was given free. The official action of county committees under the Regulations naturally aroused widespread interest in land drainage, and led to a vast amount of voluntary work being done by landowners. A return rendered recently to the Ministry by county committees shows that the acreage which has been benefited by drainage work done by or at the instance of County Executive Committees reaches the substantial total of 405,500 acres in England and Wales. The advances made by the Ministry of Agriculture to pay for the work amounted approximately to £90,000, of which about £20,000 has been recovered. Owing to changes of tenancy and other causes, it may not be possible to recover the whole of the balance, but it is estimated that the ultimate cost to the State of the whole work will not exceed an average of 2*s.* per acre.

The return above referred to is a document of great interest, not only as showing the districts in which the greatest energy has been displayed, but as indicating the different nature of the problems with which the county committees had to deal. For example, in Norfolk nine schemes were carried out, and the total area benefited was 34,000 acres, an average of 8,500 acres for each scheme.* In Cumberland 10,000 acres were improved, but this involved the carrying out of no less than 99 separate schemes, of which 74 were carried out voluntarily by landowners, at the instance of the county committee, without any advance of money being made by the Ministry. Another typical scheme, of which some account may be of interest, was carried out in East Suffolk on the Dove. The length of river which was taken in hand was about 10 miles. The area drained by it is 20,000 acres, and the total cost of the work (the prisoner labour being free) was £1,050. The average width of the river

* An account of the work done in Norfolk on the River Waveney was published in this *Journal*, July, 1919, p. 381, and December, 1919, p. 922.

varies from about 12 ft. in the highest reaches to about 30 ft. in the lowest reach, but in places it was so badly silted up and overgrown that its course could only be traced with some difficulty. No constructive engineering works were attempted; it was simply a matter of digging, and of removing numberless old roots, fallen trees, and similar obstructions. The river, as improved by the clearances, should now be fully capable of carrying off all the water that drains into it. Very notable work has been done in Essex (89,000 acres), the West Riding (82,700 acres), and Lindsey (Lincs.) (44,700 acres).

It was of course clear from the beginning that the effect of the work carried out under war-time regulations would be only temporary, unless some statutory provision could be made for perpetuating it. Such provision has been made by the passing of the Land Drainage Act of 1918.*

Part I. of this Act enables drainage boards to be established, or the boundaries of existing drainage authorities to be altered, by an Order of the Ministry of Agriculture, which does not, unless it is opposed, require confirmation by Parliament; and such Orders can now be made by the Ministry either on its own initiative, or on receipt of a petition from persons or autorities intherested. Thus there is provided a short and inexpensive procedure, and a means of carrying out a considered and homogeneous policy with regard to all the drainage areas in the country.

Drainage authorities established before 1918 were either ancient Commissions of Sewers (some of them established as early as the thirteenth century), or authorities established by local Acts or under the Land Drainage Act, 1861. The former class have, generally speaking, a wide and indefinite area, and only exercise jurisdiction over parts of it. Authorities of the latter class have generally been established to meet purely local needs, and are the outcome of Parliamentary bargains. Their areas bear no relation, as a rule, to the requirements of the whole of the area drained by any river or artery. The policy adopted by the Ministry of Agriculture since 1918 has been to form drainage boards for whole river valleys or basins, wherever possible, which shall control the main channels and their banks, while retaining "internal drainage" authorities where these exist, and creating new authorities for internal drainage where desirable.

It may be of interest to set out the stages which have to be gone through, from the first proposal or petition for the forma-

* See this *Journal*, November, 1918, p. 961, and December, 1918, p. 1121.

tion of a drainage board, to the board's final establishment. The first stage is the making of a survey of the area concerned, in order to settle the boundaries of the proposed district. These boundaries are usually fixed at a line approximately 8 ft. above the highest recorded flood level. The boundaries are plotted on 6-in. Ordnance maps, and a draft Order is prepared which provides (where necessary) for differential rating, and for the representation on the board of the several component parts of the area. The draft Order and the map are discussed with the County Councils, existing drainage authorities, and other persons or bodies interested. When necessary, local conferences are held for this purpose. No Order can be made affecting the area of an existing authority without that authority's consent. The draft Order and map are then deposited for public inspection for a month, during which objections may be lodged with the Ministry of Agriculture. When the objections have been dealt with (a public inquiry being held if necessary), the Order receives any necessary revision, and is then sealed and again deposited for public inspection for a month, during which period persons having a prescribed interest may present memorials to the Ministry of Agriculture praying that the Order shall not become law without confirmation by Parliament. If no memorials be presented, or only such as can be met by slight alterations, the Order is confirmed by the Ministry and becomes law. Otherwise, it becomes a Provisional Order requiring confirmation by Parliament.

At the end of 1919 the Ministry had confirmed eight Orders establishing drainage authorities or extending their areas, and had in hand, at various stages, from the initial survey to the final deposit, 39 others. The total area affected by all these Orders (made or in course of preparation) is approximately 1,206,000 acres.

The Ministry are also enabled by Part I. of the Act of 1918 to extend the powers of drainage authorities constituted under local Acts. The local Acts frequently imposed limits of rates which make it impossible for the authority to carry on its work, having regard to the ruling prices of material and labour. But for this power to alter the local Acts it is probable that several small drainage districts would have become derelict during the past year. Ten Orders of this nature were confirmed in 1919.

The second part of the Act of 1918 confers two very useful powers upon the Ministry. The first is the power to take over

temporarily the duties of any drainage authority which is not carrying out those duties satisfactorily, and the second is to carry out schemes for the improvement of small areas of agricultural land by clearing or improving the watercourses. Both these powers are delegated by the Ministry to county committees established for the purpose. Schemes for the improvement of areas which are not suitable for administration by drainage boards are prepared by the county committees, approved by the Ministry, and deposited in draft for a month for public inspection. After any objections which may be made have been dealt with, the schemes are carried out by the county committees, the cost being advanced by the Ministry of Agriculture, and recovered from the owners of all lands benefited by the work. After the completion of the work, a county committee (acting as the Ministry's delegate) has the powers of a drainage board for the purpose of the maintenance of the works. The drainage of all the small detached areas in any county can thus be maintained by a single authority, instead of being either neglected or maintained by small local drainage boards which are necessarily uneconomical and have tended in the past to become inefficient. Schemes of this nature can be put into operation in places where there are ancient Awards which have fallen into abeyance on account of the vagueness of their terms or for want of any properly constituted authority to carry out their provisions.

The measures referred to above have led to a fairly general appreciation of the great harm which has been done to agriculture in the past by the neglect of the rivers and brooks throughout the country. The damage does not arise only from actual floods, but arises to an even greater extent from the perpetual waterlogging which has rendered a great quantity of land entirely useless for corn-growing or for any of the deep-rooting crops, of which the value is now generally admitted. There is no doubt that much money has been wasted in the past by attempting to drain fields without providing an efficient outfall, and that the effect of much farm draining which was carried out years ago at great expense has been entirely lost through the outfalls having become choked. There seems now to be some ground for hope that the campaign which has been carried on during the last two years for the clearing of watercourses may result in widespread and permanent benefit to agriculture.

THE WHITE ROT DISEASE OF ONION BULBS.

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AND

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THE disease here described causes considerable damage to the onion crop, especially in market gardens and allotments. Until recently, however, it has not attracted serious attention, and, except in one isolated instance, it has never been the subject of scientific investigation. During the past two years the disease has been studied at the Ministry's Pathological Laboratory at Kew, and experimental work has been carried out in gardens and market gardens in that neighbourhood in which it had been found to occur. The fungus causing the disease has been isolated, grown artificially in pure culture, and the nature of its life-cycle determined. As a result of these studies the White Rot of onions has been clearly differentiated from certain diseases with which it has hitherto been confused by almost all writers. Furthermore, the fungus itself has been found to be quite distinct from two fungi (namely, *Sclerotinia bulborum* and *Botrytis cinerea*) both of which have, at one time or another, been regarded as the cause of the trouble in question, and to be identical with another parasite detected and described many years ago, but in more recent times almost entirely overlooked.

Now that the life-history of the causative organism is properly known it is possible to suggest methods for controlling the spread of the White Rot disease, although there is still room for further investigation in this direction, especially with regard to soil fungicides and trials as to the susceptibility and resistance of different varieties of onions.

The only previous account which deals in any way clearly with the White Rot disease is that* by the Italian botanist Voglino, who records its occurrence on garlic in various parts of Italy, and gives a description of the microscopic characters of the fungus. This being the case a fairly full general account of the disease and the fungus causing it is given below, though

* Le Stazioni sperimentati agrarie italiane, 1902. Vol. XXXVI. fasc. II., pp. 89–106.

technical details and other matter of purely scientific interest are omitted from the present paper.

Historical.—The destruction of onion bulbs by a fungus producing a white mould was observed by Berkeley as long ago as 1841. He described the fungus and gave it the name of *Sclerotium cepivorum*.* He states that the fungus is "very common on onions at the point from which the roots spring, and often very destructive." His description is meagre, it is true, but sufficient, nevertheless, to distinguish it from allied fungi. Berkeley's specimens, moreover, are preserved in the Herbarium at Kew; and examination of these shows that they are precisely identical with the White Rot fungus so prevalent to-day.

Since that date other forms of rotting in onion bulbs have been described, and great confusion has arisen as to the various diseases and also as to the fungi causing them. Much has been written, both in Britain and on the Continent, but with the exception of Voglino and a few quite recent writers, Berkeley's *S. cepivorum* has been more or less confused with the onion disease caused by Botrytis. No doubt the presence of the two fungi on one and the same bulb (as sometimes occurs late in the season) may partly account for this.

As a specific disease, quite distinct from Botrytis, White Rot was first correctly distinguished in this country in the Annual Report of the Plant Disease Survey of the Ministry of Agriculture for 1917 (p. 20). The popular name there employed was "Dry Rot," from the dry nature of the decay which the fungus produces. Since the term dry rot is usually associated with forms of decay occurring in storage, and as the present disease attacks the growing crops and seldom, if ever, causes trouble in storage, this term appears to be somewhat inappropriate. For this reason, therefore, another popular name, viz., "White Rot" (derived from the abundance of white mould at the base of diseased bulbs in the early stages) has been adopted, and the same name is employed in the Ministry's Plant Disease Survey Report for 1918. In Bedfordshire, where this disease is widespread, it is termed "Mouldy Nose," and in the north it is often, though erroneously, termed Mildew (see later, p. 1098).

Description of the Disease.—Onions become attacked with White Rot when the soil in which they are sown or planted is contaminated with the fungus. They usually first show symptoms of attack at the end of May or early in June. As might be expected in the case of a disease contracted from the

* Ann. and Mag. Nat. Hist., VI., January, 1841, p. 359.

(*a*) (*b*) (*c*)

FIG. 1.—Autumn-sown Onions affected with White Rot, as seen in July. The destruction of the roots and the white mycelium on the bulbs is seen in specimens (*b*) and (*c*). Specimen (*a*) shows the formation of the small, black sclerotia at the base of the bulb.

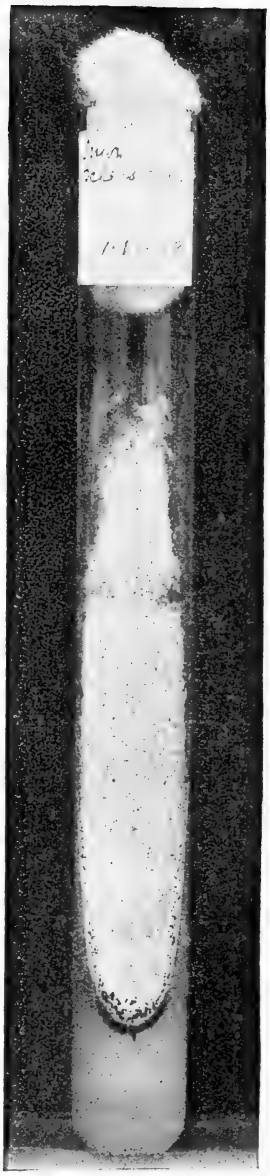

FIG. 2. FIG. 3.

FIG. 2.—Spring-sown Onion Plant attacked by White Rot, showing the white mycelium around the base of the bulb.

FIG. 3.—A pure culture of the White Rot fungus grown on potato agar in a test tube. The culture is about a fortnight old, and shows the production of numerous black sclerotia amongst the white mycelium.

soil, the attack commences with individual plants located indiscriminately over the beds, but if the soil is heavily contaminated practically all the plants will be affected. Autumn-sown plants appear to be the earliest to suffer, but spring-sown onions suffer equally and, being smaller, are more quickly killed and are sometimes destroyed in large numbers.

The earliest visible symptom is one of wilting and yellowing of the foliage. The oldest leaves turn yellow and fall over, and later the other leaves also collapse. If the diseased plants are gently pulled they will be found to come up very readily, and closer examination will show that the roots have been invaded by fungus mycelium or spawn, and have been almost entirely destroyed (Figs. 1 and 2). It is probable that in all cases the roots are attacked before the bulb. Warm, damp weather appears to be specially favourable to the growth of the parasite, and when these conditions exist the fungus develops rapidly round the base of the bulb and soon covers it with a mass of fluffy white fungus-spawn or mycelium (Fig. 1 (*c*)). This white mycelium is very characteristic of the White Rot disease, and distinguishes it at once from all other diseases of the onion. When the disease is still further advanced it will be found that the fluffy mycelium has largely disappeared or has been replaced by a more closely fitting weft which penetrates also into the tissues of the bulb (Fig. 1 (*a*)). At this stage the surface of the bulb shows the presence of numerous, black, spherical bodies about the size of small poppy seed (0.5 mm. diam.) and termed sclerotia. The sclerotia are the resting bodies of the fungus (corresponding in a rough way with seeds), and it is by means of these that the parasite persists in the soil from year to year. The fungal threads continue to penetrate the tissues of the bulb, devouring the cell-contents, and forming numerous sclerotia, until finally the bulb becomes shrunken and dried up. The sclerotia are produced in large numbers on the diseased plants, and it is obvious that if the bulbs are left in the ground the soil becomes thoroughly contaminated with the fungus.

White Rot is most in evidence from the beginning of June to early August. By August it has mostly killed or destroyed the affected plants, and comparatively few new infections appear to take place after that date.

Method of Reproduction and Over-wintering.—In order to combat the disease intelligently it is essential to know the life-history of the parasite and its methods of propagation and perpetuation.

Notwithstanding the most careful search during the last two years the only method of reproduction which has been observed is the germination of the above-described sclerotia. It has been found, by means of artificial cultures in test-tubes, that under suitable conditions of warmth and moisture these bodies put forth ordinary vegetative filaments which develop into a new growth of mycelium. The same method of germination, without doubt, takes place in the soil where the mycelium produced would invade the roots of any onion plants which were present. It would appear, therefore, that under natural conditions the sclerotia formed on the diseased bulbs in the summer remain dormant in the soil during winter, germinate in the late spring, and thus bring about the infection of the new crop.

Shortly after germination the mycelium of the fungus produces minute conidia or so-called microspores.* They are developed very freely in test-tube cultures, and were observed also on diseased onions grown under field conditions. All efforts to induce these conidia to germinate, however, failed. Similar conidia are found in certain related fungi, and these also have not been observed to germinate. Should they be capable of germination under the influence of such conditions as exist in the soil they would be of importance in that the fungus would be provided with another and partially aerial method of propagation.

In certain allied fungi (*e.g.*, *Sclerotinia sclerotiorum* on potatoes, etc., *S. trifoliorum* on clover, and *S. bulborum* on hyacinths and other ornamental bulbs), stalked, cup-shaped bodies known as ascophores, producing spores which are actively discharged into the surrounding air, are developed from the sclerotia. These bodies have not been observed, or induced to develop, in the case of the onion fungus. In order to encourage their development the usual method of subjecting the sclerotia to artificial freezing, in this way simulating winter conditions, was repeatedly tried but without effect. It would appear, therefore, that the disease is not spread by air-borne spores, but solely through the agency of sclerotia.†

Another point of great practical importance is the length of time the sclerotia retain their vitality. It is impossible

* Voglino also described these bodies, but in spite of the most critical search no trace of the sphacelial stage described and figured by him as occurring on the sclerotia themselves was observed. Dr. G. H. Pethybridge informs us that this stage could not be detected in the material he examined in Ireland.

† It is for this reason that the authors prefer to retain Berkeley's generic name *Sclerotium* rather than to transfer the species to the ascomycetous genus *Sclerotinia*.

to make an exact statement as to this, since infected soil has not been long enough under examination. From accounts collected from market gardeners and others it would appear that the fungus persists in the soil for a considerable period, at least three or four years, and, judging by analogy with allied species, the sclerotia may survive considerably longer.

Method of Spread.—The introduction of the disease into new localities obviously takes place through such means as the distribution of soil containing sclerotia, the planting of diseased plants and sets, or through the careless disposal of contaminated refuse or manure. Local spread is probably chiefly accounted for through the use of contaminated manure and rubbish, or the scattering of affected soil. For the spreading over larger areas the distribution of diseased seedlings is no doubt mainly responsible. Seedling onions for planting are brought to market in quantities in April and May. These are often reared on infected land, and on more than one occasion the white mycelium of the White Rot has been noted on retail supplies. The diseased plants are distributed to gardens and allotments; and, though seedling plants probably produce but relatively few sclerotia, a sufficient number are developed to contaminate the soil, so that with subsequent crops of onions the tendency is for the disease to increase year by year. This is especially the case when onions are repeatedly grown in the same land, and very much less so when a long interval is allowed. The disease may also be spread by the use of slightly diseased "sets," when the attack is so slight as not materially to injure the bulb or to attract attention.

Susceptibility of Varieties and other Crops.—As far as the present observations go, most of the common varieties of onions appear to be subject to White Rot. Shallots, as a rule, are markedly resistant, and have been observed growing side by side with diseased onions, but remaining perfectly free from attack. On one occasion, however, shallots grown at Kew were affected and a number of bulbs were completely killed, and one other case of this crop being diseased has been observed. Leeks also do not appear to suffer as a rule, but two instances of slight attacks on leeks have been noted.

