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THE JOURNAL

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BOARD OF AGRICULTURE

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APRIL, 1914.

A COMPARISON BETWEEN THE FAT STOCK AND THE CARCASSES EXHIBITED AT SMITHFIELD SHOW.

JAMES LONG.

In recent years the consumer has shown a greater preference for leaner meat and smaller joints than he did formerly. The bacon curer regulates the price which he pays to farmers for their pigs in accordance with the thickness of the fat upon the back. The butcher declines to pay as much money for over-fat cattle and sheep as for stock that have been normally fed, his decision being the result of the preference shown by his customers for joints which are less wasteful, or—to put it in the terms of the modern housekeeper—more profitable on the table. Where a joint, like a leg of mutton or a sirloin of beef, contains a large quantity of fat, in addition to the bone and other inedible matter, the cost of the edible meat is increased, with the result that butchers' meat becomes one of the most costly of those foods which are provided for daily consumption.

The primary aim of the Smithfield Club—as of all Fat Cattle Show Committees—is, in the words of the former, *to encourage the selection and breeding of the best and most useful animals for the production of meat, and to test their capabilities in respect of early maturity*. In conformity with this desire, numbers of landowners and farmers breed, or purchase and feed, the best class of stock for exhibition, and thus friendly competition is the means by which a large collection of pure and cross-bred cattle, sheep and pigs is, each December, displayed at the Agricultural Hall, Islington.

In 1896 it was decided to add a new section to the Smithfield Show, and to offer prizes for the best carcasses of beef and mutton; and, partly owing to the popularity and practical character of this portion of the programme, and partly to the

success which has attended it, this new form of competition has continued ever since. As the years have passed, however, there has been a considerable reduction in the live weight of the animals intended for slaughter for the carcass department as compared with those of similar age and variety shown in the regular classes. The condition of the latter has contrasted disadvantageously with that of the former, when that condition is regarded from the standpoint of profitable butchers' meat. The pig may be taken as an example, because the condition of a specimen of each type, quite apart from the weights, can be more readily compared and appreciated.

If the carcasses of mercantile pigs, *i.e.*, pigs of the most saleable and profitable class, as they hang in the shop of the butcher, are inspected, it will be found that the fat upon the back varies from three quarters of an inch to one and a half inches in thickness, or half an inch more on the collar; that the weight of the carcass varies from 100 to 130 lb.; and that joints are comparatively small. The bacon pig of the best factory type weighs 160 to 175 lb. alive, or—allowing 80 per cent. for carcass weight—56 lb. for cured lean sizable sides, or 62 lb. for the stout sizable side—those with not more than 2 in. of fat on any part of the back realising the best prices. While, therefore, the porker should not exceed 100 lb. alive, and the bacon pig 175 lb., we find that at the last Show the fat pigs in the open classes averaged from 314 lb. to 402 lb. in the junior class—*i.e.*, under 9 months—and 400 lb. to 508 lb. in the senior class (9 to 12 months).

The judges of the competition held in December last showed a decided preference, not only for lean but for small meat; and this fact applies to the carcasses of cattle and sheep, as well as to pigs. The writer carefully examined each of the 169 competing carcasses, and, with the exception of three cattle and one sheep—none was excessively fat—all the prize exhibits were normally lean; indeed, with very few exceptions, the entire collection consisted of carcasses of excellent meat. When, however, the weights of the animals before they were slaughtered are compared with those of similar breeds and ages as exhibited in the open classes—in which they were judged alive—it is found that their live weights and calculated carcass weights indicate very considerable difference, both in the size of their joints and their condition, as denoted by the relative proportion of lean and fat. This difference was accentuated in the classes for steers and heifers between two and three years old—suggesting still more forcibly than

other circumstances suggested years ago that the younger the animal matures and can be "finished" for slaughter, the smaller will be the cost of producing a pound of meat, the better its quality, and the smaller the waste. This fact has long been observable in relation to the pig. Thus, the late Mr. Allender obtained hams from pigs 27 weeks old, which, when dried and smoked, weighed 20 lb. each; while, as shown below, many other breeders have obtained great weights from very young specimens. It was in 1903 that classes for pigs were added to the carcass section of the Smithfield Show; and in that year, in which the writer examined every exhibit, the great majority of the specimens were too fat—notes in his catalogue pointing to the fact that, in the older class—for in that year there were only two classes—the fat on some carcasses reached three to nearly four inches on the back; the great majority, quite different from those shown in 1913, were excessively fat.

What occurred in the case of the pigs also occurred in connection with cattle at the commencement of the carcass competition in 1896, when each exhibit was examined. In that year the two-year-old steers averaged 1,323 lb. in weight alive, and 864 lb. in the carcass, or 65 per cent.—the winner, an Aberdeen, being excessively fat. In the older class (2 to 3 years) the winner, a Welsh, 28½ months old, weighed 1,576 lb. alive, and 1,024 lb. in the carcass, or again 65 per cent.—whereas the second prize, a Galloway, weighed 1,398 lb. alive, and 928 lb. dead, or 66 per cent. of the live weight.

The writer has only one record of the weight of sheep in 1896—the first prize shortwool lamb, a Hampshire, which, at 8½ months weighed 180 lb. alive and 122 lb. in the carcass, which was very fat, as was almost every carcass in each class. In some cases the fat on the ribs reached 1½ in. to 2 in. in thickness, while there was hardly any lean meat on the skirt. The best carcasses in the competition were, as in 1913, the Cheviots and Suffolks.

In 1898 only one carcass of beef—and that the winner of the gold medal—realized 5s. a stone; and, although no steer under two years fell below 3s. 6d., carcasses of steers between 2 and 3 years old fell to 2s. 6d. Notes were made at the time of some typical instances of cattle which were apparently sold at a loss. Thus, an Aberdeen weighing 1,146 lb. in the carcass, at 2 years 8 months and 3 weeks, was sold at 2s. 8d. a stone, or, in round figures, £19. A cross-bred Aberdeen heifer weighing 1,017 lb., at 2 years 5 months and 2 weeks, sold at 3s. 2d. per stone. Prize carcasses in this competition—all very fat—realised only 2s. 4d. to 2s. 8d. per stone.

In the classes for sheep in 1898 several of the carcasses realized only 3½d. per pound. The price paid for a Cheviot weighing 198 lb. alive, and 131 lb. dead (or 66 per cent. of the live weight), was £1 17s. 11d., or less than a good lamb of a large short-woolled breed at 18 weeks old. The market-price of good mutton at the time was 4s. 6d. to 5s. 6d., per stone, according to current quotations.

In the following Table are quoted the actual average live weights and the estimated carcass weights of the pigs in the open classes in 1913. Although fat pigs in the Smithfield and similar competitions reach higher figures, 80 per cent. has been adopted in these classes as the percentage of carcass weight. The weights in the carcass classes are the actual weights:—

Average Live and Carcass Weights of Pigs (1913).

Breed.	Under 9 months.		9 to 12 months.	
	Live weight.	Estimated weight of Carcass.	Live weight.	Estimated weight of Carcass.
	lb.	lb.	lb.	lb.
Berkshires ..	335	268	400	320
Tamworths ..	314	250	476	380
Lincolns ..	402	321	469	376
Large Whites ..	383	306	490	392
Middle Whites..	302	241	400	320
Large Blacks ..	396	316	508	406
—	Under 9 months.		Under 12 months.	
	Live weight.	Actual Carcass weight.	Live weight.	Actual Carcass weight.
	lb.	lb.	lb.	lb.
Prize pigs in Carcass class ..	180	149	255	208
—			Alive.	Carcass.
Prize pigs in class best suited for bacon			lb. 224	lb. 183

It should be pointed out that although the pigs in the carcass classes, the weights of which are averaged, were required to be under 9 months and under 12 months old respectively, it was a condition in the one case that the weights should exceed 100 lb., but not exceed 220 lb., and in the other that they should be within the limits of 220 lb. and 300 lb. In the younger class the four prize winners were respectively: 1st, 6½ months, 2nd, 8½ months, 3rd, 6¾ months, and 4th, 8¼ months old. Three were Berkshires, and one a cross between the Large White and the Berkshire. The weights of the unnoticed pigs were not taken. In the class "not exceeding 12 months" the ages were: 1st prize, 11½ months, 2nd, 10 months, 3rd, 10¾ months, and 4th, 10 months. These were all Berkshires, and their weights varied but little.

As regards 1903, the first year of the pig carcass show, of the three prize winners in the class weighing 100 to 220 lb.—no age being specified—the 1st prize went to a Berkshire weighing 200 lb. alive and 165 lb. in the carcass, and the 3rd prize to a Tamworth-Berkshire scaling 176 lb.—or 141 lb. in the carcass. These pigs, like the 2nd prize animal, a Berkshire, were excessively fat. In the class above, 220 lb. in weight, the 1st prize pig, a Middle White, weighed 294 lb. alive and 250 lb. dead, and the 2nd, a Berkshire, 288 lb. alive and 246 lb. dead—both being 8 to 9 months old. In this class the fat on the back of several specimens measured 3 in., and in one case 4 in. in depth.

The classes for carcasses of sheep at the Smithfield Show of 1913—six in number—were for lambs and wethers of Short-woolled, Long-woolled, and Cross-bred sheep. In each case the weights of the four prize-winners are taken for comparison—the weights of the remainder not being available. As, however, the breeds represented were limited in number, the average weights of these breeds are separately tabulated. Thus, in the carcass classes for Long-woolled wether lambs and wether sheep the whole of the eight prize-winners were Cheviots. While, too, the Long-wools have been grouped, the Cheviots are averaged separately, together with the leading long-woolled varieties. In the short-woolled classes the prize lambs consisted of two Southdowns and two Suffolks, and the sheep of two Southdowns, a Suffolk, and a Hampshire. Among the four cross-bred lambs, two were Suffolk-Cheviots; while, among the wethers, three were Cheviot crosses by the Suffolk, the Oxford, and the Southdown respectively—the fourth being a Suffolk cross. These facts are mentioned because the Cheviot has been a frequent and conspicuous winner in the

carcass classes, followed by the Suffolk—the more notable breeds having been almost as constantly absent.

Average Live and Carcass Weights of Sheep (1913).

Breed.	Open Classes.	
	Live Weight.	Estimated Carcass Weight.
	lb.	lb.
Long-wool lambs	172	94
" wethers	248	142
Short-wool lambs	177	99
" wethers	244	146
Short-wool crosses, lambs	187	108
Short and long-wool cross lambs	172	99
" wethers	299	180
Cheviot and Mountain 1st cross lambs..	164	90
" wethers	239	136
Cheviot lambs	152	83
" wethers	237	136
Suffolk lambs	200	112
" wethers	239	143
Southdown lambs	137	78
" wethers	191	108

Prize lots.	The Carcass Classes.	
	Live Weight.	Actual Carcass Weight.
	lb.	lb.
Long-wool lambs, all Cheviots	115	63
" wethers, all Cheviots	138	79
Short-wool lambs, Southdowns.. .. .	95	54
" Suffolk	134	75
" wethers, Southdowns	122	69
Other short-wools, wethers	160	98
Cross-bred lambs	120	58
" wethers	164	98

The carcass weights of the various breeds shown in the above table have been calculated on the basis of the percentages of the prize sheep in the carcass classes. Thus, the carcasses of

the Cheviot lambs were 55 per cent. of the live weight—the proportion throughout varying from 55 to 58 per cent. The carcass weights of the wethers varied from 56 per cent. for the Southdowns to 60 per cent. for the Suffolks and the Short-woolled crosses, which included a Suffolk-Cheviot, an Oxford-Cheviot, a Southdown-Cheviot, and a Suffolk-Southdown. It will be noticed that, whereas the lambs in the open-classes weighed alive from 137 lb. (Southdowns) to 200 lb. (Suffolks), the lambs in the carcass classes weighed only 95 lb. to 134 lb. The estimated carcass weights, also, varied from 108-180 lb.,

Steers under two years (1913).

Breed.	Open Class.	
	Average Live Weights.	Estimated Carcass Weights.
	lb.	lb.
Devons	1,290	839
Herefords	1,419	922
Shorthorns	1,483	964
Sussex	1,356	881
Red Polled	1,320	858
Aberdeens.. .. .	1,352	879
Galloways.. .. .	1,231	800
Welsh	1,391	904
Crossbred (1st cross)	1,421	924
" (2nd and 3rd cross)	1,368	889

	Carcass Class.	
	Average Live Weight.	Actual Carcass Weight.
	lb.	lb.
Prize steers	1,226	806

in the wethers, and 78-112 lb. in the lambs—the Southdowns, as the smallest sheep, weighing the least. On the other hand the greatest weights among the carcasses of lambs were smaller than the lowest estimated weight among the exhibition lambs; while the heaviest wether carcass (98 lb.) was smaller by 43 lb. than the average estimated dead weight of all the exhibition

wethers. If a comparison of the two lots—the fat sheep and the carcasses—be based upon the respective weights per quarter a still better idea of their economical value as food is obtained. It should be mentioned that the Welsh, Exmoor, Ryeland, Kerry Hill, and Dorset sheep have not been included in this examination, owing partly to the difference in their classification, and partly to their less representative character.

The section for cattle presents greater difficulties, owing to the composition of the classes in the carcass competition. In the class for steers under two years old, for example

Steers from two to three years old (1913).

Breed.	Open Class.	
	Average Live Weights.	Estimated Carcass Weights.
	lb.	lb.
Devons	1,803	1,172
Herefords	1,978	1,286
Shorthorns	1,873	1,217
Sussex	1,826	1,187
Red Polls	1,492	970
Aberdeens	1,760	1,144
Galloways	1,672	1,087
Welsh	1,722	1,119
Highland	1,513	983
Crossbred (1st cross)	1,925	1,251
.. (2nd and 3rd cross)	1,667	1,084
	Carcass Class.	
	Average Live Weight.	Actual Carcass Weight.
	lb.	lb.
The whole class	1,330	854

(Table, p. 7), two were Shorthorns; four were respectively Welsh, Devon, Galloway, and Aberdeen; and five were crossbred. In the older class—2 to 3 years old (Table above)—of

ten beasts, two were Welsh, one each Aberdeen and Galloway, and six cross-bred—the Shorthorn and Aberdeen crosses prevailing. In the carcass class for heifers (not exceeding three years old, Tables below), of twelve animals slaughtered, three were Aberdeens, including the champion, three were Galloways, one was a Dexter, and another a Dexter cross—both omitted owing to their abnormally small size—while the remainder were cross-bred—all being bred between the Shorthorn and the Aberdeen or the Galloway.

Heifers under two years (1913).

Open Class.		
Breed.	Average Live Weights.	Estimated Carcass Weights.
	lb.	lb.
Devons	1,351	878
Herefords	1,298	844
Shorthorns	1,336	868
Sussex	1,372	892
Aberdeens	1,249	812
Crossbred (1st cross)	1,269	825
.. (2nd and 3rd cross)	1,383	899
Carcass Class.		
	Average Live Weight.	Actual Weight.
	lb.	lb.
Eight animals, including the winners ..	1,146	747

As the carcasses of the steers under two weighed 65 per cent. of the live weight, this figure has been adopted in estimating the carcass weight of the live cattle in the open class. Although the cattle in the carcass class which have been included in the table on p. 7 were all products of the large breeds, their average live weights were smaller than those of the cattle in either of the open classes—the difference being most marked in the case of the Shorthorns, Herefords, Welsh, Sussex, Aberdeens, and crossbred stock.

In the class for steers between two and three years old (Table, p. 8), 65 has again been adopted as the percentage of carcass weight, although it will be seen that this figure is scarcely reached by the actual carcasses. The four prize animals, however, which were in higher condition than the unnoticed cattle,—approximating more closely to the cattle in the open classes—reached 67 per cent., which is too high a figure for judicial calculation.

There were no classes in the live competition for Red Polled, Galloway, Welsh, or Highland heifers under two years old.

Of the twelve exhibits in the carcass class for heifers under three years old, two are omitted as already mentioned—the Dexter and the Dexter cross—while two others were between two and three years old, leaving eight under two years.

Heifers two to three years old (1913).

Breed.	Open Class.	
	Average Live Weights.	Estimated Carcass Weights.
	lb.	lb.
Devons	1,598	1,039
Herefords	1,556	1,011
Shorthorns	1,606	1,044
Red Polled	1,536	998
Aberdeens	1,627	1,058
Galloways	1,358	883
Welsh	1,553	1,009
Crossbred (1st cross)	1,709	1,111
„ (2nd and 3rd cross)	1,642	1,067
Carcass Class.		
	Average Live Weight.	Actual Weight.
	lb.	lb.
Shorthorn-Aberdeen	1,382	924

It is unfortunate that the number of animals between two and three years old in the carcass class for heifers under three

years was limited to two, and that the weight of one of these was not taken. The prizes, however, all went to heifers under two. The one two-year-old, therefore, which is available for comparison is a Shorthorn-Aberdeen. The weights of first prize heifers in two previous years were respectively 1,332 lb., an Aberdeen, with a carcass weight of 908 lb.; and 1,161 lb., an Aberdeen-Shorthorn, with a carcass weight of 760 lb.

The most remarkable difference between the weights of the cattle in the live competition and the carcass classes is found in the older steers in the latter, which weighed alive 162 lb. less per head than the average of the lightest living class, and 648 lb. per head less than the average of the heaviest. The younger steers in the carcass competition, on the other hand, while scaling considerably less than every class but one (the Galloways) were only 257 lb. and 195 lb. respectively less per head than the two heaviest classes—the Shorthorns, and the first crosses. Again, the younger heifers, like the younger steers in the carcass class, approximated more closely to the carcass weights than the older heifers. In each section, however, the carcass beasts, which generally produced such excellent meat, were substantially leaner, and consequently lighter in weight than the cattle shown in the ring.

Conclusions.—The question arises whether the facts which have been elicited above warrant any practical conclusion. The average live weight of the steers under two years old in the classes tabulated is 1,363 lb. Omitting the Highland cattle the average weight in the class from two to three years is 1,772 lb., a difference of 409 lb., or an estimated difference in the carcass weight of 266 lb. This suggests in the first place that it cannot pay the feeder to retain a steer for the additional year involved, since the actual weight of beef produced would barely exceed 5 lb. a week. This fact scarcely needs further demonstration.

Again, the estimated average carcass weight of the whole of the steers under two years old is 886 lb., or 80 lb. more than that of the prize steers in the carcass class, while in the class for steers between two and three years old the estimated average carcass weight is 1,136 lb., or 282 lb. more than the actual average carcass weight of the whole carcass class. Although the facts published in the press are not sufficient to warrant the quotation of prices, there can be no doubt that if, as we believe to be the case, the exhibits in the carcass classes provided the best quality of meat, the cattle in the open classes did not, and the weights, which mean so much additional fat, support this belief.

In the classes for heifers similar results are obtained, again showing the economical value of early maturity. The average live weight of the older animals, in this case including the whole of the classes, which are not so distinct as those of the steers, is only 1,576 lb., against an average of 1,322 lb. for the younger, showing an increase of 254 lb., which is reduced to 165 lb. of carcass. No further argument is needed to show that this cannot pay. When the average estimated carcass weights are compared, over-fatness, deficient quality and reduced value are indicated. The younger heifers average 860 lb. against an actual carcass average of 747 lb., while the older heifers average 1,024 lb. against the one first class carcass weighing 924 lb. If, as one is bound to suppose, the superior meat of the carcass classes realises a better price than that provided by the fatter animals in the open classes, it would appear that the primary object of the cattle show is defeated.

Is the same conclusion warranted in relation to sheep and pigs? Exhibitors have learned from experience what class of sheep to produce in order to win in the carcass classes. The lambs average 116 lb. alive and the wethers 146 lb., whereas the average weight of the former in the open classes tabulated is 170 lb., and of the latter 242 lb. The differences in the carcass weights are equally surprising. The estimated carcass weight of the lambs in the open classes is 95 lb. and of the wethers 141 lb., while the actual average weights in the carcass classes are 62 lb. and 86 lb. If the latter weights are more suitable to the consumer, and consequently to the butcher, than the former, as they appear to be, it follows that the sheep exhibited are fattened too much without any corresponding advantage. It will, however, be within the recollection of both judges and exhibitors that the carcasses now sent to Smithfield are much superior, owing to their leaner condition, than at the earlier shows.

The remarks as to sheep apply with still greater force to the pigs, which realise much higher prices when their condition resembles that of the competing carcasses than when they are excessively fat, as were the great majority in the open competition. Breeders and feeders will, if these conclusions are correct, obtain better results by finishing their fattening cattle as early as possible, and by avoiding excessive fatness all round.

THE UTILITY POULTRY CLUB'S TWELVE MONTHS' LAYING COMPETITION, 1912-1913.

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THIS competition, which commenced on October 15th, 1912, and ended on October 14th, 1913, included a laying test of one hundred pens of six pullets each, representing seventeen different breeds.

The entries consisted of:—

Breed.	No. of Entries.	Breed.	No. of Entries.
Wyandotte ..	35	Croad Langshan ..	3
Leghorn ..	21	Salmon Faverolles ..	2
Orpington ..	14	Black Minorca ..	1
Rhode Island Red ..	7	Silver Campine ..	1
Buff Plymouth Rock ..	7	Barred Plymouth Rock ..	1
Ancona ..	4	Red Sussex ..	1
Black La Bresse ..	3		

The Land.—The land used for the test was covered with new turf consisting mainly of clover and rye-grass. It was considered doubtful whether turf so recently established would be able to withstand the heavy stocking with poultry, the probability being that it would be damaged beyond hope of recovery. At the end of the test, however, the grass runs were all well covered with turf, although the clover had completely disappeared. During the summer months a considerable amount of hay was mown. The hay removed would be of considerable value as fodder for other farm stock, but in the case of this test it was utilised mainly as nesting material and as litter for the scratching sheds.

An area of two hundred square yards was allotted to each pen. Allowing for necessary roadways and site for food and egg store-sheds, the land was stocked at the rate of 133 birds to the acre.

New turf has an advantage over old turf, since the latter, when it has been heavily stocked, becomes so saturated with poultry manure after the first few years, that it is no longer suitable for poultry. In addition, land which is heavily stocked with poultry ceases to produce clover, and this in itself is a great disadvantage, clover being especially valuable as a food for egg production. "Sweetness" of soil has an

important bearing on the success of poultry-keeping, and the value of cultivation and cropping as a means of sweetening the soil has frequently been pointed out. For example, arable land can be laid down to temporary pasture for two years, and during this time used exclusively for poultry. It can then be ploughed up, cultivated and cropped for two years, and then again laid down to temporary pasture for poultry. This is a system which should prove profitable and advantageous in the case of the small holder devoting special attention to poultry-keeping. It would certainly ensure sweet soil for the poultry, and poor arable lands treated in this manner, being enriched by the manurial residues from the poultry, could undoubtedly be made to produce larger crops and so be more profitable.

The Pens.—To return to the experiment, the pens were constructed with $2\frac{1}{2}$ -in. mesh wire-netting and were subdivided diagonally. The object of this sub-division was to allow the birds to have the use of the two halves alternately. This arrangement was most beneficial to the runs as, owing to the heavy nature of the soil, they quickly puddled, and during wet weather the water was unable to drain away. The cost per run, including erection, was £2 2s. 7½d.

The Houses.—In designing a suitable house for the test many points had to be considered, the main object being to obtain a house having all the advantages of a well constructed laying-house at a reasonable cost. Nearly all the houses were built in pairs, and were constructed in sections which bolted together. They were of the open-fronted type, boarded up from the ground to a height of 2 ft., and above this were adjustable glass slides with wooden shutters. The shutters were hinged to the roof, so that they could either be fixed to prevent rain beating into the houses, or closed up entirely, or placed on the roof in summer, thus leaving the whole of the wire-netted portion of the front of the house quite open. The houses were not provided with wooden floors, but were placed direct on the soil, on the same level as the run. This made it almost impossible to keep the floors dry during wet periods. This difficulty in keeping the houses dry necessitated extra expenditure on litter, and doubtless had some effect in reducing the egg yield during the winter months below what it might have been had the houses been set upon bricks and the centre filled in with rammed earth.

In each pen were three trap-nests, made in one set, and raised 14 in. from the ground level. This allowed the whole of the

floor space to be utilised for scratching purposes. The perches were placed above the trap-nests.

Method of Feeding.—The method of feeding adopted at the beginning of the test was to give two meals per day. A soft, warm mash was fed early in the morning, and grain in the afternoon, the latter being buried in the litter. Under this treatment the birds did not take sufficient exercise, there being a tendency to inertia after the morning feed of warm mash. This method was changed to three feeds per day; the morning feed consisting of warm mash as before, but in less quantity, followed almost immediately by grain food given in the litter. This litter consisted of oat straw, wheat straw, cavings, peatmoss, or dried grass cut from the pens, scattered to a depth of about 6 in. all over the floors inside the houses. The third feed was given in the afternoon as before. As the change was obviously beneficial, the birds appearing much brighter, healthier, and more active, the method of feeding was reversed, one feed of grain being scattered amongst the litter in the morning, and one of warm mash being provided in the afternoon. This gave better results than either of the former methods and was therefore adhered to throughout the rest of the test. It was considered essential to keep the birds busy scratching as much as possible, and by this method of feeding the maximum amount of scratching was obtained.

Foods Used.—The grain food consisted of a mixture of the following grains in the proportions stated (by measure):—

Buckwheat, 5 parts.	Kibbled Peas, $2\frac{1}{2}$ parts.
Dari, 5 "	" Beans, $2\frac{1}{2}$ "
Hemp, 1 part.	" Maize, 5 "
Millet, 1 "	

This mixture was fed in conjunction with other grains, as follows:—

- (1) Kibbled Wheat 1 part by measure.
Mixture 1 " "
- or
- (2) Kibbled Wheat 1 " "
Whole Oats 1 " "
Mixture 2 parts by measure.

The oats used were short and plump and of the Scotch Potato Oat type. Rather more maize was used in cold and wet weather, and in summer it was reduced to about half the quantity fed in winter. All large grains were kibbled as small as possible in order to encourage and prolong scratching. The meal was sifted out before feeding and utilised in the warm mashes.

The warm mash consisted of the following :—

Biscuit Meal	..	..	..	6 parts by measure.
Bran	..	..	..	6 " "
Fish or Meat Meal	..	..	..	3 " "
Sharps	..	..	..	8 " "
Sussex Ground Oats	..	..	..	2 " "

The biscuit meal, bran, and fish or meat meal were all thoroughly scalded with boiling water. They were then put into the mixing trough together with the vegetable foods, the various meals were added, and the whole mixed thoroughly by hand, until in a fairly crumbly state. In this condition the mash was fed in troughs or on the ground in the runs.

The vegetable foods were given in the form of steamed swedes, carrots, or raw, chopped onions. In winter these three vegetables were taken in rotation. In summer lawn clippings, chopped lettuce, chaffed lucerne and cabbages were given mixed in the mash, chopped raw onions being also given occasionally. Fresh green bone was given once a week in winter, the allowance being about $\frac{1}{2}$ oz. per bird. A plentiful supply of flint grit and oyster shell was always kept before the birds.

As much food was given as the birds would consume readily, the quantity depending upon the breed, on the condition of the birds, on the extent of egg laying, and on whether the birds were moulting or broody.

Cost of Food.—The total cost of the food consumed during the twelve months was £237 16s. 5d. This amount included the cost of oyster shell, grit, bone meal, and medicines. The average cost of feeding per bird for the year was 7s. 11d., or 1.8d. per bird per week. In order to pay for its food, it was necessary for each bird to lay a minimum of 83.4 eggs. Of the 600 birds competing in the test only thirty failed to lay the specified number of eggs.

	Total for 600 birds.	Per pen of 6 birds.	Per bird.
	£ s. d.	£ s. d.	£ s. d.
Value of eggs laid in twelve months	431 11 6	4 6 3.7	0 14 4.6
Cost of food for twelve months	237 16 5	2 7 6.8	0 7 11.1
Balance over cost of food	193 15 1	1 18 8.9	0 6 5.5

Food used to produce One Pound of Eggs.—In order to ascertain how much food is required to produce a given weight of eggs, the total weight of each grade of eggs, calculated on the basis of the lightest egg in the grade, has been taken. This has been necessary, since the actual weight of the eggs laid is not available, the records kept only showing the grade and not the actual weights of the individual eggs. The large eggs called "A" grade, all scaled 2 oz. and over, so that in all probability the average weight of such eggs might possibly be $2\frac{1}{4}$ oz. or even more, since a very large percentage weighed well over 2 oz. The same would apply to the "B" grade eggs, which weighed between $1\frac{1}{2}$ oz. and 2 oz., the average probably being about $1\frac{3}{4}$ oz., since many weighed almost 2 oz. Very few "C" grade eggs (under $1\frac{1}{2}$ oz.) were laid, so that they would not materially affect the total weight either way. Since the minimum weight instead of the actual weight has been taken, the weight of eggs produced per pound of dry food consumed as shown below is less than it was in reality :—

Food consumed and Eggs produced.