Distinctions between White Rot and other Diseases.—The effect of White Rot as seen in the foliage somewhat resembles an attack by the maggot of the Onion Fly. That disease, however, is distinguished by the presence of the maggots in the bulbs, and the absence of the white fungus mycelium and the black

sclerotia. The decay, moreover, is usually of the nature of a wet rather than a dry rot (see Leaflet No. 31.)

Of fungus diseases the most generally distributed is Mildew. This occurs as a whitish-lilac or grey mildew on the leaves, the bulb remaining free from attack (see Leaflet No. 178). Onion Smut, a recently introduced and serious disease, is distinguished by the presence of streaks of black spore-masses in the leaves and outer scales.*

The disease with which White Rot is most likely to be confused, except by expert mycologists, is that caused by the fungus named by the American botanist, M. T. Munn, *Botrytis allii*. In its typical form, however, the Botrytis disease is easy to distinguish by the fact that (1) it is the leaves and the top of the bulb rather than the roots and base of bulbs that suffer; (2) the mould which is present is grey and not white, and (3) the disease usually commences later in the year, namely, in late summer and autumn. *Botrytis* is particularly prevalent in wet seasons, and on poorly ripened bulbs. It is, indeed, often responsible for very serious losses in storage. *Botrytis* agrees with the White Rot fungus in producing sclerotia, but these are usually larger and flatter than in White Rot. Occasionally the two diseases are found in the same bulb. A full account of the Botrytis disease as it occurs in America has recently been published by M. T. Munn (New York Agric. Expt. Station (Geneva), Bull. 437, 1917).

Distribution of the Disease.—In England White Rot is very widespread, and is found especially in gardens, market gardens and allotments. In the Report of the Ministry of Agriculture's Plant Disease Survey for 1918 it is listed from 15 counties; it doubtless occurs in all parts of England. Mr. G. P. Berry, of the Ministry of Agriculture, has observed the disease near Edinburgh, and Dr. G. H. Pethybridge, of the Irish Department of Agriculture, states in a letter that it is plentiful around Dublin, but no published record exists of its occurrence in either of these countries. In some of the market gardens near London it is prevalent over extensive areas and causes much trouble, especially amongst spring onions. Near Manchester also it is said to cause very serious losses. From Voglino's account the disease is evidently serious in Italy, but owing to the confusion existing between White Rot and the Botrytis disease little is known as to its exact distribution on the Continent. No record appears to exist of its occurrence in America.

* See this *Journal*, May, 1919, pp. 168–174.

Methods of Control.—The only means at present known of exterminating White Rot, once it becomes established in any part of a garden or field, is by starving out the fungus from the soil. This can only be effected by keeping the ground free from onions and allied crops for a number of years. The exact length of time that is necessary cannot be stated, but judging by analogy eight or even ten years may not be too long. During this period the soil should be " worked " as much as possible, although the utmost care should be taken that contaminated soil is not conveyed to clean land. It would be advisable to make any new onion beds at a considerable distance from the infested land.

When once the bulbs become attacked practically nothing can be done to save them; the disease will gradually work through and destroy the whole bulb. As a general rule and when practicable the diseased plants should be removed as early as possible before the formation of sclerotia takes place. The plants should be carefully dug up, removed from the ground and burned. If this is persisted in during the entire season further infestation of the soil by sclerotia will be prevented.

In the case of small beds in private gardens and allotments when large bulbs are affected and the attack appears to be general it may even pay to lift the entire crop at once before the whole bed becomes infected. The healthy bulbs, being immature, should not be stored but put aside for immediate consumption; the diseased bulbs (or at any rate the diseased portions of them) should be burned at once.

Up to the present no success has been obtained with the use of soil fungicides, the hard coat of the sclerotia being probably as resistant to chemicals as the spores of the Potato Wart Disease.

No varieties of onions can be recommended at present as immune. Shallots are usually resistant, and leeks are not commonly affected. These crops might, therefore, in pressing cases be grown on infested land, but it would be preferable not to do so.

White Rot is not a disease which is liable to be introduced with the seed.

PEA AND OAT HAY.

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Need for the Crop.—If the return to grass of the newly-ploughed land is to be avoided, new methods of cropping must be introduced, as the addition made to the arable land during the War cannot be absorbed into the established farming system. The pre-war balance between winter and summer keep has been upset, and the area under root crops will be much too great if the new arable land is added to the existing system. This land has, in most cases, borne two crops of cereals, and it is undesirable that it should be cropped continuously with straw crops until its stored fertility is exhausted. At this period a mixture of peas and oats grown for hay should prove a valuable addition to the crops available to the farmer. If this mixture be grown on some of the newly-ploughed land which has carried two grain crops, the stock-carrying capacity of the farm can be maintained, and it is suggested that part of the grass land, usually mown, should be pastured, the loss of the hay crop being repaired by growing the hay required on the arable land. Further, in cases where the seeds plant failed last year the land might very profitably be sown, in spring, with the pea and oat mixture.

Soil suitable.—This crop can be grown on the poorest land, but the best yields are obtained on fairly strong land, low-lying moist soils giving better crops than the drier soils.

Sowing.—Early sowing is desirable, on dry soils. February is not too early, on average soils. March is the best month, and under any conditions the seed should be in the ground by the middle of April. On light soils the seed mixture should be sown broadcast and ploughed in about 3 in. deep; on heavier soils it should be broadcasted over the ploughing, and harrowed in with the spring-tined harrow, the land being rolled afterwards with a heavy roller. Broadcasting is preferable to drilling as it is equally effective and much less costly. The seed should be mixed at the rate of 2 bush. of oats to 1 bush. of peas, and the mixture should be sown at the rate of 3 to 4 bush. per acre.

Varieties suitable.—The large-seeded oats are quite unsuitable for this purpose, as the total weight of crop is much smaller than that of the straw-producing types, although their grain yield is heavier. Clemrotheray is the best variety of oats available for making into hay; it is very hardy, produces fine

long straw, grows very densely on the ground, and yields a large bulk. If this variety cannot be obtained, Sandy, Blainslie or Welsh Grey may be used. As regards peas, there is little to choose between the maple and dun varieties; if anything, the maple variety has the advantage. The effect of mixing is to increase considerably the growth of the oats; when oats are mixed with peas they may grow from 6 in. to 1 ft. taller than in the case of a pure oat crop.

Effect on the Soil.—The mixture, under suitable conditions, makes such a dense growth that practically no weeds can exist underneath the crop. The pea roots act as pulverisers of the soil, leaving it in particularly good condition to receive the following crop. The mixture could quite safely be grown several years in succession, as its character is such that the effect on the soil is quite different from that which results from growing of unmixed grain crop.

Manuring.—If the land is in poor condition a dressing of farmyard manure should be given, if possible, but on land which has recently been in grass no such application is necessary. The yield will, however, be considerably increased if, at the time of sowing, a dressing of from 3 to 5 cwt. of superphosphate per acre is given. Top-dressing the crop with nitrate of soda is effective in increasing the yield, but very little benefit is found to result from applications of sulphate of ammonia.

Harvesting and Stacking.—Many farmers who have grown this crop have cut it much too early, and in consequence have lost a considerable percentage of the possible yield. The correct time for cutting is when pods have formed on the peas but have not become filled with seeds. The oats are at this time—when Clemrotheray is grown—in the milk stage. Some difficulty in cutting the crop may be experienced on account of its great weight and length, and it will be necessary for a man to follow the mowing machine with a fork in order to clear the path. After the cutting operation the swaths should lie undisturbed until the surface is well dried; they should then be turned with a hay turner and again be allowed to dry, and afterwards made into large cocks. Some care is necessary in making the cocks, as the straw is very long and difficult to handle. It is not easy to form the heaps in a neat manner. Ordinary hay is most effectively cocked with the hand rake, but the pea and oat mixture can only be satisfactorily handled with a fork. Every cock should consist of at least two forkfuls of hay, the size of the heap depending on the dryness of the crop. Care must be taken to see that the straw lies in the cock as near as possible

horizontally, and that each cock is trimmed free from all loose straw. If much of the heap is composed of straw standing vertically the cock will tend to split open and so enable rain to pass right through. Peas and oats need different treatment in the making from other kinds of hay, in order to secure the best results. Such hay is not easily spoiled by bad weather in the early stages of making, but, as in the case of all other kinds, if long exposed to rain after the sap has gone from the stems, it will be seriously injured. It should be allowed to cure in the cocks for a considerable time, and it may be advisable to put two cocks into one to complete the curing process. Meadow hay may be improved by heating mildly in the stack, but pea and oat hay should not heat at all. It should be completely cured before being stacked, and it is of the greatest importance that it should be quite free from rain-water, otherwise the peas will become mouldy. The stacks must be thatched as soon as possible, as the open nature of the hay readily admits rain into the interior, and much harm to the produce may result.

Feeding. — Pea and oat hay is very nutritious, containing the materials that would have gone to form the highly nutritious seeds of the crop if ripening had been permitted, and in practice it is found to be a better food than meadow hay. It should not be expected, however, that such hay will eliminate the need for the feeding of concentrated foods. Pea and oat hay may be chaffed and used to improve inferior fodder, or it may be fed uncut; but animals which have been accustomed to feed on cut chaff and roots will, at first, leave a quantity of the rougher part of the oat straw. From 7 to 14 lb. may be fed per day. The hay is excellent for feeding with large quantities of roots, as it counteracts the tendency to scour caused by the excessive feeding of succulent fodder.

Yields.—When suitable varieties are grown heavy yields are obtained. On average soils the yield should be about 3 tons per acre, while even poor soils should give 2 tons per acre.

The Quality of Farm and Garden Seeds.

THE following tables and notes embody the results of tests made at the Official Seed Testing Station from 1st August, 1919, to about the middle of January, 1920. The publication of these results should serve to indicate to growers the probable quality of the seed available for sowing this season. In the tables the average figures for the previous year are given for purposes of comparison :—

TABLE SHOWING THE QUALITY OF CLOVER AND GRASS SEED.

Kinds of Seed.	No. of Samples on which Average is based.	Percentage—Germination (*a*) and Hard Seed (*b*).				Percentage Purity.	
	1919–1920.	1919–1920.		1918–1919.		1919–1920.	1918–1919.
		(*a*)	(*b*)	(*a*)	(*b*)		
Red Clover ..	500	**83·3**	**4·9**	81·1	4·5	**95·7**	95·9
Alsike Clover ..	120	**78·5**	**10·0**	84·0	7·5	**94·5**	96·5
White Clover ..	180	**73·6**	**8·9**	76·5	7·2	**94·2**	91·7
Wild White Clover	50	**74·2**	**12·5**	74·0	12·1	**85·3**	85·1
Trefoil	150	**80·2**	**2·9**	67·2	2·6	**98·8**	98·1
Lucerne	36	**86·2**	**5·5**	87·2	4·7	**97·7**	97·7
Crimson Clover ..	100	**90·2**	trace	87·1	·2	**97·0**	95·8
Perennial Rye-grass	200	**84·4**	—	82·7	—	**97·9**	97·6
Italian Rye-grass	250	**85·5**	—	82·4	—	**98·6**	97·9
Cocksfoot ..	80	**82·1**	—	78·0	—	**97·3**	97·1
Timothy ..	60	**92·2**	—	88·8	—	**99·0**	98·7
Meadow Fescue ..	50	**84·3**	—	84·5	—	**98·2**	98·1
Dogstail	30	**59·9**	—	70·2	—	**98·1**	97·4

TABLE SHOWING THE QUALITY OF CEREAL, ROOT AND VEGETABLE SEED.

Kinds of Seed.	No. of Samples on which Average is based.	Standard of Germination Specified in Testing of Seeds Order.	Germination per Cent.	
	1919–1920.	Per Cent.	1919–1920.	1918–1919.
Wheat	924	90	**96·2**	97·3
Barley	118	90	**96·2**	95·7
Oats	480	85	**95·7**	95·1
Rye	60	80	**92·4**	96·5
Turnip	250	Field, 75. Garden, 70.	**90·9**	88·8
Swede	150	75	**82·7**	84·9
Rape	16	80	**83·2**	83·0
Kale	100	Field, 70. Garden, 65.	**79·7**	77·4
Cabbage ..	400	Field, 70. Garden, 65.	**78·6**	75·8
Brussels Sprouts	90	65	**78·5**	84·3
Cauliflower and Broccoli ..	300	Cauliflower, 60. Broccoli, 65.	**75·8**	75·1
Peas	750	65	**84·7**	78·7
Vetches	150	90	**93·8**	92·7
Mangold	350	120	**123·5**	125·7
Beet	300	90	**120·8**	109·2
Parsnip	100	40	**67·8**	63·8
Carrot	300	50	**66·7**	64·4
Onion	600	55	**71·1**	75·2

The figures indicate that good quality seed of most crops is obtainable, though stocks are doubtless very short in some cases. In nearly all cases seeds harvested in the British Isles are showing higher germination than in the previous year. The fine weather experienced in the late summer no doubt largely accounts for this. Another factor, the full influence of which it is not easy for the Seed Testing Station to estimate, is the amount of seed held over from the previous season. The germination of such held-over seed may not deteriorate very greatly in most cases, provided the seed has been stored under favourable conditions, yet the presence of large held-over stocks always seems to lower the average germination more than would be expected. It is probable that such stocks are this year very small, except in the case of some of the vegetable seeds.

In the case of most of the cereal, pulse and vegetable seeds there is no very great difference between the two seasons' figures. Beet, however, shows an increase of 11 per cent., and reaches a figure almost as high as that of mangolds. The growth of the latter seed is rather disappointing, as it was expected that last year's average would have been improved upon. Peas show an improvement of 6 per cent., which may probably be increased when the whole of the season's results are averaged.

Among the clovers the outstanding feature is an increase of 13 per cent. in the germination of trefoil. There are some exceptionally good samples of this seed procurable this season.

Red clover shows the slight increase of 2 per cent., but the improvement in the growth of English seed this season is probably greater than this. There is a marked decrease in the amount of dodder found. Last season seeds of this weed occurred in 27·3 per cent. of red clover samples, whereas the corresponding figure this season is 21·2 per cent.

Alsike does not appear to be of quite such good quality as usual, both purity and germination being lower.

All the grasses, with the exception of crested dogstail, show improved figures. Though only a comparatively few samples of this seed have yet been tested, it appears that much of the new seed is of poor growth. Italian rye-grass shows a slightly higher germination than perennial rye-grass.

Farmers, allotment holders and others desiring to send seeds to the Station to be tested should comply with the following regulations :—

1. *The Weight of Seed* sent must be as follows:—Broad beans and Scarlet Runner beans, 8 oz.; peas and dwarf French beans, 6 oz.; wheat, barley, oats, rye, vetches, red clover, crimson clover, trefoil, lucerne, and sainfoin, 4 oz.; all grasses, alsike clover, white clover, all roots, beet and mangold, 2 oz.; all vegetable seeds, other than beet and mangold, ½ oz.
2. *Fees* must be sent at the same time as the sample. The fees are as follows: (*a*) In the case of tests which a farmer requires for his own information only, 3*d*. per sample; (*b*) in the case of tests needed for the purpose of a declaration for sale, 1*s*. per sample for cereals, 1*s*. 6*d*. per sample for roots, vegetables and vetches, and 2*s*. per sample for grasses, clovers, mangold and beet. Postage need not be prepaid when packages are properly addressed and sent by letter post.
3. *Packages* should be addressed to: The Director, Seed Testing Station, Ministry of Agriculture and Fisheries, 18, Leigham Court Road, Streatham Hill, S.W. 16.
4. *Special envelopes* may be obtained by farmers, free of cost, on application to the above address.

Notes on Agriculture Abroad.

Mechanical Pressure Silage.—In 1913 Samarani published an account* of experiments with artificially weighted silage made in containers. The pressure, at first obtained with weights (about 5–6 cwt. per square yard), applied immediately after filling, was in subsequent experiments obtained by means of a screw press. From these latter experiments the writer draws the following among other conclusions:—

(1) That as a result of the greatest possible exclusion of air "a check is given to the intercellular fermentation which tends to produce acetic acid through the formation of alcohol, and thus a larger quantity of saccharine matter is left at the disposal of the lactic acid fermentation, with an enhanced acid production."

(2) That silage so prepared, being poorer in acetic and butyric acids, provides forage of a less intense odour than ordinary sour silage.

He supports his conclusions by numerous analyses. In these experiments the thermometer during the first ten days never rose higher than 23° C. (74° F.), having recorded 19° C. (67° F.) on the day of filling. Any rise of temperature, says the writer, should be checked by the exertion of greater pressure. It is in this possibility of graduated pressure that the advantage of the screw press lies.

* Samarani: Studi intorno alla conservazione dei foraggi allo stato verde. (Boll. del Ministero di Agricoltura, etc., Italy, Aug.–Dec., 1913, pp. 87–103.)

The method described by Wirz* in 1918 and Wenckstern† in 1919, though requiring similar apparatus, is quite different in principle. It is a method of producing sweet silage under pressure that has lately come much into vogue in Switzerland. The system generally adopted, though numerous modifications are in use, is that of the Herba Co., Rapperswil. As regards Wirz, the chief point of interest is that he traces the progress of the movement from the stack silo to the container. He is not, however, very explicit as to the methods adopted in the latter process. From Wenckstern, however, we learn that the silos, which are erected under cover, should not be more than about 15 ft. high by about 14 ft. square, with a capacity of about 3,000 cubic ft. The corners inside are rounded. The press has a pressure of about 8 to 10 cwt. per square yard, sometimes as much as 16 cwt. being applied with good results.