Food consumed and Eggs produced.				T. c. lb.
Total minimum weight of	" A "	grade eggs	(2 oz.)	3 17 84
" "	" B "	" "	(1½ oz.)	0 17 97
" "	" C "	" "	(1 oz.)	0 0 7
" "	All	" "	..	4 15 76

Total weight of food consumed 25 17 28

These food and egg weights show that in order to produce 1 lb. of eggs 5.4 lb. of dry food were consumed, when the minimum weight of eggs is taken. If, however, it is assumed that the "A" grade eggs average $2\frac{1}{4}$ oz., and the "B" grade eggs $1\frac{3}{4}$ oz., then the total weight of eggs produced would be increased by 12 cwt. 78 lb., reducing the amount of food required to produce 1 lb. of eggs to 4.8 lb.

Average Cost and Value of 1 lb. of Eggs.

Weight of dry food consumed to provide 1 lb. of eggs	= 5.4 lb.
Average value of 1 lb. of eggs	= 9.7 pence.
Cost of food required to produce 1 lb. of eggs	= 5.3 "
Balance over cost of food	= 4.4 "

Quantities of Graded Eggs.

Total "A" grade laid	= 69,666	= 76.46 per cent.
" "B" "	= 21,342	= 23.42 "
" "C" "	= 107	= 0.12 "
Total "A," "B" and "C" grades laid	= 91,115	= 100. per cent.

Broody Hens.—Broody hens were removed from the nests as soon as the first signs of broodiness were apparent, and were put into spar-bottomed coops of the "Sussex fattening cage" type, which were raised about 4 in. from the ground, allowing a free circulation of air all round the birds. In most cases they quickly got over the broody stage under this treatment. During broodiness they were fed with the same foods as when laying. Many birds, though showing all the signs of broodiness, continued to lay whilst in this condition. It was thought that this fact might possibly indicate good laying qualities. With this idea in mind twenty-nine hens which showed this tendency were noted and watched. It was found that nineteen laid more than the average number of eggs, and ten laid less than the average. This in itself does not seem to indicate that this particular characteristic has any bearing upon egg production.

Test of Broody Hens.

19 birds throughout the test averaged	184.0 eggs.
10 " " "	138.0 "
29 " " "	168.1 "
Average for all birds in competition	151.9 "

Number of Eggs Laid.—The total number of eggs laid throughout the competition was 91,115—an average of 911.15 per pen, or 151.9 per bird. The greatest number of eggs laid by any one pen was 1,389—an average of 231.5 eggs per bird. The smallest number laid by one pen was 526—an average of 87.6 per bird.

Number of Eggs Laid.

Total eggs laid in 12 months by 600 pullets ..	91,115
Average number of eggs laid in 12 months by 6 pullets (1 pen) ..	911.15
Greatest number of eggs laid in 12 months by 6 pullets (1 pen) ..	1,389
Average number of eggs laid in 12 months by each pullet in best pen ..	231.5
Average number of eggs laid by best ten pens (per pen)	1,179

Value of Eggs Laid.—The total value of eggs laid was £431 11s. 6d., the valuation being made on the basis of the returns of the Board of Agriculture and Fisheries for the year 1911. Eggs weighing 2 oz. and over were valued at full market price; those under 2 oz. but over 1½ oz., at 15 per cent. less than market price, and all under 1½ oz. were considered valueless.

Values of Eggs Laid.

	No. of pullets.	£	s.	d.
Total value of eggs laid by all pens	600 ..	431	11	6
Value of eggs laid by best pen ..	6 ..	7	0	3½
Average value of eggs laid per bird in best pen	1 ..	1	3	4½
Average value of eggs laid by all pens	6 ..	4	6	4
Average value of eggs laid per bird by all pens	1 ..	0	14	5
Value of eggs laid by lowest pen	6 ..	2	7	3½
Average value of eggs laid per bird in lowest pen	1 ..	0	7	10½

Selecting the Best Layers.—The most reliable method of selecting the best layers in a flock at the present time undoubtedly consists in the use of the trap-nest, but it has certain disadvantages which rather detract from its value. The great disadvantages are (1) the initial extra expenditure required in the purchase or manufacture of suitable trap-nests, and (2) the extra labour entailed in carrying out the actual work of trap-nesting and recording. These disadvantages are sufficient to deter the small poultry keeper from keeping accurate records. The larger poultry keeper is able to reduce the cost of labour considerably by running large numbers of birds together in specially constructed houses, but even then the outlay on trap-nests is not reduced.

Observations were made to ascertain the relationship between the time of commencement of laying and the total number of eggs produced in a year. From previous observations, it was conjectured that early laying and especially prolificacy during the early winter months, were probable signs of a good layer. All the birds tested were hatched in the same year, principally in March and April, the lighter breeds being hatched chiefly in April, and the heavier in March. The result of the observations made in connection with this Competition showed that all those birds which laid ten eggs or more, or commenced to lay at all, during the first month of the test, gave a higher average than any others in the Competition, and the average number of eggs for those which commenced to lay in the second month was higher than that for those commencing in the third month, which again was higher than that for those which did not lay in the first three months.

Average Number of Eggs Laid by Birds Commencing to Lay at Different Times.

	Average.
Birds which laid 10 or more eggs in first month ..	187.5
Birds which laid at all in first month ..	167.7
Birds which did not lay for one month ..	161.4
Birds which did not lay for two months ..	135.8
Birds which did not lay for three months ..	106.3
Average for whole of birds entered ..	151.9

From these figures it would seem that those birds which laid well during the first month might then have been picked out, and on the average would have proved exceptionally good layers, and that those which laid at all during the first month might have been chosen and expected to lay reasonably well, and so on according to the time of commencing to lay. The important months seem to be October, November and December, October being the most important. If such indications, on being substantiated by further tests, should prove a reliable guide in the selection of the best layers, considerable time, labour, and expense could be saved by discarding all those birds which, if hatched during March or April, did not commence to lay before the end of the same year. In applying this hypothesis, however, it must be remembered that there will be many exceptions due to individual characters and health, and consequently a single bird which lays well during the autumn need not necessarily prove an excellent layer throughout the year, but the average yield of all such birds will be high. This does not take into consideration external effects such as method of rearing, feeding, or housing, which may have a considerable influence upon egg production.

Returns from an Acre of Grass.—A comparison has been made of the gross returns obtainable from one acre of grass land when stocked entirely with poultry, and the same area used for milk production.

An experiment carried out on the College farm at the same time as the competition, shows that one acre of grass land can be made to produce 2,528 lb. of milk. The cows producing this had extra food valued at 8s.; the value of the milk produced was £6 1s. 2½d. From this must be deducted rent and rates (£2 per acre) and cost of extra feeding (an allowance of 10s. is made in the rent for value of winter grazing). This would leave a gross profit over food of £4 3s. 2½d. In the case of the poultry the balance, after deducting the cost of the food from the value of the eggs, was £193 15s. 1d. over the whole experiment, which gives a

balance of £42 19s. per acre. Deducting the same rent and rates as in the milking experiment (£2 per acre), the gross profit from the poultry is £40 19s. per acre. To obtain the net profit per acre, depreciation of stock and plant should be taken into consideration, also interest on capital expended, and the cost of labour. Since the necessary amount required to be expended in plant and labour, in the case of a laying competition, is very much greater than would be necessary were the same number of birds kept on commercial lines, these figures have not been considered here, as the results would not be representative of actual practice. For example, the cost of plant alone in this test works out at nearly £1 per bird, whereas if the birds were kept on the semi-intensive system, all in one large house, the cost for plant per bird would not be more than 5s. It must be borne in mind that, although the gross return per acre in the case of the poultry is so much greater than for cattle, expenses in the former case would be correspondingly high; that is to say, the capital, labour, and depreciation of stock would be very much greater. Unfortunately there do not appear to be any available figures which might be utilised for the purpose of comparison. That the possibilities of egg production on commercial lines are great cannot be denied. The actual determination of these possibilities, and the factors which govern production, should prove an interesting and profitable field for further investigation.

THE POLLINATION AND FERTILISATION OF HOPS; AND THE CHARACTERISTICS OF "SEEDED" AND "SEEDLESS" HOPS. *

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Differences in the Nature of the Crop due to the Action of Male Hops.—Some actual cases which have been closely investigated may now be given to show what differences in the weight and nature of the crop may be caused by the fertilising effect of the male hop. In these, the value of planting male hops is shown on a large and practical scale, and the evidence completes that of the statistical diagrams already examined.

One of the most closely examined cases is that of the hop-garden at Wye College in the season of 1907. In Fig. 8 a plan of this garden (of 6 acres) is given. In July of that year there was plenty of bine and plenty of "burr," and the College garden compared favourably with any garden in the neighbourhood. As the season advanced, however, it became clear that the promise of a good crop was not going to be fulfilled, and as a matter of fact the hops throughout the garden never "grew out"—except in two places. In these two places, which were some distance apart, the hops for some way along several consecutive alleys were well grown out (and seeded), and presented the appearance shown in Fig. 10, the upper branch in Fig. 9 and the lower row of hops in Fig. 1.† Elsewhere in the garden the hops were miserably small, seedless and not grown out, and presented the appearance shown in Fig. 11, the lower branch in Fig. 9, and the upper row of hops in Fig. 1.

An investigation was made in order to discover the cause of the great difference in the hops in different parts of the garden. It was found that there were four male hop-plants in the garden; their position is shown by the four black dots in the main garden (Fig. 8). The two places where the hops grew out well were situated immediately to the N.E. of two of these males, one male being in the low row on the S. side, and one being towards the middle of the lower half of the garden. It seemed probable, therefore, that pollen-dust had drifted on the wind in a north-easterly direction from these two males, and had fertilised the "burr" in these two areas, causing it to develop into well grown out and seeded hops. On consulting the College

* Continued from the *Journal* for February, 1914, p. 953.
† See this *Journal* for February last.

records of the direction of the wind from July 27th to August 21st, which covered the time when the hops were in "burr," it was found that the wind had been S., or W., or W.S.W. on every day but two, thus confirming the supposition that the pollen-dust had been carried from the two males in a N.E. direction to the two places where the hops were well grown out. This meteorological record explains further why pollen-dust had not entered the garden to any appreciable extent from the

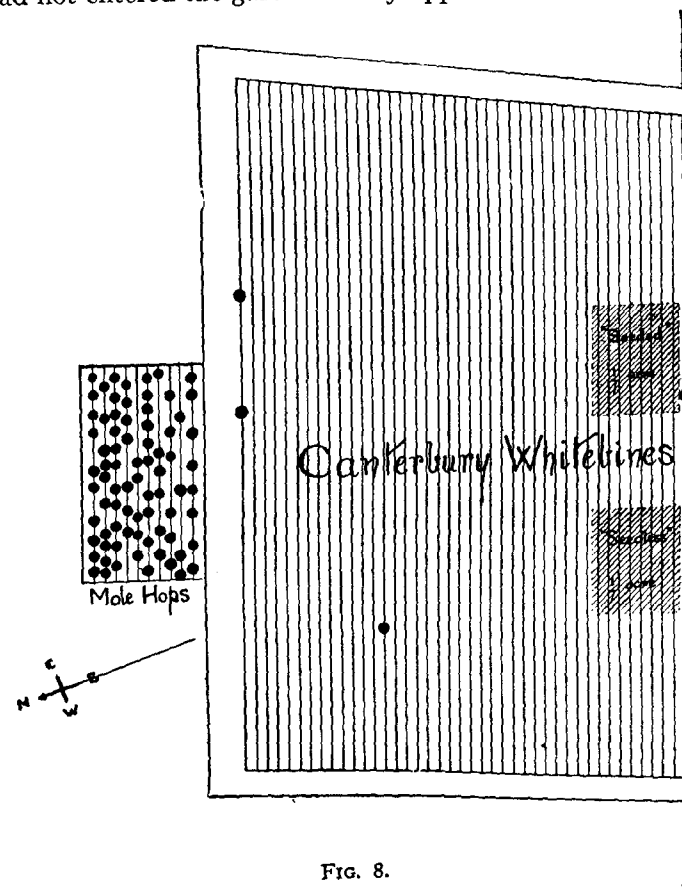


FIG. 8.

two male plants in the low row on the N. side, nor from the 77 male hops which were then being grown for experimental purposes in a garden on the N. side (see Fig. 8). The College hop-garden occupies an isolated position as regards other hop-gardens; consequently the hops had depended for pollen entirely (except for two days) on the male hop in the low row on the S. side and on the male hop towards the middle of the garden.

To ascertain exactly what the differences were in the parts of the garden where fertilisation had taken place, and where it had not, two plots of equal size were selected, and thoroughly investigated. One of the two places where the hops grew out well was situated close to the male in the lew row on the S. side: here an area of $\frac{1}{7}$ acre (comprising hills in eight alleys) was marked off. This area, labelled "seeded," is shown shaded in the plan (Fig. 8). A few yards to the N.W. of this area the hops were not "grown out," and were very small. An exactly similar area, of $\frac{1}{7}$ acre, comprising hills in the same eight alleys as in the first area, was marked off here; this is shown shaded and labelled "seedless" in the plan (Fig. 8). The hops were picked separately from these two areas and weighed, dried, and pocketed separately. Finally, samples from each pocket were submitted to hop-factors.

The results obtained are given in Table X. Before examining these, it will be well to note the difference in the general appearance of the hops from the two areas. The branch of

TABLE X.

Wye College Hop-garden (Canterbury Whitebines).	" Seeded " Area.	" Seedless " Area.
Area picked	$\frac{1}{7}$ acre.	$\frac{1}{7}$ acre.
Number of bushels	88 $\frac{1}{2}$.	42 $\frac{1}{2}$.
Dry weight	1 cwt. 1 qr. 9 lb.	2 qr. 26 lb.
Equal to per acre	91 $\frac{1}{2}$ cwt.	5 $\frac{1}{2}$ cwt.
Average number of seeds per hop (100 hops)	9 $\frac{1}{2}$	$\frac{1}{2}$
Average length of hop (100 hops) ..	1 in.	$\frac{3}{4}$ in.
Average number of bracteoles per hop (100 hops)	26 $\frac{1}{2}$	28 $\frac{1}{2}$
Value per cwt., as estimated by Factors in the Borough, London	84/- to 95/-	54/- to 70/-

well "grown out" hops in Fig. 10, also the upper branch in Fig. 9, and the lower row of hops in Fig. 1, are representative of the crop in the "seeded" area. The branch of small, not "grown out" hops shown in Fig. 11, also the lower branch in Fig. 9, and the upper row of hops in Fig. 1, are representative of the crop in the "seedless" area.

It is important to note that the hops of the "seedless" area were small, not because an insufficient number of "petals" had been produced, but simply because, through the absence of pollen-dust, no fertilisation of the "burr" had taken place.



FIG. 9.—Above, a branch of hops from the "seeded" area. Below, a branch of hops from the "seedless" area.

This can be seen clearly by an examination of Fig. 1. The third hop (counting from left to right) in the upper row of seedless hops was composed of more "petals" than the second hop (counting from left to right) in the lower row of seeded hops, and would have attained a greater size than this if it had received pollen-dust when in "burr."

Turning now to the differences enumerated in Table X.: the number of bushels picked was $88\frac{1}{2}$ from the "seeded" area, $42\frac{1}{2}$ from the "seedless" area. The dry weight of the hops was 1 cwt. 1 qr. 9 lb. from the "seeded" area, while from the "seedless" area it was 2 qr. 26 lb. This is equal to a weight *per acre* of $9\frac{5}{16}$ cwt. as against $5\frac{1}{8}$ cwt.

One hundred hops from each area had been taken without selection from the "green bags" as soon as the picking was finished; each hop was picked to pieces, and the results of the analysis tabulated as shown in Table II*, which records the characteristics of 25 hops from the "seeded" area. It was found that the average number of seeds per hop in the "seeded" area was $9\frac{1}{2}$, that is to say, on the average, the first hop would be found to contain 9 seeds, the second 10 seeds, the third 9 seeds, and so on. In the "seedless" area the average number of seeds per hop was one-half, that is to say, on the average, the first hop would have no seeds, the second one, the third none, and so on.

The average length of the hop in the "seeded" area was 1 inch; in the "seedless" area $\frac{3}{4}$ inch. Now the increase in weight of the crop of the "seeded" area over that of the "seedless" area was $4\frac{3}{16}$ cwt. per acre. This increase was solely due to the "growing out" of the "seeded" hops as the result of fertilisation and the consequent production of seed. The figures show, then, that an average increase of $\frac{1}{4}$ inch in the length of the hop added $4\frac{3}{16}$ cwt. per acre to the yield.

A very important fact remains to be noted, viz., the average number of "petals" of which the hops in the two areas were composed. If, on analysis, it had been found that the hops from the "seeded" area contained more "petals" than the hops from the "seedless" area, the increase in weight of the crop from the "seeded" area might have been due to the increased vigour of the bines in that part of the garden. The analysis, however, showed (Table X.) that, judging from the number of "petals" per hop, the bines in the "seedless" area were quite as vigorous as those in the "seeded" area, since in the "seeded" area the average number of *bracteoles* per hop was only $26\frac{1}{2}$, while in the "seedless" area it was $28\frac{1}{2}$.

* *Journal*, February, 1914, p. 962.

It is quite clear, therefore, that the increase in yield shown by the bines in the "seeded" area was due solely to the fact that the "burr" had received pollen-dust from a male hop.

Samples were drawn from the pockets of the "seeded" and "seedless" hops, and submitted to several well-known firms of hop-factors in the Borough, London. The prices per cwt. quoted were as follows: for the "seeded" hops 84s. to 95s.; for the "seedless" hops 54s. to 70s. Taking these figures, and those of the yield per acre of the two areas, we find that the difference in the value of a crop of $9\frac{5}{8}$ cwt. at the average between 84s. and 95s., and one of $5\frac{1}{8}$ cwt. at the average between 54s. and 70s., is equal to the sum of £25 15s. 9d. per acre.

To sum up: the male hop had, through fertilising the "burr" with its pollen-dust and so making the hops "grow out" better, increased the yield at the rate of $4\frac{3}{8}$ cwt. per acre, and the value of the crop (at the price of hops then current) at the rate of £25 15s. 9d. per acre.

One further point is worthy of note as completing the evidence of the value of the male hop in the above case. There was every reason to believe that the hills in the two areas were equal as regards their vigour; the areas were within a few yards of one another, on the same kind of soil and with the same aspect, and the hills were of the same variety and age, and had received exactly the same manuring and cultivations. Actual proof, however, was obtained that the hills in the "seedless" area were *potentially* equal to those in the "seeded" area with regard to the production of large hops. It so happened that earlier in the season two opposite fertile lateral branches of the same bine of a hill in the "seedless" area had been used for an experiment in "cross" breeding, and the "burr" of one branch was dusted over with pollen, while that of the other (control) branch received no pollen. When the hops were ripe it was found that the unpollinated branch bore small seedless hops, similar to those in the "seedless" area generally, while the hops of the pollinated branch were well grown out and seeded, and—although borne by a bine in the middle of the "seedless" area—they exactly resembled those gathered from the "seeded" area.

There can be no doubt, then, that if pollen-dust had reached the "burr" throughout the "seedless" area, the hops there would have been equal in size to those of the "seeded" area. In other words, we have the final proof which shows conclusively that it was the presence of pollen-dust alone which increased the crop in the "seeded" area to the extent of $4\frac{3}{8}$ cwt. per acre.

The facts obtained by the systematic examination of a sample

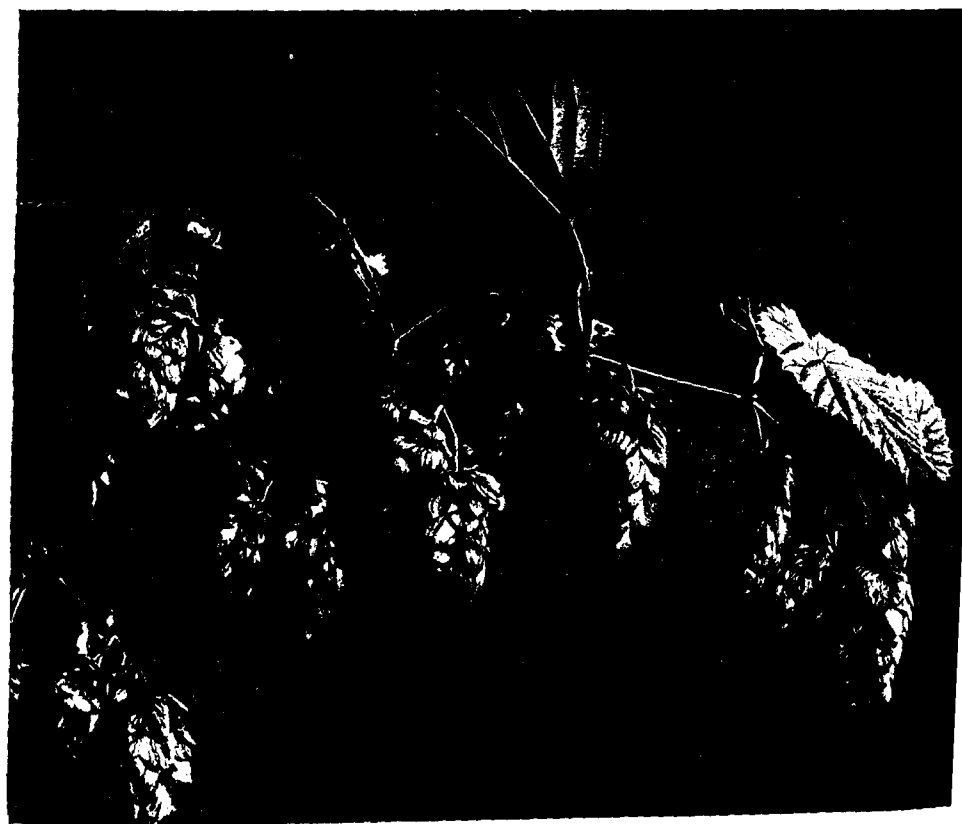


FIG. 10.—A branch of "seeded" hops (Canterbury Whitebine) from Wye College hop-garden.



FIG. 11.—A branch of "seedless" hops (Canterbury Whitebine) from Wye College hop-garden.

of the crop in the College hop-garden for four consecutive seasons afford striking evidence as to the effect of fertilisation in increasing the crop. The following Table gives the particulars obtained from the crops grown from 1906 to 1909, the figures being the result of an analysis of 100 hops taken each season from the "green bags" at the time of picking.

TABLE XI.

Year.	Average Length of Hop in inches.	Average Number of Bracteoles per Hop.	Average Number of Seeds per Hop.	Ratio of Seeded to Seedless Bracteoles.
1906	.85	27	1.1	10 to 235
1907 ("seedless" area)	.75	28	.5	10 to 550
1907 ("seeded" area)	1.10	27	9.7	10 to 18
1908	1.17	30	10.2	10 to 19
1909	1.19	29	13.6	10 to 11

It can plainly be seen that the gradual increase in the length of the hop from .85 inch in 1906 to 1.19 inch in 1909 has been dependent on the increase in the number of seeds per hop. This is due entirely to the influence of male hops on the garden. Further, the quality of the hops has undoubtedly been improved from the market standpoint, as shown by the prices obtained for these hops. Leaving the history of this garden at this point it may be said that in 1906 the hops were not "grown out" because of the absence of sufficient seed; in 1909 the hops were well "grown out" because of the production of sufficient seed.

As further illustrating the practical importance of supplying male hops, three cases may be mentioned concerning, respectively, the Amos' Early Bird, the Bramling, and the Fuggles varieties, where the hops did not "grow out" properly.

In Fig. 12 we have a photograph of two branches (on the same scale) of the "Early Bird" hop. These branches were gathered in different parts of the same hop-garden, and it can be seen at once that the hops are properly "grown out" only on the left-hand branch. An examination of the garden showed conclusively that this difference in the "growing out" of the hops, which was noticeable in many places in the garden, could not be attributed to any differences in the vigour of the respective hills, the nature of the soil, or the aspect. The cause of the difference was found on picking to pieces the hops of the two branches. Table XII. gives the structure of the

TABLE XII.

No. of Hop in Fig. 12 (left hand branch).	Length of Hop in inches.	Number of Seeded Bracteoles.	Number of Seedless Bracteoles.	Total Number of Bracteoles.
1	$1\frac{3}{4}$	9	38	47
2	$1\frac{1}{2}$	10	29	39
3	$1\frac{5}{8}$	11	27	38
4	$1\frac{1}{4}$	6	22	28
5	$1\frac{3}{4}$	18	26	44
6	$1\frac{1}{4}$	7	25	32
7	$1\frac{1}{4}$	9	21	30
8	$1\frac{3}{4}$	11	30	41
9	$1\frac{1}{4}$	8	20	28

TABLE XIII.

No. of Hop in Fig. 12 (right-hand branch).	Length of Hop in inches.	Number of Seeded Bracteoles.	Number of Seedless Bracteoles.	Total Number of Bracteoles.
1	$1\frac{1}{2}$	2	44	46
2	1	1	33	34
3	$\frac{7}{8}$	0	36	36
4	$1\frac{1}{8}$	0	40	40
5	1	0	40	40
6	$\frac{7}{8}$	0	38	38
7	1	1	27	28
8	$\frac{7}{8}$	0	34	34
9	1	2	26	28
10	$\frac{3}{4}$	0	30	30
11	1	0	40	40
12	$\frac{3}{4}$	0	28	28

nine largest hops of the left-hand branch. In the hops which are properly "grown out," each hop consists of from 28 to 47 bracteoles, and contains from 6 to 18 seeds per hop. These may be called the "seeded" hops. Table XIII. gives the structure of the twelve largest hops of the right-hand branch shown in Fig. 12. Here each hop is composed of from 28 to 46 bracteoles, and is either quite seedless or contains 1 or 2 seeds only. These may be called the "seedless" hops. It will now be useful to compare (Table XIV.) those hops from the two branches shown in Fig. 12, which are composed of approximately the same number of bracteoles.

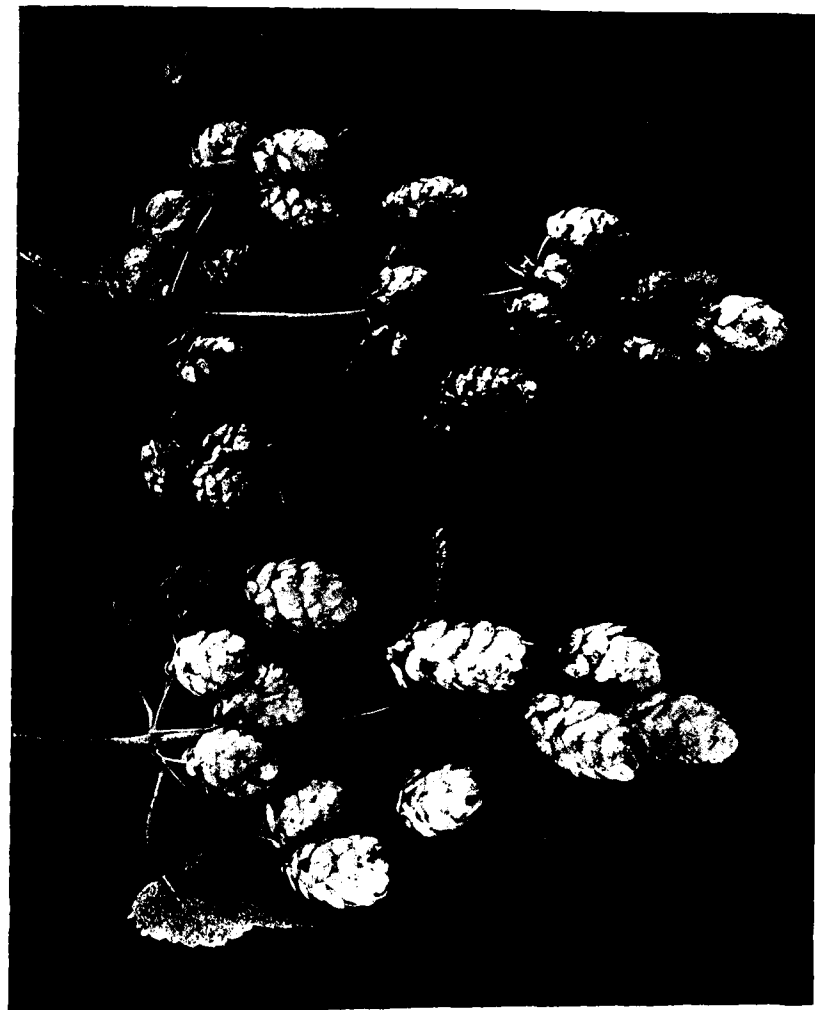


FIG. 12.—Photograph of two branches (on the same scale) of the "Early Bird" hop; the one to the left had been fertilised by a male hop, and the hops have "grown out"; the branch to the right had not been fertilised, and the hops have consequently not "grown out."