The most explicit directions are iven as to every stage in the process. The grass must be wilted but not really dry, though dry enough to exude no moisture when twisted in the hand; the correct moisture content is about 74 per cent. The wilted grass must be loosely spread in the silo, about 1½ to 2 yards deep at a time, and allowed to rise quickly to a temperature of 50° to 60° C. (122° to 140° F.); the temperature must then be checked by compression either by means of a fresh layer or with the press. The material must never at any time be trodden; when pressed there must be no interstices or hollows in any part of the mass. The reasons given for these directions are that the slight drying of the grass assists loose layering, which in turn admits air and oxygen, thus inducing plant respiration which leads to rapid heating. Acetic acid fermentation is active between the temperatures of 18° and 35° C. (65° and 95° F.) and is quite checked at 50° C. (122° F.). Butyric acid fermentation is most active between 35° and 37° C. (95° and 99° F.) and ceases at the latter temperature. Lactic acid fermentation begins at from 30° to 35° C. and can go on after 50° C. (122° F.) is reached. This, then, is the right stage at which to check any further development and to secure the lactic acid described by Wenckstern as "the farmer's friend." The impression left after reading the directions is that the success of the system depends on too many minute observances—too much thermometer reading and sampling by taste and smell. The system, as Wenckstern suggests, is more likely to be used

* Wirz: Die Süssfutterbereitung.—Zurich, 1918.

† Wenckstern: Das neue Süsspressfutter verfahren in Silos mit Selbsttätiger Pressvorrichtung.—Berlin, 1919.

by the small holder, who would attend personally to all the details, and for whom also it is adapted as allowing of the conservation of small quantities of fodder. Doubts are raised as to the suitability of this silage for meat and cheese production. Wenckstern gives numerous analyses both of acid contents and statements as to feeding value. The books of Wirz and Wenckstern are both usefully illustrated.

Economic Results of Drainage.—In a small volume by Grünert* most interesting figures are given as to the economic results of drainage systems in various parts of Germany and Austria. The following average percentage increases in crop production are calculated on the basis of returns from drained lands in Germany, Bohemia and Moravia: Wheat, 40–81; Oats, 44–45; Barley, 41–64; Clover, 30–100; Sugar beet, 80–136; Potatoes, 90–180.

Average increased returns for the 10 years, 1905–1914, from drainage on twenty-two estates in the Rhine Province are as follows:—

Crop.	*lb. per acre.*	*Increase per cent.*
Rye	435	37
Oats	670	42
Wheat	535	30
Potatoes	3,560	50

The average percentage increase is 40 per cent. estimated at a value (on German pre-war prices) of 46*s.* 6*d.* per acre.

In the thirty years 1887–1917 the average increases in yields attributable to drainage in the Archduchy of Austria are worked out in a publication of the Lower-Austrian Land Committee as follows:—

Cereals	803 lb. per acre.
Potatoes	2,677 ,, ,,
Roots	11,600 ,, ,,
Hay	2,231 ,, ,,
Straw	1,249 ,, ,,

The writer directs attention to the figures for roots and to the increased yield of straw.

Agricultural Costings.—Results of the Danish Costings Bureau for the second year (1917–18) have now been published.† They are based on a total of 235 accounts, 182 of which were available for the first time for the year in question. As regards the pig industry the report points out that the state of affairs brought about by the introduction in February, 1917, of unrestricted U-boat warfare culminated in the summer of that

* Grünert: Anleitung zur Dränage.—Berlin, 1919.
† Denmark: Undersögelser over Landbrugets Driftsforhold II, 1917–18.

year in an almost national catastrophe. An analysis of accounts furnished by 158 pig keepers bears out this comment. The average takings on an average fat pig were 149 kroner (roughly £8) and the average expense 168 kroner (roughly £9), thus leaving an average deficit of 19 kroner (or, say, £1).†

An interesting table is given showing the average deficit in the 158 holdings grouped according to size. From this it appears that in holdings under 25 acres the average amount of food needed to produce an average fat pig was 477 "food units" (a "food unit" is taken as roughly equal to a kilo, or 2·2 lb., of concentrated food), and the deficit was 7 kroner (or, say, 7*s.* 6*d.*) per pig. In the next four groups—ranging from over 25 to under 250 acres—the average amount fed was 551 "food units" and the average deficit 19 kroner (say, £1), corresponding more or less with the total average. On the group of large farms, however, of over 250 acres, the amount fed was 614 "food units" and the loss 40 kroner, or rather over £2. "These results," the report states, "may be regarded as emphasising the importance of the care and attention which pigs usually receive on small holdings, as a result of which the consumption of food per lb. of live-weight increase is reduced."

Another significant set of figures deals with the question of horse labour on farms of various sizes. The table is as follows, with substitution of English equivalents :—

Size of Holdings.	No. of Holdings.	Working Hours per Working Horse.	Food Units per Horse.	Cost of Horse Labour.		
				Per Working Hour.	Per Acre.	Per Working Horse per Year.
				s. *d.*	*s.* *d.*	*s.*
Under 25 acres	10	609	1,675	0 9·3	49 7	442
25– 50 ,,	29	1,097	2,394	0 8·1	40 0	665*
50– 75 ,,	43	1,274	2,579	0 7·6	44 8	565*
75–125 ,,	48	1,377	2,711	0 8·4	46 6	696
125–250 ,,	17	1,527	2,712	0 8·2	45 7	944
Over 250 ,,	9	1,825	3,111	0 7·7	42 4	1,104

On this table the report comments : "The most noticeable points are the working hours and the consumption of food per horse in the various groups . . . . with increasing size of holdings the working hours increase, so that on the largest

* There appears to be some misprint in the original, with one or both of these figures. Possibly they should be transposed.

† Normal rate of exchange.

they are three times as long as on the smallest holdings. Consumption of fodder per horse is nearly twice as great on the large as on the small holdings. As against this the costs per working hour and per acre (" hectare " in original) are heaviest in the smallest holdings, but the difference is not nearly so great as might be expected, owing to some extent to the fact that on small holdings ponies, which are considerably cheaper to keep, are employed, and also because the land in the small-holder group is, taken all through, of a somewhat lighter character. . . . The total cost per horse per year increases with absolute regularity from group 1 to group 6 ; this is due to the increase in food consumed, which again is the result partly of the increasing size of the horses and partly of the increased number of working hours per horse."

Notes on Manures for March:
From the Rothamsted Experimental Station.

Time for Spring Dressings.—It is now time to begin the application of spring dressings to the winter corn crops. Sulphate of ammonia can go on wherever the land is in suitable condition for the distribution, but nitrate of soda need not be applied for another month or six weeks if circumstances compel delay. Owing to the favourable conditions at the time of sowing and the dryness of the winter, the corn is in better condition than usual, and there was less washing out of nitrate than appeared likely during the wet month of December. Consequently, the need for spring dressings is less than it might have been, and probably in few cases will more than 1 cwt. per acre of nitrate of soda or sulphate of ammonia be given, even to a second corn crop. Corn following roots fed off or clover ley ploughed in last autumn is not likely to need anything this year.

Lime on heavy Soils.—It is generally found that on heavy soils lime gives better results on arable land than almost any other manure, but it does not produce nearly such striking results on the grass land, where it is much out-distanced by basic slag. Farmers on heavy land with only a limited amount of lime or ground limestone will therefore be better advised to use it on their arable rather than on their grass land. It can still be applied to land which is being prepared for roots.

Use of Gas Lime.—A correspondent asks if he can safely use gas lime on his soil. This course would have been perfectly safe in the autumn or early winter, but it is rather risky now, especially if the sample smells strongly. Really evil-smelling gas lime is a potent insecticide which can be used with considerable effect in a pest-ridden field. It is also, however, poisonous to crops, and the effect takes some time to wear off, although it disappears in the course of a few weeks.

Use of Broken Straw or Dust from threshing on Grass Land.—During threshing there is a certain amount of broken straw, cavings, dust, etc., which can hardly go into the yards because it contains arable weed seeds and is, therefore, sometimes carried on to the grass land. If the distance is not great this may be worth doing, but the material is not really very good and does not justify any great expense in carting. At Rothamsted the effect of chopped wheat straw on grass land was studied for a number of years. Applied at the rate of nearly one ton per acre, along with artificial manures, it gave increases varying from 3 to 10 cwt. of hay per acre on the plots receiving artificials only. The results were :—

Average Yield of Hay. Cwt. per Acre.

	1856–65.	*1866–75.*	*1876–97.*
Artificials only	$53\frac{5}{8}$	.. $48\frac{1}{2}$	.. $58\frac{7}{8}$
Artificials + 2,000 lb. chopped wheat straw.	$55\frac{1}{4}$	.. $59\frac{5}{8}$	.. $67\frac{1}{8}$

For the first ten years the results were hardly worth the labour involved, though subsequent effects were more marked.

The Use of City Refuse as Fertiliser.— During the War numerous attempts were made to utilise city refuse as fertiliser, and dumps located in various districts were carefully examined. In many cases, however, the material was of only low value ; it usually contained only about :—

$\frac{1}{2}$ per cent. of nitrogen.
1 ,, ,, phosphates.
2 ,, ,, potash.

On heavy land it has advantages which these figures do not show, as it makes the soil lighter and more workable. These advantages are often more important to allotment holders than to farmers, who tend to lay down heavy land to grass. Farmers who are situated near the dumps, however, would be well advised to secure samples for analysis and then determine whether it would be worth their while to use this material.

Fresh material delivered direct from the city depots is probably somewhat more valuable. A sample recently examined from a London Borough Council contained :—

31·2 per cent. of organic matter ;
0·5 per cent. of phosphoric acid (equivalent to 1¼ per cent. of calcium phosphate) ;
0·5 per cent. of potash, and, in addition, nearly 3 per cent. of lime.

As it stands this material is poor, but its phosphate content is to be increased by the inclusion of offal from the fried fish shops and markets. The material is sent out in good condition, and its value to the farmer corresponds with its analysis.

The question is sometimes asked, however, whether it is safe to use such material where potatoes are grown. Any danger that arose would be from spores of disease organisms adhering to the potato peelings which have gone through the ash-pit and so got into the refuse. The danger is only slight, but it exists, and where there is reason to fear the prevalence of wart disease among potatoes it could hardly be overlooked. On grass land or farms where there is no intention of growing potatoes the risk may quite well be taken.

Effect of Fertilisers in Overcoming the bad Effects of Climate.—Farmers are now thoroughly familiar with the fact that artificial fertilisers increase the growth of crops. There is, however, another aspect of their use which in many instances is highly important.

Chief among the many difficulties arising out of natural conditions with which the farmer has to deal is climate, and particularly rainfall. There is, unfortunately, no known way in which the rainfall can be controlled, nor can the possibilities of rain even be forecasted for more than a short period. Its effects, however, can be mitigated to some extent in two ways :

(1) By using appropriate varieties of crops.
(2) By suitable treatment with artificial manures.

The most effective way of mitigating the effects of heavy rainfall is to give a small dressing of nitrogenous manure at the time of sowing, or as soon as possible after the plant is up, in order to secure an early start, and to accompany this by a relatively large dressing of superphosphate, or, on acid soils, of basic slag. Thus, in a high moorland district where oats are required for cattle, the following might be tried :—

Varieties : Golden Rain, Yielder, Victory.
Manuring : ½ cwt. sulphate of ammonia, 3 or 4 cwt. superphosphate.

The effect of the phosphate is to hasten the ripening processes and thus bring on the harvest some days before it would otherwise be ready. This use of phosphates is well seen in some of the northern counties where cereals liberally treated with superphosphate are ready sometimes as much as ten days in advance of the untreated crops.

In dry conditions, or where the plant tends to ripen off soon, another course must be adopted. Potassic fertilisers should be here used, or failing them, salt. The effect is to continue the growing processes longer than would otherwise happen, with the result that yields are increased. This is probably one of the reasons for the beneficial effect of salt or potassic fertilisers on light sandy or chalky soils; but no doubt other factors are concerned as well.

Final Report of the Nitrogen Products Committee.

IN June, 1916, a Committee, known as the Nitrogen Products Committee of the Munitions Inventions Department, was appointed with the sanction of the Minister of Munitions to deal with the matters comprised in the following terms of reference:—

To consider the relative advantages for this country and for the Empire of the various methods for the fixation of atmospheric nitrogen, from the point of view both of war and peace purposes; to ascertain their relative costs, and to advise on proposals relevant thereto, which may be submitted to the Department.

To examine into the supply of the raw materials required, *e.g.*, pure nitrogen and hydrogen, and into the utilisation of the by-products obtained.

Since some of the processes employed depend for their success on the provision of large supplies of cheap power, to ascertain where and how this can best be obtained.

To consider what steps can with advantage be taken to conserve and increase the national resources in nitrogen-bearing compounds and to limit their wastage.

To carry out the experimental work necessary to arrive at definite conclusions as to the practicability and efficiency of such processes as may appear to the Committee to be of value.

As a result of the foregoing steps, to advise as to starting operations on an industrial scale.

The Committee consisted of a number of eminent scientists and representatives of Government Departments, and was under the chairmanship of Colonel Sir Henry E. F. Gould-Adams, K.B.E., C.B., C.M.G., R.A.

It was considered desirable at the end of 1916 that the Committee should submit practical proposals at an early date, and an Interim Report was accordingly issued in February, 1917. A note on the main recommendations of this Report was published in the issue of this *Journal* for February, 1918, page 1254.

The Committee have now issued their Final Report (Cmd. 482, 1920),* a comprehensive document of some 350 pages. They review in some detail the general situation of the nitrogen products industry before and during the War, and express opinions as to the post-war prospects. A large portion of the Report is devoted to the industry in its relation to agriculture, and in view of the increasing use of nitrogen as a fertiliser some of the statements made are deserving of special notice.

Influence of the War.—In their opening remarks the Committee state that the last years of the war situation have been responsible for a fundamental alteration in the status of agriculture in the United Kingdom. The present policy of food production has already had the effect of increasing the home demand for nitrogenous fertilisers to an extent far exceeding the pre-war consumption, and the maintenance of this policy after the War, or its further development, is vitally interconnected with the future of the nitrogen industry. The importance of combined nitrogen in agriculture has long been recognised, but under war conditions a very large proportion of the world's supplies of combined nitrogen had been diverted from agriculture to the production of munitions, thus affording a significant lesson as to the extent to which the security of a nation may depend upon its ability to procure or produce an adequate supply of essential nitrogen products. The continuous increase in the world's demand and the constant upward trend of the price of combined nitrogen, however, have led to the invention and development of processes for fixing atmospheric nitrogen, thus opening up a practically unlimited source of supply. The Committee enumerate and deal in detail with the four principal processes, viz., the by-product ammonia process, the retort process, nitrogen fixation processes, and the ammonia oxidation process.

Post-war Position.—In regard to the post-war demand the Committee express the opinion that the requirements of agriculture are certain to be much larger than formerly, the imperative need for maintaining and extending the world's production of

* Obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2

food, and the vital importance of combined nitrogen for this purpose, having emerged as one of the salient lessons of the later stages of the War.

They state that the consumption of combined nitrogen practically doubled in the ten years before the War. In evidence given before the Committee it was stated that owing to advances upon the former backward state of scientific knowledge concerning the use of nitrogenous fertilisers, the future consumption could not be expected to continue to increase at the same rate. The Committee are unable to agree with this view for the following reasons: When account is taken of the relative areas under cultivation in the food-producing countries of the world, of the pre-war consumption of nitrogenous fertilisers in the most progressive of the agricultural countries, and of the corresponding consumption in the remaining countries, it is abundantly clear that the quantities of nitrogenous manures employed were in many cases below the most advantageous or profitable level. The difficulties experienced during the War period in obtaining supplies have already provided a salutary lesson as to the importance of fertilisation, and the resulting wider recognition of the value of fertilisers will lead to a large increase in the demand for nitrogenous manures in countries where the consumption has hitherto been very small in proportion to the area under cultivation. In the opinion of the Committee, the provision of a really cheap supply of fixed nitrogen, say, at £40 to £45 per metric ton, or 8*s*. to 9*s*. per unit, would lead to a greatly extended consumption of nitrogenous fertilisers.

Estimating the post-war requirements of the United Kingdom the Committee state that, owing to the war policy of food production, the agricultural demand for fixed nitrogen in the form of ammonium sulphate and nitrates has attained at the present time a figure of 60,000 tons per annum, as compared with a pre-war consumption of 25,000 tons, and that there is every prospect of a further increase in the immediate future. From a general consideration of the prospects under a progressive agricultural policy and of a number of other factors bearing on the question, they are of opinion that the future consumption of artificial nitrogenous fertilisers in the United Kingdom might amount to the equivalent of about half a million tons of ammonium sulphate per annum, or 100,000 tons of fixed nitrogen.

The Report concludes with a number of recommendations as a *minimum* provision for safeguarding the future and for

meeting a portion of the growing home demand for various nitrogen products. The recommendations are mainly concerned with the development of the various processes by which nitrogen is obtained, the encouragement of research, and the safeguarding of imperial supplies.

Notes on Feeding Stuffs for March: *From the Animal Nutrition Institute, Cambridge University.*

IT has recently been decided to remove maximum prices from all oil cakes and meals. Prices are not at present sufficiently stable to make it possible to compile a table of prices for any considerable number of feeding stuffs. The only possible course for guiding purchasers at the present time is to advise them to make use of the annexed table, which gives the feeding value of a number of the more common feeding stuffs classified according to their relative richness in proteins, fats and carbohydrates. Column (1) of the table gives the name of the feeding stuff. In this connection it should be noted that the table does not include all the feeding stuffs on the market. This is best explained by a few examples. The first feeding stuff on the list is ground-nut cake. The cake referred to under this name is a decorticated cake from which the husks of the ground nuts have been removed. Two other kinds of ground-nut cake are now on the market, known respectively as undecorticated and semi-decorticated. The latter of these has only come on to the market recently, and the writer is not at present in possession of figures for the composition of this cake. Before next month it is hoped that a number of samples may be collected and analysed so that figures for the composition and feeding value may be added to next month's table. Readers of these Notes will confer a favour on the writer if they will inform him of any common feeding stuffs on the market which are not included in the table, so that samples of these may be collected and examined with a view to their future inclusion.

Column (2) of the table gives the nutritive ratio, that is to say, the relative proportions in which protein or flesh-forming constituents, and carbohydrates and fats or heat-forming constituents, are present in the food.

FEEDING VALUE OF COMMON FEEDING STUFFS.