TABLE XIV.

" SEEDED " HOPS.			" SEEDLESS " HOPS.		
No. of Hop in left-hand branch.	No. of Bracteoles.	Length of Hop in inches.	No. of Hop in right-hand branch.	No. of Bracteoles.	Length of Hop in inches.
4	28	$1\frac{1}{4}$	7	28	1
9	28	$1\frac{1}{4}$	9	28	1
7	30	$1\frac{1}{4}$	10	30	$1\frac{1}{4}$
6	32	$1\frac{1}{4}$	2	34	1
3	38	$1\frac{1}{8}$	6	38	$1\frac{1}{8}$
2	39	$1\frac{1}{2}$	5	40	1
8	41	$1\frac{3}{4}$	11	40	1
5	44	$1\frac{3}{4}$	1	46	$1\frac{1}{4}$

Table XIV. shows that hops of the " Early Bird " variety having the same " structure," *i.e.*, the same number of " petals," depend for " growing out " on being fertilised by a male hop. The " seeded " hops of the left-hand branch in Fig. 12 show an increase in length of from $\frac{1}{4}$ inch to $\frac{3}{4}$ inch over the " seedless " hops of the right-hand branch, *although the structure of both is the same*. This increase in length of the " seeded " hop means a considerable difference in the weight of the crop. In the case of a Canterbury Whitebine garden which was closely investigated (see above, p. 22), it was found that an average increase of $\frac{1}{4}$ inch in the length of the hop increased the yield by $4\frac{3}{8}$ cwt. per acre. In the present case the increase in length of these " Early Bird " hops would mean an increase of some 8 cwt. per acre. It can be said, therefore, that the small hops of the right-hand branch could be transformed into the large, properly " grown out " hops of the left-hand branch—a change meaning an increase of some 8 cwt. per acre—*simply by the planting of male hops which bloom at the time when these " Early Bird " hops are in " burr."*

Further evidence establishing the same point is shown by the hops, also of the " Early Bird " variety, seen in Figs. 13 and 14. In each case is shown a bunch of four small hops by the side of four properly " grown out " hops. Taking first the hops shown in Fig. 13, it was found on analysis that the larger hops (to right) were composed as shown in the next table.

The hops consisted of 24 to 40 bracteoles, they were well "grown out," mostly over an inch in length, and contained 4 to 11 seeds.

Number of Hop in Fig. 13 (to right).	Length of Hop in inches.	Number of Seeded Bracteoles.	Number of Seedless Bracteoles.	Total Number of Bracteoles.
1	1	4	20	24
2	1½	5	25	30
3	1½	11	19	30
4	1½	7	33	40

The small hops (Fig. 13, to left) were examined, and found to be composed as follows:—

Number of Hop in Fig. 13 (to left).	Length of Hop in inches.	Number of Seeded Bracteoles.	Number of Seedless Bracteoles.	Total Number of Bracteoles.
1	1	1	29	30
2	1	1	37	38
3	¾	0	34	34
4	1	0	44	44

The hops were much smaller, not properly "grown out," and did not exceed an inch in length—a condition *not* due to lack of "petals"—since these hops have from 30 to 44 bracteoles—but to the *almost total absence of seed in the hop*.

With regard to Fig. 14, the larger hops (to left) were composed as follows:—

Number of Hop in Fig. 14 (to left).	Length of Hop in inches.	Number of Seeded Bracteoles.	Number of Seedless Bracteoles.	Total Number of Bracteoles.
1	1½	11	29	40
2	1½	5	25	30
3	1½	11	19	30
4	2	15	35	50

The seeds in these hops were distributed at regular intervals along the "strig," and usually there was only one seed to each pair of bracteoles. For the reason already stated, this had the full effect of lengthening the hop as much as possible.



FIG. 13.—Photograph of two branches, each bearing four hops (*on the same scale*); the hops to the right are "seeded" and "grown out"; those to the left are "seedless" and not "grown out." (For explanation of numbers, see p. 30).



FIG. 14.—Photograph of two branches, each bearing four hops (*on the same scale*); the hops to the left are "seeded" and "grown out"; those to the right are "seedless" and not "grown out." (For explanation of numbers, see p. 30).

The smaller hops (Fig. 14, to right) were composed as follows :—

Number of Hop in Fig. 14 (to right).	Length of Hop in inches.	Number of Seeded Bracteoles.	Number of Seedless Bracteoles.	Total Number of Bracteoles.
1	1	0	30	30
2	1½	0	30	30
3	1	0	30	30
4	1½	2	50	52

The small hops in Fig. 14 did not "grow out" owing to the absence of fertilisation and the consequent absence of seed.

The point of practical importance for the hop-grower is this : that hops of the small size shown in Figs. 13 and 14 will grow into hops of the large size shown there *if male hops which bloom at the right time are planted in the neighbourhood.**

(To be continued.)

THE CULTURE OF EARLY FLOWERS IN CORNWALL AND THE SCILLY ISLANDS.†

In various parts of Cornwall and the Scilly Islands a large business is carried on in the production of early flowers, more particularly Narcissi, for the English markets, and as the industry is one about which information is often sought, visits were paid to some of the principal growing centres during the third week of March, 1913, for the purpose of enquiring into the conditions under which the flowers are grown and marketed, the knowledge thus obtained being summarised in the accompanying notes.

The bulb industry had its inception about 30 years ago, the object in view being the provision of a supplementary farm crop for agriculturists who had previously depended to a great extent upon the production of broccoli and early potatoes. For several years the work was largely of an experimental nature and only affected a few people, but it is now included as a necessary and regular part of the routine of many arable farms and small holdings, and farmers and cottagers alike

* In the writer's opinion the successful commercial cultivation of the Early Bird variety—a Golding hop of the finest flavour—is absolutely dependent on the presence in the garden of suitable (*i.e.*, very early-flowering) male hops.

† W. Dallimore, *Kew Bulletin*, No. 5, 1913.

derive a certain portion of their income from the sale of flowers and bulbs.

All of the five Scilly Islands that are inhabited are equally interested in the industry, viz., St. Marys, Tresco, St. Agnes, St. Martins, and Bryher. On the Mainland, the neighbourhood of Penzance is the centre of the industry, although there are growers in the vicinity of Falmouth and elsewhere. Farmers thereabouts are handicapped by the long distance which separates them from important markets, hence, to recuperate themselves for losses due to heavy railway rates and packing, they rely upon the extra profit which is obtained by producing crops a few weeks earlier than is possible in a less favoured climate, for throughout winter, climatic conditions are very equable and the slight frosts which occur are at infrequent intervals. In the past, the two most approved crops for the purpose were potatoes and broccoli and these were repeated with almost unfailing regularity, almost to the exclusion of other crops, until bulb-growing came to be thoroughly understood, when it was found to be more profitable than either of the other crops, although it entailed more work. Fortunately the deep loamy soil which produces good crops of potatoes is quite suitable for bulb culture, therefore it is possible to effect a distinct change of crop and still retain one which is remunerative.

Soil and Situation.—The soil generally is a fertile loam composed largely of humus and disintegrated granite, and the best land in the neighbourhood of Penzance is said to be rented at from £8 to £10 an acre. Much of that on the cliffs, however, is worth less than half that amount. Many of the bulbs are grown within a short distance of the sea, and between the village of Paul and Penzance the faces of the cliffs, from a few feet above sea-level to the summit, have been terraced to form small irregular-shaped fields which are fully exposed to the sun. The reclamation of this land from the bare hillsides has been a costly undertaking, for beneath a rough vegetation of gorse, coarse grasses, and other weeds, the ground was plentifully besprinkled with pieces of granite varying in weight from a few ounces to several tons. All that could be handled were removed to a depth of 1½ or 2 feet and built up as protection walls and windbreaks around the fields, the larger ones being left where they stood. An idea of the cost involved in this work may be gathered from the fact that the last two acres cleared on one farm, including wall building, cost upwards of £60 an acre. It is possible, however, that the work would have been done much cheaper by contract.

Shelter from Wind.—Generally, the bulbs growing on the cliff sides are as healthy and vigorous as those planted elsewhere, but in a few instances, where the foliage is sometimes washed by spray or there is insufficient shelter from wind, they are not doing well. The two most serious drawbacks to successful cultivation appear to be badly-drained ground and exposure to rough winds, and it is courting failure to form plantations unless proper provision is made to ensure thorough drainage and efficient shelter. In the most exposed places on the Mainland, shelter is first provided by walls of stones and soil, 3 to 4 feet high, and after that by hedges of elderberry. The elderberry does not, however, appear to be an ideal plant for the purpose, as it becomes leggy and thin at the bottom. In Tresco, the great hedge plant is *Escallonia macrantha* and the bulb fields are intersected by hedges 6 ft. high. But these are within a shelter belt of *Pinus insignis* and *Cupressus macrocarpa*, and it is doubtful whether the same plant would prove so satisfactory on the exposed cliffs near Penzance. The plants one would suggest for trial are *Euonymus japonicus*, *Olearia Haastii*, sea buckthorn (*Hippophae rhamnoides*), common gorse, and various kinds of *Tamarix*. In one place *Fuchsia Riccartoni* was noted doing very well as a hedge in a very exposed place. Between the *Escallonia* hedges at Tresco, further protection is provided by screens of the common reed (*Phragmites communis*). The reeds are collected when dry and woven between strands of wire to form long mats. These are then secured in an upright position between stout posts. In other places old fishing nets are used as a wind break, but the reed mats are vastly superior and may be easily made by farm hands. Ordinary close sheep hurdles might also be introduced with advantage. There is one use for which old fish netting is well adapted, that is secured on stakes to form a screen for young hedges. Plants screened in this way develop much more rapidly than those left unprotected. Wind plays the greatest havoc amongst the bulbs after the leaves are fully grown, although it is a disadvantage from the time growth commences. A violent wind causes the leaves to be laid almost flat on the ground, and although some rise again, many are so injured that they die prematurely and the bulbs suffer in consequence. The injurious effect of wind may be easily seen in fields where one part is more exposed than another, for in the exposed places the leaves are shorter and narrower and the bulbs smaller than where there is greater protection.

Cultivation.—The cultural methods adopted in the Scillies and on the Mainland are practically the same. As a rule,

ground which is to be planted with Narcissi is heavily manured and cropped with potatoes the previous spring. Favoured manures are farmyard manure, seaweed, and the various fertilisers which are rich in potash and phosphates. The potatoes are lifted between the last week in April and the end of May, and the ground is dug or ploughed, levelled, and prepared for planting as opportunity offers. No manure is given at this period, but if lime is required a dressing is provided. Planting is usually done as early as possible, although, if there is proper storage convenience for the bulbs, it may be left as late as the end of September. Late planting is favoured when the ground is very weedy, as unplanted ground is cheaper to clean than that which has been planted. In the larger fields a plough is used in the planting. By its aid a shallow furrow or trench is made. Men or boys follow and place the bulbs in position and they are covered with about four inches of soil as the next furrow is made. The furrows are made about 9 inches apart and the bulbs are placed from 4 to 6 inches apart in the rows according to variety. Six furrows are made and planted, then a space of a foot or so is left to facilitate weeding and the gathering of the flowers. This is followed by more beds of six rows each, with paths between, throughout the field. In the smaller fields the same method is adopted, but the work is usually done with spades. Some growers allow the paths to remain almost on a level with the surface of the beds, but others prefer to arrange that the tops of the paths shall be a little lower than the bases of the bulbs so that in wet seasons the ground drains better and the bulbs ripen more satisfactorily. As no two growers appear to plant at quite the same distance apart it is difficult to say definitely how many bulbs are planted on an acre of ground, but there are usually between 200,000 and 220,000. After early planting, the ground is hoed once or twice before the shoots are near enough to the surface to be injured by the hoe, and subsequently the ground is cleaned periodically until the bulbs are lifted. Lifting takes place at the end of the third year as soon as the foliage is dead. Some growers turn the bulbs out with a plough, but others prefer to lift them with forks. They are carried into shallow heaps and dried, graded into three or four sizes, sometimes by hand and sometimes by machinery, and stored in heaps out of doors, or in sheds, until planting time or until they are sold as the case may be. The ground they have occupied is then manured heavily and planted with potatoes the following spring, after which it is again planted with bulbs. A distinct change of crop for a longer period is

advised whenever it is possible, but the difficulty of providing proper shelter is against a long rotation of other crops. The exchange of bulbs between the Scilly Islands and the Mainland is productive of good results, as it infuses new vigour into those which show signs of deterioration.

Harvesting and Packing.—The earlier flowers appear about Christmas, and from that time until Easter flowers are gathered regularly. All are collected in the bud stage or as they are about to open, partly that they may be hastened into flower and partly that they shall not be injured by rough weather. They are placed at once in jars of water in a sunny greenhouse or shed, which is usually heated by hot water pipes, to open. When fully expanded they are tied in bunches of 12 blooms each, care being taken to exclude poor flowers and to arrange them so that all face in the same direction. Some growers place a little foliage with the flowers, but the practice is not a general one, for it is said to make little or no difference to the price, whilst it increases the labour, and adds to the weight, so increasing cost of carriage. The bunches are then placed in water until a short time before they are despatched. They are then packed in light wooden boxes made to a regulation size for convenience of handling. The dimensions are roughly 23 inches long, 16 inches wide and 4 inches deep. The boxes are lined with soft paper, leaving sufficient to hang over the sides and ends to cover the flowers when packed. From two dozen bunches of the larger-sized flowers to five-and-a-half dozens of the smaller-flowered kinds are packed in each box. The lids are secured with string instead of nails for the convenience of salesmen and buyers, and when a large consignment is being sent to one place three boxes are tied together. In each case the number of bunches and the name of the variety is written on the outside for the information of commission agents and buyers, and after addressing and delivering to the boat or station the grower has finished, the commission agent paying transit charges and deducting them, together with his commission, from the proceeds of the sales. A great many flowers are sent to Covent Garden, but markets for others are found in Birmingham, Liverpool, Leeds, Manchester, and other towns.

The boxes are not returned, but are sold with the flowers. They are made by the farmers, but the wood is purchased cut to the necessary size. Delivered at Penzance the wood costs at the rate of £15 per thousand boxes, an increase, it is said, of between £3 and £4 a thousand within the last year (1912-13).

Yield.—During last spring the flower crop was smaller than usual, but in a normal year every good, sound bulb

planted during the previous year is calculated to produce one flower; those in their second year usually produce two flowers each, and those in their third year three or more flowers each. Any which are left in the ground for a longer period deteriorate and hardly pay for gathering. Thus, an acre of ground may be said to produce a minimum of from 200,000 flowers the first year to 600,000 the third year. Ground which has been planted with small bulbs, however, gives practically no return the first year. Much of the work connected with cultivation is conducted by the ordinary hands in the regular routine of the farm, but extra hands are engaged for bunching and packing. Some of these are paid by the day, a certain number of bunches constituting a day's work, whilst others work piece work. On one of the largest farms the former practice is adopted and after the regulation number for the day has been tied, the workers are allowed to make overtime at the rate of 6d. an hour.

As the conditions under which the work is conducted vary to some extent in different places it was not possible to obtain definite figures regarding the actual expenses and income of an acre of ground, but anyone who requires such information can obtain a good guide from the article by Mr. J. Waugh on "Narcissus Cultivation" which appeared in the *Journal of the Board of Agriculture*, for March, 1909, pp. 897-909.

Prices.—With regard to the prices of flowers, those in the table on p. 37 were given by a Penzance farmer as the average gross prices of the chief kinds grown, arranged in their order of flowering.

The following figures, taken from advice notes of sales conducted during Easter week, give an idea of the railway charges and salesman's commission:—Eight boxes containing 32½ dozen bunches realised £2 10s. 7d., less 7s. 11d. expenses, and twelve boxes containing 39 dozen bunches made £3 11s. 11d., less 11s. 9d. expenses. These were sent from Penzance to London. Of blooms sent to Manchester, ten boxes containing 33 dozen bunches were sold for £3 3s. but there were expenses amounting to 10s. 5d., whilst six other boxes realised £1 4s. 3d., with expenses of 6s. 2d. The variety in each case was Emperor. The Barrii and Poeticus varieties cost less in carriage, and more bunches can be packed in a box. Twelve boxes of Poeticus ornatus sent to Manchester with the Emperors realised £4 2s., and the expenses were 9s. 11d.

Need for Co-operation.—The smaller growers appear to suffer from low prices more than those who market large quantities of flowers, probably by reason of a more limited choice of markets, whilst there are numerous complaints from

both large and small growers about high railway rates and French competition. Everyone, however, whether he is a large or small grower, seems to work on his own account, and

Prices of Flowers.

Variety.	Price per dozen bunches.		Remarks.
	Earliest flowers.	Later flowers.	
	s. d.	s. d.	
Soleil d'Or ..	1 6	1 0	
Henry Irving ..	2 6	1 6	
Golden Spur ..	2 6	1 6	
Princeps ..	1 3	—	Keeps a steady price.
Sir Watkin ..	1 6	1 0	
Victoria ..	2 6	2 0	
Emperor ..	2 0	—	Keeps a steady price.
Empress ..	1 9	1 6	
Poeticus ornatus ..	1 6	—	
Barrii conspicuus ..	2 0	—	
Scilly White ..	1 3	—	Flowers throughout the greater part of the season and keeps a steady price.

it is possible that the adoption of some scheme of co-operation would be attended with good results. A co-operative society with a distributing centre in Penzance, in communication with the chief markets of the country, might very easily place many of the flowers to better advantage than at present, whilst manures, wood for boxes and other things might be obtained more economically.

Such a society might also be the means of extending the flower industry by encouraging the culture of other kinds of flowers. Already a few other kinds are grown, such as violets, anemones, and tulips, but a larger business might be developed. *Anemone fulgens* about Penzance is less satisfactory than Narcissi, for it does not give good results in succeeding years. A scheme has therefore been adopted by which roots are purchased from Dutch growers, flowered, and returned to Holland as soon as the foliage is dead.

Richardia africana, the so-called "calla" or "arum lily" thrives remarkably well on the cliffs about Penzance. Several large masses were noted with leaf stalks 3 feet long bearing blades 15 inches by 9 inches. The flower stalks were up to 4 feet in height. The inflorescences have not been marketed,

but there appears to be a future for them provided the plants could be covered with lights whilst the spathes are developing. From the manner in which this plant is thriving, there can be little doubt but that it will prove valuable for the cut flower trade; but a few experiments are required in order to discover the best means of finishing and marketing the spathes.

A Typical Farm.—On the estate of Mr. Dorrien Smith, at Tresco, some 70 acres of bulbs are cultivated, and, in addition to the flowers which are grown out of doors, many hundreds of thousands are forced annually, a number of long, low, market houses having been erected for this purpose and for tomato-growing in summer. The flower shed is a model of its kind, and is representative of the methodical and business-like arrangements which everywhere exist. The front only is of glass which can be shaded with light blinds when necessary. Immediately before the glass is a stage about $3\frac{1}{2}$ or 4 feet high, the upper six inches having been converted into a water-trough, the bottom of which is covered with small stones. Over the trough are trellises divided into two-inch squares. The middle of the shed contains a long wide table for bunching and packing. As the flowers are tied in bunches, two bunches are placed in each square of the trellis, the stalks in this way standing in water. An hour or so before packing, the water is drained off and the stalks drain quite dry through standing on the stones. Early in the morning all hands begin to pack, the boxes having been prepared overnight, and in a very short space of time, 200 or 300 boxes are ready for despatching. On Easter Monday morning (1913), 10,000 bunches were packed and despatched in a little over an hour, about 30 men and boys being employed on the work. In addition, a large number of parcel post boxes were sent away. As the Penzance boat starts from Scilly between nine and ten o'clock in the morning, and only on alternate days, the early morning hours are amongst the busiest of the day, for the weight of flowers despatched from the several islands is reckoned in tons. The crop this year (1913) was far below the average, 225 tons against 987 tons in 1912. The heaviest consignment despatched from the islands in 1913 was 17 tons on March 18th, against a record of 53 tons on March 21st, 1907.

A great many kinds of Narcissi are grown at Tresco, but the following sorts are chiefly relied upon for market:—Soleil d'Or, Scilly White, Grand Monarque, Gloriosus, Poeticus ornatus, P. "Horace," Cynosure, Leedsii, Frank Miles, Emperor, Empress, M. J. Berkeley and Golden Spur. Various new kinds are under trial for market work whilst numerous other sorts are grown for their bulbs which find a ready sale at lifting time.

It is obvious that, as the supply of dung from towns decreases, owing to the substitution of motor for horse traffic, the price must go up and gardeners must resort more to artificial manures than they do now; so that, apart from any increase in the number of market gardeners and small holders, the demand for trustworthy information about the manuring of market garden crops will be even greater in future than in the past.

**Potash Manuring
and Market Garden
Crops.**

The very careful experiments on the manuring of market garden crops carried out at Hadlow by Dr. Bernard Dyer and Mr. F. W. E. Shrivell, F.L.S., are well known, and, in addition to the special and exhaustive reports (the latest was published at the end of 1913*), accounts of the results have appeared in this Journal (Vol. IX., p. 461) and other publications, while the very reliable information obtained forms the basis of the Board's Leaflet No. 106 on "Fertilisers for Market Garden Crops."

The work of these two experimenters has mainly resolved itself into an enquiry as to how far the large quantities of purchased stable manure used by market gardeners are necessary, or how far, where necessary, they are being used to the greatest economic advantage. In the main, "the experience accumulated indicates that, on soils in fairly good mechanical condition, if one could but predict a rainfall normal in quantity and distribution, it would probably be economical to dispense with stable manure altogether for many vegetable crops, although not by any means for all. The market gardener must, however, insure himself against the uncertainties of the season, and cannot afford to forgo altogether the valuable mechanical assistance derivable from stable manure, even at the risk of some extravagance." The results, nevertheless, show conclusively that "the average bill for stable manure can be largely reduced, without detriment to either the size or the quality of the crops, provided that the grower supplements the diminished quantity of stable manure with a suitable mixture of chemical or concentrated fertilisers."

It is not, however, intended to discuss here the results of the experiments from this point of view, but rather to call attention to the effects produced on market garden crops by potash starvation.

It may be recalled that the plots were laid out in 1894 in a field which was previously under ordinary arable cultivation,

Manuring of Market Garden Crops, Bernard Dyer, D.Sc., and F. W. E. Shrivell.

AVERAGE ANNUAL YIELDS PER ACRE FOR THE THIRTEEN SEASONS, 1898-1911.

Manures.	Beet.	(6) Parsnips.	(5) Carrots.	Celery.	(3) Globe Artichokes.	(10) Jerusalem Artichokes.	Cauliflowers.	(6) Broccoli.	Brussels Sprouts.	Savoy.
	t. c.	t. c.	t. c.	Av. wgt. of plant in oz.	t. c.	t. c.	t. c.	t. c.	sieves.	t. c.
In addition to phosphates and nitrate of soda:—	11 3	13 3	13 5	33.7	4 5	13 13½	24 4½	16 14½	271	27 13½
Dung, potash ..	11 8½	11 6	12 1½	33.3	3 15	12 10½	23 16½	16 5½	278	27 2
Dung, no potash ..	19 17	9 12	11 2	25.9	—	11 17	23 9	17 4	274	27 16
No dung, potash ..	6 18	5 11	7 2	15.1	—	9 1	20 5	15 9	231	26 2
No dung, no potash ..										

Manures.	(6) Summer Onions.	(7) Tripoli Winter Onions.	(8) Early Potatoes.	(9) Late Potatoes.	(6) Cabbages for spring and early summer cutting.	Cabbages for autumn cutting.	(1) Winter Spinach.	(1) Summer Spinach.	(3) (10) Winter Lettuce.	(4) Asparagus.	(2) Rhubarb.
	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	c.	t. c.
In addition to phosphates and nitrate of soda:—	7 7½	15 12	6 15½	11 2	—	—	31 2½	9 11½	17 8½	18.7	50 4½
Dung, potash ..	7 4½	14 6	6 11½	10 0	—	—	31 3½	9 7	16 16½	18.0	47 6½
Dung, no potash ..	5 8	10 2	4 16	7 8	23 15	29 16	28 11	8 5	14 3	16.7	51 1
No dung, potash ..	1 15	4 0	3 7	5 11	22 0	27 4	25 4	5 15	10 15	15.7	49 16
No dung, no potash ..											

Average of 6 seasons.
 (1) " " "
 (2) " " "
 (3) " " "
 (4) " " "

Average of 11 seasons.
 (5) " " "
 (6) " " "
 (7) " " "

Average of 17 seasons.
 (8) " " "
 (9) " " "
 (10) Dung applied to previous crop.

the soil being a poor clay loam or brick earth of lightish colour resting on a deep bed of heavy clay. With slight alterations suggested by experience obtained in the course of the trials, the plan of the experiments has been the same throughout, and in the case of most of the crops it is possible to observe the effect of withholding potash over a long series of years from crops grown both with and without a moderate dressing of dung.

Vegetables.—The results given in the table on page 40 for various vegetable crops have been calculated from the information given in the report mentioned above.

The quantity of dung applied was 25 loads (12½ tons) per acre. The nitrate of soda was tested at three different rates when used with dung, viz.: 2 cwt., 4 cwt., and 6 cwt., per acre, so that the results shown for the dunged plots with and without potash are in each case the average from the three plots over the period stated*. Where no dung was used there was only one plot in each case, and the quantity of nitrate of soda applied was 8 cwt. per acre.

From an examination of the figures in the above table it is evident that, on the whole, and except in cases where the dung was applied to the previous crop, an application of 12½ tons of stable manure per acre has, on the Hadlow soil, fairly well satisfied the requirements of the different vegetables as regards potash. There were, however, slight increases from the addition of potash in almost every instance.

When, however, crops were grown with artificials alone (and it is interesting to note that, even on such inferior soil, the table shows that it is possible to grow many market garden crops satisfactorily without dung) the necessity for the inclusion of potash is quite evident, and it is obvious that the different plants have suffered seriously when potash has been withheld.

In the Table the results are given for various periods preceding 1911, this being the latest year for which particulars are available. In the autumn of 1911 the crops were examined on behalf of the Board, and the following observations on their appearance were made:—

On the plots which had been supplied with potash either in stable manure or in mixed artificial manures the vegetables and fruit crops looked well, and showed the growth which

* Except for Globe Artichokes, Tripoli and Winter Onions, and Early and Late Potatoes: in these cases the results are the averages of two plots, there being no 6 cwt. nitrate of soda plot.

one would have expected from the particular type of manuring employed in each case. On the plots receiving no potash in either form cauliflowers were just beginning to show the effects of potash starvation, a faint yellow tint being visible on most of the leaf margins, and the weight of the crop was much reduced, though the plants were not noticeably unhealthy. In the case of broccoli, absence of potash was less felt; at that time (1911) there was very little indication of starvation other than a slight reduction in the size of the crop. The same remarks applied to both cabbages and Brussels sprouts. The crop was less, but there were no traces of discoloration in the margin of the leaves. In the case of savoys, the absence of potash was more felt than on the ordinary cabbage plot, but was less noticeable than on the cauliflower plot. The effects of starvation were clearly marked in the case of beet and very marked in parsnips and artichokes. Without potash parsnips were almost a complete failure. Celery also was very poor where potash had been withheld.

Fruit.—The results in the case of various kinds of fruit are not available for so long a period as in the case of vegetables. The average annual results per acre are as follows:—

Manures.	Goose- berries: 12 seasons.	Rasp- berries: 8 seasons.	Black currants: 8 seasons.	Red currants: 8 seasons.	Strawberries.	Plums: 5 seasons.
	lb.	lb.	lb.	lb.	lb. (5 plantations on 19 dif- ferent crops)	lb.
In addition to phos- phates and nitrate of soda:—						
Dung; potash ..	4,807	2,202	1,438	1,165	—	2,238
Dung; no potash ..	3,703	2,198	1,254	1,085	—	3,242
No dung; potash ..	2,370	1,970	992	1,165	2,429	6,100
No dung; no potash..	860	1,420	737	655	1,740	2,870

The results shown for the dunged plots are the averages of three plots in each case, the nitrate of soda being applied in three different amounts, viz: 1 cwt., 2 cwt., and 4 cwt., per acre. Where no dung was applied the results are from one plot only, in each case, the quantity of nitrate of soda used being 4 cwt. per acre.

The average crop of gooseberries on the plot receiving no dung has been nearly trebled as a result of the addition of potash. In some years the non-potash plot has almost refused to produce a crop at all; and even on plots receiving dung every year potash salts have consistently produced a steady increase. Only stunted and obviously unhealthy canes of raspberries are produced on the plot receiving neither dung nor potash. For plums the omission of dung and potash has led to a reduction in the yield by more than one half.

Experiments have also been conducted on apple trees, but unfortunately no reliable results have been obtained for a series of years.

When the experimental plots were inspected on behalf of the Board in 1911 it was felt that the case of apples was particularly interesting, as the different varieties were differently affected. Absence of potash had dwarfed the trees of Cox's Orange and Bramley's Seedling, and all the leaves were (Oct. 20th) shrivelled, brown and unhealthy, with curled margins. In the case of Newton Wonder there was no very pronounced effect. In the variety known as Baumann's Red Reinette starvation was as marked as in Bramley's Seedling. The plantation originally contained Wellingtons, but these did not yield well and the whole were cut down and regrafted with Baumann's Red Reinette. The difference between the Red Reinette on the original stock and on the Wellington was remarkable. In the latter case the trees were much larger, the leaves were healthy, and there was little sign of marked potash starvation. The reason would appear to be that Wellington, when used as the scion, had induced greater root growth in the stock than Red Reinette, so that when Red Reinettes were regrafted on the Wellingtons they had the advantage of the wider range of root developed by the Wellington variety.

The results obtained in these experiments are all the more striking when it is remembered that of all soils clays are, as a rule, least benefited by potash manuring, and that nitrate of soda was the nitrogenous manure employed in every case. The Rothamsted experiments have shown that, as a rule, when nitrate of soda is used, potash manure is less necessary than when the nitrogen is derived from other sources.

The source of potash in the above experiments was sometimes sulphate of potash and sometimes kainit, the two being alternated; the quantity used per annum was 1 cwt. of sulphate of potash or 4 cwt. of kainit per acre.

SAINFOIN, which, in common with the clovers, is a member of the natural order *Leguminosæ*, has been known and cultivated as a fodder crop for over 200 years, having been introduced into this country about the middle of the seventeenth century from France, under the

Sainfoin
(*Onobrychis sativa*). The name "Sainfoin," by which it is commonly known, is a corruption of "Saint-foin," or "holy hay."

Soil and Climate.—Sainfoin is a perennial plant indigenous to dry chalky soils. Under suitable conditions the primary root descends to a great depth, and the plant is able to withstand the severest drought, being almost independent of surface moisture. Although sainfoin seems to prefer light soils containing a considerable percentage of lime, it is probably adaptable to a much wider range of conditions than is generally believed to be the case. Good crops are grown both on clays and loams in districts where the climate is dry and warm. As a forage crop, specially adapted for sheep, it is of great importance in the South of England. It is sometimes sown instead of clover, more particularly in the Eastern Counties, where clover "sickness" is common.

Preparing the Seed-bed.—The cultural conditions best suited to the growth of sainfoin are practically the same as for lucerne. The soil should be clean and in good heart, and the subsoil readily penetrable by the tap-root.

Varieties, Seed, and Method of Sowing.—There are two varieties in cultivation, the Common Sainfoin (*Onobrychis sativa*) and Giant Sainfoin (*Onobrychis sativa* var. *bifera*). These flower during May and June, the Common Sainfoin being rather later than the giant variety. The Common Sainfoin is distinguished by its characteristic and somewhat meagre aftermath, which consists of long leaves, flowering stems being absent. The Giant Sainfoin is of more rapid and heavy growth; the second cutting produces flowering stems, and in consequence of this habit is shorter lived. Giant Sainfoin is best adapted for making into hay, while Common Sainfoin is the better for grazing. It must, therefore, be clearly borne in mind that the two varieties play distinct parts in husbandry. Giant Sainfoin is more of the nature of a rotation plant, whereas Common Sainfoin should be regarded chiefly as a long-ley crop paying for special cultural and manurial treatment. On land that is not particularly suitable for growing a successful crop of sainfoin, the farmer would be well advised to sow the giant in preference to the common variety, as on land which is not able to hold Common Sainfoin for the usual term of years, the giant variety will yield more bulky crops in the time, and may be cut more often. Common Sainfoin is usually at its best about the third year, but under suitable conditions it may be allowed to stand with profit for from five to seven years or even longer.

^a In the purchase of "seed" a guarantee as to variety should be required, and it is also of prime importance that attention be paid to the purity and vitality of the sample. The single-

seeded fruit of sainfoin is irregularly half-moon shaped, with a flat and more or less spiny "wing" round the curve. Both sides are convex, with a coarse network of raised veins, provided, in some instances, with spiny projections. In good fresh samples the seed pods are fairly bright, and the colour is a dark straw or a light reddish-brown. Very dark and dull-looking "seeds," should be avoided, and also pale yellowish-green "seeds," the former denoting old age, the latter immaturity. The milled seed (that is, the seed removed from the husk or pod) and the entire fruit are both used by the farmer, but perhaps the latter is the more generally sown. The seed removed from the pod has a smooth surface, is reniform or kidney-shaped, and in good samples it is plump and yellowish-grey or light brown in colour. When black or shrivelled it has either been spoilt by bad harvesting or old age, and perhaps by a combination of both.

As a rule, sainfoin is fairly free from foreign seeds—the most common impurity being burnet.

The "seeds" of burnet are in reality two-seeded fruits, and the difference in their shape and size, compared with the "seeds" of sainfoin, is well marked, yet, owing to both being wrinkled and of the same colour, unless the sample is closely scrutinized the burnet may be easily overlooked.

The best means of ensuring a practically pure seed—and, consequently, if other things are equal, a clean crop—is to purchase milled seeds only. The burnet, if present, will be seen at once, as it cannot be milled, and the only result of the milling is seen in the bruised and broken-winged appendages of the "seed."

As sainfoin ripens somewhat irregularly, and some difficulty is experienced in removing immature "seeds," the germination, when in the pod, is comparatively low, but there is no difficulty whatever in obtaining seeds showing a vitality varying from 75 to 85 per cent., and in milled seed 90 per cent. and over. The seed is drilled from February to May, usually at right angles to the corn crop already sown and after a root crop fed off with sheep. It is especially important in the case of Common Sainfoin, which is intended to occupy the ground for a number of years, that the soil be free from weeds, and it may even be advisable in some cases to sow this variety without a covering crop. Four bushels per acre of unmilled seed or 56 lb. of milled seed is the customary rate of sowing.

It is usual to grow sainfoin pure in the Eastern Counties, but on chalky soils in the South and West of England it is often used as a constituent of a mixture for temporary or

permanent leys. A mixture of Giant Sainfoin, Red Clover and Italian Rye Grass makes excellent hay.

Manuring.—A dressing of very short dung, *i.e.* thoroughly rotted to destroy weeds, given during the first autumn, helps the plant in the early stages, and is, moreover a protection against frost. If a crop is cut each year the land may receive further occasional dressings of farmyard manure, with dressings of phosphatic and potassic manures in the intervening years, but as a rule dung should be used sparingly as a direct manure to this crop, although it may be freely applied to the preceding root crop.

Cutting the Crop for Hay.—Sainfoin grows to a height of 1½ to 2 ft., and produces numerous succulent branches with abundant foliage, bearing many-flowered spike-like clusters of flesh-coloured or rosy-red flowers; the compound pinnate leaves are sufficiently distinctive to aid one in recognising the plant.

It is important that cutting for hay should start directly flowering commences, as the plant is then at its best for feeding purposes, and each day's delay impairs both the quality of the hay and the future yield of the crop. It should be handled with great care, like lucerne and clover, to avoid breaking off the fine leaf; but it is not readily spoiled, if left alone unturned, even in the wettest weather. A yield of 30 to 40 cwt. of hay is considered an average crop. In the case of Giant Sainfoin two crops of hay are often mown the first year, while seed is generally taken from the second crop of the second year; when allowed to ripen for seed, cutting takes place in July or August, after which it is carefully dried before being stacked. In a good season 25 to 30 bushels of seed in the husk may be obtained per acre.

It is usual to cut sainfoin for hay in the first year; afterwards it may be mown or grazed as circumstances require. Whether as hay or as green forage it is an admirable food, and is regarded as the best possible change for stock which may not be thriving on ordinary pastures.

MILLEPEDES and Centipedes belong to the group of the animal kingdom known as *Myriapoda*. They are closely allied to insects (*Insecta*) but differ from them in many characters, among which the most obvious is the possession of one or two pairs of legs to every segment. In general appearance the more common forms are quite distinct from all other land animals occurring in this country.

* This article is a somewhat revised form of Leaflet No. 94.

Owing, however, to the fact that they are sometimes referred to as "wireworms," confusion often arises between them and the true wireworms which are the larvæ of various click beetles (Leaflet No. 10, *Wireworms*). The possession of legs on each segment will at once distinguish the millepede or centipede from the click beetle larva, to which the term wireworm should be confined.

Millepedes and centipedes are somewhat alike in general form, and since millepedes are distinctly injurious, while centipedes are on the whole beneficial, it is necessary to distinguish clearly between them. The following points will serve for this purpose. Millepedes have *two* pairs of legs to each segment of the body, which, with the exception of the form known as *Polydesmus*, is rounded or cylindrical in form. Centipedes have only *one* pair of legs to each segment of the body, which is somewhat flattened. As regards differences in habit millepedes are rather sluggish and when disturbed coil themselves up like a watch spring, while centipedes are active and usually escape by running as soon as they are discovered.

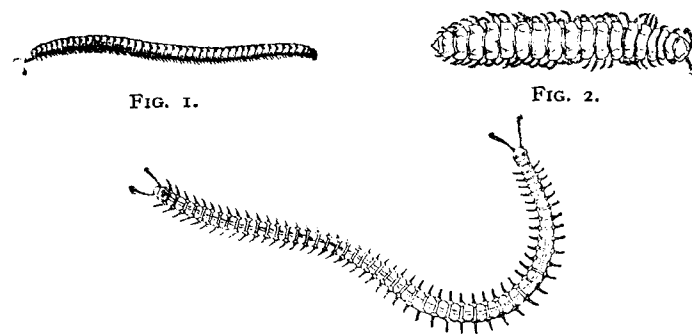


FIG. 3.

Figs. 1 and 2, Millepedes (1, *Julus pulchellus* × 3; 2, *Polydesmus complanatus* × 1½); Fig. 3, Centipede (*Geophilus subterraneus*, magnified).

CENTIPEDES.—Since they are not injurious to plants centipedes may be dealt with briefly. The common genera in Britain are *Lithobius* and *Geophilus*. The former is a rather large, stout centipede, of a uniform brown colour, and is often to be found under stones and logs of wood. *Geophilus* is a long, slender animal, the most common form being very light brown in colour, with the exception of the head, which is dark brown; it is sometimes found under stones, but is more common in leaf mould and in the surface layers of the soil.

Centipedes are carnivorous and feed mainly on small slugs, snails and insects. Mention should, perhaps, be made of the fact

that some centipedes, notably *Geophilus electricus*, are at times phosphorescent and yield quite a bright light. Little is known of the origin of this phosphorescence, but it appears to be derived from some material on the surface of the animal, which may leave a glowing track as it passes along.

MILLEPEDES.—Millepedes of several genera are found in Britain, but for practical purposes it will suffice to notice two of these—*Julus* and *Polydesmus*.

Julus comprises those forms with a smooth cylindrical body of 30 or more segments. The most injurious species is *Julus pulchellus* (sometimes known as *Blanjulus pulchellus*). It is a small, slender millepede, about $\frac{1}{2}$ in. in length when full grown; in colour it is yellowish, with a row of crimson or purple spots along each side, a character by which it may always be recognised. A second common species is *J. terrestris*, a larger millepede of a leaden black colour with whitish legs.

The species of *Polydesmus* differ from those of *Julus* in having only 20 segments to the body and in being rather broad and flat. The sides of the body are not smooth as in *Julus* but, owing to projections from each segment, appear to be notched. The most common species is *P. complanatus*, which, when adult, is about 1 in. in length and varies from a pale purplish white to a dull red or brown colour.

Life History.—The life history of *Julus terrestris* has been described as follows:—Breeding takes place in May, June, and July. The female, when about to lay eggs, burrows down into the soil and forms a kind of nest out of grains of earth glued together with saliva. The nest is like a hollow sphere, smooth inside but rough externally, and until the eggs are laid a small hole is left at the top. From 60-100 eggs are placed inside the nest, and the opening is blocked up. The eggs hatch in about 14 days. The young millepedes at first have only three pairs of legs, the others appearing in groups by degrees. Growth in a millepede takes place by lengthening at the hinder end, the increase occurring between the last segment and the one before it.

Plants Attacked.—The food of millepedes is almost entirely of a vegetable nature. Roots, bulbs and tubers of all kinds are attacked, and when the animals are numerous the resulting damage may be considerable. There is nothing very peculiar in the form of injury produced, and the best method of diagnosis is the discovery of the millepedes themselves. In the case of *J. pulchellus* the animals may often be found in a cavity in the root or tuber, which is gradually eaten away; occasionally, however, they seem to attack the cuticle of the

root only, and where the damage takes this form in potatoes a type of scab is produced which closely resembles that attributed to "mechanical injury." (See Leaflet No. 137, *Varieties of Scab in Potatoes*). In the case of an attack of the larger species an examination of the soil near the injured plant, or of any rubbish close by, will usually show which species is responsible. It should be noted, however, that in all cases of attack a certain amount of decay is produced which attracts other enemies, and the identity of the original offender may be thus obscured.

Treatment and Prevention.—(1) In many cases of damage by millepedes which have been brought to the notice of the Board, there is also evidence of bad cultivation; where high cultivation is practised there is much less likelihood of a serious attack.

(2) Care should be exercised in the use of fresh leaf mould and decaying vegetable matter, which frequently contain these pests.

(3) Millepedes may be trapped by placing just under the ground mangolds, beets, or turnips which have had the interior scooped out. The traps must be examined at frequent intervals and the millepedes collected and destroyed.

(4) Millepedes may be poisoned by soaking pieces of potato, mangold, etc., in a strong mixture of Paris green in water. The baits should be placed near the attacked plants and should be covered with a board, stone, or large leaf to prevent them becoming very dry. It should be noted that baits so treated are poisonous to man and animals as well as millepedes.

(5) Carbon bisulphide injected into the soil is stated to be a certain remedy, but the treatment is expensive and need only be used where the plants attacked are valuable and the area involved small.

(6) Lime, distributed broadcast and dug in, and soot, or soot and water, have been found to be partial remedies.

Wheat and Meat Supply.

THE Report on Colonial and Foreign Agricultural Statistics for 1912 (Cd. 7271) contains a review of the wheat and meat supply of the world, as it affects the United Kingdom.

Wheat.—Reference is made to the Report on Colonial and Foreign Statistics for 1911, in which Mr. Rew attempted a brief survey of the wheat area of the world, with especial reference to the extent to which it had expanded in relation to the growing demand during the decade 1901-11. The.

conclusion arrived at appeared to be reassuring, so far at any rate as immediate requirements are concerned. The figures summarised showed that in the British Empire the increase in the acreage under wheat had been 45.5 per cent. and in population 6.6 per cent. during the 10 years. In Europe the wheat area had increased by 17.1 per cent. and population by 15.6 per cent., while in the other countries for which comparative figures could be given—Algeria, Argentina, Japan, Siberia, United States, and Uruguay—the wheat area had increased by 19.9 per cent. and population by 20.6 per cent. It was pointed out that the population of the wheat-growing countries are not all wheat-eaters, so that the comparison could not be regarded as very precise, and a calculation—if such were possible—of the increase of wheat consumers would be necessary for a complete analysis of the situation. The figures given represented that the amount of land devoted to wheat over the greater part of the world—including the main wheat areas and all the chief wheat-eating nations—had increased from about 0.28 to about 0.31 of an acre per head, and in view of the fact that on the whole the production per acre has increased the position was regarded as fairly satisfactory.

Meat.—It is not easy to form a trustworthy estimate of the relative progress of wheat supplies, but the materials are even more scanty for an estimate of the supplies of meat. The subject is one of serious interest for this country. It was pointed out in the Report on Part IV. of the Agricultural Statistics for 1912 that our imports of meat have not in recent years kept pace with the growth of population, and that the reduction in overseas supplies amounted during the preceding decade to about 1½ lb. per head. There is practically no measure of the annual production of meat in different countries, but for those which are regular exporters the extent to which they are keeping pace with demand may be approximately indicated by comparing the numbers of stock at a sufficient interval. It is convenient to take the numbers in census years for ready comparison with the growth of population.

In Australia, Canada, and New Zealand—the meat exporters of the British Empire—the total number of cattle increased from 15½ millions in 1901 to 20½ millions in 1911, and the total number of sheep from 94½ millions to 119 millions, being an increase of 32 and 26 per cent. respectively. During the same period the population of these States increased by 28 per cent.

For the chief meat-exporting countries in Europe (including the whole Russian Empire in this category) the following table shows, in millions, the numbers of cattle, sheep, and pigs in 1901 and 1911, or nearest available year:—

	Cattle.		Sheep.		Pigs.	
	1901.	1911.	1901.	1911.	1901.	1911.
Denmark	1.8	2.3	0.9	0.7	1.5	1.5
France	14.7	14.4	19.7	16.4	6.8	6.7
Netherlands	1.6	2.0	0.8	0.9	0.8	1.3
Russia	42.7	46.3	70.9	62.0	14.4	13.7
Sweden	2.6	2.7	1.2	0.9	0.8	1.0
Servia	1.0	1.0	3.1	3.8	1.0	0.9

For Denmark the earlier figures are for 1903 and the later for 1909. For Netherlands and Servia the later figures relate to 1910. In the Russian figures are included those of 1900 and 1910, respectively, for Finland, and of 1904 and 1911 for Siberia and the Steppes, and the numbers of sheep include goats. The earlier figures for Servia relate to 1900.

Taking these countries in the aggregate we find that cattle have increased by 4½ millions, sheep have declined by 12 millions, and pigs remain stationary. Comparing so far as possible the number of stock with the population of these countries in 1901 and 1911, it appears that there were 34 cattle, 49 sheep, and 13 pigs per 100 inhabitants in the earlier period, and 33 cattle, 42 sheep, and 12 pigs at the later date.

The records of the number of cattle in the United States possess very great importance from the meat-supply point of view. There was at every census from 1870 to 1900 a large increase in the total number of cattle returned. At the census of 1910, however, a somewhat startling reduction by no less than 6 millions was recorded. Some doubt arose as to the extent to which the change in the date of the census—from June 1st in the earlier to April 15th in 1910—may have affected the comparison, it being evident that from April to June large numbers of calves would be born.

Whatever the precise facts may be, it appears certain that during the decade 1901–11 the meat-producing stock of the United States—with the possible exception of pigs—had not increased, but, on the contrary, had somewhat decreased. During that decade the population of the United States increased by over 16 millions, or nearly 21 per cent., and it is not surprising, therefore, that the surplus meat exports,

on which this country in particular has so long relied, should have dwindled and practically ceased, and that the United States should have become an importer rather than an exporter of beef.

Such returns as are available for the South American countries afford a somewhat more cheerful outlook. For Argentina, Chile, and Uruguay the following approximate comparison can be made, the numbers again being given in millions :—

	Cattle.		Sheep.		Pigs.	
	1901.	1911.	1901.	1911.	1901.	1911.
Argentina	21.7	28.8	74.4	80.4	0.7	2.9
Chile	1.0	1.8	1.0	1.2	0.2	0.2
Uruguay	6.8	8.2	18.6	26.3	0.1	0.2

These figures are not very satisfactory, as in no case is the interval precisely 10 years. Thus, for Argentina the earlier figures refer to 1895, which is the year nearest to 1901 for which returns are available. For Chile the earlier figures relate to 1902, while for Uruguay the years represented are 1900 and 1908. No fair comparison with the growth of population can therefore be made, but the substantial increase of live stock in Argentina and Uruguay corroborates the indication given by the exports from those countries, that to them we may look in the immediate future to make good declining supplies of meat from other sources.

THE grasslands in this country may be divided into two classes, viz., those which are natural to their environment and those artificially introduced. The natural grasslands may further be separated into two groups, differing in their origin—the permanent types and the migratory types. The permanent grasslands occur on ground which has been for long periods subject only to slow geological change; they depend on the nature of the underlying rocks and change little under the present climate; thus they occur on chalk downs, on exposed hills and ridges of rocks containing an abundance of lime, and on basic igneous rocks. The migratory types occur chiefly on areas where surface changes have been recently in operation, and are to be found on alluvial

* *Journal of Agriculture Science*, January, 1914; W. G. Smith, B.Sc., Ph.D., and C. B. Crampton, M.B., C.M.

and periodically flooded surfaces along rivers or on the flanks of mountains. The artificially induced grasslands occupy many types of soil, and differ according to their origin and their treatment.

The natural conditions which favour grassland in this country are those which prevent :—1. Leaching of the surface in well-drained positions, which favours the growth of heath in competition with grassland; 2. Rapid accumulation of raw humus and peat, and consequent competition of moorland species of grass; 3. Stagnancy and souring of the soil in low-lying positions, and competition of marsh; and 4. The growth of forest in places protected from wind.

The influence of grazing animals (including rabbits) on the development of grassland is very marked. The grasses belonging to woodland, moorland, and heath are rarely pasture grasses, since most of them are hairy, rough, odorous, or otherwise protected against grazing animals. Pasture grasses are usually to some extent favoured by the grazing, manuring and treading of animals. Such grasses generally invade other types of vegetation from disturbed areas, frequently from flushed lands, and become established when grazed by animals, since this prevents the reconstitution of woodland, moorland or heath, as the case may be; when left ungrazed, however, a rapid return to the original type of vegetation usually takes place.

The natural congregation of grazing animals tends strongly to favour grasslands of distinctive types; thus sheep and rabbits usually produce mat or down-like types of grass, according to the nature of the surface, while cattle induce types ranging from mat to meadow, as determined by soil and moisture. If the animals fail to produce a suitable type of grassland they desert the place, and other types of vegetation gain the ascendancy.

British grasslands may be generally grouped into four distinct classes, as follows :—

Turf-forming Types.—These are usually pastures on smooth, firm surfaces. They are for the most part perennially green and flower meagrely. These grasslands include permanent types on thin residual soils over rocks on elevated, smooth and well-drained surfaces, or on slopes receiving only atmospheric precipitation. Such grasses are chiefly wiry plants of the sheep's fescue (*Festuca ovina*) type, mosses being scarce or absent. Migratory types are also included in this category, being found on the surfaces of slopes periodically flushed by springs or the surface drainage from higher levels. These are the mat-pasture varieties, consisting chiefly of forms of *Agrostis*,

Anthoxanthum, *Triodia*, and also often *Holcus lanatus*. Mosses like *Hylocomium squarrosum* or *Hypnum molluscum* are abundant among these migratory species.

Meadow Types.—These are generally found on porous alluvial loams with a high water-table and usually subject to periodical flooding. The meadows require greater summer warmth and hence are situated in the lowlands or in sheltered places. They are characterised by the dominance of taller herbage. Tall mesophytic herbs of the *Spiraea ulmaria* and *Angelica* types are frequent. *Poa trivialis*, *Dactylis*, *Phleum*, *Alopecurus*, *Hordeum*, *Lolium*, *Triticum*, *Festuca* and *Aira*, with other species, are found in this type of pasture in districts favouring their growth.

Tussock Types are composed of coarse, hard or wiry grasses which tend to accumulate soil by means of stools or tussocks of dead shoots, and usually carry their dead leafage throughout the resting season. They are capable of surviving intensely unfavourable conditions of surface and exposure, and are, therefore, natural chiefly to habitats unfavourable to other types of vegetation. A *Nardus* type of grassland and sometimes an *Agrostis* type occupy areas subject to much scour by streams, and also sterile soils subject to wind-action. The *Agrostis* type occasionally encroaches on degenerated artificially formed pastures.

Stooled Meadow Types.—These might be considered as exaggerated forms of the tussock types; they assume the stooled habit rather as an adaptation to frequent gentle flooding and silting, or to standing water, than to scour by wind and water. Thus they frequently form a belt round lakes and along still streams between the reed-belt and aquatic marsh plants and the more typical meadow types. The principal species are *Aira caespitosa* and *Molinia coerulea* in its large stooled form.

The study of the economic aspect of grassland has usually been based on experiment or on the compilation of scattered information obtained from practical men, but little has been said as to the general causes which lead to the appearance or degeneration of grassland. A consideration of the natural factors briefly outlined above will, however, lead to more suitable methods of improving poor pastures, draining marshlands, and dealing with other similar practical questions, provided that due attention is given to the modifications suggested by local experience.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Liming of Meadow Land (*Lancs. C. C. Educ. Com. Agric. Dept., Farmers' Bull. No. 24*).—In liming land it is the common practice to place small heaps of cob lime (burnt lime) regularly over the field. Slaked lime is produced from this cob lime after exposure to the moisture in the atmosphere or by putting a small quantity of water upon the heaps; this slaked lime is easily spread over the field. In course of time, however, and before the slaked lime becomes effective in the soil, it combines with the carbon dioxide in the air, and forms carbonate of lime (limestone). Ground lime is produced by grinding cob lime to a fine powder, thereby making possible the broadcasting of lime in its quick or caustic condition. This form also becomes converted into carbonate of lime, and in view of the cheapness of limestone compared with cob lime and ground lime it was decided in these experiments to ascertain whether ground limestone would not give as good results as these two other forms of lime.

The cob lime and ground lime were applied at the rate of one ton per acre and the ground limestone at the rate of $1\frac{1}{2}$ tons per acre, this amount containing as much lime as one ton of either of the former. The dressings were given in January, 1906, and December, 1909. The further treatment of the plots was left to the discretion of the various farmers who carried on the experiments. The yields of hay resulting from the treatment have been noted during the eight years 1906–1913. The total increase in the hay yield per acre over the unlimed plot during the eight years was $14\frac{1}{2}$ cwt. from cob lime, 13 cwt. from ground lime, and $27\frac{1}{2}$ cwt. from ground limestone. Valuing these increases at 2s. 6d. per cwt. and deducting in each case the cost of the two lime dressings at 1914 prices, there was found to result a profit per acre over eight years of 4s. 2d. from cob lime, and 27s. 7d. from ground limestone, and a loss of 14s. 2d. from ground lime. Ground limestone thus proved to be much the most effective form of lime.

There was a marked change throughout the experiment in the composition of the herbage of the plots at most of the centres, due to the dressings of limes, the outstanding feature being the great reduction in the amount of Bent.

The following recommendations are made in the bulletin:—

1. Ground limestone is a suitable form of lime to apply to meadow land which is deficient in lime. It should contain at least 95 per cent. of carbonate of lime, and should be finely ground, not less than 40 per cent. passing through a sieve having 10,000 holes to the square inch. Samples more finely ground can be obtained, but they are more costly and not to be recommended.

2. Should proximity to a lime kiln or any other factor make the farmer decide in favour of cob lime, he should see that it is spread evenly over the ground before it gets into a "sticky" condition.

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

3. Although the dressing of ground lime proved the most costly and least satisfactory in the experiment, there are occasions where it may be used with advantage, but care should be taken that it is not delivered at the farm before all arrangements have been made for its application, or loss may occur through bursting of bags. It should contain at least 90 per cent. of lime.

4. For low-lying land, and soils of a peaty nature, and especially for meadows which have been continuously manured with farmyard manure, a dressing of lime is recommended.

5. It is not a good practice to give a second dressing of lime too soon after the first application; rather should the improvement induced by the early treatment be assisted and supplemented by a judicious course of manuring.