(1) Name of Feeding Stuff.	(2) Nutritive Ratio.	(3) Per cent. digestible. Protein.	(4) Per cent. digestible. Fat.	(5) Per cent. digestible. Carbohydrates and Fibre.	(6) Digestible Food Units per ton.	(7) Starch equiv. per 100 lb.	(8) Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.							
Ground nut cake ..	1: 0·8	45·2	6·3	21·1	145	78	102
Soya bean cake ..	1: 1·1	34·0	6·5	21·0	122	67	88
Decort. cotton cake ..	1: 1·2	34·0	8·5	20·0	126	71	93
Linseed cake, Indian	1: 1·9	27·8	9·3	30·1	123	77	101
Linseed cake, English	1: 2·0	26·7	9·3	30·1	120	76	100
Cotton cake, Egyptian	1: 2·1	15·5	5·3	20·0	72	40	53
Cotton cake, Bombay	1: 2·5	13·1	4·4	21·5	65	38	49
Distillers' grains ..	1: 2·9	18·7	10·2	29·0	101	57	75
Maize gluten feed ..	1: 3·0	20·4	8·8	48·4	122	87	115
Brewers' grains, dried	1: 3·5	14·1	6·6	32·7	85	50	66
Coconut cake	1: 3·8	16·3	8·2	41·4	103	77	101
Palm kernel cake ..	1: 4·5	14·1	6·1	48·9	96	77	101
Linseed	1: 5·9	18·1	34·7	20·1	154	119	157
Bombay cotton seed ..	1: 6·6	11·0	16·8	30·1	100	78	102
Fairly Rich in Protein, Rich in Oil.							
Maize germ meal ..	1: 8·5	9·0	6·2	61·2	99	81	107
Rice meal	1: 9·4	6·8	10·2	38·2	79	68	90
Rich in Protein, Poor in Oil.							
Fish meal	1: 0·1	54·0	2·0	—	125	56	74
Peas, Calcutta white ..	1: 2·1	23·3	1·1	45·9	97	70	88
Beans, English ..	1: 2·6	19·3	1·2	48·2	100	67	88
Beans, Chinese ..	1: 2·6	19·6	1·7	47·9	101	67	88
Peas, English maple ..	1: 3·1	17·0	1·0	50·0	97	70	92
Palm-nut meal (extracted)	1: 3·4	15·6	1·9	48·7	92	66	87
Brewers' grains, wet ..	1: 3·5	3·5	1·5	8·6	21	13	17
Malt culms	1: 3·6	11·4	1·1	38·6	70	39	51
Cereals, Rich in Starch, not Rich in Protein or Oil.							
Barley, feeding ..	1: 8·0	8·0	2·1	57·8	83	68	89
Oats, English	1: 8·0	7·2	4·0	47·4	75	60	79
Oats, Argentine ..	1: 8·0	7·2	4·0	47·4	75	60	79
Maize, American ..	1:11·5	6·7	4·5	65·8	94	81	107
Maize, Argentine ..	1:11·3	6·8	4·5	65·8	94	84	110
Maize meal	1:13·0	5·5	3·5	63·9	86	79	102
Wheat middlings ..	1: 4·8	12·8	4·1	52·5	95	73	96
Wheat sharps	1: 5·1	11·6	3·4	51·6	90	62	80
Wheat pollards ..	1: 4·5	13·6	3·7	52·5	97	62	82
Wheat bran	1: 4·7	11·3	3·0	45·0	78	50	65
Wheat bran, broad ..	1: 4·7	11·3	3·0	45·4	80	48	63
Locust bean meal ..	1:22·1	4·0	0·7	69·2	80	71	94

Columns (3), (4) and (5) give the percentages of digestible proteins, fats and carbohydrates respectively.

Column (6), which is calculated from Columns (3), (4) and (5), gives the number of digestible food units in a ton of each feeding stuff.

Columns (7) and (8) give the starch equivalent and the linseed cake equivalent respectively of 100 lb. of the feeding stuff.

The table can be used both as a guide to purchasing, and as an indication of the feeding value of the different feeding stuffs. To use it as a guide to purchasing, the procedure is as follows :

First ascertain the price at which several suitable feeding stuffs can be purchased locally. To these figures add the estimated cost of railway carriage, cartage, grinding or other method of preparation. This will give the cost of the feeding stuffs as fed to the animals. Next look up in the table the number of digestible food units contained in a ton of the feeding stuffs, and divide *the cost per ton of the feeding stuff as fed to the animals* by this figure. A few instances will make this plain. The price of bran at the present time is about £12 10*s.* per ton at the mill; to this must be added, say, 10*s.* per ton for carriage and other expenses, so that the cost of bran as fed to the animals would be, say, £13 per ton. Looking up bran in the table, Column (6) states that it contains 78 food units per ton. The price per food unit is therefore £13 divided by 78, or 3*s.* 4*d.* per food unit. Dried grains at the present time cost about £14 10*s.* per ton at the factory or wharf. Again, adding, say 10*s.* per ton for railway and other expenses, the cost of dried grains as fed to the animals would be £15 per ton. According to Column (6) of the table, dried brewers' grains contain 85 food units per ton. Dividing £15 by 85 the cost per food unit is 3*s.* 6*d.* Bran and dried grains are quite similar feeding stuffs suitable to replace each other. At present prices bran is cheaper than dried grains by about 2*d.* per food unit. Calculated in the same way, palm kernel cake at about £12 10*s.* per ton at the mill would cost as fed to the animals about 2*s.* 9*d.* per food unit, and linseed cake at £25 per ton at the mill about 4*s.* 3*d.* per food unit.

As soon as prices have settled down it will be possible to give comparative tables of costs per food unit worked out from the standard prices by this method. In the meantime, while prices are so variable, it is hoped that purchasers may be able to determine the price per food unit for themselves as indicated above.

The table is also useful as an indicator of the relative feeding value of different feeding stuffs. The number of digestible food units per ton is not an exact measure of the feeding value, because it includes an allowance for the manurial value of the feeding stuff. Columns (7) and (8) give a much more reliable estimate of the relative feeding value. Column (7) gives the number of pounds of starch which has the same feeding value as 100 lb. of the feeding stuff; similarly Column (8) gives the number of pounds of linseed cake equivalent in feeding value to 100 lb. of the feeding stuff. Live-stock owners should buy according to the number of digestible food units given in

Column (6), and should be guided in using feeding stuffs by the starch equivalent or linseed cake equivalent as given in Columns (7) and (8).

It may perhaps be useful to give some idea as to the prospect of supplies of feeding stuffs in the future. It appears likely that the supply of millers' offals, which was so short during the War, will be considerably increased in the coming season. The prospects for supplies of feeding barley are, however, not so good, and this feeding stuff is likely to be scarce and dear for some time There has been during the last few years a considerable change in the importation of barley. Countries which used to send considerable quantities of barley to the United Kingdom have been prevented from doing so by war and post-war conditions. North America has less than the usual quantity of barley to export, and the exchange between the United Kingdom and the States at the present time makes the importation of American barley extremely expensive. The supplies of home-grown oats seem to be fairly satisfactory, but the prospect of importing normal quantities of oats is not good. As regards maize, several countries which used to supply large quantities are no longer able to do so. Last year's maize crop, however, was quite good, both in North and South America, but, as in the case of barley, the exchange makes the importation of maize from these countries extremely expensive. The importation of oil seeds during the last year has increased very largely, resulting in the production of very large quantities of cakes of all kinds. Consumption of cakes, probably on account of the high prices, and possibly, too, because farmers have discovered during the War that they could keep their animals quite satisfactorily on much smaller cake rations than they were accustomed to use before the War, has not increased so rapidly as the production. There is consequently a large stock of cakes in the country at the present time, and it is quite likely that prices will decrease. For some time past cakes have sold considerably under the maximum prices; so much so, that the maximum prices have now been removed, as well as almost all restrictions on their use.

Land Settlement through Local Authorities.

THE present time (5th February) seems a fitting time to review, very briefly, the work accomplished by County Councils and Councils of County Boroughs on behalf of the Ministry of Agriculture and Fisheries, with regard to the work of the settlement of ex-Service men on the land.

Councils have on their lists 25,905 ex-Service applicants, who have applied for 450,603 acres. Of these applicants 16,017 have so far been approved as suitable for 269,025 acres.

Councils have actually acquired, or agreed to acquire, 162,247 acres, and in addition the councils have 75,000 acres under consideration, the bulk of which, it is hoped, will be acquired at an early date. Of this area 11,620 acres are proposed to be acquired in the exercise of the compulsory powers entrusted to the councils by Parliament.

The London County Council have up to the present not acquired any land for ex-Service men.

Up to date 4,250 men have actually been provided with holdings, on a total area of 59,136 acres. The figures given show that a substantial beginning has been made in the direction of carrying out the promises of the Government with regard to the provision of land for men who have fought for their country.

Poultry Laying Trials at the Harper Adams Agricultural College, Newport, Salop.*

THE poultry laying trials at the Harper Adams Agricultural College for the 12 months 1918–19 ended on 29th October last, and a Report has recently been issued. This Report sums up the work which is being done for poultry breeders and others who are interested in the improvement of egg production.

The general interest taken in the trials, as evidenced by the increasing number of other trials held since the College commenced this branch of work in 1912, is not confined to the owners of the pens, as the information obtained and fully described in the reports is of considerable value, not only to all who are engaged in improving stock, but also to those who are concerned with egg production. The breeders of utility poultry must remain at a disadvantage compared with the exhibition or "fancy" breeder until a definite standard of points can be agreed upon, and, though steps are being taken to arrive at some agreement in this direction, it is now only

* Contributed by the Harper Adams Agricultural College.

by actual performance at these 12 months' laying trials that the owner of utility birds can prove the quality of his stock.

The results of the College trials for 1918–19 are conclusive in demonstrating the improvement which is taking place in the quality of the utility poultry stock of this country, and it is satisfactory to note that, not only is the standard attained higher, but the general average shows a distinct improvement. Thus, contrasting the results of the first 12 months' trials with those just concluded, the figures are extremely interesting:—

	1912–13.	*1918–19.*
Best pen (6 birds) ..	1,389 eggs.	1,444 eggs.
Worst pen (6 birds) ..	526 ,,	813 ,,
Average per pen (100 pens)	911·15 eggs.	1,121·51 eggs.
,, ,, bird (600) ..	151·9 ,,	186·92 ,,

The pens were representative of the leading poultry yards, and also included birds from a number of less well-known people who have not yet established their reputations as breeders of utility stock. The birds competing comprised:—

Light Breeds—	*Heavy Breeds*—
Leghorns.	Wyandottes.
Campines.	Rhode Island Reds.
Anconas.	Buff Rocks.
Minorcas.	Sussex.
	Orpingtons.

The comparison of the breeds is particularly interesting in view of the details obtained as regards the size and weight of the eggs produced, and brings out the fact that a marked improvement is taking place in the hitherto less-favoured breeds such as Rhode Island Reds, Rocks and Sussex, as compared with the more numerous White Leghorn and White Wyandotte breeds:—

	Egg Average, 1918–19.		
	No. per Bird.	Weight per Egg per Bird.	Value of Eggs per Bird.
		oz.	*s. d.*
Leghorns	189·8	2·04	65 4
Wyandottes	194·14	2·03	68 5½
Rhode Island Reds	194·41	2·09	69 4½
Rocks	173·25	2·06	59 5½
Orpingtons and Sussex	173·05	2·08	61 10½
Other Light Breeds	172·66	2·15	60 3½
Average of all Breeds	186·92	2·06	65 4½

In comparing the quality of the output the total weight of eggs produced by the birds has been ascertained, but for the purpose of valuation the standard of 2 oz. has been taken as the size of grade A egg, and here again the less well-known or favoured breeds show a high standard of output, as will be seen by the following table:—

——	Total Weight.	No. of Eggs Laid.		Percentage Proportion of Grades.	
	oz.	*2 oz. and over.*	*under 2 oz.*	*2 oz. and over.*	*under 2 oz.*
Leghorns (32 pens) ..	74,470	28,295	8,147	77·64	22·34
Wyandottes (33 pens) ..	78,163	29,579	8,861	76·95	23·05
Rhode Island Reds (8 pens)	19,564	8,172	1,160	87·57	12 43
Rocks (8 pens)	17,201	6,255	2,061	75·21	24·79
Orpingtons and Sussex (10 pens)	21,630	8,864	1,519	85·37	14·63
Other Light Breeds (10 pens)	22,302	9,877	483	95·34	4·66
All the Birds (101 pens) ..	233,330	91,042	22,231	80·38	19·62

The number of eggs produced has naturally varied with the season, and it is of interest to compare the number, weight and value of eggs produced during the year. The relationship of these three factors is not very apparent. The figures are given for periods of four weeks commencing with the first period from 3rd to 30th November, 1918:—

——	Period.						
	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.
No. of Eggs ..	3·44	7·11	15·24	15·25	17·93	20·78	20·68
Value	1/8½	3/0	6/8½	6/8¼	7/4	5/10	5/6¼
Weight in oz.	6·4	14·0	31·1	31·2	37·1	43·0	43·8
	8th.	9th.	10th.	11th.	12th.	13th.	
No. of Eggs ..	17·88	16·78	15·15	14·06	12·47	5·95	
Value	4/6¾	5/2	5/0¼	4/10¾	4/5¾	2/6½	
Weight in oz.	36·4	34·5	31·2	29·24	26·0	12·6	

To poultry keepers the question of cost of feeding is all-important, and the results of the trials, where an accurate record is kept of the amount consumed, as well as the cost, are of great comparative value. The quantity of food consumed per bird in lb. during the year was: Compound meal, 13·7; bran, 4·7; fish meal, 6·1; clover meal, 2·6; pig meal, 0·1; crushed oats, 5·0; wheat, 14·3; oats, 1·9; mixture, 29·0; sharps, 6·6; maize meal, 3·5; palm kernel meal, 1·4.

The cost of feeding has varied slightly month by month and may be stated as under:—

	Cost per Bird.			*Cost per Bird.*	
	s.	*d.*		*s.*	*d.*
1st Period ..	1	3¼*	8th Period ..	1	2½
2nd ,, ..	1	5	9th ,, ..	1	1
3rd ,, ..	1	4¾	10th ,, ..	1	3½
4th ,, ..	1	5	11th ,, ..	1	4½
5th ,, ..	1	5¼	12th ,, ..	1	6
6th ,, ..	1	1	13th ,, ..	1	5¾
7th ,, ..	1	1¼			

During the trials a varied food sheet was possible, though at times it was necessary to use such foodstuffs as were available, as against what was really required. The values as between eggs produced and food consumed seem to have been in an inverse ratio, the cost dropping sharply as the value of eggs increased and *vice versa*. Thus cost of food dropped sharply from £6 11*s.* 1½*d.* per 100 birds for the period ending 30th November to £5 12*s.* 5*d.* for that ending 19th April, and then rose steadily until £7 12*s.* 5½*d.* was recorded for the final period. On the other hand, egg values only reached £8 10*s.* during the first period, but rose steadily until the March period, when £36 17*s.* 8½*d.* was the value of the output per 100 birds. From this highest value the decline was gradual until October, but fell sharply to £12 14*s.* 2*d.* for the final month. The weight of food consumed was more constant, and fluctuated between a minimum of 640 lb. and a maximum of 727 lb. per 100 birds per four weeks, the average per period being—cost of food, £6 15*s.* 11*d.*; amount consumed, 692 lb.; and value of eggs produced, £24 8*s.* 6*d.* per 100 birds. Such figures very clearly bring out the fact that flocks which are showing a low flock average output must be yielding a very low profit, and in many cases are probably being kept at a loss.

The need for egg records is thus obvious. In this connection the question whether a bird can be classed satisfactorily at the end of its first three months' laying as a good or bad layer seems to be decided in the affirmative by the comparison of the best and worst layers in the flocks under trial. It is noted that almost without exception the birds that produced a total of over 200 eggs in the pullet year averaged a 47-egg output during the first three months, whereas the poor layers—of less than 100 in the pullet year—showed an average of only 15·8 during ths first three months. Whether or not this test of

* Price carried to nearest farthing. Another ½*d.* per period should be added to cover cost of grit and vegetables.

output can be regarded as sufficient in itself may seem doubtful, but taken in conjunction with other indications it should certainly be possible to weed out the wasters before any serious loss is incurred on their behalf.

The College trials during the year 1918–19 also included a Single Pen Test—a form of trial not previously known in this country—and the results fully justify the claims which have been made in Australia for this method of comparison of breed and strain. The highest output was that of a White Leghorn pullet, which laid in the 12 months 271 eggs, of which 267 were first grade and the total weight was 588 oz.

The full Report of the College trials has been published, and contains a summary of the results of other competitions which have been held in this and other countries.

Employment of Women in Agriculture.

THE increased employment of women in agriculture during the War has involved the consideration of a number of questions relative to their continued employment in the different branches of the industry when more normal conditions of rural labour were restored. It was felt that numbers of women who had been working on the land during the War would wish to remain in agricultural occupations and to avail themselves of openings which might be offered, either on farms or in industries allied to agriculture. A Committee composed mainly of representatives of the Ministry of Agriculture was appointed under the chairmanship of Mrs. Roland Wilkins in November, 1917, to consider what economic part women can take in agriculture, and to recommend what steps should be taken to give practical effect to such conclusions as might be drawn.

The Report of the Committee has recently been issued.* It sets out in some detail the prospects open to women in arable farming, stock farming and dairying, small holdings, market gardening, flax growing and various rural industries. A chapter on the history of the employment of women in agriculture should be of special interest to the agricultural student. After touching on a number of other subjects bearing on the problem of the employment of women in agri-

* Report of Sub-Committee appointed to consider the Employment of Women in Agriculture in England and Wales. Obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, price 1*s.* 6*d.* net.

culture, such as voluntary associations and women's institutes, the Report concludes with a summary of the Committee's conclusions and recommendations.

The conclusions of the Committee can be briefly summarised as follows :—

The Supply of Women Workers.

(1) There is a large unsatisfied demand for the domestic farm servant in certain areas; this type of worker appears to be an essential factor in the economy of small hill farms of the stock-raising and dairy type.