Soil Sickness Experiments (*Mitt. der Landw. Lehrkanzeln der k.k. Hochschule für Bodenkultur in Wien, Band II., 2 Heft.*).—In this article Professor Kaserer describes experiments which he has carried out with flax, peas and barley in order to throw further light on the relation of soil sickness to these crops. While his investigations were necessarily of a somewhat preliminary nature, he considers the following conclusions may safely be drawn from them:—

There are two forms of sickness in flax, "germinating" sickness and "growth" sickness. The "germinating" sickness of flax in which the seeds rot away in the ground, presents similar symptoms to "germinating" sickness of peas. In the case of both plants the rotting away, which is probably caused by pectin ferment bacteria, is, apart from the question of vitality of the seed, dependent not only on the soil conditions, such as dampness, but also on temperature and the number of micro-organisms attacking the seeds. With repeated sowings and the use as manure of straw containing pectin, thereby encouraging a greater number of organisms, the "germinating" sickness is increased. Soil which is flax sick is also pea sick, and the reverse is frequently, but not always, the case. The sickness may, however, subsequently wholly or partly disappear.

"Growth" sickness, the chief symptom of which is decreased grain yield, could only be completely confirmed on flax. Manuring did not seem to increase this form of sickness except when flax straw manure was used, but repeated cropping with flax and inoculation with flax sick soil encouraged the disease. Healthy plants suffer if planted in flax sick soil, but germination in sick soil does not apparently produce any bad effect if the plants are transferred early to healthy soil. Pea sick soil affects unfavourably a flax as well as a pea crop.

No symptoms of sickness could be observed with the barley. As an intervening crop between flax and peas or the reverse, it had the effect of reducing the severity of the attacks of sickness. Pea sick soil in particular seemed congenial to the barley.

FIELD CROPS.

Varieties of Barley (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1914*).—Two selections of Archer raised by the Department, and a hybrid barley (Beaven's "145") obtained by Mr. E. S. Beaven, by crossing an Archer with a broad-eared barley of the Goldthorpe type, were tested in 1912 and 1913, and little difference was found between the three in yield and, so far as the year 1913 was concerned, in quality also. Mr. Beaven's variety, both in 1912 and 1913, exhibited

an immunity to loss by ears breaking off the straw, which renders it a particularly valuable variety for districts where broad-eared barleys are grown.

Manuring of Mangolds (*Univ. Coll. of N. Wales, Bull. II., 1913*).—

These experiments, commenced in 1909, were brought to a conclusion in 1913. The following table shows the manures used, their cost, and the average yields in the five years (all per acre):—

Plot.	Manure.	Cost of Artificial. 1913.	Average yield in 5 years.
		£ s. d.	tons. cwt.
1	No manure	—	11 13
2	10 tons farmyard manure	—	21 7
3	20 tons farmyard manure	—	24 13
4	10 tons farmyard manure		
	256 lb. nitrate of soda	2 19 0	26 15
	698 lb. superphosphate		
	164 lb. muriate of potash		
5	20 tons farmyard manure		
	256 lb. nitrate of soda	2 19 0	29 6
	698 lb. superphosphate		
	164 lb. muriate of potash		
6	20 tons farmyard manure		
	202 lb. sulphate of ammonia	2 18 0	27 9
	698 lb. superphosphate		
	164 lb. muriate of potash		
7	10 tons farmyard manure		
	128 lb. nitrate of soda	1 9 6	24 16
	349 lb. superphosphate		
	82 lb. muriate of potash		
8	20 tons farmyard manure		
	128 lb. nitrate of soda	1 9 6	26 12
	319 lb. superphosphate		
	82 lb. muriate of potash		

An application of 10 tons farmyard manure resulted in an increased crop of about 10 tons of mangolds per acre, but a further application of 10 tons only resulted in a further increase of less than $3\frac{1}{2}$ tons. Where artificials were used to supplement the farmyard manure the returns for the extra dressing of 10 tons farmyard manure were still less.

A moderate dressing of artificials, costing 29s. 6d., when used to supplement the 10 tons of farmyard manure, gave an average increase per acre of about $3\frac{1}{2}$ tons (see plots 2 and 7). The same mixture of artificials when used with a 20-ton dressing of farmyard manure gave an increase of only 2 tons (see plots 3 and 8). The increased crop obtained by doubling the artificials was, on an average, 2 tons (see plots 4 and 7). As the extra manure cost 29s. 6d. the increase could hardly be regarded as profitable. Doubling the dressing of artificials, along with a 20-ton dressing of farmyard manure, gave an increased crop of about $2\frac{1}{2}$ tons per acre (see plots 5 and 8). The mangolds must be valued at not less than 10s. a ton to make this a profitable practice.

Nitrate of soda, applied as a top dressing after the crop was thinned, gave decidedly better results than sulphate of ammonia applied in the rows.

Varieties of Wheat (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1914*).—Red Fife, Burgoyne's Fife, Red Chaff White and

Queen Wilhelmina were compared on two soils, one a strong loam and the other a light gravelly loam on a gravelly subsoil, each of the two plots being an acre in size. On both soils Queen Wilhelmina gave the best yields, with Burgoyne's Fife taking second place; on the light loam, however, Red Chaff White gave as good results as the latter. Red Fife and Burgoyne's Fife are superior in quality to the other two varieties.

The experience gained in this and previous experiments shows that Red Fife and Burgoyne's Fife produce the best crops when sown in the spring. Red Fife is an exceptionally poor tillerer, and it is, therefore, necessary to sow more seed of this than of the heavier tillering varieties. Queen Wilhelmina and Red Chaff White should be sown in autumn, but the latter, on light soils, may be sown up to the end of February.

Varieties of Oats (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1914*).—In 1913 experiments were carried out at 16 centres. The yields of grain and straw per acre from the different varieties were as follows:—Black Tartarian, 21½ cwt. grain, 34 cwt. straw; Potato Oat, 21½ cwt. grain, 36 cwt. straw; Yelder, 21½ cwt. grain, 31 cwt. straw; Abundance, 20½ cwt. grain, 31 cwt. straw; Banner, 20½ cwt. grain, 29 cwt. straw; and Waverley, 20 cwt. grain, 29 cwt. straw. The average yields of these varieties per acre, in the seven years 1906–12, were:—Black Tartarian, 22½ cwt. grain, 35 cwt. straw; Potato Oat, 21½ cwt. grain, 35 cwt. straw; Yelder was not tested; Abundance, 21½ cwt. grain, 33 cwt. straw; Banner, 23 cwt. grain, 34 cwt. straw; and Waverley, 23 cwt. grain, 34 cwt. straw.

Tobacco Growing in Ireland (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1914*).—These experiments have been conducted under the supervision of the Department since 1904. In 1912 the crop was experimentally grown under the Large Scale Experiments Scheme by twenty growers on an area of 108 acres, the average yield per acre being 665 lb., which was below the average annual yield and only about half that of the previous year. The following table shows the cost of production and the returns for each class of tobacco grown:—

	Pipe (average of 5 centres).	Cigarette (one centre).	Pipe and Cigarette (one centre).
Average yield per acre in lb.	595	863	1035
Cost of production, per lb. ..	10.9d.	11.2d.	6.6d.
Amount received, per lb. ..	3.9d.	4.9d.	5.3d.
Cost of production, per acre .	£ s. d. 27 1 0	£ s. d. 40 5 8	£ s. d. 28 7 5
Amount received, per acre ..	9 10 10	17 15 6	22 13 4

Except as regards the cost of production per acre these figures compare very unfavourably with those of 1911 (see this *Journal*, April, 1913, p. 46). The effect of the cold, wet season of 1912, which was terminated prematurely by a disastrous frost, not only greatly curtailed the yield, but lowered the quality to such an extent that the prices obtained for the crop were below the averages of several previous years. The returns for the 1913 crop are not yet available, but there is every indication that they will show a great improvement upon those of 1912.

The Influence of Potash and Phosphates on the Quality of Malting Barley (*Landw. Jahrb., Bd. XLV., Heft 5*).—The experiments were carried out in connection with the Agricultural Institute of Giessen University with the object of ascertaining how and under what conditions potash and phosphates affect the quality of malting barley. The following results were obtained:—

The soil responded in every case to applications of a phosphatic manure; the use of this manure led also to an increased utilisation of potash and nitrogen. Where medium and heavy applications of phosphates were made there was a real need for potash.

Manuring with potash and phosphates in every case produced an increased gross yield.

The protein content was diminished by manuring with potash and phosphates.

Independently of the yield, the dry matter contained in the grain increased almost regularly with increased applications of potash and phosphates. Whether this was due to a higher degree of maturity of the better nourished barley or to a larger deposit of potash and phosphates in the grain, was not determined.

In most cases there was an improvement in weight, conformity to type, and proportion of chaff.

Increase in weight was generally accompanied by greater conformity to type, but by a decrease in the weight of chaff.

Manuring with potash and phosphates resulted in a noticeable, if not pronounced, improvement in the germinating power.

Barley manured with potash and phosphates had almost always a canary yellow colour.

Collectively, the results showed that potash phosphatic manuring produced a general improvement in the quality of the barley.

The following principles may be put forward in regard to the manuring of barley for malting purposes. To obtain the best quality, nitrogen should be available in minimum quantities; this end may be most safely attained by the omission of nitrogenous manuring and by a liberal manuring with potash and phosphates. If the highest yield is desired it may be considered advisable to apply a nitrogenous manure. It should be remembered, however, that the largest yield is not consistent with the best quality: there is, however, a point up to which nitrogenous manuring may increase the yield without leading to deterioration in quality. The attainment of this aim is dependent upon suitable manuring with potash and phosphates.

LIVE STOCK AND FEEDING STUFFS.

Pig Feeding (*Jour. of Agric., Victoria, Jan., 1914*).—The points investigated were the comparative feeding values of various grain rations, the weekly gains made by pigs from birth to maturity, and the cost of producing a pound of live pork at various periods of growth. During the eighteen months over which the experiments have lasted so far, 34 tests have been conducted with an average of five pigs in each test. The rations were pollards and skimmed milk either alone or along with peas, barley meal, mangolds, maize, or potatoes. A small quantity of bran was as a rule used with the ration, and all pigs up to 16 weeks of age had a small quantity of bone meal daily.

Increases from birth up to 10 weeks of age.—In the case of pigs in this class the sows were weighed before farrowing and any loss in weight

during suckling was deducted from the weight of the litter at 10 weeks old. All the food eaten by both sow and litter was charged against the litter. The average weekly gain of the 49 pigs in this class was 5.3 lb. per head at a cost of 1.26d. per lb. for food. The best results in this class were obtained from 18 pigs fed on pollards, bran, and skimmed milk, and allowed a run on rape pasture, the gain being made at a cost of .9d. per lb.

Increases from 10 up to 16 weeks.—The average weight of 59 pigs at 16 weeks was 104 lb., the average weekly gain from 10 to 16 weeks being 8.52 lb. made at a cost for food of 1.45d. per lb. A gain of 8.33 lb. per head per week was made from pollards, bran and skimmed milk at a cost of 1.4d. per lb.; from pollards, peas and skimmed milk the gain was 8.74 lb. at a cost of 1.68d. per lb.; and from pollards, bran, barley meal and skimmed milk the gain was 9.6 lb. at a cost of 1.71d. per lb.

Increases from 16 weeks upwards.—The average weight of 62 pigs at 24 weeks was 190 lb., the average weekly gain, 10.8 lb., being made at a cost of 1.8d. per lb. From pollards, barley meal, bran, and skimmed milk, an average weekly gain of 11.33 lb. at a cost of 2d. per lb. was obtained; from pollards, bran, and skimmed milk 10.54 lb. at a cost of 1.73d. per lb.; from pollards, peas, and skimmed milk 10.19 lb. at a cost of 1.66d. per lb.; from pollards, bran, mangolds, and skimmed milk 9.75 lb. at a cost of 1.67d. per lb.; and from pollards, maize, and skimmed milk 11.45 lb. at a cost of 1.84d. per lb.

The average cost per lb. of live weight increase for pigs of all ages was 1.67d. and on the average, the selling price was 4.8d. per lb.

The general conclusions drawn from these tests, carried out in Victoria, are that the younger the pig, the cheaper is the gain per lb.; that pollards and milk, with a little bran, is one of the cheapest rations to feed to pigs of all ages; that rape pasture is likely materially to reduce the cost of production; that with well-bred pigs, properly fed and cared for, first grade pork and bacon can be produced in Victoria for about 1½d. per lb. live weight or under 2½d. per lb. dressed weight; and that an average weekly gain of about 8 lb. should be expected, and the pig put on the market at from 180 to 200 lb. live weight within six months.

Fattening of Cattle in Stalls (*Kildare Committee of Agric., Report on Expts., 1912-13*).—These experiments were carried out to compare the relative merits of home-grown and foreign concentrated foods for cattle fattening. The tests at the two centres were kept quite distinct.

Barberstown.—Eight Shorthorn cross-bred bullocks of 2½ years of age were divided into two lots of uniform weight and condition. Each bullock received 70 lb. of turnips, 10 lb. of hay, and one feed of straw per day. As regards concentrated foods each animal in Lot I. received 3 lb. per day, consisting of a mixture of two parts wheat meal, three parts barley meal, and four parts ground oats, while Lot II. was given a similar weight of food composed of one part decorticated cotton cake and two parts maize meal. The experiment commenced on November 29th; on January 3rd the allowance of concentrated food was increased to 5 lb. per head per day for each lot, and on February 22nd a further increase to 7 lb. took place. The cattle were sold on March 26th, each lot making the same price, viz., 41s. per cwt. live weight. The results of the periodical weighings were as follows:—

	Lot I.	Lot II.
	cwt. qr. lb.	cwt. qr. lb.
Nov. 29th	44 1 14	44 1 14
Jan. 28th	48 0 14	47 3 14
Feb. 25th	49 0 0	50 0 14
Mar. 26th	50 3 14	51 3 14

The cost of the concentrated foods given to Lot I. was 7s. 2d. and to Lot II. 7s. 4d. per cwt.

Coursetown.—The eight bullocks, which were of Shorthorn type, were divided into two lots as at Barberstown. Each animal was given about 100 lb. of swedes and 16 lb. of straw per day, but no hay. The concentrated foods were given at first at the rate of 3 lb. per day and the ration was gradually increased to 10 lb. per day. The experiment commenced on November 22nd and the animals were sold on May 1st, making slightly over 41s. per cwt. live weight. The weights at various periods were as follows:—

	Lot I.	Lot II.
	cwt. qr. lb.	cwt. qr. lb.
Nov. 22nd	41 1 0	41 0 0
Mar. 14th	46 0 0	47 1 0
Apl. 29th	49 0 0	50 1 0

The cost of the concentrated foods was the same as in the Barberstown experiment.

The results of the two experiments show that cattle can be successfully fattened on the mixture of home-grown foods indicated. In each case Lot II. made a rather larger gain in weight than Lot I., and it was found, moreover, that they lost less in the course of transit to the market. The slight superiority in fattening value of the foreign foods might, however, be offset by the somewhat higher cost.

Fish Meal (*Fühlings Landwirtschaftliche Zeitung, February 15th, 1914*).—As the result of investigations conducted at the Agricultural Experiment Station at Harleshausen it is pointed out that, provided it is of good quality, fish meal forms a suitable supplementary feeding stuff for farm animals, especially for pigs. Unfortunately, however, it is made in many cases from inferior products, such as decomposing fish and herring meal containing excessive quantities of salt, or it may be adulterated with bone meal and carcass meal. Fish meals made from low grade material may have a harmful effect on the health of the animals to which they are fed.

Fish meal, it is said, is commonly produced partly from fish offal and partly from whole fish condemned as unfit for human consumption, or which is unsaleable owing to an excessive supply. Purchasers are warned that great care is necessary in buying fish meal as, apart from the varied nature of the raw material from which it is made, the methods of preparation may produce wide differences in its composition. From the analyses of a large number of different samples of fish meal the proportion of different constituents was found to vary between the following limits:—

Water	5.90 to 18.91 per cent.
Crude protein	38.83 to 58.96 ..
Digestible protein ..	30.43 to 54.52 ..
Fat	1.55 to 14.03 ..
Phosphate of lime ..	7.80 to 36.16 ..
Salt	.70 to 20.10 ..
Ash	20.53 to 45.07 ..
Sand	.10 to 6.05 ..

Its richness in protein renders fish meal especially suitable for combination with foods, such as roots and potatoes, which possess a low percentage of that constituent. If fed in too large quantities or containing too high a percentage of oil the meal is liable to give a fishy taste to the meat product. It has been commonly accepted that high grade fish meal should not contain more than 2 to 3 per cent. of fat, but when the proportion of meal used in the ration is not too high it is considered that there is no objection to using meals containing up to 4 per cent. Among the mineral constituents contained in fish meal are phosphate of lime and salt, both of which are indispensable in the feeding of animals. In the case of salt, however, an excessive amount is valueless and may even cause illness. For this reason the proportion of salt contained in fish meal should not exceed 3 per cent.

The quantity of fish meal which may be fed with advantage to the different kinds of farm stock varies according to the class of stock and to the quality of the meal. It is suggested that the following amounts may be given daily if the meal is of good quality:—Cattle 2 lb. for every 1,000 lb. live weight; pigs $\frac{1}{2}$ to $\frac{1}{4}$ lb. per head according to weight; and sheep $\frac{1}{10}$ to $\frac{1}{4}$ lb. for every 100 lb. live weight.

WEEDS AND PLANT PESTS.

Destruction of Eelworms (*Kew Bulletin*, No. 9, 1913, G. Massee).

—This paper describes various eelworms, gives some of the host plants, and discusses methods of prevention. With regard to *Heterodera radiculicola*, which attacks vines, potatoes, roses, phloxes, balsams, and, less frequently, fruit trees, it is stated that so far as preventive or curative methods are concerned, there is no known method by which the eggs of these eelworms can be killed in open ground, and even when treating a limited amount of soil in houses, the most drastic measures, accurately applied, can alone command success. The reason why eelworms are so difficult to exterminate arises from the fact that eggs are produced in immense numbers throughout the year, or at all events so long as living roots are available, and young eelworms are constantly being liberated into the soil; consequently the dressing capable of killing eelworms should be repeated for a considerable number of times, extending over a long period, which becomes almost impracticable. A dressing of sulphate of potash, 3 cwt. per acre, will kill all active eelworms with which it comes in contact, but however well it may be worked into the soil many will escape, and its efficacy soon passes away. When, however, a growing crop is suffering from eelworm, the application of sulphate of potash, if at a sufficiently early date, will check the progress of the disease to some extent, but it will not prove a cure, since the eggs are not destroyed. The application of lime is practically useless against eelworms. Gaslime, now hardly procurable, is a more satisfactory remedy, as its lasting power in the land means the death of successive generations, but to obtain this end the land must lie fallow for some time. The use of a "trap crop" is advocated by experts in Germany, where the injury to sugar-beet by eelworm is often considerable. The idea of a trap crop is to grow on infected land some plant readily attacked by eelworms; the crops should be pulled up and sun-dried, if practicable, when a considerable number of larval nematodes have entered the roots, and before a new brood is produced; summer rape

is recommended for this purpose, on account of its quick growth and great spread of root. Success, of course, entirely depends on the removal of the crop at the proper time. This method so far reduces the number of eelworms present in the land that a fairly good crop may be secured, but its effect is not lasting.

For the complete destruction of eelworms in soil in tomato and cucumber houses, etc., the method recommended by Stone and Smith is as follows:—

"The most effectual, complete, and practical method at the present time of exterminating nematodes in greenhouses is by heating the soil by means of steam. This can be accomplished without much expense providing proper attention is paid to the method of applying the steam. A pressure of steam exceeding 50 lb. is not only cheaper but more effective than a pressure which falls below this, and the amount and cross section area of the tile [pipe] is important. The cost of heating soil depends upon the equipment employed and cost of labour, etc. Probably not far from 100 cubic feet of soil under the most favourable conditions can be heated in one hour's time to a temperature of over 200° F. The minimum amount of heat necessary to kill nematodes and their eggs while confined to the soil is about 140° F., but for all practical purposes it is desirable to make use of a higher temperature, at least from 180°–212° F. The benefit of steaming or sterilising soil is not alone confined to the destruction of nematodes. Many other greenhouse pests are killed. The mechanical conditions of the soil are moreover greatly improved, and the numerous compounds are rendered more available for plant food, which results in giving plants grown in a sterilised soil a considerable acceleration in their rate of growth."

It has been suggested that dressing the soil with rape meal destroys eelworms. This may possibly hold in check or kill active eelworms, but it will not kill the eggs.

It is well known that a poor physical condition of the soil not only favours the spread of eelworms, but also prevents their destruction, owing to the difficulty of diffusion and permeation of the remedial agent applied.

Potassium permanganate, 1 part in 200 parts, kills eelworms, if the soil is saturated at intervals of ten days, and does not injure growing plants. This again may be used to save a growing crop, but as it has no effect on the eggs, it must not be depended upon for exterminating the pests. Finally, carbon bisulphide injected into the soil will kill any active eelworms present.

The treatment for *Tylenchus devastatrix* on clover, if the diseased patches are observed when quite small, is to dig up the plants and burn them on the spot when dry, taking care to remove the plants well beyond the zone of apparent injury; and then to dress with sulphate of potash as previously advised for *H. radiculicola*. "Segging" of oats or "Tulip root" is also caused by *T. devastatrix*. Deep ploughing, where allowable from other standpoints, and treatment with sulphate of potash are recommended for infected land, which should not be sown with a crop susceptible to the disease, such as clover; barley or root crops are safe for this purpose. The same eelworm is the cause of a disease of the strawberry plant, the treatment recommended being the removal and burning of diseased plants, and the treatment of the land with sulphate of potash.

Removal of diseased plants and the application of sulphate of potash is also recommended in the case of *Aphelenchus fragariae* which causes "cauliflower" disease of strawberry plants. (See also Leaflets Nos. 46, 75, and 271.)

Eradication of Charlock and Wild Radish by Calcium Cyanamide (*Deut. Landw. Presse*, 21st Jan., 1914).—Experiments were carried out at 50 different centres in the spring of 1913 by the Luxemburg Union of Agricultural Societies, as to the efficacy of calcium cyanamide in the eradication of charlock and wild radish. There was a wide range of soil and weather conditions at these centres. The crops were spring sown, and in most cases, oats; the calcium cyanamide was applied at the rate of 134 lb. per acre on the average.

The weed plants were at different stages of development at the different centres when the calcium cyanamide was applied. The applications were always made in the early morning after a dewy night. In most cases the succeeding weather was favourable, i.e., without rain, and in these cases the effects of the calcium cyanamide on the charlock and wild radish were visible on the two succeeding days, plants with from 4 to 6 leaves being completely burnt, and even stronger plants being usually killed. Plants in bloom were not completely burnt, but were weakened to such an extent that the oats overgrew them later. At four centres where there was rain after the application of the calcium cyanamide the effect was not visible until a few days later and was less marked than in the preceding cases.

The experiments also showed thistles to be very susceptible to calcium cyanamide.

Although there was a yellowing of the oat plants a few days after the applications, it was established at all centres that the calcium cyanamide had no harmful effect on the young oats.

At eleven centres clover was sown in the oats. In nine cases, when the oat crop was taken, the clover was seen to be better than on untreated plots; in two cases it was worse, but attained a better growth by the autumn. In no case did the calcium cyanamide permanently harm the clover.

At all centres, the manurial effect of the calcium cyanamide was very noticeable—equal, in fact, to that of either sulphate of ammonia or nitrate of soda when these were tested.

In the less badly infested fields the gain from the treatment was about 5 cwt. of grain per acre over the control plots. But for the treatment in some of the badly infested fields, these would have had to be ploughed up.

Destruction of Wild Radish with Calcium Cyanamide (*Deutsche Landw. Presse*, February 21st, 1914).—Experiments were carried out near Gratz in Austria during 1913 to ascertain the effect of calcium cyanamide in destroying wild radish. The crop treated was oats in which wild radish was very prevalent. Good results were obtained from an application of 1 cwt. of cyanamide per acre, although it was deemed advisable to increase this amount slightly where the weed was more than usually abundant. The wild radish was most effectively destroyed by applying the cyanamide when the majority of the plants had developed from three to four leaves. If applied earlier many wild radish

plants escaped and developed later. It was found better also to distribute the cyanamide after rain or when the early morning dew was on the leaves; if the plants were dry the destruction was not so complete. While the oat crop suffered a little from the application of the cyanamide it soon recovered, and, compared with the part of the field untreated, the straw was found to be longer and the yield greater. Where clover was sown with the oats it was found that unless the cyanamide was applied with care the clover plant was liable to be damaged; especially was this the case if the period was a dry one and the general manuring for the crop had been insufficient to induce a good growth.

Effect of Formalin and Bluestone on the Germination of Wheat (*Jour. of Agric., Victoria*, August, 1913).—A number of wheat seeds were immersed in a solution of formalin, 1 to 300, for five minutes, others in a 2 per cent. solution of bluestone for one minute. After pickling the seed was thoroughly dried.

One hundred untreated seeds and seeds treated in each of the above ways were germinated every week over a period of 54 weeks.

From the first there was a marked difference in the vigour and growth of the plants, the untreated being quickest to germinate and the most vigorous and luxuriant in subsequent growth. The germination percentages for the untreated seeds varied between 99 and 91 (94 in the last week), with an average of 95.

The seed pickled in formalin was the next in germination and vigour, the average germination percentage over the 54 weeks being 91. In the first week the germination was 98 per cent., but there was a drop thereafter until the seventh week, between which and the twenty-fourth week there were fluctuations, after which the drop was resumed, the germination in the last week being 84 per cent.

All through the test the seed treated with bluestone could be detected, being greatly behind the control and formalin treated seed. The germination percentage in the first week was 95, following which there was a more or less gradual fall, 32 per cent. being reached at the end of the experiment, the average percentage being 48½.

The experiment showed the need for sowing treated seed as soon as possible after pickling.

MISCELLANEOUS.

Atmospheric Impurities near an Industrial City (*Journ. Agric. Sci., Vol. V., Part IV., October, 1913*).—These investigations were carried out at the Department of Agriculture of Leeds University by C. Crowther, M.A., Ph.D., and D. W. Steuart, B.Sc., and were aided by a grant from the Development Fund.

From July 1st, 1911, to July 1st, 1912, samples of rain were collected at 14 stations round Leeds. The analyses of these samples brought out very clearly the marked difference in the purity of the atmosphere between the industrial-rural area to the west and south, and the purely agricultural area to the north and north-east of Leeds. They showed the sulphur-content of the rain to afford a fairly reliable index of the degree of pollution of the atmosphere by smoke, provided the observations are prolonged over several months. The sulphur-content of the leaves of trees was also found to afford useful assistance in the diagnosis of smoke pollution.

These rain analyses showed further that appreciable smoke-pollution still remains throughout the agricultural area at distances of seven

miles from the city, the rate of improvement of the atmosphere on passing away from the city into the purely agricultural areas being appreciably slower in the direction following the prevailing winds than in other directions.

Throughout the industrial-rural area, abundant evidence of damage to leaves was found, and there could be no doubt of the consequent check to growth.

POULTRY.

Eleven Years' Records in Egg-laying Competitions (*Dept. of Agric., New South Wales, Farmers' Bull. No. 70*).—The eleventh year's work in connection with egg-laying competitions at Hawkesbury Agricultural College, New South Wales, was completed on 1st April, 1913. At this date, also, four years' work had been accomplished as regards the egg-laying of ducks.

The results of the eleventh year showed the hens to return nearly double the average profit shown by the ducks, in spite of the fact that a new world's record for first-year laying was made by a pen of six Indian Runner ducks with an output of 1,601 eggs.

The following results have been obtained with third-year and second-year hens :—

THIRD-YEAR HENS.

(Averages for Three Competitions.)

	Eggs per Hen.			Value per Hen.		
	1st year.	2nd year.	3rd year.	1st year.	2nd year.	3rd year.
30 White Leghorns	203	162	123	s. d.	s. d.	s. d.
12 Silver Wyandottes	180	147	92	20 6	12 5	12 7
12 Black Orpingtons	165	123	99	18 0	16 2	10 2
6 White Orpingtons	127	112	94	15 4	11 0	9 10
				12 5	11 4	11 3

SECOND-YEAR HENS.

(Averages for Six Competitions.)

	Eggs per Hen.		Value per Hen.	
	1st year.	2nd year.	1st year.	2nd year.
6 Rose-comb White Leghorns..	224	171	s. d.	s. d.
114 S. C. White Leghorns ..	206	141	23 4	18 7
42 Black Orpingtons ..	191	124	20 1	14 4
12 Plymouth Rocks ..	184	121	19 3	13 3
6 Silver Wyandottes ..	189	112	19 3	13 4
			18 11	11 4

The following results have been obtained with fourth-year and third-year ducks :—

FOURTH-YEAR DUCKS.

	Eggs per Duck.				Value per Duck.			
	1st year.	2nd year.	3rd year.	4th year.	1st year.	2nd year.	3rd year.	4th year.
18 Indian Runners	186	185	121	109	s. d.	s. d.	s. d.	s. d.
6 Buff Orpingtons	184	147	117	104	19 8	12 8	10 8	11 1
					19 10	16 7	9 9	9 11

THIRD-YEAR DUCKS.

	Eggs per Duck.			Value per Duck.		
	1st year.	2nd year.	3rd year.	1st year.	2nd year.	3rd year.
6 Cantonese ..	171	164	164	s. d.	s. d.	s. d.
24 Indian Runners	187	176	128	17 8½	10 8	17 0
				14 4½	13 10½	13 0

The following table shows the results of the whole eleven years' work with hens :—

Year.	No. of Pens.	Average per Hen.	Average Value per Hen.	Cost of Food per Hen.	Profit over Food.
			s. d.	s. d.	s. d.
1	38	130	15 6	6 0	9 6
2	70	163	17 9	5 9½	12 0
3	100	152	12 9	4 5½	8 3
4	100	166	13 3	5 3½	8 0
5	100	171	14 10	5 10	9 0
6	60	173	17 2	7 0	10 2
7	50	180	19 2	7 9½	11 4
8	60	181	21 9	6 9	15 0
9	40	168	16 3½	6 5½	10 2
10	50	184	18 5½	6 1½	12 4
11	50	178	19 4½	7 3½	12 0½

NOTES ON AGRICULTURAL CO-OPERATION.

A RETURN [H.C. 84, 1914] published by the Registrar of Friendly Societies in February, 1914, contains particulars of agricultural credit societies registered as specially authorised societies under the Friendly Societies Act of 1896, together with a statement showing the types of land banks and societies registered to deal with small holdings and loans for agricultural purposes.

Agricultural Co-operative Credit in England and Wales.
Land Banks.—With one exception the banks registered under the Industrial and Provident Societies Act which have been founded with a view to business in rural districts, are all of quite recent establishment. The exception is the Central Co-operative Agricultural Bank, which was promoted by a Joint Committee of the Agricultural Organisation Societies. Its primary objects are stated to be the carrying on of banking in all its branches, including the advancing of money to agricultural credit societies and agricultural co-operative societies, and thereby assisting the development of agricultural co-operative credit and other forms of agricultural co-operation. It issues £1 shares; its dividends are limited to 5 per cent., and its borrowing powers are limited to £100,000 (excluding deposits taken in the ordinary course of its banking business). Its deposits are limited to £5,000, for any one person. In 1912 its total receipts were £228, it advanced £39, while its share capital amounted to £420, deposits to £542, and total amount of loans owing to the Society to £464.

At 31st December, 1912, five societies were registered with rules approved by the Small Holders' League. Their objects are to carry on the business of banking and finance, and in carrying on such business, to arrange and negotiate with bankers or other lenders on behalf of their members for sums of money in order to enable them to buy land, stock, &c., to build or repair pig sties, cow houses, or other buildings, to carry on the business of dealers in agricultural instruments, and to provide members of the society with agricultural implements on the most economical terms. All the societies issue £1 shares, and in one case the society may receive loans and deposits not exceeding £50,000, while in the other cases deposits and loans are not limited. Of the profits, 10 per cent. is to be carried to a reserve fund, and from the remainder a dividend may be paid not exceeding 5 per cent.

During 1912 the Small Holders' League registered a complete Amendment of Rules and became the Small Holders' Union. By its amended rules its objects were stated to be—

(a) To carry on the business of banking in all its branches and departments, in particular to borrow or raise money, to arrange and negotiate loans with bankers or other lenders on behalf of the Society or on behalf of its members, and to promote the formation of credit banks;

(b) To carry on the business of dealers in every commodity required or produced by small holders;

(c) To carry on the business of improving and developing agricultural industries in Great Britain.

The Society has 5s. shares, its borrowing powers are limited to £100,000, its deposits to £10,000, and its dividends to 5 per cent.

Nine societies have subsequently been registered with rules approved by the Small Holders' Union, and with objects similar to those of that Society. The shares vary in value from 1s. to £1, and the societies have power to receive loans and deposits. Dividends are in all cases limited to 5 per cent.

Although the carrying on of the business of banking is one of the objects of the Agricultural Co-operative Federation, Ltd., the annual returns of this society do not disclose any banking business.

One other small society, whose objects are stated to be horticulture, rural industries, storekeeping and banking, makes provision in its rules for the use of barter notes and barter cheques. The last of its rules reads as follows:—

"Although no one is entitled to demand as a right the redemption of barter notes or barter cheques with money, the Committee shall endeavour, so far as it can consistently with the Society's interests, to meet, in this matter, the convenience of the members."

From an examination of the Annual Returns it would not appear that any considerable advances on mortgage security of property used for agricultural purposes are made by societies incorporated under the Building Societies Acts.

*Agricultural Credit Societies.**—Of the 47 Agricultural Credit Societies in England and Wales, 40 have used the model rules issued by the Agricultural Organisation Society. The following are the object rules of these societies:—

(a) The objects of the society shall be to create funds by monthly or other contributions to be lent out to, or invested for, its members or for their benefit, pursuant to the Friendly Societies Act, 1896, and to the Special Authority of 23rd April, 1903.

(b) Loans to members shall only be made on condition that the purpose for which money is borrowed is, in the opinion of the Committee, such that there is a sufficient prospect of the loan repaying itself by the production, business, or economy which it will enable the borrower to effect.

Their rules provide for an entrance fee, to be fixed by the Committee and not to exceed 5s., and for the receiving of deposits from members and non-members, and the borrowing of money at interest from persons other than members. Membership is confined to persons resident in the neighbourhood of the Society, and every person on becoming a member of the Society is entitled to a loan provided the Committee are satisfied with the trustworthiness of the applicant, the sufficiency of the security offered, and the profitableness by productiveness or saving which the use of the loan may effect, and that there are sufficient funds under the Society's control. The total sum loaned at any time to a member may not exceed £50. No profits, bonus, or dividend of any amount is to be divided among the members; any surplus is to be carried to a reserve fund.

In one other society the rules appear to be identical with the model rules of the Agricultural Organisation Society, with the exception that the contributions are weekly instead of monthly.

Three more societies have adopted the model rules supplied by the Co-operative Banks' Association. These rules appear to be practically

* The Return under notice gives a list of these societies, with date of registration, number of members and total assets. These particulars were fully dealt with in the *Journal* for Jan., 1914, p. 915.

identical with the model rules supplied by the Agricultural Organisation Society, and two at least are now affiliated to that Society. The remaining three societies' rules are those supplied by the Agricultural Banks' Association. These societies were among the earliest Agricultural Credit Banks established.

Small Holders' Societies.—There were in England and Wales in 1912, 216 societies, registered under the Industrial and Provident Societies Act, whose primary object was to acquire land to be used for small holdings. The rules of 197 of these societies had been approved by the Agricultural Organisation Society. Four societies used the general rules of the Co-operative Union, with special rules of the Agricultural Organisation Society for small holdings. Three societies used the rules supplied by the Co-operative Union, while the remaining 12 societies do not appear to have been assisted in their promotion by any organisation.

In the societies connected with the Agricultural Organisation Society, the object rules follow more or less closely one of the following two examples:—

The objects of the society shall be—

- A.—(1) To carry on the business of creating or promoting the creation of small holdings or allotments, and encouraging their proper cultivation, with power to acquire land from local authorities acting under the provisions of any Act for the time being in force relating to small holdings or allotments or from any other person or body, to adapt any land so acquired for small holdings or allotments by the erection of dwelling houses, or other buildings, or the execution of any other improvement, and to let the land to members of the society to be cultivated by them as small holdings or allotments.
- (2) To carry on the business of wholesale and retail dealers in agricultural requirements, dairy, farm, and garden produce, eggs and poultry; and any other trades, industries, or businesses which may seem calculated to develop the society's property, or conduce to the more profitable working of small holdings or allotments. Or—

B.—The objects of the society shall be to acquire land for the purpose of letting the same in small holdings and allotments, and to carry on the trades, industries, or businesses of manufacturers of butter, hard and soft cheeses, cream, bottled milk, and other dairy products; of wholesale and retail dealers and distributors in agricultural requirements, dairy, farm and garden produce, and in any other class of goods the committee may direct; and any other trades, industries, or businesses which may seem calculated to conduce to the more profitable working of farms, small holdings, and allotments.

The shares are generally of £1 value, in a few cases of 10s., and in one case of 2s. only, but in the last-mentioned case the ordinary member must take five shares, while a member occupying land must take shares to the amount of one year's rental on his holding. The number of shares that a member must take up varies a good deal, but in the majority of societies an occupying member must hold shares to the value of three years' rental, while in a number of the remaining societies the number of shares varies from one to five according to the acreage of

the land occupied. Provision is made for obtaining loans limited to twice the amount of the capital of the society issued at the date of the loan and deposits are not taken either from members or non-members.

In making provision for the allocation of profits, the rules allow for the payment of 5 per cent. interest on share capital as a first charge, and of the remainder at least one-half goes to the reserve fund, not less than 5 per cent. as a bonus to the workers, and the balance to members and non-members who have had dealings with the society.

Societies which have adopted the rules of the Co-operative Union may take deposits. The shares in the different societies are £1, 10s., or 2s., and the minimum holding of shares is one share, with no special provisions for occupying members.

Of the societies not attached to any organisation at least half appear to be concerned with garden allotments rather than with small holdings, and several of them appear to have adopted a common model for their rules. In most cases they limit their membership, sometimes to 1,000 and sometimes to 100 members. The interest on share capital is generally limited, sometimes to 4 per cent. and sometimes to 5 per cent. Shares vary from 1s. to £1 in the different societies, the general provision being a minimum of one share. In three societies, however, where the shares are of £1 the rules provide for one share per acre, two shares per ½th-acre and one share per 5-acre holding respectively. In some cases the garden allotments societies limit their holdings to 20 poles.

A society was registered in 1910 called the Agricultural Small Holding Development Association. Its objects, as set out in its rules, are as follows:—

“To carry on the business of assisting in establishing small freehold farms on the land in the agricultural districts of Great Britain and of forming and encouraging the formation of model village communities with a view to the scientific co-operation of such freeholders for their mutual benefit. To carry on such business as may be necessary for the furtherance of these objects, including banking and dealings of any description in land; the purchase and subdivision of estates; the erection of farm buildings and dwellings, homesteads and cottages, and to carry on a general agricultural co-operative business. The Society shall have power to advance part of the purchase money to members in order to enable them to become the owners of their farms.”

The Society issued ordinary and preference shares of £1 nominal value and has power to contract loans and receive deposits. The total amount of loans and deposits, however, must not exceed the issued capital of the Society.

Another society, the Allotments and Small Holdings Association of England, was registered in 1912, with the following among other objects:—

(a) “Negotiating or assisting in negotiations with providing authorities, private landowners, and tenants of land, for and on behalf of members of the Society being applicants for allotments or small holdings.”

(b) “Promoting or assisting in the promotion amongst its members, of societies on a co-operative basis having for their object, or one of their objects, the provision or profitable working of small holdings or allotments, whether in relation to the purchase of requisites, the sale of produce, credit banking or insurance, or otherwise.”

(c) “Promoting or assisting in the promotion of federations of such societies on practical lines for their common benefit.”

(d) "Assisting in any way possible in aiding and developing agriculture and rural industries in the interests of the members of the Society."

The shares are of 10s., the Society may not receive loans or deposits, and the rules provide that surplus profits shall only be allocated, in such proportions as an ordinary general meeting shall direct, to any of the objects of the Society.

There are 118 other societies registered under the Industrial and Provident Societies Act connected with the supplying of small holders with seeds, manures, feeding stuffs, agricultural implements, &c., and the carrying and marketing of small holders' produce. In all cases the model rules of the Agricultural Organisation Society have been used, and the object rules present slight variations of the following example:—

"To carry on the trades, industries or businesses of wholesale and retail dealers in agricultural requirements, dairy, farm and garden produce, eggs and poultry, and in any other class of goods the Committee may direct, and any other trades, industries or businesses which may seem calculated to conduce to the more profitable working of farms, small holdings or allotments."

In 10 of these societies, however, the rules state the primary object of the society to be "the business of manufacturers of butter, hard and soft cheeses, cream, bottled milk and other dairy products," and the secondary business, that of dealers in agricultural requirements, &c.

Although these 118 societies do not include as part of their objects the acquiring of land for small holdings and allotments, they have power according to their rules "to deal in any way with land or buildings."

The insurance of all cattle and pigs of over three months old which are slaughtered in the kingdom of Saxony was made compulsory from 1900 onwards by an Act of 1898. This insurance protects the owners from loss through the total or partial rejection of the carcasses after slaughter, eighty per cent. of the loss (*i.e.*, of the difference between the actual value of the slaughtered animal and its value reckoned on its weight, at current market prices) being paid to the owner in such cases. The administration of the scheme is in the hands of a central body and no local decentralisation exists.

Particulars of the working of the scheme in the five years, 1908-12, are given in the *Deut. Landw. Presse*, January 21st, 1914. It is interesting to note that, of the cattle killed in slaughterhouses that were rejected in the five years, the reason, in 42 per cent. of the male animals and in 79 per cent. of the female animals, was the presence of tuberculosis.

The average annual amount paid in the five years in compensation for rejected animals was £114,700 (£130,500 in 1912). For animals killed in slaughterhouses this compensation averaged £7 12s. per head of male cattle, £4 16s. per head of female cattle, and £2 per head of swine rejected; for animals slaughtered on farms, &c., these amounts were £5 13s., £5 9s. and £1 14s.

It may be mentioned that appeals may be made by the State against the decisions of the central body in cases of compensation. Of 85 such appeals made in the five years only eight were allowed.

The expenditure of the central body, including compensation, in the five years averaged £126,767, the chief expenses other than com-

pensation being for valuation of animals (£7,650) and collection of premiums (£3,050). Towards expenses, the State, in addition to bearing the whole of the costs of management (£3,650), makes a grant to the central body of one quarter of the total amount paid in compensation (*i.e.*, averaging in these five years £28,675).

The insurance contributions averaged £55,225 per annum. In the five years, for the whole of the animals insured, these premiums averaged, for male cattle, 2s. 8d., for female cattle 4s. 5d., and for swine 8d. In 1912 and 1913, however, the premiums were 3s., 5s., and 8d., and in the current year they have been raised to 4s., 8s., and 1s. 2d. respectively.

It was necessary in each of the five years to make a levy to cover the loss on the previous year's working. This contribution is levied from all cattle owners in the kingdom in proportion to the number of animals above three months old in their possession, as determined by the animal census.

OFFICIAL NOTICES AND CIRCULARS.

THE Board desire again to draw the attention of farmers, small holders and others to the fact that the Weekly Return of Market Prices is issued *free*, and may be obtained regularly

Weekly Return of Market Prices. on application.

This Return gives every week the prices of fat and store stock, dairy cattle, meat, wool, poultry, corn, milk, provisions, hops, fruit, vegetables, roots for cattle feeding, hay, and straw, at the chief representative markets in England and Wales. It is issued every Friday and contains reports of markets up to the preceding Wednesday.

That this Weekly Return of Market Prices serves an extremely useful purpose and, as such, is very widely appreciated by agriculturists, is evident, not only from the large number of copies distributed every week in response to applications, but from the fact that numerous recipients have written to the Board acknowledging that this information as to the current market prices all over the country has been very helpful to them in the conduct of their business.

Farmers who desire to receive this Return regularly should apply to "The Secretary, Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W." The envelope in which the application is enclosed need not be stamped.

The Board of Agriculture and Fisheries have received information that the summer stage of American Gooseberry Mildew (*Sphaerotheca Mors-uvæ*) was discovered in a Cambridgeshire

American Gooseberry Mildew—Warning. garden on the 6th inst. All gooseberry growers are advised to examine their bushes carefully and, should any sign of disease be found, to spray their bushes with a solution of liver-of-sulphur (1 lb. to 32 gall. of water). A leaflet describing the disease and giving directions for dealing with it can be obtained from the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W., gratis and post free. Letters so addressed need not be stamped.

Growers are reminded that, by Article 3 of the American Gooseberry Mildew Order of 1911, they are required to report the presence of this disease on their premises to the Board or the Clerk of the Local Authority for the district either directly or through an Inspector, and that the failure to report is punishable by a fine.

The International Phytopathological Conference summoned by the French Government in conjunction with the Italian Government to meet at the International Institute of Agriculture was inaugurated by His Majesty the King of Italy on the 24th February last and was brought to a conclusion on the 5th March, in the presence of all the fifty delegates, who represented the 35 States who took part in the Conference.

International Phytopathological Conference.

The details of the proposed International Convention are as follows:—
Adhering States pledge themselves in the first place to take whatever legislative and administrative measures are necessary to prevent the distribution of all diseases of plants in their own countries, but especially to organise an effective service of supervision over nurseries, gardens, glasshouses, and other establishments which carry on a trade in living plants. The proposed Convention, however, excludes vines, grain, seeds, tubers, edible bulbs, rhizomes and roots, as well as fruit, fresh vegetables, field roots, and the general agricultural produce (*produits de grande culture*).

The measures which adhering States would pledge themselves to take include (a) the erection of one or more Institutes for scientific studies and research; (b) the organisation of an effective service of supervision over nurseries, including the packing and dispatch of plants; (c) the issue of phytopathological certificates. They would bind themselves only to admit plants accompanied by phytopathological certificates issued by or from a competent official authority, except in the case of plants which are imported for scientific research at an Institute authorised by the Government.

These certificates must be in conformity with a model given in the Appendix to the proposed Convention. They include a declaration by the consignor that the plants come from a nursery subject to phytopathological inspection, a certificate in accordance with the Phylloxera Convention of Berne, and a certificate from the official phytopathological service that the plants are in a satisfactory state of health, and are free from any of the diseases, or enemies of plants, scheduled by the Government of the country to which they are being sent.

The compilation of this list is left to each importing country, but it was decided that this list must be as short as possible, and confined to those diseases which are epidemic in character, and destructive or at least injurious in their action, as well as being easy of propagation. Common diseases which are widely distributed (*les espèces banales dont la dispersion déjà ancienne s'étend à presque tous les pays*) are excluded.

Adhering States would recognize the International Agricultural Institute of Rome as the official headquarters for all questions dealt with by the Convention. The Institute would collect all information of an administrative, scientific and practical character concerning the diseases of plants submitted to the adhering States and would issue a monthly bulletin giving the results.

The Conference was particularly concerned to interfere as little as possible with trade, and to harmonise the interests of plant hygiene with those of commerce. A special article prohibits adhering States from giving better terms to those outside the Convention than is accorded to those inside it.

Since March 12th, the date mentioned in the article in the *March Journal*, all restrictions which were imposed by the Board on the movement of animals in connection with the outbreaks of foot-and-mouth disease in Durham and Worcestershire have been withdrawn, and those applied on account of the outbreak at Conway, Carnarvonshire, have now been reduced so as to apply only to a very small area immediately surrounding the premises on which the disease existed. Two further outbreaks of the disease have, however, occurred in the city of Liverpool, but the Board have felt justified in reducing the limits of the original scheduled district and giving further facilities for the movement and marketing of animals therein, subject to certain conditions.

The Board were informed by the Department of Agriculture and Technical Instruction for Ireland of the issue by that Department on March 25th of an Order, the effect of which is to prevent the movement of animals, by sea or by land, from the southern part of Ireland into the northern part of Ireland. The boundary line between these two areas is approximately represented by the line joining the following towns:—Drogheda, Navan, Oldcastle, Finnea, Mullingar, Moate, Athlone, Ballinasloe, Athenry and Oranmore. This Order came into operation on March 27th.

In consequence of this action, and in view of the general position as regards foot-and-mouth disease in Ireland, the Board decided that they might safely allow the importation of animals for slaughter from the northern area, and they accordingly made an Order on March 26th authorising the landing of animals brought from the Irish ports of Dundalk, Belfast, Londonderry and Sligo, to the authorised landing places at Birkenhead, Glasgow and Manchester, and requiring them to be slaughtered in the landing places within 96 hours after their landing. The Board's Order took effect on Tuesday, March 31st.

Report by the Chief Veterinary Officer for 1912.

The Annual Report by the Board's Chief Veterinary Officer for the year 1912 [Cd. 6737-1. Price 2½d.] has been recently issued, and contains a very full history of the outbreaks of foot-and-mouth disease in 1912, together with an account of the measures undertaken in that year to combat this and other diseases.

Part V. of the Agricultural Statistics for 1912, dealing with Colonial and Foreign Statistics, and containing an index to the volume for 1912, has been issued [Cd. 7271, Price 7½d.]. The tables of acreage, live stock and prices are prefaced by a Report by Mr. Rew discussing the changes in the crop areas and live stock, the wheat and meat supply of the United Kingdom, and the relation between live stock and population.

Manuring for Hay.

In the article on Manuring for Hay, which appeared in the *Journal* for February, 1914, p. 980, the words "a small dressing of dung," on p. 983, fourth line from the bottom of the page, should read "a small dressing of artificials."

MISCELLANEOUS NOTES.

Importation of Plants, Seeds, etc., into the United States.—The Board of Agriculture and Fisheries desire to bring to the notice of nurserymen and exporters of plants and bulbs that the importation by parcel post into the United States of all growing or living plants, seeds and other plant products for propagation (except field, vegetable and flower seeds), except in the case of parcels addressed to the Department of Agriculture, Washington, is now prohibited.

Importation of Animals into Canada.—The Board of Agriculture and Fisheries have been officially informed that the Government of the Dominion of Canada will require official certificates to accompany horses and other livestock exported from the United Kingdom after the 1st June next. Particulars regarding the documents required in respect of animals from Great Britain may be obtained from the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

The importation of cattle, sheep, other ruminants, and swine, from the United Kingdom into Canada is not permitted at present, and certificates will not be issued for these animals until the prohibition is withdrawn.

Importation of Poultry into Belgium.—In view of the fact that certain contagious diseases of poultry are common to all farmyard birds, the Belgian Government have issued a Decree, which came into force on March 1st, 1914, extending the provisions of the Decree of August 29th, 1901, which related only to fowls, to include all farmyard birds imported into Belgium. The Decree of 1901 provided that fowls could only enter Belgium through certain frontier stations (including Antwerp, Ghent and Ostend). Imported fowls were to be examined by a veterinary surgeon at the expense of the importer. Fowls suffering from diphtheria, contagious coryza (discharge from the eyes), or chicken cholera would be refused admission.

Importation of Cattle into Costa Rica.—The Board have received information, through the Foreign Office, of a Congressional Decree, dated November 20th, 1913, which imposes a tax of 9s. 7d. per head on all cattle imported into Costa Rica.

Dairy Herd Records in the United States.—The first record of cows was made in the United States in 1887, in order to collect particulars as to the cost of producing milk on a number of farms. The purpose of the investigation was to discover the gross returns and approximate profits of the dairy on every farm visited, and to ascertain the conditions under which the cows were kept, in order to study the effects of good breeding, care, feeding and management. Records were obtained of 5,507 cows, distributed over 367 farms. Following this original investigation, a series of similar enquiries was carried out between 1899 and 1908 in various districts of the country. In all, 26 enumerations were made, including 2,163 herds and 28,447 cows. The figures thus obtained have been summarised in the present bulletin, and a

Notes on Agriculture Abroad.

number of comparative tables show, as far as possible, the factors which make for profitable dairying.

It was found that the average cow of those herds housed comfortably returned the owner an annual profit of nearly £3 over the cost of food, while the average cow of herds which were badly housed yielded an annual profit of only about 1s. The average annual yields of milk and butter fat in the case of the former were 4,793 lb. and 180 lb. respectively, as against 3,514 lb. and 130 lb. in the case of the latter. Moreover, the ratio of profitable to unprofitable herds was more than seven times as great among herds kept in good cow-houses as it was among those in poor cow-houses. It cannot be believed that this difference is due only to the housing, and it is justifiable to assume that the cows comfortably housed were, on the whole, better animals, and had better care and food.

Comparing the herds receiving silage with those not reported to be so fed, it was found that the ratio of profitable to unprofitable herds among those receiving silage was to the similar ratio among those not reported as being fed on silage as 2.8 to 1; that is to say, the probabilities of making a profit appeared to be increased nearly three-fold by the use of silage. The cows fed on silage each yielded, on the average, 4,760 lb. of milk and 182 lb. of butter fat per annum, while those not receiving this food gave only 4,045 lb. and 151 lb. respectively.

In the herds reported as being composed of dairy cows of a good type, the cows gave an average annual profit of, over the cost of food, £3 12s. 6d., while from those herds consisting of dual-purpose cattle or other cows not of the best dairy type an annual profit per head of only 8s. 6d. was obtained. Each of the good type dairy cows yielded an annual average of 5,104 lb. of milk, 189 lb. of butter fat (or 240 lb. of butter), compared with 3,550 lb., 138 lb. (or 162 lb.), respectively, in the case of the poorer type cows. Cows of good dairy strain were found in only 17 per cent. of the least profitable herds, while they occurred in 71 per cent. of the most profitable herds.—(*U.S. Dept. of Agric., Bur. of An. Ind., Bull. 164*).

Romney Marsh Sheep in New Zealand.—The *New Zealand Journal of Agriculture* for September, 1913, contained an article on Romney Marsh or Kentish Sheep in New Zealand. It stated that this breed promises to hold the pre-eminent position in the sheep-breeding world of the Dominion. It is becoming generally recognised that the Romney Marsh is a breed eminently suited to the conditions prevailing over a very large area, especially in the North Island. The breed has further established itself in favour with the New Zealand sheep farmer on account of its general-purpose character, and has proved itself the best breed in the Dominion for the production of fat lambs. Judicious selection has greatly improved the Romney Marsh sheep in the country, and, while the fleece and carcass have been brought to a very high standard, the characteristic hardness of these sheep has been retained. It appears to be certain that no other breed of sheep will thrive as well under varying conditions, and for this reason there is an increasing demand for Romney Marsh sheep in the bush country of the Dominion.

Trials of Agricultural Machines in Sweden (*Bulletin of Agricultural Intelligence*, February, 1914).—The permanent trial Stations for testing agricultural machinery in Sweden were originally established in 1897, as a result of a donation from a large firm of agricultural machine manufacturers. This donation, together with the proceeds from the

entrance fees, served to maintain the Stations until 1907, when the State commenced to make them an annual grant. New regulations introduced in 1913 fixed the annual subsidy from the State at £1,155. Of the two Stations at present established, the one at Ultuna, in Central Sweden, deals exclusively with agricultural machinery, and that at Alnarp, in South Sweden, with both agricultural and dairy machinery.

The Stations have a common board of management which deals with the general business, such as the fixing of fees for trials and the scheme of work. In addition, each Station has a special committee which conducts the trials. Since 1912 one director has been nominated for the two Stations at a salary which enables him to devote his whole time to the trials and the compilation of reports.

Both machines already on sale and machines which are still in the experimental stage may be submitted for trial, but in the latter case the maker may ensure that the results are not published.

The trials are divided into three classes:—(a) trials comprising whole classes of machines, these being usually organised by the board of the trial Stations every year free of charge; (b) trials of individual machines made at the request of farmers, manufacturers or vendors of the machines, a fixed fee being charged in this case; and (c) trials undertaken on the initiative and at the expense of the trial Committees of machines which it appears desirable to make known. Owing to the large number of trials undertaken under classes (a) and (b) there have been only a few trials under (c). The machines submitted must be in all respects similar to those sold in the ordinary way.

The person entering a machine for trial must be present at the trial himself or send a representative. When a machine is entered other than by the maker, or if it comes under class (c), the maker must be informed and given the option of being represented. Apart from those interested, no one has the right to be present at the trials without the Committee's authorisation.

The entrance fee varies from 11s. to £4 2s. 6d., when the price of the machines is below £55; if the price is above £55 the fee is increased by 5 per cent. of the amount above this sum.

In the trials the machines are chiefly considered from the point of view of construction, quality of material, durability, quality of work, consumption of power, and facility of handling. The policy of judging by points has been discontinued, as it was found that it was liable to mislead buyers. After the main trials are finished the machines are tested over a longer period under ordinary farm conditions. Generally speaking the trials are carried out at the Stations, where there are naturally the best facilities for the work, but makers of large machines sometimes prefer to have the tests conducted in their own factories. This they can do by paying a higher fee and defraying the travelling and other expenses of the Committee.

The reports of the trials include a description of the machine, an account of the trial and the judgment. When several machines are tested, and in the case of the series trials, the reports are supplemented by comparative tabular statements of the results. The maker may insert the final results in his advertisements or prospectus, but if he publishes it in such a way as to be misleading, the trial Stations are bound to have the error publicly rectified.