(2) There is a very slightly increased demand over pre-war times for full-time milkers and stock women, dairy-maids who milk, and poultry workers.

(3) It is likely that the demand for part-time milkers will increase substantially.

(4) An increase in the women dependents of small holders will naturally follow that of the men established under the Government scheme, and these women being an important factor in the success of the small holding, every consideration should be given to all local possibilities of their education, organisation, and social life.

(5) A demand for certain types of workers is conditional on the extension of certain branches of farming which may be encouraged by Government policy; some again, such as the casual field workers on arable farms, depend on the general condition of other trades.

(6) The present supply of local seasonal workers in market gardens and in afforestation is likely to prove adequate: the increased demand due to any extension in the areas devoted to these branches of cultivation during the next few years balancing the reversion of the substitution of women for men which took place during the War.

In the case of teachers of dairying similar conditions are anticipated.

The Retention of Local Women in Rural Areas.

(7) The establishment of certain industries such as fruit-canning, jam-making, fruit-bottling and milk-drying in rural areas has caused a small demand for workers drawn from the locality. Should these undertakings spread the number of workers required would be correspondingly greater. The Committee have pointed out that this would act advantageously in retaining women in rural areas, owing to the variety of interest offered in employment. The retention of these local women

is an important factor in the development of rural areas.

(8) Further, bacon factories and those dealing with fruit, while only offering in themselves a small demand for women's work, indirectly influence the permanent settlement of women in the district by encouraging the development of small holdings in the immediate area for the supply of their raw materials.

Actions required.—The specific recommendations of the Committee are :—

(1) That fuller immediate action be taken along the lines recommended by the Report of the Education Conference on the Agricultural Education of Women with regard to local instruction by County Authorities.* These recommendations are :—

a. Itinerant instruction should take the form of organised classes rather than that of lectures, and every part of a county should be covered in a definite cycle of years.

b. Farm schools, or fixed courses of instruction taking their place, should be increased, so as to provide one for every county or two counties.

c. Domestic economy should form part of the curriculum in every organised course.

d. Provision of scholarships—

(*a*) from itinerant classes to farm schools.

(*b*) from farm schools to collegiate institutions.

(2) That the curriculum of Farm Institutes should provide special domestic economy classes dealing mainly with labour-saving methods and the use and preservation of home-grown produce ; and that, in those areas where the system of domestic farm servants exists, the Farm Institutes should organise local demonstration classes and simple trials on the above subjects.

(3) That a number of scholarships for the best of the farm servants themselves should be established at the Farm Institutes for the counties in which farm servants are numerous.

(4) That all measures for the simplification and acceleration of methods of working in the home and byres should be considered by those responsible for agricultural education and manual training in the local areas.

* See this *Journal*, December, 1915, p. 859.

(5) That Women's Institutes should develop as fully as possible the experiments they have begun in organising demonstrations in labour-saving methods and in the various branches of household economy; and that local Education Authorities should give them every facility for classes in connection with these subjects.

(6) That Women's Institutes should endeavour to extend their organisation as widely as possible amongst wives of farmers and small holders and amongst farm servants.

(7) That the attention of farmers and landowners be directed to the desirability of improvements in byres, yards and homes with a view to curtailing unnecessary labour.

(8) That in dairying districts Local Education Authorities should organise milking classes.

That Local Agricultural Associations should consider the advisability of offering prizes for women milkers at local shows.

(9) That short courses should be provided for training women as stock-women at Farm Institutes as long as the demand for their services exist; and that scholarships or financial assistance should be given in connection with the short courses.

(10) Scholarships or assisted Studentships for training for skilled posts in dairying and cheese factories should be provided so as to place these posts within the reach of the small farmer's daughter and the farm servant.

(11) That the recommendations of the Agricultural Education Conference as regards poultry be acted on. (These recommendations are (*a*) the formation at one of the existing Agricultural Colleges of a training course for poultry keepers, (*b*) the institution of a national examination in poultry in connection with the above.)

(12) That the present system of itinerant instruction in poultry keeping be extended and supplemented by the establishment of demonstration centres.

(13) That the system of supplying stock poultry and eggs through approved stations be extended.

(14) That demonstration centres should be established in market-gardening districts in which small holders are numerous; and that instruction in all kinds of skilled work in connection with fruit be provided for women.

(15) That the duty of obtaining accurate statistics relating to women engaged in agriculture, and of maintaining

adequate information upon any changes in the number of women so engaged, be urged upon the appropriate authority.

A detailed statement of the Committee's conclusions and recommendations, taking each type of industry separately, is given in tabulated form.

Farming of Land Broken up during the War.

THE question of the future cropping of the land recently broken out of grass is seriously exercising the minds of many farmers. There are at least four different ways in which such land can be treated, viz. :—

1. The land may be worked in with the rotational system hitherto in force.
2. A proportion of the root shift may be devoted to silage crops.
3. Temporary leys of several years' duration may be introduced into the rotation.
4. The land may be sown down to permanent grass.

1.—With the introduction of the Norfolk or 4-course rotation, in which roots occupied 25 per cent. of the arable land, it was possible to keep the land clean, and, by feeding cattle and sheep, to maintain a reasonable level of fertility without recourse to artificial manures. As such manures, however, came more and more into use, a smaller area of roots sufficed to maintain the land in good condition, and roots came to occupy 20 per cent. or less of the arable land. (In the case of heavy land the proportion may be as low as 5 per cent.) Even before the War, roots were commonly regarded as an expensive crop. Under present conditions they are still more so. It seems clear, therefore, that the extra arable area arising out of war conditions will not generally be maintained on a short rotational system, in which roots requiring singling, lifting and storing would take the same prominent place as of old. If the rotation hitherto practised is adopted, crops such as rape and kale will probably, in part, replace the ordinary root crops.

2.—In recent years farmers have begun to look to ensilage as a means of reducing the root shift, particularly under conditions where roots are a specially risky crop. An autumn-sown silage crop is largely independent of weather, does not need a fine tilth, keeps down weeds, and is ready for removal in July, thus affording opportunities for a half fallow, or, if required, a second green crop.

In the absence of a silo, a mixed crop of oats and vetches, or oats and peas, may be made into hay or ripened, and so reduce the root shift and the winter bill for feeding stuffs. (In suitable circumstances lucerne might be tried.)

3.—A third possibility is the lengthening of the rotation by the introduction of temporary leys. If these were of three years' duration, then in a rotation of seven years there might be three shifts in corn, or 43 per cent. as compared with 50 per cent. in a 4-course rotation. The production of about an extra quarter per acre, which might reasonably be expected in the case of the longer rotation, would bring the yield of corn per 100 acres arable up to that of the shorter rotation. Thus, from the standpoint of corn production, the country would not lose by the change; indeed, it might well gain considerably. The root and clover crops would probably be healthier.

There remains the doubt that will arise in many minds as to whether temporary leys can be successfully established under all conditions. In Scotland, in Wales, and generally in districts with considerable rainfall, the practice is already common. Trials have been made in other districts, but further experiments on this point in such districts are necessary. In experiments carried out in the Eastern Counties under the auspices of Cambridge University it would appear that such leys can be successfully laid down, particularly if the seed mixture adopted is on the lines of the Clifton Park system, that is to say, if it consists of a variety of pasture plants including those of a deep rooting and drought-resisting character.

Many of the heavier and of the lighter lands, too, are to-day suffering from lack of organic matter. The former are consequently difficult to work and both are apt to dry out. The ploughing-under of a three-years'-old turf would go far to mitigate this state of affairs.

4.—The last resort is a return to permanent grass. In the case of difficult, inaccessible, or inadequately drained land, or land adjoining the homestead, which has recently been ploughed out, a return to permanent grass may be justified, but care should be taken to choose a suitable seed mixture. The present cost and scarcity of seed makes such care all the more necessary. Farmers with no experience to guide them should consult the Agricultural Organiser of their county, with a view to being supplied with all available data on the subject.

OFFICIAL NOTICES AND CIRCULARS.

N.B.—The Orders mentioned in this section of the JOURNAL *may usually be obtained at the price of 1d. each from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, and 28, Abingdon Street, London, S.W. 1; 37, Peter Street, Manchester, and 1, St. Andrew's Crescent, Cardiff.*

THE following Circular Letter (No. C.L. 276/C.1) was addressed to County Councils in England and Wales, except the London County Council, by the Ministry on 15th January :—

Ministry of Agriculture and Fisheries Act, 1919.

SIR,—I am directed by the Minister of Agriculture and Fisheries to invite the attention of your Council to the provisions of the Ministry of Agriculture and Fisheries Act, 1919,* which received the Royal Assent on 23rd December, 1919.

This Act is not concerned in any way with agricultural policy, but is simply a measure for rendering more efficient the existing machinery for dealing with agricultural matters. It marks an epoch in the history of County administration, for it enables the numerous powers and duties of the County Council, in regard to agriculture, to be brought within the range of a single Committee. Furthermore, it brings formally within the County organisation the work now done by the Agricultural Executive Committees.

It cannot be emphasised too clearly that the Act is not designed to supersede any Committee of the County Council now dealing with a particular branch of administration. On the contrary, it is the intention of the Act that so far as possible the existing Committees should be linked together and fitted into a general scheme, which will give to agriculture in the work of the County Councils a position appropriate to its importance. Certain changes may be needed in order to obtain a workable scheme, but, broadly speaking, no efficient machinery need be scrapped, and no existing Committee of the County Council dealing with agriculture need be placed in a position of less authority in consequence of the passing of the Act.

The Minister would like to take this opportunity of expressing his high appreciation of the admirable and efficient work done by those who undertake, often at the cost of much personal sacrifice, the ever increasing burden imposed on Local Authorites in connection with the local adminstration of matters affecting the agricultural industry. Lord Lee feels confident that under the new legislation the authority of County Councils in dealing with agricultural matters will be strengthened and that the cordial relationship which has always existed between Councils and the Ministry will be maintained.

The Act makes provision for setting up Councils of Agriculture and an Agricultural Advisory Committee for England and Wales, and also an Agricultural Committee for each Administrative County and County Borough. This Circular deals only with the County Committees provided for in Part III. of the Act, and its object is to set forth as concisely as possible the main provisions of that Part of the Act and to indicate their effect on county administration.

* See also this *Journal*, January, 1920, p. 962.

Every County Council (except the London County Council) is required to establish an Agricultural Committee to be appointed in part by the County Council and in part by the Minister. The County Council is to nominate not less than two-thirds of the members, and persons so nominated need not be members of the Council if the Council so determine. Each Council must make a scheme establishing an Agricultural Committee to be approved by the Minister before 23rd June, 1920, and if by that date a scheme has not been approved, the Minister may make a scheme after consultation with the Council.

Powers of the new Committees.—To the Agricultural Committee and its Sub-Committees in each county will stand referred all matters relating to the exercise of the Council's powers under :—

(1) The Destructive Insects and Pests Acts, 1877 and 1907.
(2) The Diseases of Animals Acts, 1894 to 1914.
(3) The Fertilisers and Feeding Stuffs Act, 1906.
(4) The Land Drainage Act, 1918.
(5) The Small Holdings and Allotments Acts, 1908 to 1919; and also all other matters relating to agriculture except (*a*) such matters as under the Education Act, 1902, stand referred to the Education Committee, and (*b*) the raising of a rate or borrowing.

With regard to education, provision is made for arranging that matters relating to agricultural education, which otherwise would stand referred to the Education Committee, may be referred to the Agricultural Committee.

A County Council may delegate to the Agricultural Committee any of their powers in relation to the matters specified above It will, however, obviously be impossible for an Agricultural Committee itself to deal with the whole of the matters brought within its range, and the Act therefore provides for the appointment of Sub-Committees and for delegation to those Sub-Committees of any of the powers of the Agricultural Committee. The scheme should provide the necessary authority for such delegation of powers to Sub-Committees.

The Act authorises payment as part of the expenses of the Agricultural Committee of travelling expenses and subsistence allowance of members of that Committee or of any of its Sub-Committees if the scheme so provides.

It is obligatory for the Agricultural Committee to appoint :—

(1) A Small Holdings and Allotments Sub-Committee.
(2) A Diseases of Animals Sub-Committee.

These Sub-Committees will act as the Statutory Committees under the Small Holdings and Allotments Acts, 1908–1919, and the Diseases of Animals Act, 1894, respectively. The Small Holdings and Allotments Sub-Committee will, until 31st March, 1926, have full executive powers (except the power to raise a rate or loan) without special delegation of powers by the County Council or the Agricultural Committee. The Act provides that this Sub-Committee shall comprise one or more members to represent tenants of small holdings and allotments.

The Minister may authorise the Agricultural Committee or a Sub-Committee to exercise on his behalf any of his powers under Part IV. of the Corn Production Act, 1917, or Part II. of the Land Drainage Act, 1918.*

* See article on Land Drainage in this issue, p. 1088.

It will be seen from these provisions that the County Council may so constitute their Agricultural Committee that the Small Holdings and Allotments Committee and the Agricultural Executive Committee shall become, without substantial alteration, component parts of the new committee, and carry on without interruption the work of which their members have acquired an intimate knowledge.

Attention is, however, called to Sub-section (4) (*a*) of Section 7 of the Act, which requires that a scheme shall provide for the appointment by the Minister of not more than one-third of the members of the Agricultural Committee or of any Sub-Committee to which the powers of that Committee are delegated. The Minister will expect to appoint the full quota of members of the Small Holdings and Allotments Sub-Committee, the Agricultural Executive Committee and any other Sub-Committee whose operations entail actual or contingent liabilities for expenditure from State funds.

A further Circular will be issued shortly containing suggestions as to the lines on which a scheme for constituting an Agricultural Committee should be prepared and enclosing a Model Scheme. In the meantime any County Council is at liberty to formulate its scheme, and it may, therefore, be useful to remind the Council that schemes must provide for the appointment of such persons only as have practical, commercial, technical or scientific knowledge of agriculture, or an interest in agricultural land, and for the inclusion of women as well as men.

I am to add that the further circular referred to above will deal not only with matters of organisation but also with the question of finance and accounts.

I am, etc.,
(Signed) LAWRENCE WEAVER,
Director-General of Land Settlement.

THE following information was contained in a Memorandum recently issued to County Horticultural Sub-Committees by the Ministry :—

Potato Trials.

Introduction.—The important part played by the potato crop makes it desirable that growers should be able to obtain adequate and reliable information on all matters relating to potato culture, the many phases of which may best be brought to the growers' notice through demonstration plots instituted for the purpose of finding out those varieties best suited to the different districts and of demonstrating the approved methods of potato culture.

Wart Disease Note.—The Ministry require the planting of immune varieties in those areas in which Wart Disease is known to be common and widespread, and in such areas committees should use immune varieties only for their trials; whilst those committees in the clean districts should demonstrate the value of these immune varieties and test their comparative merits with well-known susceptible kinds.

Supply of Seed.—The source of the seed potato influences the resulting crop to such an extent that all the seed should be obtained from the same source. It is advisable, therefore, that the seed should be purchased in bulk by the Ministry and distributed to the various committees. The seed potatoes will be invoiced at cost price to the committees.

Quantity of Seed.—In carrying out these trials 14 lb. of each variety should be planted on land which has been prepared according to the instructions given below.

Preparation of Land.—The land used in all allotment trials should be bastard trenched.

Manures.—The land should receive farmyard manure at the rate of 10-15 tons per acre, and, preferably, to be applied in the drills at the time of planting.

Artificial Manures.—These should be applied as follows :—

Superphosphate,* 26 per cent.	4 cwt. per acre.
Sulphate of Ammonia	1 ,, ,,
,, Potash,* 49 per cent. ..	1 ,, ,,

In making these suggestions regarding manuring, it must be borne in mind it may be necessary to modify them in accordance with the local customs and conditions.

Varieties.—In 1920 it is proposed that the trials should be divided into two main sections :—

Part 1.—Demonstration of the cropping powers of the well-known immune kinds, such as :—

1st Earlies.—Snowdrop, Dargill Early.

2nd Earlies.—Great Scott, Arran Comrade.

Main Crops.—Majestic, Kerr's Pink, Golden Wonder, Tinwald Perfection, Abundance.

Part 2.—Early Varieties.—During 1920 it is considered important to institute trials to test the earliness of cropping qualities of certain early varieties. It must be realised that certain varieties are grown and marketed as earlies, which are not really earlies, if regarded from the point of view of maturity. "Epicure" is a good example of this It is a variety which "bulks" early, and can be marketed early, yet if judged by its date of maturity, it is a second early. The same remark applies to "Eclipse" or "Sir John Llewellyn."

It has been maintained that "King George" is a variety which, if treated as an early, will be ready for lifting quite as soon as "Epicure." Last season, in many districts "Arran Comrade" matured earlier than "Epicure." It is, therefore, of the greatest importance that this year this problem of earliness should be tested in a thorough manner in all those districts where early potatoes are grown.

Note.—The trials of early varieties are for the express purpose of comparing the earliness of some particular varieties. To obtain reliable results it is obvious that the seed of the many kinds must all come from the same source, be treated in a similar way, planted on the same date, and the crop given equal opportunities for development. The important point is not merely the determination of a date when the crop matures, but of a period when the crop may be profitably marketed. This is a point that should be well considered.

The instructions regarding supply of seed, manuring, etc., are the same as for the cropping trials, but the varieties may be different, as below :—

Varieties for 1920.—Three of the leading well-known first earlies should be grown as controls with which the new varieties may be compared. The three varieties which should be used for this purpose are "Duke of York," "Ninetyfold," and "Epicure."

* If other grades are used, such quantity should be applied as will provide the same amounts of phosphate or potash as those indicated.

To summarise, the varieties to be included in this year's trials are :—

Duke of York
Ninetyfold.
Epicure. } For clean lands only.
Dargill Early.
Arran Rose.
King George.
Nithsdale.
Arran Comrade.
Snowdrop.

Planting.—The time of planting will vary slightly according to the district. The trial plots should be planted at what is considered a suitable time for planting potatoes in the district. It is further suggested that a distance of 26 in. between the drills and 12 in. between the sets should be adopted throughout all the trials. Any departure from these distances should be noted in the reports of the trials.