The published reports appear in the Bulletin of the Board of the trial Stations.

Budget of the Russian Ministry of Agriculture for 1914.—In the Russian Budget for 1914 an estimated expenditure of £16,638,600, or £2,335,500 more than in 1913, has been assigned to the Ministry of Agriculture. The main items of expenditure are as follows:—

General expenditure of administration	£2,644,400
Educational establishments	645,600
Land organisation and agricultural industries ..	5,000,300
Encouragement of fireproof building among peasants	612,200
Colonisation	3,167,300
Development and encouragement of cottage industries	192,700
Drainage of bogs, irrigation and peat cutting ..	1,178,700
Forestry	949,400

In addition to the sum directly set aside for forestry, part of the amount assigned to "Land Organisation and Agricultural Industries" is for the encouragement of afforestation, and part of the increased expenditure of administration is to be spent in the remuneration of the increased personnel required in connection with forestry.

Under the heading "Land Organisation and Agricultural Industries" provision is made for the maintenance of Government scientific, experimental and model agricultural institutions, and subsidies to zemstvos and societies for the same purpose, general measures for the development and improvement of various agricultural industries, and assistance to peasants in districts under land organisation.

Included in the encouragement of cottage industries is new expenditure for maintenance of instructors' schools and subsidies to zemstvos, cottage industries committees, and societies, etc., for the establishment and upkeep of stores, workshops, schools, exhibitions and museums. Increased sums are also voted for the maintenance of the higher agricultural colleges, and agricultural education generally.

The sum to be spent in the administration of the studs, encouragement of horse-breeding, etc., is to be largely increased, and the estimated amount to be spent during 1914 is £484,800, or £211,000 more than in 1913. The increase includes £152,400 more for the purchase of horses, and £42,000 more for wages.

Heifer Calf Exchange at Wittenberge (*Deutsche Landw. Presse*, February 21st, 1914).—The Exchange, which was originally established in 1905 by the Brandenburg Chamber of Agriculture at Neustadt, was transferred in 1911 to Wittenberge. It was brought into being with the idea of facilitating the sale of heifer calves from dairying districts, where there was little demand for them, to breeders in districts where efforts were being made to improve the general standard of the cattle kept. That the institution has served a useful purpose is shown by the fact that since its inception over 3,000 calves have been sold with its assistance.

The procedure adopted is as follows: On the birth of the calves the owner is required to supply the particulars as to parentage, colour and date of birth, whereupon the Exchange grants the permits necessary for consigning the calves. To avoid expense, no inspection is carried out on behalf of the Exchange as regards verification of these particulars; but where the owner is found to give wrong information the Exchange refuses to assist him in selling any further calves. The calf is usually despatched when 10 days old, the owner paying the carriage up to 4s. and the buyer anything in excess of this, which is unlikely. The buyer

deposits the price of the calf with a Savings and Loan Bank. On learning that the calf has been received in a healthy condition the Bank pays over the amount to the seller. The seller guarantees that the calf shall be quite healthy when it reaches the buyer, and disputes on this point are usually settled by the substitution by the seller of another calf for the one originally sent.

The calves sold with the assistance of the Exchange fall chiefly into two classes. *Class 1a*: For pedigree calves, both sire and dam being registered in the herdbook. The price for this class of calf is about 76s., but the supply is far below the demand. *Class 1b*: The sire is registered, and the dam, while not entered in the herdbook because she is utilised exclusively for dairying purposes, could have been registered if it had been considered desirable. The supply and the material in this class are consistently good. The price is 66s. Originally there was, in addition, a lower class of calf sold through the Exchange, but the demand was so small that this class has been discontinued.

The Exchange is under the immediate supervision of the Chamber of Agriculture for Brandenburg, and the work is carried out by the District Cattle Breeding Inspectors.

Agricultural Exhibition at Prague.—The Annual Agricultural Exhibition at Prague will be held this year from 16th to 21st May. A copy of the programme (in French) may be seen at the Office of the Board, 4, Whitehall Place, S.W.

The *Bulletin of Agricultural and Commercial Statistics* for March, 1914, issued by the International Institute of Agriculture, gives figures which may be taken to represent the world's production of cereals in the harvest year 1913-14. The countries included are Germany, Austria, Hungary, Belgium, Bulgaria, Denmark, Spain, France, Great Britain and Ireland, Italy, Luxemburg, Norway, Netherlands, Rumania, Russia in Europe (63 governments), Switzerland, Canada, United States, India, Japan, Russia in Asia (10 governments), Algeria, Egypt, Tunis, Argentina, Australia, and New Zealand.

Wheat.—The total production in the above-mentioned countries, excepting Egypt, amounted to 489,714,000 qr., as compared with 456,062,000 qr. in 1912-13, the increase being equal to 7.4 per cent. The area under production was greater by 1.7 per cent.

Rye.—The production in the above countries, with the exception of Bulgaria, Great Britain and Ireland, India, Japan, Algeria, Egypt, Tunis, Australia and New Zealand is placed at 215,552,000 qr., against 214,562,000 qr. in the previous year, or an increase of 0.5 per cent. The area planted, however, showed a decrease of 12.9 per cent.

Barley.—For the countries specified, excluding Bulgaria, India, Egypt, and Australia, the production amounted to 187,061,000 qr., this showing an increase of 9.4 per cent. over 1912-13, when the production was 170,934,000 qr. The area under production showed an extension of 5.6 per cent.

Oats.—The total production in the above-named countries, with the exception of Bulgaria, India, Egypt, and Australia, amounted to 481,243,000 qr., as compared with 472,995,000 qr. in the previous year, or an increase of 1.7 per cent. The area planted was also greater, by 1.8 per cent., than in 1912-13.

Maize.—The production in the specified countries, excluding Germany, Belgium, Denmark, France, Great Britain and Ireland, Luxemburg, Norway, Netherlands, India, Algeria, Australia, and New Zealand, amounted to 405,127,000 qr., as against 465,237,000 qr. in 1912-13, the decrease being equal to 12.9 per cent. The area under production, however, was smaller than in the previous year by only 0.1 per cent.

Austria.—The final figures of the harvest of 1913 place the production of wheat at 7,451,000 qr., which shows a decrease of 14.4 per cent. as compared with 1912. Rye amounted to 13,659,000 qr., an increase of 10.0 per cent.; barley to 9,643,000 qr., an increase of 2.6 per cent.; oats to 18,913,000 qr., an increase of 10.2 per cent.; maize to 1,552,000 qr., a decrease of 13.0 per cent.; and sugar beet to 6,851,000 tons, a decrease of 12.1 per cent.

Denmark.—The final data for 1913 give the production of wheat as 834,000 qr., which is equal to an increase of 84.5 per cent. as compared with 1912. Rye totalled 1,992,000 qr., a decrease of 9.6 per cent.; barley, 3,273,000 qr., an increase of 9.2 per cent.; and oats 5,819,000 qr., an increase of 9.5 per cent.

Condition of Winter Cereals.—The condition of the crops on March 1st was as follows (100 being taken to represent the prospect of an average crop):—*Wheat*—Denmark, 101; Scotland, 100; Luxemburg, 97; Portugal, 100; Rumania, 125; Egypt, 97; Tunis, 75. *Rye*—Denmark, 108; Luxemburg, 96; Portugal, 100; Rumania, 125. *Barley*—Luxemburg, 94; Portugal, 100; Rumania, 125; Egypt, 94; Tunis, 70. *Oats*—Portugal, 90; Tunis, 80.

Germany.—The stocks of grain in farmers' hands on March 1st are estimated by the German Agricultural Council as follows (corresponding figures for March 1st, 1913, in brackets):—*Wheat*—5,509,000 qr. or 25.8 per cent. of the total crop (5,688,000 qr. or 28.4 per cent.); rye, 15,407,000 qr. or 27.5 per cent. (15,680,000 qr. or 29.4 per cent.); oats, 26,697,000 qr. or 38.9 per cent. (24,959,000 qr. or 41.5 per cent.); and barley, 5,491,000 qr. or 27.1 per cent. (5,207,000 qr. or 27.1 per cent.).

Russia and Rumania.—The weather has been seasonable and very few complaints have recently been heard regarding the outlook for the autumn-sown crops. Spring sowings are proceeding under generally favourable conditions, although interfered with, here and there, by wet weather; this moisture, however, will be beneficial in other respects. (*Beerbohm's Evening Corn Trade List*, March 27th.)

Rumania.—The *Moniteur Commercial Roumain* of March 1st gives the following estimates of the areas sown with autumn cereals (in acres, and 1912 figures in brackets):—*Wheat*, 4,829,000 (3,852,000); rye, 201,000 (208,000); and barley, 105,000 (97,000).

The total area under wheat is estimated at 5,187,000 acres, compared with 4,043,000 acres in 1913. (*Dornbusch*, March 30th.)

Italy.—The Official Report relating to the ten days, March 10-20, states that the cold and stormy weather which prevailed during this period in Northern and Central Italy stopped field work and, without damaging the crops, delayed their growth, which had been favoured by the mild weather of the previous ten days. The weather was generally favourable in the south, although rain would be welcomed on the Adriatic coast. Rain is necessary for the crops in Sardinia.

Generally, cereals are growing under the most satisfactory conditions, and spring-sown crops are doing well (*Broomhall's Corn Trade News*, April 4th).

India.—According to the second General Memorandum on the wheat crop of 1913-14 the total area under the crop, reported up to March 12th, was 25,900,000 acres, compared with 29,716,000 acres (revised figure) at the same date last year and 27,866,000 acres, the average of the five years ending 1911-12. There is thus a decrease of 3,822,000 acres or 13 per cent. as compared with last year, and one of 1,966,000 acres or 7 per cent. as compared with the average. The 1913-14 figures, however, are probably incomplete, a further 1,000,000 acres being usually reported before the end of the season. The condition and prospects of the crop are reported to be generally from fair to good, except in parts of the United Provinces, Central India, and the Bombay Presidency, where the crop has suffered through deficient rainfall.

Beerbohm's Evening Corn Trade List of March 27th states that the weather has continued favourable for the late crops and harvest work is progressing satisfactorily.

Australia.—According to the latest information received the yield of wheat is now estimated at between 1,250,000 and 1,500,000 qr. larger than that of last season. (*Beerbohm's Evening Corn Trade List*, March 27th.)

Live Stock in the United States.—The Department of Agriculture estimates, on the basis of the census of 1910, the numbers of live stock on January 1st, 1914, as follows (1913 figures in brackets):—Horses, 20,962,000 (20,567,000); mules, 4,449,000 (4,386,000); dairy cows, 20,737,000 (20,497,000); other cattle, 35,855,000 (36,030,000); total cattle, 56,592,000 (56,527,000); sheep (not including spring lambs) 49,719,000 (51,482,000); and pigs, 58,933,000 (61,178,000).

Live Stock in India.—The numbers of live stock in 1911-12 were as follows:—Bulls and bullocks, 37,085,104, against 37,085,577 in 1910-11; cows, 28,067,259, against 28,047,423; sheep, 22,848,043, against 22,921,660; horses and ponies, 1,539,945, against 1,524,374 (*Bulletin of Agricultural and Commercial Statistics*, March, 1914.)

The supply of agricultural labour in England and Wales during March was, according to statements in the Board's Monthly Agricultural

Agricultural Labour in England and Wales during March.

Report (April 1st, 1914), practically everywhere quite sufficient, largely, however, because of the persistent wet preventing work and thus curtailing the demand. In several districts some scarcity is apprehended when work is in full swing again. Reports have been received from various parts of the country of some increase in wages at the spring hirings. The summaries for the different districts are as follows:—

Northumberland, Durham, Cumberland and Westmorland.—In Northumberland the tendency is for weekly wages to increase, and in north Durham increases are expected at the forthcoming hirings.

Lancashire and Cheshire.—In west Lancashire higher wages were obtained at the Candlemas hiring fair, especially by women, and domestic servants for farms are scarce in the north Lonsdale district.

Yorkshire.—In several districts wages have advanced recently.

Shropshire and Stafford.—The supply of labour has been deficient.

Derby, Nottingham, Leicester, and Rutland.—In north and west Nottingham and north-west Leicester the supply is deficient, and skilled labour is scarce in south Leicester.

Lincoln and Norfolk.—In north-west Lincoln there is a tendency for wages to increase, and in the north-east some farmers have raised wages. In all parts of east Norfolk a general increase of wages by 1s. per week is reported, and there has been an advance in one district in the west of the county.

Suffolk, Cambridge, and Huntingdon.—No changes of wages are mentioned, except in part of north Suffolk where men who did not get a rise of 1s. a week last spring are now getting it, and in South Cambridge, where farm hands are getting a similar increase.

Bedford, Northampton, Warwick, Buckingham, Oxford, Berkshire, Worcester, Hereford and Gloucester.—Good men were in demand in south Worcester and east Hereford, and there was an occasional scarcity of skilled men in Buckingham, Oxford and Berkshire.

Cornwall, Devon and Somerset.—A deficiency is expected and wages have risen slightly in several districts.

Dorset, Wiltshire and Hampshire.—Several reporters state that there has been a general rise in wages of about 1s. per week.

Surrey, Kent, and Sussex.—In an east Sussex district a scarcity is reported, and in south-east Kent the supply is expected to be short when work gets into full swing. In south Kent wages are rather higher, and piece-work, such as hop-digging, dressing, etc., costs more.

Essex, Hertford and Middlesex.—In south Essex it is stated, that wages of farm labourers have increased by 1s. a week during the last twelve months.

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales during March, all refer to the wet weather that prevailed during the month.

Agricultural Conditions in England and Wales on April 1st. But beyond delaying farm work very generally the rains do not appear to have done any material injury.

Wheat is generally looking very well and promising, except on low-lying land, where the heavy rains have often caused it to lose colour, particularly that sown later; still, it is nearly everywhere stated that better weather would remedy this. The area under wheat this year is reported to be greater than in 1913, perhaps by 4 per cent. Relatively more has been sown in the north than in the south.

The persistent rain has everywhere delayed spring sowing, and in many, perhaps most, parts of the country hardly anything could be done during the month. Consequently, whereas field work was very forward at the end of February, it is now in most cases backward, but the favourable conditions which prevailed before the advent of March have been of great benefit in minimising the harmful effects of so long a delay. In some parts of the country, especially in the north-east, farm work is still described as more forward than usual.

Some progress has been made with potato planting, particularly in the more important districts, such as Lincoln and the East Riding, and a little had been done in Lancashire. But this work is generally behindhand, and in many parts of the country a start had not been made by 1st April.

Lambing appears to have been quite satisfactory, a fully average, and sometimes an over-average fall being reported all over the country, with relatively few exceptions. The hill flocks have hardly commenced lambing yet. Ewes and lambs are very generally strong and healthy, and losses do not appear to be as numerous as might have been anticipated from the trying conditions which lasted throughout the whole month. Some reporters refer to the good condition of the ewes as having enabled them to withstand the prolonged wet successfully; but in some districts they are beginning now to lose condition, and warmer, drier weather would be welcomed.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on April 1st, 1914, certain diseases of animals existed in the countries specified:—

Austria (on March 25th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 441 HÖfe infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period March 1st—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (7 outbreaks in 6 "communes"), Rabies.

Bulgaria (for the period March 1st—8th).

Blackleg, Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Denmark (month of February).

Anthrax, Foot-rot, Glanders and Farcy, Swine Erysipelas, Swine Fever.

France (for the period March 15th—21st).

Anthrax, Blackleg, Foot-and-Mouth Disease (23 outbreaks), Glanders and Farcy, Rabies, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period March 1st—15th).

Foot-and-Mouth Disease (202 infected places in 70 parishes), Glanders and Farcy, Swine Fever.

Holland (month of February).

Anthrax, Foot-and-Mouth Disease (5 outbreaks in 5 provinces), Foot-rot, Swine Erysipelas.

Hungary (on March 11th).

Anthrax, Dourine, Foot-and-Mouth Disease (total of 680 "cours" infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period March 9th—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (555 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period February 1st—15th).

Sheep-pox.

Norway (month of February).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period March 8th—13th).

Dourine, Foot-and-Mouth Disease (30,453 animals), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of October).

Anthrax, Foot-and-Mouth Disease (83,025 animals in 1,047 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period February 14th—21st).

Sheep-pox, Sheep-scab.

Spain (month of January).

Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (24 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of February).

Anthrax, Blackleg, Swine Erysipelas.

Switzerland (for the period March 16th—22nd).

Anthrax, Blackleg, Foot-and-Mouth Disease (157 "étables" entailing 1,722 animals, of which 45 "étables" were declared infected during the period), Swine Fever.

The Weather in England during March.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
<i>Week ending May. 7th:</i>	F.	F.	Inches.	Inches.		Hours.	Hours.
England, N.E. ...	43.7	+5.0	0.30	-0.05	4	3.5	+0.6
England, E. ...	44.7	+5.9	0.46	+0.11	4	3.1	+0.1
Midland Counties ...	44.4	+5.6	0.49	+0.07	4	2.7	0.0
England, S.E. ...	45.5	+5.5	0.45	-0.01	5	3.0	-0.1
England, N.W. ...	43.8	+4.3	0.99	+0.44	6	1.9	-0.9
England, S.W. ...	45.9	+4.9	1.16	+0.46	7	2.6	-0.5
English Channel ...	47.3	+3.5	0.62	+0.01	7	2.6	-1.2
<i>Week ending Mar. 14th:</i>							
England, N.E. ...	40.3	+0.8	0.57	+0.15	5	3.3	-0.1
England, E. ...	42.6	+3.0	1.74	+1.40	7	2.7	-0.7
Midland Counties ...	41.9	+2.2	1.20	+0.78	6	3.0	-0.1
England, S.E. ...	44.4	+3.6	2.04	+1.59	7	3.0	-0.4
England, N.W. ...	41.8	+1.7	0.89	+0.33	6	3.7	+0.7
England, S.W. ...	43.7	+2.2	2.64	+1.97	7	2.2	-1.2
English Channel ...	47.2	+3.0	1.70	+1.12	7	2.4	-1.8
<i>Week ending Mar. 21st:</i>							
England, N.E. ...	40.1	-0.6	0.68	+0.26	6	2.0	-2.0
England, E. ...	40.7	-0.2	1.01	+0.68	6	2.5	-1.5
Midland Counties ...	40.3	-0.7	0.61	+0.24	6	2.3	-1.2
England, S.E. ...	42.0	0.0	1.48	+1.05	6	3.0	-0.8
England, N.W. ...	40.5	-0.7	1.00	+0.49	6	3.4	+0.1
England, S.W. ...	41.6	-0.9	1.19	+0.62	6	4.4	+0.6
English Channel ...	44.8	-0.3	1.31	+0.84	6	4.5	-0.3
<i>Week ending Mar. 28th:</i>							
England, N.E. ...	41.6	+0.3	0.26	-0.11	4	4.4	+0.1
England, E. ...	41.9	+0.1	0.27	-0.10	4	5.4	+1.1
Midland Counties ...	40.9	-0.9	0.39	+0.02	5	2.9	-1.0
England, S.E. ...	42.0	-0.9	0.72	+0.32	5	4.0	-0.3
England, N.W. ...	41.8	-0.1	0.41	-0.12	4	4.0	+0.2
England, S.W. ...	42.2	-1.1	1.01	+0.43	5	4.1	-0.3
English Channel ...	46.0	+0.1	1.69	+1.22	6	3.9	-1.8

Unit Prices of
Artificial Manures.Statement of cost to the purchaser of 1 per
cent. per ton of Nitrogen, Soluble and In-
soluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d.	s. d.	s. d.	s. d.
Nitrogen from:				
Sulphate of Ammonia } 95% pure ...	13 2	13 3	13 1	12 10
Calcium Cyanamide ...	11 10	11 10	11 10	12 3
Nitrate of Soda } 95% pure... } 90%	15 0	14 9	14 7	15 0
Nitrate of Lime ...	15 10	16 3	15 2	15 3
Soluble Phosphates from:				
Superphosphate 35%	1 8	1 7	1 9	1 10
" 33%	1 8½	1 8	1 9	1 10
" 30%	1 8½	1 8	1 9	1 11
" 26%	1 10	1 9	1 10	2 1
Dissolved Bones ...	2 6	2 8	2 4	2 4
Allowed for Nitrogen	18 1	18 6	16 4	16 7
Allowed for Insol. Phos.	1 10	2 0	1 8	1 9
Insoluble Phosphates from:				
Basic Slag ...	1 6	—	1 6	1 3
Bone Meal ...	1 7	1 7	1 6	1 5½
Allowed for Nitrogen	15 9	15 3	13 9	14 2
Steamed Bone Flour ...	1 4	1 6	1 3	1 4
Allowed for Nitrogen	12 9	14 0	12 1	12 10
Potash from:				
Kainit ...	4 1	3 11	3 10	4 2½
Sulphate of Potash ...	4 7	4 3	4 5	4 11½
Muriate of Potash ...	3 11	3 7½	3 6½	4 0
Potash Salts ...	—	—	—	—

NOTE.—These unit prices are based on the probable retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified. They are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the per-

various sources, at certain Ports and Manufacturing Centres, for
April, 1914.

Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
13 2	{ 12 10 93% pure. 11 10 13 10 13 9	{ 12 9 93% pure. — 13 10 —	13 7 11 11 15 7 15 8	12 11 11 10 14 5 15 8	13 8 11 10 14 6 15 6
1 10½	1 9½	1 8½	1 10	1 9½	1 10
—	1 9½	1 8½	1 10	1 10	1 10½
1 11	1 9½	1 8½	1 10½	1 10	1 10½
2 1	1 11	1 10	2 0	2 0	2 0
2 6	2 6	2 6	2 7	2 7	2 8
17 7	18 3	18 4	18 7	18 6	18 10
1 10	1 11	1 11	2 0	1 11	2 0
—	1 3	1 1	1 5	1 8	1 7½
1 7	1 6½	1 6	1 6	1 5	1 8
15 3	14 7	14 7	13 7	13 10	15 6
1 5	—	—	1 3	1 4½	1 5
13 8	—	—	13 2	13 5	13 10
4 3	4 3	4 3	4 4	4 4½	4 4½
4 10	4 7	4 6	4 9½	4 10	4 9
4 0	3 8½	3 8½	—	4 2½	4 3½
3 3½	—	—	—	—	—

centages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and re-bagging the ingredients, bags, and loss of weight.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in March and February, 1914.(Compiled from Reports received from the Board's Market
Reporters.)

Description.	MARCH.		FEBRUARY.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—				
Cattle:—	per stone.*	per stone.*	per stone.*	per stone.*
Polled Scots	s. d.	s. d.	s. d.	s. d.
Herefords	9 4	9 2	9 2	8 9
Shorthorns	9 3	8 9	9 0	8 6
Devons	9 1	8 6	9 0	8 4
Welsh Runts	9 0	8 4	8 11	8 3
	per lb.*	per lb.*	per lb.*	per lb.*
Veal Calves	d.	d.	d.	d.
	10	8½	9½	8½
Sheep:—				
Downs	10½	9½	10	9
Longwools	9½	8½	9½	8½
Cheviots	10½	10	10½	9½
Blackfaced	10½	10	10½	9½
Welsh	10	9½	10	9½
Cross-breds	10	9½	10	9
Pigs:—	per stone.*	per stone.*	per stone.*	per stone.*
Bacon Pigs	s. d.	s. d.	s. d.	s. d.
Porkers	8 4	7 10	8 4	7 10
	8 11	8 5	9 0	8 6
LEAN STOCK:—				
Milking Cows:—	per head.	per head.	per head.	per head.
Shorthorns—In Milk ...	£ s.	£ s.	£ s.	£ s.
—Calvers	23 12	19 17	24 0	20 4
Other Breeds—In Milk ...	22 7	18 17	23 6	19 10
—Calvers	21 10	17 18	20 13	17 16
	18 0	16 5	—	16 0
Calves for Rearing	2 13	2 0	2 11	1 19
Store Cattle:—				
Shorthorns—Yearlings ...	12 8	10 17	11 18	10 7
—Two-year-olds... ..	16 12	14 13	15 17	14 6
—Three-year-olds	19 16	17 10	19 6	16 15
Herefords—Two-year-olds... ..	18 15	16 11	18 5	16 10
Devons—Two-year-olds... ..	17 4	15 1	16 7	14 13
Welsh Runts—Two-year-olds... ..	18 5	16 2	17 6	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs	s. d.	s. d.	s. d.	s. d.
Downs or Longwools	50 11	44 10	51 0	43 9
Store Pigs:—				
8 to 12 weeks old	28 7	22 3	27 6	21 6
12 to 16 weeks old	40 7	31 9	40 3	31 5

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in March, 1914.(Compiled from Reports received from the Board's Market
Reporters.)

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
BEEF:—		s. d.	s. d.	s. d.	s. d.	s. d.
English	1st	61 0	60 0	62 6	61 6	63 0
	2nd	56 6	57 6	59 6	57 6	59 0
Cow and Bull	1st	54 0	54 0	54 0	50 0	55 0
	2nd	49 6	49 6	49 0	45 6	50 0
Irish	1st	—	56 0	56 0	57 0	56 0
	2nd	—	54 0	50 0	52 0	51 6
Argentine Frozen—						
Hind Quarters	1st	43 6	44 0	44 6	43 0	44 6
Fore	1st	39 0	38 6	38 0	37 6	38 0
Argentine Chilled—						
Hind Quarters	1st	47 6	47 0	46 6	49 6	46 6
Fore	1st	38 6	37 6	37 6	37 0	37 6
Australian Frozen—						
Hind Quarters	1st	42 0	42 6	42 0	41 0	42 0
Fore	1st	38 0	38 0	37 6	37 6	37 6
VEAL:—						
British	1st	84 0	76 0	83 6	78 0	81 6
	2nd	77 0	70 0	74 6	70 6	74 6
Foreign	1st	—	72 6	—	79 6	—
MUTTON:—						
Scotch	1st	—	—	85 6	83 6	87 0
	2nd	—	—	79 6	75 0	83 6
English	1st	75 0	79 6	80 6	74 0	82 0
	2nd	67 0	74 6	73 6	67 6	76 0
Irish	1st	—	—	71 0	70 0	65 6
	2nd	—	—	64 0	66 6	51 6
Argentine Frozen	1st	41 0	42 0	42 0	40 6	42 0
Australian	1st	39 0	39 6	41 0	38 6	41 0
New Zealand	1st	—	—	—	45 0	—
LAMB:—						
British	1st	97 0	118 0	105 0	112 0	107 6
	2nd	92 0	—	—	102 6	100 6
New Zealand	1st	58 6	60 6	59 6	61 0	59 6
Australian	1st	56 0	56 0	54 0	55 6	54 0
Argentine	1st	54 0	56 0	54 0	50 6	54 0
PORK:—						
British	1st	77 0	72 6	76 0	69 6	77 6
	2nd	71 0	69 0	70 0	63 0	71 0
Foreign	1st	69 0	65 6	67 6	65 6	67 6

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 1912, 1913 and 1914.