Reports.—The committees will, of course, prepare full reports for the instruction of farmers and allotment holders in their own districts. The Ministry will, however, also require a brief report drawn up on certain definite lines in order that they may issue a summarised report of all the trials in the country.

In previous years trials of potatoes were carried out for the Ministry by a few people in various parts of England, and, where satisfactory, committees should continue the trials at the old centres and institute fresh trials in other districts.

List of Growers of Immune Varieties of Potatoes in England and Wales.

IN dealing with Wart Disease of potatoes it is essential that only true stocks of immune varieties of potatoes should be planted in infected areas. To assist growers in these areas in obtaining suitable stocks for planting this season the Ministry last year arranged for their Inspectors to examine growing crops of immune varieties and to certify those which were true to type and reasonably free from "rogues." A list of the growers whose crops were inspected and certified has been prepared and is now published as Miscellaneous Publication No. 26. Copies of this publication may be obtained from the Ministry, 3, St. James's Square, London, S.W.1, price 6*d.*, post free.

Decontrol of Home Cheese.

IN accordance with the decontrol of British- and Irish-made cheese, already announced (see Note in last month's issue, p. 1041), the Food Controller has issued an Order (No. 98) revoking as on 1st February, 1920, the following Orders :—

1. The British Cheese Order, 1917.
2. British Cheese (Requisition) Order, 1918.
3. Cheese (Export from Ireland) Order, 1918.
4. Caerphilly Cheese (Retail Prices) Order, 1919.

As already announced, the Ministry of Food will purchase the suitable varieties of whole-milk hard cheese manufactured in Great Britain and Ireland up to and including 31st January, 1920, and

delivered or advised to the Government Factors up to and including 29th February, 1920. Such cheese not advised or delivered to the Government Factors on or before 29th February, 1920, will not be accepted as Government purchase. The cheese accumulated in the Government Pool will be distributed during the months of January February and March, 1920, under Government Control.

Legal Decisions under the Corn Production Act.

AT the Lambeth County Court his Honour Judge Parry gave his reserved judgment in the case of Deering *v.* Watney, in which John Deering, of Plaxtol, claimed at the Sevenoaks County Court, from Colonel Charles F. Watney, of Ivy Hatch Court, £24 3*s.*, being the difference between wages received by him as gardener and the minimum wage allowed by the Agricultural Wages Board (under the Corn Production Act) for odd time that he alleged he was engaged in agriculture.

"The defendant," said his Honour, "has about 20 acres of land attached to his house, about five or six lawns and gardens, of which an acre and a half is kitchen garden. There are five acres of plantation, five acres of grazing and five acres of cherry and apple orchard. The defendant does not carry on the business of agriculture. He has sold surplus fruit, but this year there was no surplus fruit. The applicant was employed to work in the gardens, especially the kitchen garden, and to do odd labouring jobs when not wanted in the garden. There is no doubt that he did work in the plantation pruning the nut bushes. The evidence is conflicting as to how long he worked there. The defendant was at the War, and his wife left matters to the bailiff. No objection was taken or claim made at the time, and no record of hours kept by either party. He also cut some bracken for bedding. I find, as a fact, that he was employed on these jobs for four weeks in all and not more, and during the rest of his time he was employed on his main and proper work in the kitchen gardens.

"The applicant contends that he is entitled to the minimum wage during the whole of his employment. Clause 4 of the Act says that 'Any person who employs a person in agriculture,' shall pay the minimum wage rate. Clause 17 says that agriculture includes the use of land as orchard or woodland or market garden. I think the main work of the applicant was in the kitchen gardens, and I hold that the applicant cannot claim the minimum wage when so employed. I think for about four weeks he was employed in agriculture within the meaning of the Act. I see nothing in the Act to prevent a man employed in another capacity claiming a minimum wage, during such time as he is actually employed in agriculture. He put in a claim for a fortnight's haymaking. He could not swing a scythe, but he helped to pitch the hay. Everyone in the house, from the visitors downward, did the same. It is an almost universal practice in English country life for all the household, including domestic servants and visitors, to help in the hay-field during the hay harvest.

"I do not think, if a man's butler helped to pitch hay, he would be a workman employed in agriculture within the Act, and I have not allowed the applicant anything on this part of his claim. In my view the mere fact, in an estate of this kind, that a man does an odd job of an agricultural character does not entitle him to the minimum wage,

but when he is taken away from his usual work and put for a substantial time in real agricultural work he is entitled to the minimum wage. The actual orders of the Wages Board were not produced, but the applicant is entitled to the difference between the minimum wage and the actual wage paid to him for four weeks. If this is not agreed, I remit to the Registrar to assess the amount." (*Wages Board Gazette*, 15th January, 1920.)

Profiteering on Hay and Straw.

AN Order applying the Profiteering Act to hay and straw has been made by the Board of Trade. The text of this Order was published in the issue of the *London Gazette* for 6th January.

Revocation of Oils, Oil Cakes and Meals Order, 1917.

THE Food Controller has issued an Order revoking, as from 1st February, 1920, the Oils, Oil Cakes and Meals (Requisition) Order, 1917. Previous references to this Order were published in the issues of this *Journal* for December, 1917, p. 1046, and May, 1919, p. 211.

The Control of Hides.

IT was announced by the Food Controller on the 31st January, that the administration of the regulations affecting the control of hides hitherto exercised by the Ministry of Munitions will be vested in the Ministry of Food for the remainder of the period of meat control.

Seed Production in Denmark and United States of America.

ACCORDING to the issue of the *Seed World* (United States) for 19th December last, it would appear from information furnished by the Agricultural Adviser to the Danish Government that Denmark must now be regarded as a serious competitor in the world market for certain kinds of seed, the supply of which before the War was practically the monopoly of English growers. In 1916 the acreage under turnips for seed in Denmark was less than 3,500 acres; last year it had increased to 16,677 acres. Swede seed showed an increase from 2,372 to 7,790 acres, and mangold from 3,410 to 5,310 acres in the same period. The remarkable extension of seed growing in Denmark has been caused by the rapid rise in seed prices during the War. Many Danish farmers took up the growing of seeds, who, lacking the knowledge and experience of old growers and frequently unable to obtain satisfactory stock seed for planting, could not maintain the high quality which has characterised Danish-grown seeds in the past; nevertheless, the increased production must affect the hold that the English growers have had on the world market for such seeds.

Attention is also being given to the growing of root seeds in the United States of America. Before the War the production was negligible, but last year the States produced 123,000 lb. of swede and 456,000 lb. of turnip seed.

Budget of the United States Department of Agriculture for 1919-20.

THE amount provided for in the Budget of the United States Department of Agriculture for the year 1919–1920 is £7,060,000, or and increase of £1,250,000 over the amount provided for in the previous year 1918–1919. The following are the amounts* allotted to the principal Bureaus in the two years.

	1919–1920.	*1918–1919.*
	£	£
Office of Secretary ..	167,000 ..	160,000
Weather Bureau ..	392,000 ..	399,000
Animal Industry Bureau	1,205,000 ..	850,000
Plant Industry Bureau ..	704,000 ..	653,000
Forest Service	1,244,000 ..	1,195,000
Chemistry Bureau ..	290,000 ..	259,000
Soils Bureau	102,000 ..	102,000
Entomology Bureau ..	286,000 ..	206,000
Biological Survey ..	155,000 ..	123,000
Division of Publications...	50,000 ..	45,000
Crop Estimates Bureau ...	77,000 ..	72,000
State Relation Service....	1,023,000 ..	657,000
Public Roads Bureau ..	124,000 ..	124,000
Markets Bureau	586,000 ..	422,000

The largest increases during the year are shown by the Bureau of Animal Industry (£355,000), the Bureau of Plant Industry (£51,000), the Forest Service (£49,000), the Bureau of Entomology (£80,000), the States Relation Service (£366,000), and the Bureau of Markets (£164,000). The States Relation Service consists of federal contributions to the experiment stations, demonstrations and extension work of the States.

New United States Government Stallion Farm.

A NEW stallion farm, the only one of its kind in the country, was established by the United States Department of Agriculture in co-operation with the Wyoming Agricultural College, at Buffalo, Wyo., early in July. It is to be known as the United States–Wyoming Horse-breeding Station, where the work that has been done for the past 15 years by the Department in co-operation with the Colorado Agricultural College will be continued. The object of the work at this station will be to produce high-class stallions suitable for the production of utility horses adapted to western range and farm conditions. Stallions at this station are available for use by mare owners in the community, and from time to time they will be sent for service to different parts of Wyoming and Colorado. Stallions developed for the range weigh from 1,200 to 1,400 pounds. A standard-bred stallion, Harvest Aid, has recently been purchased. He is by the champion trotting stallion, The Harvestor, and his dam is Santos Maid, a mare which holds the trotting record of 2·08¾, and a daughter of Peter the Great, the leading sire of speed in America. It is not the purpose at the horse-breeding station to develop speed animals, but it is well understood that a good stallion from a family noted for its speed is highly desirable for the production of active utility horses. — (*The Breeder's Gazette*, 25th September, 1919).

* The amounts are "par values."

Agricultural Credit Facilities for Devastated Regions in France.

A NOTE published in the issue of the *Journal Officiel* for the 14th October, 1919, gives particulars of an Act passed by the French Government respecting the formation in France of different kinds of agricultural benefit societies, with a view to assisting the population in districts devastated by the War. The conditions of formation of these Societies are to be decided by the Ministries of Agriculture and Food, and Finance. The Societies may receive State loans through local banks. All people connected with agricultural development, in any way, may form themselves into credit societies. Rural artisans, who do not employ more than two men continuously, such as shoeing-smiths, smiths, implement repairers, harness-makers, shoemakers, and charcoal burners, also come within the provisions of this Act.

Legal Decisions affecting Minimum Wages.

DECISIONS have recently been given by the High Court on two points of importance in connection with the administration of Part II. of the Corn Production Act. One case was heard on the 21st and the other on the 22nd January before the Lord Chief Justice and Justices Avory and Sankey.

In the first case the Agricultural Wages Board appealed against a decision of the Knaresborough Bench. The Board had proceeded against an employer for the non-payment of the minimum to a horseman who was engaged on a contract of service for one year, which was still running, at a wage of £20 per annum, in addition to board and lodging. The Court have decided that while the contract is void as regards the amount mentioned therein, it was still a contract for service for a year, and that the liability to pay the worker not less than the minimum wages did not arise—and in fact that no legal liability to make any payment arose—until the end of the term. If then the employer failed to pay a sum which for the whole term of service amounted to less than the minimum rates fixed, he would commit an offence, but until that time no offence could, in fact, be proved. The effect of this judgment appears to be far-reaching, as it seems to imply that any man engaged for a year is dependent on the good-will of his employer for any payments during his year of service.

In the case heard on the 22nd January, the Agricultural Wages Board appealed against a decision of the Warwick Bench, the point at issue being whether a private garden from which a certain amount of produce is sold comes within the definition of a market garden under the Corn Production Act. The judgment lays down that a market garden is a holding cultivated wholly or mainly for the purpose of the trade or business of market gardening. The decision of the High Court clears up a question about which there has been much discussion, and the appeal was taken by the Wages Board so that uncertainty might be removed for the future.

Both decisions were given in full in the issue of the *Wages Board Gazette* for 2nd February.

Foot-and-Mouth Disease.

SINCE the last issue of the *Journal* (p. 1044), outbreaks of Foot-and-Mouth Disease have been confirmed in six fresh centres, and the position in the districts concerned is as follows:—

Wiltshire.—The initial outbreak was confirmed at Grittenham, Brinkworth, on the 15th January, since which date six further outbreaks have occurred, the latest being on the 11th February. The usual Order prohibiting movement over a wide area was issued on the 15th January, and on the 29th January the Scheduled District was extended on the eastern side owing to the spread of disease in that direction. Restrictions have now been modified except as regards the Prohibited Area around the scenes of the outbreaks.

Bedford, Northumberland and Flint.—Isolated outbreaks were confirmed at Willington (Beds.), Amble, Acklington (Northumberland), and Rhuddlan (Flints.) on the 24th January, 21st January, and 31st January respectively. No further developments occurred, and in all cases restrictions have been modified in respect of considerable portions of the Scheduled Districts.

Lancashire.—Two outbreaks of disease were confirmed in Lancashire on premises near Newton in Cartmel, the first being on 24th January and the second on the following day. Since the latter date there has been no extension of disease, and the restrictions have been modified except in a small area surrounding the Infected Places.

Devonshire.—An outbreak of Foot-and-Mouth Disease occurred at Dean Prior near Buckfastleigh on the 28th January, and the usual Order prohibiting movement was issued accordingly. On the 5th February an outbreak occurred near Bow, some six miles outside the Scheduled District, and the Scheduled District had to be extended northwards for about 15 miles. A further outbreak occurred on the adjoining farm on the 7th February. The restrictions imposed have since been modified in the outer portions of the original Scheduled District.

All restrictions on movement of animals imposed in connection with the outbreaks in Durham, West Sussex, Yorkshire (West Riding), Hampshire, Dorset and Essex have been withdrawn and modifications of the restrictions have been made in the East Kent district.

Rabies.

SINCE th note which appeared in the last issue of the *Journal* was written, a further case of Rabies has been confirmed (on 13th January) at Addlestone, Surrey, in the Inner or dangerous Zone of the London, Middlesex, and District Muzzling Area. The inquiries which were made by the Inspectors of the Ministry show that the infected dog was apparently bitten by what is known as the "Ealing dog," that is, the animal which ran between Ealing and Weybridge in April last. It is fortunate that this case occurred well within the dangerous Zone, which was specially scheduled to catch up any cases of this kind. The result of this outbreak is that it has not been possible entirely to revoke the Muzzling Orders affecting the London, Middlesex, and District

Area, as had been hoped, by the end of January. The Ministry, however, have felt justified in contracting the existing Area so as to exclude from the Muzzling Order the whole of the County of London, the whole of Middlesex (except the portion lying to the south-west of a line from Uxbridge to Twickenham), that part of Hertfordshire which was previously subject to the Order, a small part of Buckinghamshire, and the south-eastern half of Surrey. An Order to this effect came into operation on the 2nd February.

This Order does not withdraw the restrictions on the movement of dogs out of the contracted Muzzling Area, nor the restrictions on the movement of dogs out of the Inner or Dangerous Zone. This last includes the western portion of Surrey and small parts of Berkshire and Hampshire.

The outbreak at Addlestone on the 13th January has rendered the maintenance of restrictions in this dangerous Area; for a further period, essential.

Revocation of the Milk (Licensing) Order, 1918.

THE Food Controller issued an Order dated the 24th January, 1920, which revoked as on the 1st February, the Use of Milk (Licensing) Order, 1918. A note on the provisions of this Order was published in the issue of this *Journal* for June, 1918, p. 354.

The National Egg Distribution Scheme.

IN 1916, as a war measure, with a view to increasing food production by a rapid improvement of our poultry stock, the Ministry of Agriculture made arrangements for the distribution of sittings of eggs, day-old chicks, and adult stock birds, to small holders and cottagers. The scheme has been worked through Egg Stations, which sent out sittings from January to May; day-old Chick Stations, distributing chicks between February and June; and Incubating Stations, from which eggs, chickens, and stock birds could be obtained. The egg and chick stations are selected annually for seasonal work; the incubating stations are more permanently established for work throughout the year.

The scheme has accomplished valuable work, and it is now arranged that Local Authorities shall take it over as part of their ordinary activities. Two-thirds of the cost will be borne by the Ministry of Agriculture. One hundred and forty-four Egg Stations and 19 Chick Stations have been approved in 26 counties to date; returns from the remaining counties have not yet been received. Distribution from the Incubating Stations in Anglesey, Cornwall, Cheshire and Denbigh is to continue. Four hundred and twenty-seven thousand three hundred and seventy-four eggs and 16,233 chickens have been distributed from the Egg and Chick Stations since 1916 at reduced rates. This year the subsidy to station holders will be 2*s*. per dozen for sittings of eggs, and up to 5*s*. per dozen for chickens. The price charged to

applicants for sittings and chicks is fixed by the County Authority for the area in which the Station is situated, to whom application should be made for particulars regarding the scheme.

January Journal: Errata. On p. 963, lines 3 and 15 from the bottom, in the Editorial Note, "The Forestry Act, 1919," for "a Forest Station" read "afforestation."

NOTICES OF BOOKS.

A Course of Practical Chemistry for Agricultural Students, Vol, 2, Part I.—H. A. Neville and L. F. Newman (Cambridge: University Press, 1919, 5*s.* net). Primarily designed for the use of students taking the degree n agricultural science at Cambridge, this series of laboratory exercises should also prove useful to agricultural students who have not taken a course in organic chemistry. The directions for practical work are accompanied by simple explanatory notes.

Land Drainage from Field to Sea.—C. H. J. Clayton, M.B.E., A.M.I.M.E. (London: "Country Life," Ltd., 1919, 6*s.* net). This work has been designed to convey in as popular and untechnical manner as possible some of the leading principles and items of practice which underlie the operations necessary to prevent the flooding and waterlogging of agricultural land. Although the sub-title "From Field to Sea" suggests the course naturally followed by drainage water, the subject is dealt with in the inverse order, with the object of emphasising the prime necessity of improving and maintaining the main outfall channels. The book contains an introduction by Sir Ailwyn Fellowes and a brief history of drainage legislation, and should appeal not only to agriculturists and landowners but to members of Drainage Boards, Commissioners of Sewers and County Drainage Committees.

Botany for Agricultural Students.—John N. Martin (New York, John Wiley & Sons, Inc.: London, Chapman & Hall, Ltd., 12*s.* 6*d.* net). The author, who is Professor of Botany in the Iowa State College of Agriculture, states that this book is intended for elementary courses in botany in colleges and universities. In its preparation the aim has been to present the fundamental principles of botany, with emphasis upon the practical application of these principles from the point of view of agriculture. The subject matter is presented in two parts. Part I. is devoted to the study of the structures and functions chiefly of flowering plants, and Part II. deals with the kinds of plants, relationships, evolution, heredity, and plant breeding.

Physiology of Farm Animals (Part I. General), T. B. Wood, C.B.E., and F. H. A. Marshall (Cambridge: University Press, 1920, 16*s.* net). This first volume, which is by Dr. Marshall, is addressed primarily to students of agriculture who may wish to obtain some knowledge of the simpler physiological processes as they occur in farm animals, but

it should be useful also to veterinary students. The animal organism is dealt with in successive chapters, commencing with the digestive organs and finishing with the female generative organs and the mammary glands. The book contains numerous diagrams and illustrations. The second volume, by Prof. Wood, on the subject of animal nutrition, will be published shortly.

Cattle and the Future of Beef Production in England.—K. J. J. Mackenzie (London: Cambridge University Press, 1919, 7*s*. 6*d*. net). In this book the author makes a strong plea for agricultural reform. He drives home the lesson, taught by the War, of the folly of relying upon other countries for food that might be produced at home. He specially urges the need of co-operation amongst farmers, of the development of "dual-purpose" cattle, and above all of systematic research on the part of scientists into the many problems of modern agriculture. Detailed descriptions of the principal breeds of cattle are given, while Dr. F. H. A. Marshall contributes a preface and a chapter on the physiological aspects of breeding.

It may be recalled that a résumé of a Report on "Beef Production," by Messrs. Mackenzie and Marshall, appeared in the issue of this *Journal* for September, 1918. It is hoped shortly to publish the full Report in the form of a *Journal* 'Supplement.'

Commercial Poultry Farming: being a description of the King's Langley Poultry Farm.—T. W. Toovey (London: Crosby Lockwood and Son, 1919, 7*s*. 6*d*. net). The purpose of this book is to give a plain, unvarnished account of the system of management and also, so far as possible, a detailed description of the plant of a large commercial poultry farm devoted to egg production. The system adopted is that known as the "semi-intensive," and the number of adult stock kept on the farm is 5,000 head, but the author states that it is not necessary that the operations should be so large, as the system is perfectly suitable to a small farm.

The World's Meat Future: an account of the live stock position and meat prospects of all leading stock countries of the world, with full list of freezing works.—A. W. Pearse (London: Constable & Co., Ltd., 1920, 21*s*. net). The author, who is editor of the *Pastoral Review*, deals in a comprehensive manner with the present position and future prospects of the meat industry. Principal attention is naturally devoted to the chief producing countries, Australasia, Argentina and the United States, but the author also examines the situation in the case of the smaller producers, especially those countries where the industry offers possibilities of expansion. Numerous illustrations of typical animals are given.

Report on Insect and Fungus Pests of Plants in 1918, Ministry of Agriculture and Fisheries, 3, St. James's Square, London, S.W.1, price 6*d*., *post free*.—The second of a new series of Annual Reports on the distribution of insect and fungus pests of plants in England and Wales has just been published by the Ministry. It has been chiefly compiled from the records contained in Monthly Reports sent in by qualified observers stationed in different parts of the country, and it forms a comprehensive survey of the distribution and economic importance of plant pests during the year 1918. The Report is some-

what technical in character and is intended primarily for scientific workers on plant diseases and perhaps even more for those who will be engaged in this work in future. In addition to notes on the most important pests the Report gives the records in tabular form, so facilitating reference. For the convenience of readers weather charts have also been added.

A Handbook on the Law of Allotments.—E. Lawrence Mitchell (London: The Cable Printing and Publishing Co., Ltd., 1920, 6*s.* net). This book sets out in a concise manner the duties and powers of local authorities with regard to the provision of allotments. It contains the Rules and Regulations of the Ministry of Agriculture and Fisheries, the Provisions of the Small Holdings and Allotments Act, 1908, the Land Settlement (Facilities) Act, 1919, and the Acquisition of Land (Assessment of Compensation) Act, 1919, so far as these Acts relate to allotments. The book also contains an excellent index.

MISCELLANEOUS NOTES.

Notes on Crop Prospects Abroad.

THE *International Crop Report and Agricultural Statistics* for January, 1920, published by the International Institute of Agriculture, gives particulars concerning the production of the cereal crops of 1919 in the Northern Hemisphere.

Wheat.—For a group of countries representing about 60 per cent. of the world's yield, the production is estimated at 261,908,000 qr., or a decrease of 6·7 per cent. compared with 1918, the area sown being larger by 1·6 per cent.

Rye.—In respect of countries representing about 10 per cent. of the world's yield the estimated production is placed at 24,689,000 qr. in 1919, or an increase of 1·7 per cent. compared with 1918, the area sown showing an increase of 8·2 per cent.

Barley.—For a group of countries representing about 40 per cent. of the world's yield the production is estimated to amount to 68,087,000 qr., or a decrease of 20·4 per cent. compared with 1918, the area sown being smaller by 18·9 per cent.

Oats.—For a group of countries representing about 50 per cent. of the world's yield the production is estimated at 227,868,000 qr., or a decrease of 13·6 per cent. compared with 1918, the area sown showing a decrease of 2·9 per cent.

Maize.—For a group of countries representing about 75 per cent. of the world's yield the total production in 1919 is placed at 365,773,000 qr., or an increase of 15·2 per cent. compared with 1918, the area sown being smaller by 4·1 per cent.

Sowing of Winter Cereals in the Northern Hemisphere.—The areas estimated to have been sown with winter corn in 1919–20, compared with the areas sown during the corresponding period of 1918–19, expressed as percentages, are as follows:—*Wheat*: Belgium 99, England

and Wales 98, Canada (area sown up to November) 109, United States 77, Guatemala 101; *rye*: Belgium 101, United States 76; *barley*: Belgium 102.

Crops in the Southern Hemisphere.—The production of wheat in Australia in 1919–20 is estimated at 5,499,000 qr., against 10,102,000 qr. in 1918–19, or a decrease of 45·6 per cent., while the area sown with wheat in Argentina in 1919–20 is 11·9 per cent. less than in the previous year.

Prussia.—According to the Prussian Statistical Bureau the average condition of the grain crops in Prussia at the beginning of December was as follows (2=good, 3=average, 4=poor):—Wheat 3·2 (3·0, 2·6); spelt, 2·8 (2·6, 2·7); rye, 3·2 (2·9, 2·4); and barley, 2·9 (2·7, 2·3). The condition at the beginning of November, 1919, and December, 1918, respectively, is given in brackets. (*Broomhall's Corn Trade News*, 19th January, 1920.)

Sweden.—H.M. Minister at Stockholm reports that the production of the principal crops in Sweden, in 1919, is officially estimated (final figures) as follows (1918 figures in brackets):—Autumn wheat, 10,112,000 qr. (9,919,000 qr.); spring wheat, 1,771,000 qr. (1,331,000 qr.); autumn rye, 25,836,000 qr. (22,088,000 qr.); spring rye, 1,075,000 qr. (999,000 qr.); barley, 15,763,000 qr. (14,000,000 qr.); oats, 78,534,000 qr. (59,348,000 qr.); potatoes, 20,792,000 tons (19,047,000 tons); sugar beet, 8,985,000 tons (7,992,000 tons); hay, 42,318,000 tons (27,170,000 tons). The production of spring wheat and potatoes in 1919 is the largest on record.

France.—According to an estimate issued by the Ministry of Agriculture, the condition of the crops on 1st January, 1920, was as follows (figures for January, 1919 and 1918, in brackets):—Wheat, 68 (71 and 70); meslin, 69 (72 and 72); rye, 69 (73 and 72); barley, 68 (72 and 71); and oats, 69 (72 and 70). (80 = good, and 60 = fair.) The averages under the crops are as follows:—Rye, 1,958,000 acres; winter oats, 1,932,000 acres; winter barley, 346,000 acres; and meslin, 232,000 acres. (*Broomhall's Corn Trade News*, 9th February, 1920.)

According to the issue of the *Journal Officiel* of 5th February, the area sown with maize in France in 1919 was 739,794 acres, compared with 753,374 acres in 1918 and 1,126,567 acres in 1914, and the yield was 299,040 tons, as against 247,907 tons in 1918 and 572,294 in 1914. The area under buckwheat was 744,514 acres in 1919, compared with 768,812 acres in 1918 and 1,116,612 acres in 1914, and the crop amounted to 267,531 tons in 1919, as against 224,780 tons in 1918 and 532,401 tons in 1914. (*London Grain, Seed and Oil Reporter*, 9th February, 1920.)

India.—According to the first preliminary estimate, the area sown with wheat in India in 1919–20 is 27,429,000 acres, as compared with 23,403,000 acres, the first forecast last year, 23,764,000 acres, the final return last year, and 35,497,000 acres, the total area sown in the season 1917–18. (*London Grain, Seed and Oil Reporter*, 9th February, 1920.)

Canada.—The finally-revised official estimates of the production of the grain crops in Canada in 1919 are as follows:—Wheat, 193,260,000

bush. compared with 189,075,000 bush. in 1918; and oats, 394,387,000 bush. compared with 426,312,000 bush. (*London Grain, Seed and Oil Reporter*, 26th January, 1920.)

Agricultural Conditions in England and Wales on 1st February.

THE monthly crop report of the Ministry on 1st February was as follows:—The weather of January was mild but wet, and the rains hindered field work in all parts of the country. In the west little cultivation was possible, except on the lightest lands, but in the east conditions were rather more favourable, and fair progress was made, though heavy land was generally unfit to work. Cultivation is still fairly well forward for the time of year. Young crops have done well during the mild weather, though occasionally they have suffered from the wet on low-lying, heavy lands. Wheat is very promising, being regular and healthy, and oats are also satisfactory. Beans are a good plant, but are often backward.

Ewes are healthy, but they are not in good condition as a rule; they have generally suffered somewhat owing to the scarcity of keep and the wet weather, and have frequently lost condition during January. Lambing prospects are, however, considered favourable. The fall of lambs among early flocks has been satisfactory, and the young lambs are healthy and doing well.

The scarcity of winter keep is telling on other live stock also, and they are usually only in fair condition. The mild weather, which has allowed cattle to be kept in the fields to a greater extent than usual, has helped to conserve the small stocks of fodder, but supplies are still short, though the position in this respect is relatively easier than a month ago.

There is a sufficient supply of labour in practically all districts, but skilled men, more especially horsemen, cattlemen and hedge cutters, are not always available.

Agricultural Labour in England and Wales during January.

The following local summaries give details regarding agricultural labour in the different districts of England and Wales:—

Northumberland, Durham, Cumberland, and Westmorland.—The supply of labour is generally equal to the demand, but skilled men are still required in some areas.

Lancashire and Cheshire.—The supply of labour is on the whole about sufficient for requirements, though in some districts skilled men are scarce.

Yorkshire.—The supply of labour is, as a rule, sufficient; but horsemen, shepherds and cattlemen are in demand in some areas, and in one or two districts of the West Riding more casual labour is wanted.

Shropshire and Stafford.—The supply of labour is, as a rule, sufficient, but skilled men are still difficult to obtain in some areas of both counties.

Derby, Nottingham, Leicester, and Rutland.—The supply of casual and unskilled labour appears to be adequate, but there is still a shortage of skilled men.

Lincoln and Norfolk.—The supply of labour is generally regarded as adequate and only in a few districts is complaint made of the shortage of skilled men.

Suffolk, Cambridge, and Huntingdon.—The supply of labour is almost everywhere equal to the demand, and sometimes plentiful, though occasionally there is a shortage of skilled men.

Bedford, Northampton, and Warwick.—The supply of ordinary labour is sufficient, but skilled men are scarce in most districts, cattlemen, horsemen and hedge cutters being in demand.

Buckingham, Oxford, and Berkshire.—As a rule there is a sufficient supply of labour, but good cattlemen are difficult to obtain in some districts.

Worcester, Hereford, and Gloucester.—Labour is generally sufficient to meet present requirements, although in a few districts there is some difficulty in obtaining skilled men.

Cornwall, Devon, and Somerset.—Labour is now fairly plentiful, though there is still a demand for skilled men in most districts.

Dorset, Wiltshire, and Hampshire.—The supply of labour seems to be fairly abundant now, but skilled men, such as hedgers, and to a lesser extent milkers, are still scarce.

Surrey, Kent, and Sussex.—The supply of labour is generally sufficient, but in some districts skilled men, horsemen and cattlemen in particular, are in demand.

Essex, Hertford, and Middlesex.—The supply of labour is sufficient to meet requirements, but skilled men are still needed in some parts of Essex and Middlesex.

North Wales.—The supply of labour is, as a rule, sufficient, but skilled men, horsemen and stockmen particularly, are still in demand.

Mid Wales.—The supply of labour is considered sufficient in most districts, although skilled men are scarce in a few districts.

South Wales.—In some districts the supply of labour is sufficient for requirements, but in others there is a scarcity, especially of skilled men.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of January, 1918, 1919, and 1920.

	WHEAT.			BARLEY.			OATS.		
	1918.	1919.	1920.	1918.	1919.	1920.	1918.	1919.	1920.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
London ...	74 4	73 1	72 10	59 2	62 5	111 4	54 2	62 5	62 5
Norwich ...	70 10	72 6	72 6	57 3	61 10	110 2	47 8	55 9	60 3
Peterborough	70 11	72 5	72 6	58 9	62 3	106 2	44 0	51 6	59 0
Lincoln ...	71 2	72 4	72 8	58 10	62 6	108 3	52 1	51 8	57 3
Doncaster ...	70 10	72 3	71 7	58 2	61 4	106 4	42 0	46 8	56 5
Salisbury ...	70 10	72 3	72 1	58 9	62 5	96 8	47 4	49 2	56 8

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1918, 1919 and 1920.

Weeks ended (in 1920).	WHEAT.						BARLEY.						OATS.					
	1918.		1919.		1920.		1918.		1919.		1920.		1918.		1919.		1920.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan. 3 ...	71	2	72	2	72	7	58	0	62	3	107	1	45	5	48	8	57	8
,, 10 ...	71	2	72	6	72	6	58	2	62	5	109	7	46	9	49	8	57	7
,, 17 ...	71	3	72	7	72	7	58	1	62	3	110	6	47	9	50	0	57	6
,, 24 ...	71	1	72	7	72	7	58	7	61	10	108	11	48	2	49	6	57	10
,, 31 ...	71	2	72	8	72	7	58	10	62	4	106	2	50	2	49	7	58	7
Feb. 7 ...	72	0	72	7	72	6	59	0	62	3	103	9	50	6	49	2	58	9
,, 14 ...	72	3	72	8			58	11	62	5			52	0	49	0		
,, 21 ...	72	2	72	8			58	9	62	6			52	3	49	4		
,, 28 ...	72	2	72	7			57	9	62	7			52	0	48	8		
Mar. 6 ...	72	3	72	6			58	5	62	7			52	2	48	6		
,, 13 ...	72	4	72	5			56	10	62	5			51	0	46	8		
,, 20 ...	72	3	72	7			56	9	62	1			50	3	46	4		
,, 27 ...	72	4	72	7			56	7	62	8			48	10	46	11		
Apr. 3 ...	72	11	72	6			56	7	62	8			49	10	47	2		
,, 10 ...	73	3	73	0			56	6	62	9			47	2	47	1		
,, 17 ...	73	3	73	1			56	6	62	9			47	0	47	3		
,, 24 ...	73	3	73	1			56	10	62	9			46	8	48	1		
May 1 ...	73	5	73	2			56	5	62	8			47	4	48	7		
,, 8 ...	73	5	73	2			56	6	63	1			47	6	47	5		
,, 15 ...	73	4	73	3			56	6	62	4			46	4	47	11		
,, 22 ...	73	3	73	2			56	6	62	7			47	8	47	11		
,, 29 ...	73	8	73	3			60	0	62	7			44	9	48	3		
June 5 ...	73	11	73	2			59	2	62	6			45	5	47	10		
,, 12 ...	74	3	73	3			57	9	62	8			45	7	48	11		
,, 19 ...	74	4	73	3			58	5	62	8			47	8	48	7		
,, 26 ...	74	4	73	3			57	10	63	4			46	4	49	1		
July 3 ...	74	4	73	4			61	7	62	4			46	10	49	0		
,, 10 ...	74	4	73	3			57	5	63	1			47	0	49	11		
,, 17 ...	74	3	73	4			60	5	62	9			45	4	49	11		
,, 24 ...	74	3	73	4			56	11	63	4			46	2	48	11		
,, 31 ...	74	3	73	3			57	1	62	10			45	10	50	3		
Aug. 7 ...	74	7	73	4			57	7	73	8			46	3	55	6		
,, 14 ...	74	2	73	3			61	4	75	2			55	11	61	4		
,, 21 ...	74	8	73	10			62	6	83	4			56	9	62	0		
,, 28 ...	74	8	73	3			60	1	86	7			57	11	61	10		
Sept. 4 ...	72	3	73	4			60	4	89	3			56	9	61	1		
,, 11 ...	72	5	73	5			60	1	92	5			49	2	62	4		
,, 18 ...	72	6	73	4			60	4	94	7			49	11	61	3		
,, 25 ...	72	7	73	0			60	3	95	2			50	3	60	2		
Oct. 2 ...	72	8	73	4			60	3	94	4			50	9	59	6		
,, 9 ...	72	6	73	1			60	3	95	5			51	6	58	10		
,, 16 ...	72	7	73	0			60	3	93	10			50	9	57	9		
,, 23 ...	72	5	73	0			60	3	95	1			50	5	57	5		
,, 30 ...	72	4	72	9			60	3	96	0			50	8	56	4		
Nov. 6 ...	72	4	72	8			60	3	97	10			49	11	55	3		
,, 13 ...	72	5	72	7			60	3	100	7			49	10	55	7		
,, 20 ...	72	4	72	7			60	10	104	11			51	1	55	11		
,, 27 ...	72	3	72	7			62	2	107	9			50	4	56	0		
Dec. 4 ...	72	4	72	7			62	6	108	11			51	4	55	10		
,, 11 ...	72	3	72	6			62	7	105	2			51	4	56	9		
,, 18 ...	72	4	72	6			62	3	103	6			50	5	56	3		
,, 25 ...	72	3	72	6			62	3	105	10			50	6	57	2		

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

NOTE.—The above prices are based on returns received from Inspectors during the week named. They represent on the whole the average prices ruling in the preceding week.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in January, 1920, and December, 1919.

(Compiled from Reports received from the Ministry's Market Reporters.)

Description.	JANUARY.		DECEMBER.	
	First Grade.	Second Grade.	First Grade.	Second Grade.
	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.	per cwt. live weight.
FAT STOCK:—	s. d.	s. d.	s. d.	s. d.
Cattle:—				
Polled Scots	84 10	80 0	83 1	77 3
Herefords	85 8	80 3	82 5	77 4
Shorthorns	84 9	79 9	82 5	77 4
Devons	85 3	79 9	82 1	77 1
Welsh Runts...	84 8	78 6	80 11	76 8
Fat Cows	79 8	71 8	77 4	69 3
	First Quality. per lb.*	Second Quality. per lb.*	First Quality. per lb.*	Second Quality. per lb.*
	d.	d.	d.	d.
Veal Calves	19	16½	17½	15
Sheep:—				
Downs	16	16	15½	15½
Longwools	16	16	15½	15¼
Cheviots	16	16	15½	15½
Blackfaced	16	16	15½	15¼
Welsh...	16	16	15¼	15½
Cross-breds	16	16	15¼	15¼
	per score. live weight.	per score. live weight.	per score. live weight.	per score. live weight.
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	23 0	23 0	23 0	23 0
Porkers	23 0	23 0	23 0	23 0
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	58 1	43 17	58 17	44 2
,, —Calvers ...	54 10	40 1	53 1	39 13
Calves for Rearing	4 9	3 9	4 3	3 0
Store Cattle:—				
Shorthorns—Yearlings ...	15 7	12 16	15 1	12 4
,, —Two-year-olds	27 3	22 6	26 18	21 12
,, —Three-year-olds	35 12	31 3	37 9	33 4
Herefords —Two-year-olds	27 14	23 7	29 16	23 17
Devons— ,,	27 17	22 16	27 8	22 16
Welsh Runts— ,,	—	—	25 10	20 10
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	87 11	66 6	73 9	56 11
Store Pigs:—				
8 to 12 weeks old	56 7	41 8	47 0	33 10
12 to 16 ,, ,, ...	100 9	80 10	92 10	72 11

* Estimated carcass weight.

NOTE.—The prices per lb. for sheep do not include the value of the skins, which during January, 1920, made prices equivalent to an additional 3¾*d.* per lb. of the carcass weight for Downs, Longwools and Crossbreds, 2¾*d.* for Welsh, 3¾*d.* for Cheviots, and during December, 1919, 2¾*d.* per lb. for Downs and Blackfaced, 2¼*d.* for Welsh and 3*d.* for Longwools, Cheviots and Crossbreds.

AVERAGE PRICES of PROVISIONS, POTATOES and HAY at certain MARKETS in ENGLAND in January, 1920.

(Compiled from Reports received from the Ministry's Market Reporters.)

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER :—	*s. d.* per 12 lb.	*s. d.* per 12 lb.	*s. d.* per 12 lb.	*s. d.* per 12 lb.	*s. d.* per 12 lb.	*s. d.* per 12 lb.
British	—	—	—	—	—	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	—	—	—	—	—	—
,, Factory	—	—	—	—	—	—
Imported (Controlled)	259 0	—	259 0	—	259 0	—
CHEESE—						
British—						
Cheddar	163 6	—	—	—	163 6	—
			120 lb.		120 lb.	
Cheshire	—	—	175 0	—	175 0	—
			per cwt.		per cwt.	
Canadian	163 6	—	163 6	—	163 6	—
BACON :—						
Irish (Green)	205 6	—	205 6	—	205 6	—
Canadian (Green sides)	192 0	—	192 0	—	192 0	—
HAMS :—						
York (Dried or Smoked)	—	—	—	—	—	—
Irish (Dried or Smoked)	—	—	—	—	—	—
American (Green) (long cut)	195 0	—	195 0	—	195 0	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120
British...	—	—	—	—	50 0	—
Irish	—	—	50 0	—	50 0	49 0
American	39 0	—	39 1	37 10	40 0	38 0
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Arran Chief	250 0	220 0	243 6	—	260 0	247 6
Edward VII.... ...	290 0	268 6	280 0	268 6	275 0	262 6
Other Late Varieties...	282 6	257 6	206 6	186 6	260 0	245 0
HAY :—						
Clover...	—	—	—	—	312 6	286 0
Meadow	—	—	—	—	306 0	282 6

AVERAGE PRICES OF DEAD MEAT at certain MARKETS in ENGLAND in JANUARY, 1920.

(Compiled from Reports received from the Ministry's Market Reporters.)

Description.	Quality.	Birmingham.	Leeds.	London.	Manchester.
		per cwt.	per cwt.	per cwt.	per cwt.
		s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
BEEF :—					
English	1st	140 0	140 0	140 0	140 0
	2nd	140 0	140 0	140 0	140 0
Cow and Bull	1st	140 0	140 0	140 0	140 0
	2nd	140 0	140 0	121 6	121 6
Irish : Port Killed	1st	140 0	—	140 0	—
	2nd	140 0	—	140 0	—
Argentine Frozen—					
Hind Quarters	1st	126 0	126 0	126 0	126 0
Fore ,, ...	1st	98 0	98 0	98 0	98 0
Australian Frozen—					
Hind Quarters	1st	126 0	126 0	126 0	126 0
Fore ,, ...	1st	98 0	98 0	98 0	98 0
New Zealand Frozen—					
Hind Quarters	1st	—	—	126 0	—
Fore ,, ...	1st	—	—	98 0	—
VEAL :—					
British	1st	98 0	98 0	98 0	98 0
	2nd	—	98 0	98 0	98 0
MUTTON :—					
Scotch	1st	147 0	147 0	147 0	147 0
	2nd	147 0	147 0	147 0	147 0
English	1st	147 0	147 0	147 0	147 0
	2nd	147 0	147 0	147 0	147 0
Irish : Port Killed	1st	—	—	—	—
	2nd	—	—	—	—
Argentine Frozen	1st	98 0	98 0	98 0	98 0
New Zealand ,, ...	1st	—	—	98 0	98 0
Australian ,, ...	1st	98 0	98 0	98 0	98 0
LAMB :—					
British	1st	—	—	—	—
	2nd	—	—	—	—
New Zealand	1st	98 0	—	98 0	98 0
Australian	1st	—	98 0	98 0	98 0
Argentine	1st	98 0	98 0	98 0	—
PORK :—					
British	1st	—	—	163 6	—
	2nd	—	—	—	—
Frozen	1st	133 0	133 0	133 0	—

DISEASES OF ANIMALS ACTS 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Ministry of Agriculture and Fisheries.)

DISEASE.	JANUARY.	
	1920.	1919.
Anthrax :—		
Outbreaks	43	23
Animals attacked	48	24
Foot-and-Mouth Disease :—		
Outbreaks	24	12
Animals slaughtered as diseased or exposed to infection ...	1,277	744
Glanders (including Farcy) :—		
Outbreaks	3	—
Animals attacked	6	—
Parasitic Mange :—		
Outbreaks	837	868
Animals attacked	1,582	1,885
Rabies :—		
Number of cases	2	16
,, ,, Dogs affected ...	2	15
,, ,, other animals affected ...	—	1
Sheep-scab :—		
Outbreaks	140	103
Swine Fever :—		
Outbreaks	223	89
Swine slaughtered as diseased or exposed to infection ...	82	34

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	JANUARY.	
	1920.	1919.
Anthrax :—		
Outbreaks	—	—
Animals attacked	—	—
Glanders (including Farcy) :—		
Outbreaks	—	1
Animals attacked	—	2
Parasitic Mange :—		
Outbreaks	21	11
Sheep-scab :—		
Outbreaks	51	71
Swine Fever :—		
Outbreaks	1	5
Swine slaughtered as diseased or exposed to infection ...	4	13

The Weather in England during January.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.		Diff. from Average.	No. of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	In.	Mm.*	Mm.*		Hours.	Hours.
Week ending 3rd Jan.:								
England, N.E. ...	38·1	−0·1	0·75	19	+ 7	4	1·0	−0·1
England, E.	40·2	+2·1	0·79	20	+ 8	5	1·0	−0·2
Midland Counties ...	39·5	+1·6	0·82	21	+ 6	5	0·8	−0·3
England, S.E. ...	41·7	+1·8	1·21	31	+16	6	0·9	−0·4
England, N.W. ...	40·0	+0·1	0·91	23	+ 4	5	1·1	+0·1
England, S.W. ...	41·4	+0·9	2·02	51	+26	7	0·9	−0·4
English Channel ...	46·0	+0·9	2·01	51	+30	7	1·1	+0·7
Week ending 10th Jan.:								
England, N.E. ...	37·4	−0·5	0·66	17	+ 4	4	1·5	+0·4
England, E.	37·4	−0·3	0·55	14	+ 1	3	1·8	+0·4
Midland Counties ...	37·4	−0·3	0·99	25	+10	4	1·3	+0·2
England, S.E. ...	38·3	−1·2	0·93	24	+10	4	1·8	+0·3
England, N.W. ...	38·6	−0·7	1·01	26	+ 7	4	0·7	−0·4
England, S.W. ...	39·3	−1·9	1·70	43	+20	4	2·2	+0·7
English Channel ...	43·0	−1·8	0·68	17	− 3	4	2·4	+0·6
Week ending 17th Jan.:								
England, N.E. ...	43·5	+5·7	0·39	10	0·0	4	1·7	+0·6
England, E.	45·3	+8·1	0·50	13	+ 3	5	1·0	−0·6
Midland Counties ...	46·0	+9·0	0·44	11	0·0	5	1·4	+0·1
England, S.E. ...	46·9	+8·1	0·67	17	+ 5	5	0·9	−0·7
England, N.W. ...	44·7	+5·7	0·72	18	+ 3	5	1·4	+0·2
England, S.W. ...	46·9	+6·4	1·16	29	+10	6	0·9	−0·7
English Channel ...	48·0	+4·1	1·15	29	+11	6	1·0	−0·9
Week ending 24th Jan.:								
England, N.E. ...	42·2	+3·9	0·40	10	+ 2	5	2·0	+0·5
England, E.	42·4	+3·7	0·29	7	− 2	4	1·4	−0·1
Midland Counties ...	43·3	+5·4	0·24	6	− 4	5	1·3	−0·1
England, S.E. ...	43·8	+4·5	0·22	6	− 6	5	1·4	−0·2
England, N.W. ...	43·7	+4·1	0·93	24	+ 8	5	1·6	+0·3
England, S.W. ...	45·2	+4·1	0·36	9	− 9	5	1·7	+0·2
English Channel ...	46·5	+2·3	0·39	10	− 4	5	2·3	+0·3
Week ending 31st Jan.:								
England, N.E. ...	39·7	+1·2	0·86	22	+13	6	2·5	+0·8
England, E.	41·3	+3·0	0·82	21	+12	5	2·4	+0·3
Midland Counties ...	41·1	+2·7	1·47	37	+25	6	2·5	+0·9
England, S.E. ...	43·3	+3·7	1·30	33	+21	6	2·6	+0·7
England, N.W. ...	41·5	+1·8	1·24	32	+14	6	1·7	0·0
England, S.W. ...	43·5	+2·5	1·99	50	+29	7	2·1	+0·3
English Channel ...	45·8	+1·6	1·42	36	+20	6	1·9	−0·4

* 1 inch = 25·4 millimetres.

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

The Use of Electricity in Agriculture, with special reference to its Development in Germany, *J. F. Crawley.* (Jour. Roy. Soc. Arts, 26th September, 3rd and 10th October, 1919.) [63.17(04).]

Further Studies on the Soils of N. Wales, *G. W. Robinson* and *C. F. Hill.* (Jour. Agric. Sci., September, 1919.) [63.111.]

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The Amount and Composition of Rain Falling at Rothamsted, *E. J. Russell and E. H. Richards.* (Jour. Agric. Sci., October, 1919.) [551·5.]

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Observations on Soil Protozoa, *D. W. Cutler.* (Jour. Agric. Sci., October, 1919.) [63.115.]

A Note on the Capillary Rise of Water in Soils, *B. A Keen.* (Jour. Agric. Sci., October, 1919.) [63·112.]

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Some Cases of Buttercup Poisoning in Cattle, *W. S. Mulvey.* (Vet. Jour., August, 1919.) [63.255.]

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Birds, Poultry and Bees—

Nosema Apis in Hive Bees, *J. Rennie* and *Elsie J. Harvey.* (Scott. Jour. Agric., October, 1919.) [63.81.09.]

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KESTON HERD OF PEDIGREE MIDDLE WHITE PIGS, owner Dr. M. J. Rowlands. Strains from all the best known herds. Reared on open-air system, out winter and summer; the only way to breed pigs free from tuberculosis. All pigs guaranteed true to type, size, and, above all, health. Prices from 2 guineas per month. Apply Nash Farm, Keston, Kent.

JEROME, Mrs., Bilton Hall, York.—Pedigree Middle White Pigs, prize-winners. Boars and Gilts for sale.

PIGS—*continued.*

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STAPLEFORD HERD OF MIDDLE WHITE PIGS. A few choice gilts and boars always for sale at reasonable prices. C. S. HARVEY, Wymondham, Oakham.

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LARGE BLACK.

EDGE, S. F., GALLOPS HOMESTEAD, DITCHLING, SUSSEX.—Pedigree Large Blacks, marvellous open air strain.

LUDLOW HERD OF LARGE BLACK and ASHFORD HERD OF MIDDLE WHITE PIGS.—Pedigree Boars and Gilts for sale; bred on open air system from unrelated stock; eligible for Herdbooks.—Apply MANAGER, Woodlands Pig Farm, Ludlow, Shropshire.

NEWHOUSE HERD of Pedigree Large Black Pigs. Boars and Gilts from best strains.—ROBERT FORTUNE, Newhouse Cranleigh, Surrey.

PICKWELL HERD of Pedigree Large Pigs. Boars and Gilts from best strains at reasonable prices. Captain CLAUDE W. HEMP, Pickwell, Bolney, Sussex.

DUNSTALL HERD of Pedigree Large Blacks, bred from prize strains under natural conditions. Prolific, hardy, grand doers and of choice type. Young Boars and Gilts. Prices Moderate.—LIONEL E. HORNE, Moreton-in-Marsh, Glos.

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THE FAIRFIELD HERD OF GLOUCESTER OLD SPOT PIGS for Sale. 100 to choose from, including winners at Hereford and Worcester Show. Gilts, Boars, and S ws with litters; also, owing to change of blood, several Boars by Berkeley Foreman.—J. B. DOWDING, Fairfield, Leominster.

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WILLIAM ROBERTSON,

Seed Potato Growers,

PERTH.

LONDON JOINT CITY & MIDLAND BANK

LIMITED.

BALANCE SHEET, 31st December, 1919—

continued.

LIABILITIES.	£	s.	d.
Brought forward	418,848,771	12	9
	£418,848,771	12	9

ASSETS.	£	s.	d.
Brought forward	206,899,504	18	7
Advances on Current and other Accounts	162,966,744	16	0
Advances on War Loans...	15,589,303	5	2
Liabilities of Customers for Acceptances	29,014,568	4	5
Bank Premises, at Head Office and Branches	,618,960	8	7
Belfast Bank Shares :—			
50,000 £12 10 0 Old Shares £2 10 0 paid			
150,000 £12 10 0 New Shares £2 10 0 paid			
Cost £1,237,500			
Less part premium on Shares issued... 477,810 0 0	759,690	0	0
	£418,848,771	12	9

PROFIT AND LOSS ACCOUNT for the year ending 31st December, 1919.

Dr. **Cr.**

	£	s.	d.
To Interim Dividend at the rate of 18 per cent. per annum, less Income Tax, paid 15th July, 1919	522,211	11	4
,, Dividend at the rate of 18 per cent. per annum, less Income Tax, payable on 2nd February, 1920	530,292	2	1
,, Salaries and Bonus to Staff with H.M. Forces and Bonus to other Members of the Staff	475,202	14	8
,, Special "Peace" Bonus to Staff ...	250,000	0	0
,, Reserve for Depreciation of War Loans and Future Contingencies	1,000,000	0	0
,, Bank Premises Redemption Fund ...	250,000	0	0
,, Balance carried forward to next account...	726,852	6	2
	£3,754,558	14	3

	£	s.	d.
By Balance from last Account	675,097	14	7
,, Net profits for the year ending 31st December, 1919, after providing for all Bad and Doubtful Debts	3,079,460	19	8
	£3,754,558	14	3

R. McKENNA, CHAIRMAN.

W. G. BRADSHAW, A. H. GOSCHEN, F. W. NASH, DIRECTOR. — DEPUTY CHAIRMEN.

S. B. MURRAY, F. HYDE, J. F. DARLING, — JOINT MANAGING DIRECTORS.

REPORT OF THE AUDITORS TO THE SHAREHOLDERS OF THE LONDON JOINT CITY & MIDLAND BANK LIMITED.

In accordance with the provisions of Sub-section 2 of Section 113 of the Companies (Consolidation) Act, 1908, we report as follows:—

We have examined the above Balance Sheet in detail with the Books at Head Office and with the certified Returns from the Branches. We have satisfied ourselves as to the correctness of the Cash Balances, Cheques on other Banks *in transitu*, and the Bills of Exchange, and have verified the correctness of the Money at Call and Short Notice. We have also verified the Securities representing the Investments of the Bank, and having obtained all the information and explanations we have required, we are of opinion that such Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Company's affairs according to the best of our information and the explanations given to us and as shown by the books of the Company.

WHINNEY, SMITH & WHINNEY, CHARTERED ACCOUNTANTS, *Auditors.*

LONDON, 13*th January*, 1920.

THIS BANK IS THE PROPRIETOR OF THE BELFAST BANKING COMPANY, LIMITED.