Weeks ended (in 1914).	WHEAT.			BARLEY.			OATS.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Jan. 3...	s. d. 33 2	s. d. 30 5	s. d. 31 1	s. d. 33 3	s. d. 28 6	s. d. 26 2	s. d. 20 7	s. d. 19 10	s. d. 18 2
" 10...	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
" 17...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
" 24...	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
" 31...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb. 7...	34 0	31 0	31 0	33 2	28 10	26 7	21 4	20 1	18 9
" 14...	34 4	30 9	31 0	32 10	29 1	26 7	21 7	20 2	18 11
" 21...	34 6	30 11	31 0	32 8	28 8	26 7	21 6	20 7	18 11
" 28...	34 1	31 0	31 0	32 0	28 6	26 6	21 6	20 4	18 11
Mar. 7...	34 1	31 3	31 5	31 7	28 5	26 2	21 8	20 0	18 9
" 14...	34 0	31 1	31 6	31 2	27 11	26 0	21 8	20 2	18 7
" 21...	34 1	31 1	31 5	31 10	28 6	25 8	21 9	19 11	18 6
" 28...	34 4	31 3	31 4	30 3	27 6	25 7	21 8	19 7	18 8
Apl. 4...	34 10	31 4	31 6	30 9	27 0	25 6	21 11	19 2	18 5
" 11...	35 4	31 3		30 2	27 8		22 1	19 2	
" 18...	36 7	31 6		29 11	26 11		22 4	18 10	
" 25...	37 10	31 8		30 4	26 7		22 9	19 3	
May 2...	38 1	32 2		30 2	25 11		23 1	19 6	
" 9...	37 11	32 6		31 1	25 9		23 7	19 6	
" 16...	37 8	32 10		31 2	25 4		23 7	19 9	
" 23...	37 2	32 10		31 1	25 3		23 7	19 11	
" 30...	36 10	32 7		30 0	26 1		23 9	20 1	
June 6...	36 11	32 10		29 11	26 2		24 0	19 8	
" 13...	37 0	32 8		30 8	24 7		23 10	20 2	
" 20...	37 5	32 8		30 8	23 10		24 0	19 8	
" 27...	37 10	32 8		30 2	24 3		23 11	19 1	
July 4...	38 2	33 1		31 7	25 2		23 11	21 0	
" 11...	38 3	33 4		30 2	25 10		24 1	19 4	
" 18...	38 10	33 6		30 9	24 9		24 8	20 5	
" 25...	38 9	33 10		30 9	24 1		23 4	20 8	
Aug. 1...	38 4	34 1		28 6	24 5		22 2	20 3	
" 8...	39 2	34 1		30 7	24 9		22 4	19 0	
" 15...	38 2	34 3		28 3	24 7		21 8	18 7	
" 22...	35 6	33 7		28 1	26 5		20 10	18 8	
" 29...	34 10	32 7		28 6	29 0		20 8	17 10	
Sept. 5...	35 1	31 11		29 9	30 11		21 8	17 8	
" 12...	33 5	31 9		29 0	31 5		20 5	18 0	
" 19...	32 7	31 7		29 6	30 9		19 10	17 11	
" 26...	31 7	31 6		29 9	30 1		19 5	17 9	
Oct. 3...	31 8	31 3		29 7	29 9		19 8	17 10	
" 10...	31 10	31 0		30 4	29 1		19 5	17 10	
" 17...	32 2	30 11		30 11	28 8		19 9	17 9	
" 24...	33 1	30 7		31 6	28 7		19 10	18 0	
" 31...	33 4	30 1		31 10	28 2		20 1	17 9	
Nov. 7...	33 1	30 0		31 11	28 1		19 11	17 9	
" 14...	32 10	30 1		31 2	27 8		19 9	17 11	
" 21...	32 1	30 4		30 11	27 5		19 11	18 1	
" 28...	31 9	30 9		30 8	27 0		19 8	18 4	
Dec. 5...	31 0	31 2		29 11	26 8		19 6	18 4	
" 12...	30 8	31 2		29 2	26 5		19 3	18 6	
" 19...	30 7	31 2		28 11	25 11		19 1	18 5	
" 26...	29 10	31 0		28 6	25 10		19 2	18 4	

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.

AVERAGE PRICES of **Wheat, Barley, and Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

		WHEAT.		BARLEY.		OATS.	
		1913.	1914.	1913.	1914.	1913.	1914.
France:	February ...	s. d. 47 3	s. d. 45 5	s. d. 30 2	s. d. 28 5	s. d. 23 11	s. d. 22 3
	March ...	47 7	45 8	30 1	28 5	23 10	22 3
Paris:	February ...	47 6	45 7	31 0	29 2	23 6	21 0
	March ...	48 11	46 7	30 6	29 0	22 10	21 9
Belgium:	January ...	34 7	32 2	30 5	25 5	22 8	20 8
	February ...	34 5	32 8	30 5	25 6	23 2	20 4
Berlin:	January ...	43 0	40 11	—	—	24 0	21 2
	February ...	42 10	41 2	—	—	23 5	21 1
Breslau:	January ...	37 10	38 6	29 5*	27 6*	21 10	19 11
	February ...	37 8	38 7	26 9†	25 3†	21 7	19 11

* Brewing.

† Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of March, 1913 and 1914.

		WHEAT.		BARLEY.		OATS.	
		1913.	1914.	1913.	1914.	1913.	1914.
London...	...	s. d. 32 8	s. d. 32 5	s. d. 25 10	s. d. 24 10	s. d. 22 4	s. d. 19 4
	...	31 11	31 1	27 3	25 7	20 3	18 0
Norwich	...	29 1	30 11	26 2	25 3	16 4	18 2
	...	28 3	31 8	27 4	26 2	19 2	19 5
Peterborough	...	28 5	31 7	27 6	25 2	19 9	18 9
	...	30 11	30 7	28 10	25 6	20 5	18 3
Lincoln...	...						
	...						
Doncaster	...						
	...						
Salisbury	...						
	...						

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in March, 1914.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER:—	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
British ...	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Factory ...	105 0	98 0	105 0	97 0	125 0	122 6
Danish ...	—	—	126 0	122 6	134 0	130 0
French ...	—	—	—	—	111 0	108 0
Russian ...	112 0	108 0	113 0	111 0	111 6	108 0
Australian ...	116 6	113 0	112 0	110 6	115 6	112 6
New Zealand ...	118 0	115 0	115 6	113 6	117 6	114 6
Argentine ...	115 0	112 0	113 0	110 6	113 0	110 6
CHEESE:—						
British—						
Cheddar ...	84 0	76 0	83 0	80 0	83 6	78 0
Cheshire ...	—	—	120 lb.	120 lb.	120 lb.	120 lb.
Canadian ...	70 6	67 6	per cwt.	per cwt.	per cwt.	per cwt.
BACON:—						
Irish (Green) ...	81 0	75 6	74 6	70 0	81 6	77 6
Canadian (Green sides)	67 0	65 0	67 0	65 6	67 0	64 6
HAMS:—						
York (Dried or Smoked) ...	128 0	120 0	—	—	125 0	119 6
Irish (Dried or Smoked)	—	—	—	—	118 6	112 0
American (Green) (long cut) ...	69 0	66 6	68 0	65 6	69 6	67 0
EGGS:—						
British ...	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
Irish ...	9 2	—	—	—	10 2	9 4
Danish ...	9 4	9 1	9 5	8 11	9 7	8 7
POTATOES:—						
Edward VII. ...	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Langworthy ...	88 6	71 0	53 6	50 0	80 0	70 0
Up-to-Date ...	70 6	61 6	75 0	70 0	92 6	82 6
HAY:—						
Clover ...	—	—	87 6	65 0	78 6	69 0
Meadow ...	—	—	—	—	70 0	62 6

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks ...	76	55	243	174
Animals attacked ...	84	58	261	191
Foot-and-Mouth Disease:—				
Outbreaks ...	6	—	11	—
Animals attacked ...	43	—	74	—
Glanders (including Farcy):—				
Outbreaks ...	5	15	25	46
Animals attacked ...	23	36	69	136
Parasitic Mange:—				
Outbreaks ...	209	268	957	1,016
Animals attacked ...	373	512	1,799	2,148
Sheep-Scab:—				
Outbreaks ...	18	14	134	105
Swine Fever:—				
Outbreaks ...	294	165	781	467
Swine Slaughtered as diseased or exposed to infection ...	2,763	2,342	7,278	5,819
Tuberculosis:—				
Number of Premises notified...	486	*—	1,403	*—
Number of bovine animals notified as for slaughter ...	521	*—	1,488	*—

* The Tuberculosis Order came into operation on 1st May, 1913.

IRELAND.

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

DISEASE.	MARCH.		THREE MONTHS ENDED MARCH.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks ...	1	—	1	—
Animals attacked ...	2	—	2	—
Foot-and-Mouth Disease:—				
Outbreaks ...	50	—	52	—
Animals attacked ...	492	—	520	—
Glanders (including Farcy):—				
Outbreaks ...	—	—	—	—
Animals attacked ...	—	—	—	—
Parasitic Mange:—				
Outbreaks ...	4	9	29	73
Sheep-Scab:—				
Outbreaks ...	70	43	288	210
Swine Fever:—				
Outbreaks ...	29	3	63	38
Swine Slaughtered as diseased or exposed to infection ...	93	27	317	206

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THIRD REPORT ON THE PARTIAL STERILISATION OF SOILS FOR GLASSHOUSE WORK.*

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Rothamsted Experimental Station, Harpenden, Herts.

PARTIAL sterilisation consists in treating the soil in such a way as to kill some, but not all, of the organisms present, and it is carried out either by heating the soil or by dosing it with mild poisons.

The effects of the treatment have been investigated at Rothamsted for some years past, and it has been shown to lead to (1) an increase in the production of ammonia and nitrate, (2) the destruction of many disease organisms and pests, and also of protozoa and organisms detrimental to bacteria, (3) the formation of certain substances not usually present in the soil, and (4) a physical improvement in heavy soils. The effect on the plant is therefore to give it a larger supply of nitrogenous food and a healthier medium in which to live ; the unusual compounds also have certain effects on quality which, however, are not always very marked. The practical importance of the treatment is that it acts like a dressing of nitrogenous manure, and also enables the grower to deal with diseased or "sick" soils.

In attempting to apply partial sterilisation methods in practice there was the initial difficulty that the cost of the process was much more than any farmer could pay. The fertilising effect could be obtained more cheaply by the application of manure, and the difficulty of diseased soils, when it troubled the farmer at all, could be obviated by the simple expedient of growing some other crop not liable to be affected.

* The previous Reports appeared in this *Journal* in January, 1912, p. 809, and January, 1913, p. 809.

In short, it was necessary both to cheapen the methods very considerably and to make them workable by labourers.

An elaborate series of plot experiments might have been planned for the purpose, but this would have been tedious and costly, and might have led to no useful result.

The plan was therefore adopted of finding growers to whom the question of soil diseases was of importance, and making experiments with their soils; the results were sufficiently promising to justify them in trying the method in their own houses. The growers soon improved and cheapened the methods considerably, and made them applicable to a wider circle than was possible before; important observations were also made which are dealt with in this report. The general result has been to confirm the earlier laboratory and pot experiments and to show that useful crop increases can be obtained by adopting partial sterilisation methods in a commercial nursery: there are some complicating factors and difficulties, but nothing that could not be overcome. The method is now in use on a large scale, and the growers have gone further and set up an Experimental Station in their midst, where any further difficulties may be dealt with as they arise, and where their other problems can be investigated.

So far as the immediate object of improving the method is concerned the nursery experiments have been entirely successful. In the First Report issued in this *Journal* (January, 1912) the cost of steaming was given at 1s. 2d. to 1s. 6d. per ton of soil: a method is now at work which costs only 6d. to 9d. Although no chemical antiseptic has yet been found to act as well as steam, this side of the work has been pushed forward and definite advances have been made.

Partial sterilisation methods have a clear field in a commercial nursery, because they afford the only practicable means of dealing with diseased soils. The fertilising effect may be otherwise and more cheaply obtained (at present at any rate), but the purifying effect cannot. Years ago Dr. Julius Kühn recommended that cabbage and white turnips should be grown thickly on infested land, and then lifted and destroyed after four or five weeks so as to remove eelworms; this plan was actually used in the case of sugar beet. The grower under glass, however, never took it up; he found it cheaper to throw out his soil, sacrificing all the valuable manurial residues it contained, and to import fresh turf or loam each year to take its place. It is now found that partial sterilisation is effective in killing the disease organisms and

those others which are detrimental to bacteria and therefore responsible for the low bacterial efficiency of "sick" soils.

The methods available for partial sterilisation fall into two classes: (1) Treatment by chemical means; and (2) Various heating methods.

Chemical Methods.

Treatment by chemical means is much the more attractive because it allows of obvious extension from the nursery to the field, while heating apparently does not. The chemical method consists in adding to the soil some poison strong enough to kill all harmful organisms—whether harmful to the plant or to bacteria—without permanently poisoning the soil for plants or bacteria. Obviously a suitable solid substance that could be put on like any artificial fertiliser would be worthy of wide application. In spite of many efforts the ideal chemical substance has not yet been found; but experiments are still in progress at Rothamsted and in the laboratories of several firms who have taken great interest in this aspect of the question.

The method of treating the soil depends upon the nature of the antiseptic: a solid is simply mixed with the soil like horn or bone meal would be, but a liquid has to be watered in and the soil then turned to make the mixture as complete as possible. The usual proportion used has been one to two parts per 1,000 of soil, or 2 to 4 lb. per ton. As a dressing on the border this is equivalent to $\frac{1}{2}$ to 1 lb. watered in per square yard. Experiments have been made to ascertain whether smaller quantities than these can safely be used, but it was found that they could not. The best results were always obtained by using the larger amount. The past season's experiments at Rothamsted were carried out in conjunction with Mr. W. Buddin, B.A., and were made with the same antiseptics as before, and, in consequence, the antiseptics can now be classified rather more accurately than was possible last year. The grouping arrived at is:—

Class I.—Most effective—Formaldehyde, Pyridine.

Class II.—Cresole, Carbolic acid, Calcium sulphide, Carbon disulphide, Toluol, Benzol, Petrol.

Class III.—Least effective—Naphthalene, etc.

The order of these classes is roughly the order of merit indicated by all the experiments, but considerable deviation occurred in individual trials. The method of experiment was as follows:—

A quantity of tomato-sick soil was obtained from a nursery and divided up into several lots, to each of which an antiseptic was added as above described: after a fortnight's

interval tomato seeds were sown, and the young plants were subsequently pricked out into 60's, 32's and 16-inch pots containing soil treated in the same manner. Thus, from start to finish, each lot was grown on soil treated with the same antiseptic. No food was supplied until the fruit "set": after this took place a mixture of two parts each of sulphate of ammonia and superphosphate and three parts of sulphate of potash was given at the rate of $\frac{1}{4}$ oz. per plant each fortnight. As in the earlier experiments, the plants on the partially sterilised soils made the best growth, and gave the largest quantity of early fruit. After a time, however, the feeding began to equalise matters, and in the end there was little difference in the final yield. Examination of the roots showed that eelworm had not developed to any marked extent in the untreated soils, and the disease factor was much less in evidence than in previous years. The experiment demonstrates that partial sterilisation simply serves to supply food when diseases no longer intervene, and that dressings of nitrogenous manure have the same effect. It is, of course, the early crop that pays, and most interest therefore attaches to the early results given in Table 1 (p. 101). It should be noted that the exigencies of the work at Rothamsted preclude the raising of early tomatoes, so that our fruit comes later than in a commercial nursery.

There were 16 pots of untreated soil, and eight of each of the others. The plants are illustrated in Fig. 1.

Formaldehyde is distinctly promising, but it costs 5d. per lb., while carbolic acid can be obtained below 1½d. per lb. For the moment, therefore, carbolic acid has the advantage as an agent for commercial use.

Several chemicals have been used in large nurseries, including carbolic acid at the rate of about $\frac{1}{2}$ to $\frac{3}{4}$ lb. per square yard (1 barrel of 20 gall. per house), and some of the more important proprietary articles. The use of these agents is perfectly feasible in practice, although attended with the difficulty that they are absorbed by the surface of the soil and therefore do not mix well, or wash down as freely as might be expected.

Heating Methods.

For the present none of the chemical agents is as effective as heat for nursery work, and most of the season's nursery trials were carried out on heated soil. Usually a house was selected that had given a bad crop in the previous year; the soil of the whole house was heated and the plants were then set out. This is therefore a more ambitious affair than

the mere heating of a little soil for pot experiments. The Lea Valley, where many of these trials were made, contains some of the most skilful growers in the trade, and is admirably

TABLE I.

Yields of Tomatoes on Partially Sterilised Tomato-sick Soil, 1913.

	Grammes per plant up to		Relative weights per plant to	
	Aug. 18th.	Sept. 30th.	Aug. 18th.	Sept. 30th.
Untreated	101	100	100	100
Steamed A	443	439	439	433
" B	421	417	417	412
Treated with:—				
<i>Liquids—</i>				
Formaldehyde, 1 part per 1,000	532	527	527	504
Formaldehyde, $\frac{1}{2}$ part per 1,000	391	387	387	389
Carbolic acid, 2 parts per 1,000	351	348	348	344
Carbolic acid, 1 part per 1,000	237	235	235	233
<i>Solids—</i>				
Calcium sulphide, 2 parts per 1,000	152	128	128	128
Impure calcium sulphide, 1 part per 1,000	369	365	365	367
Formaldehyde preparation, $\frac{1}{10}$ part per 1,000	221	219	219	223

adapted for the trials, since each grower introduces some modification in the method of working. No two men heated their soils in quite the same way: roughly speaking, however, the methods adopted fell into four groups:—1. Hot water; 2. Baking; 3. High-pressure steam; 4. Low-pressure steam.

1. *Hot Water.*—This was run from the hot-water pipes on to the soil, until the top eight inches was saturated. Satisfactory results were obtained in some cases, but it is not clear exactly what the effect was, because flooding with cold water has also been found to be beneficial in some cases. These results will therefore not be discussed at present.

2. *Baking.*—Baking seems to be far the best method for the small grower. Mr. Holmes, of Tuckswood Farm, Norwich, has shown considerable ingenuity in devising suitable forms of apparatus in which the heat is utilised as fully as possible, so that only a minimum amount of fuel is necessary. Mr. Holmes states that baking can be done at $5\frac{1}{2}d.$ per ton of soil when it is worked in properly with the other operations going on in the nursery. One large grower who baked a

considerable amount of soil found the cost of fuel to be about $2\frac{1}{2}d.$ to $3d.$ per load treated, and of labour approximately $5d.$ a load: the total cost therefore is about $8d.$ a load.

Most of the large growers, however, prefer steaming; some use high-pressure, others low-pressure steam.

Two distinct cases arise. Cucumber borders are removed from the house each year according to present practice; the soil can therefore be heated in some form of apparatus outside the house. Tomato soils, however, are not moved out—indeed could not be except at prohibitive expense; the steaming must therefore be done in the house itself, and of course the less labour wanted the better.

3. *High-pressure Steam.*—Two methods of applying high-pressure steam were tried. In one a box was made, without top or bottom, about 6 to 9 ft. by 3 ft. and some 18 in. deep. This was placed on a grid formed of iron pipes $1\frac{1}{2}$ to 2 in. in diameter, perforated with $\frac{1}{8}$ -in. holes and connected with the boiler. Soil was then put into the box and covered with sacks; steam was blown in at a pressure of 40-80 lb. for 20 minutes, and the soil was then thrown into a heap. This method was used for soils wanted for cucumber borders and for tomatoes in pots.

The other method, used in tomato houses, consisted in steaming the soil *in situ* and did not involve taking the soil out. It is a combination of trenching and steaming. The trenching is done in the usual way: a section, 9 in. deep, 2 ft. 6 in. across, and 9 ft. long, is excavated and the soil removed; a grid is laid at the bottom; then soil from the next adjoining section is thrown in and packed up level, leaving a new trench of the same dimensions; steam is then blown through for 15-20 minutes. The grid is then pulled forward by means of hooks or short chains into the new trench, and soil is thrown on as before, leaving a new trench into which the grid can be drawn after the steaming is done. One gang of men can keep two grids going side by side, and the work can be so organised that neither boiler nor men have to be kept waiting, *i.e.*, the grid has to be pulled forward and covered up and the trench prepared in 15-20 minutes, the steam meanwhile being blown through the other grid. The work is sometimes rather trying because a good deal of steam escapes into the house.

The past season's experience suggests that 1 in. to $1\frac{1}{2}$ in. piping is big enough for the main and $\frac{3}{4}$ -in. to 1 in. big enough for the grids: these dimensions are a little less than those given earlier. The holes may be $\frac{1}{8}$ -in. in diameter, 6 in. apart at the



FIG. 1.—Tomatoes grown in "sick" soil.
1. Untreated. 2. Treated with formaldehyde, 1 part per 1000. 3. Treated with formaldehyde, $\frac{1}{2}$ part per 1000. 4. Treated with carbolic acid, 2 parts per 1000. 5. Treated with carbolic acid, 1 part per 1000. 6. Treated with calcium sulphide, 1 part per 1000.

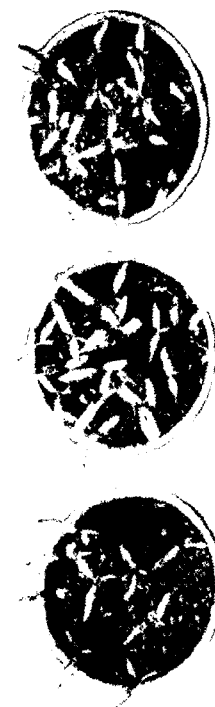


FIG. 2.—Tomato seedlings raised in—1. Untreated soil. 2. Heated soil mixed with rotted dung. 3. Heated soil. Last season there was no retardation on the treated soil at Rothamsted.

sides and 1 ft. at the top. The ordinary form of grid has to be lifted bodily out of the soil, which is rather heavy work, but Mr. V. G. Minard's comb-shaped grid (described fully in "The Fruit Grower, Fruiterer, etc.", Jan. 30th and Feb. 6th, 1913), which is 9 ft. by 2 ft. 6 in. with 13 prongs of $\frac{3}{4}$ -in. pipe, bored with holes 6 in. apart, obviates this difficulty entirely, and need only be drawn out. A blowpipe arrangement of steam and water jet is used by Mr. Minard for getting round piers and pipes. In the previous report a harrow-like apparatus was described for use in steaming the soil, but it is now believed that this is inferior to the grid. It is not yet clear to what depth the steaming should be carried out, but a usual depth has been the top nine inches; greater depths have been tried, but there was nothing to show that the results justified the expense. On the other hand, good results have been obtained when only the top six inches was heated. No general rule can be given as to the time required for steaming, but every part of the soil must be heated above 200° F.; it is therefore desirable to take the temperature. Less than 15 minutes' steaming is not usually sufficient, and unsatisfactory results have followed steaming for shorter periods.

In an earlier report* it was pointed out that dry soil required less steam to raise it to 210° F. than moist soil; experience in the nurseries, however, has shown that some degree of moistness is necessary, otherwise the soil does not heat well on account of its low conductivity. The mean has therefore to be discovered by making a few trials at the beginning to find when the soil is sufficiently moist for proper working.

4. *Low-pressure Steam.*—This is used with the box and grid for cucumber soil exactly like high-pressure steam. The grid is covered with loose boards, through the chinks of which the steam issues; by thus keeping the soil off the grid the steaming becomes more efficient and the soil is left drier than when it lies direct on the grid. Steam at 20 lb. pressure is blown through for 30 minutes: a box larger than usual is adopted, suitable dimensions being 12 ft. by 3 ft. 6 in., and 18 in. deep.

Another method used by Mr. Holmes has the advantage of not requiring the soil to be moved out of the house. The soil is first forked over, and on it is inverted a tray made of metal, e.g., galvanised iron, backed by boards; the steam is then blown underneath and finds its way into the soil, raising the temperature to a depth* of 10 in. or more. If the

* *Journal*, January, 1912.

trays are left after the steaming is discontinued the temperature only falls slowly; after 18 hours it was found to be still 120° F. at a depth of eight inches below the surface. There should be very little escape of steam into the house, and to ensure this the trays are carefully banked with earth.

The trays are six feet wide, this width being chosen so that they can fit easily between the piers and pipes, which are commonly seven feet apart. The best length is not yet determined, but is probably six feet, as the trays are then square and not too heavy to be handled by two men. Iron piping of 1½ in. diameter is used for the steam main, and plugs are introduced at intervals to allow the insertion of lateral delivery pipes; these terminate in a T so that the steam shall not blow out with too much force. The time necessary for steaming naturally depends on the area of soil and the volume of steam, so that trials have to be made at the outset by inserting a thermometer to a depth of 8 in. In one nursery one hour's steaming sufficed; fifteen minutes only were given in another; while in a third a number of trays were laid end on end and steam was run for some hours; the trays were then left as long as possible (*e.g.*, over night) so that the cooking might continue. In this case the movement of the steam is facilitated by digging a channel in the soil the whole length of the trays. Only low-pressure steam is needed and no forced draught is required.

The great advantage of this method is the reduction in the cost of labour, hitherto the most expensive item in heating. There is also less waste of steam in the house. Its efficiency has yet to be established, but the method appears to be good.

Cost.

All the systems described have their advocates, their advantages and their disadvantages, but the great determining factor must necessarily be the cost. The present methods of growing require that cucumber borders must be cleared out from the houses, and hence some outside arrangement for heating is necessary: tomato and other soils, however, need not be removed, and therefore they must be steamed *in situ*. The following are some of the figures as to cost that were actually obtained in nurseries in the past season:—

Method.	Outside Methods, used for Cucumber Borders.			Total.
	Cost of labour.	Cost of fuel.		
Baking	5d.	2½d.		7½d. per ton.
Steaming	9d.*	3½d.		15. 0½d.* per ton.

* Higher because the soil had to be wheeled out to the steriliser and then back again.

Inside Methods, used for Tomato Houses.

Method.	Cost of labour.	Cost of fuel.	Total.
Grid	1½d.	1½d.*	3d.† per square yard.
Tray method			
Nursery A	¾d.	1d.	1½d.
„ „ B	2d.†	1½d.	3½d.* „ „

Nothing has been allowed for depreciation of apparatus, interest on outlay, &c., because of the difficulty of knowing how long the outfit will last and what other use can be made of the boiler. When an allowance satisfactory to the grower is added the total cost comes to 1s. 3d. to 1s. 6d. per ton for cucumber soil and £8 to £10 per house for tomato soil by the grid method, or £3 to £5 by the tray method, the houses being usually ⅛ to ¼ acre in extent, often 25 to 28 ft. wide, and about 200 ft. long. It must be remembered, however, that part of the labour is necessary to the growing and would be required in any case; the figures, therefore, are on the high side.

Results Obtained in the Nurseries.

As a general rule germination is retarded on freshly steamed soils, and the young plants show marked retardation in comparison with others grown on untreated soil. The effect is less visible on soils that have been exposed after heating, and is also less on light than on heavy soils or those rich in organic matter. It is probably due to some of the decomposition products formed by the action of the heat on the soil organic matter, but it depends so much on the plant, the season, the management, and the conditions generally, that it is very difficult to investigate satisfactorily: indeed, it is not invariably produced, and sometimes an increased rate of germination and seedling growth is obtained almost from the outset. This happened at Rothamsted during the past season, and a still further acceleration was produced by mixing well rotted dung with the soil (Fig. 2).

The retardation is a source of some anxiety when it appears, but it soon passes away, and is, in any case, more than counter-balanced by the fact that the seedlings are invariably freer from disease than those raised on contaminated untreated soil, such as often has to be used in the nursery.

Heated soil behaves rather differently from unheated soil on watering, and therefore care is needed until the men get used to the new conditions.

* Later experience showed that a lower pressure steam would have sufficed than was actually used (120 lb.), and that an economy in fuel could have been effected.

† A rearrangement of work was afterwards made whereby the labour was reduced by one-third, and the total cost of the last sections was therefore 3d. per square yard.

Flowering and Early Fruiting.—The results obtained with tomatoes in pots were entirely similar to those described in earlier reports and need not be discussed again. The steamed soil not only gave larger crops but earlier crops, and there was no disease brought in by the soil. Very satisfactory results were obtained by steaming old cucumber soil in winter and putting it straight into pots for the growth of early tomatoes.

The fear was entertained last year that tomato plants grown in steamed borders might develop too vigorous a habit of growth to "set" their fruit well. It was true that the "setting" was always good in the Rothamsted experiments, but there the plants were grown in pots where the root system was necessarily restricted. The conditions of a border, on the other hand, allow of much more extended root development, and of a greater tendency to rankness. Careful watch was therefore kept to see under what circumstances success and failure were respectively obtained.

Tomatoes set out in borders which have been steamed soon begin to grow very vigorously, and develop a good system of very white and clean fibrous roots, in marked contrast to the brown, knotted roots in houses where "sick" soil occurs. In the early stages plants often do very considerably better than in "sick" soil, and almost always form large dark green leaves and stout stems. The grower does not particularly desire this vigorous growth; he wants early and copious fruit rather than big leaves and stems. Two distinct stages, in fact, are noticeable in the life of the tomato plant: the first leading up to the "setting" of the fruit, and the second to the swelling or growth of the fruit.

Very little is known about the causes that determine "setting," but the grower has learnt by experience that vigorous growth is not particularly favourable, and may be detrimental. Some anxiety was therefore felt when the young plants began to grow very vigorously, and in some cases the anxiety was justified, because setting was actually bad in certain houses.

Good setting was observed when the following treatment was adopted throughout the stage from planting out to setting of fruit:—

- (a) When water had been withheld from the roots till the plants were almost on the point of suffering—as the grower picturesquely puts it, till the plants cried for it;*
- (b) When no nitrogenous manure had been supplied;
- (c) When a brisk heat had been kept up.

* Recourse may be had to damping overhead in sunny weather in order to keep the atmosphere moist.

These observations are in accordance with the experience of Mr. Dyke, who has given this aspect of the subject very close attention, and has done as much as anyone in applying partial sterilisation methods to glasshouse work.

On the other hand, bad results have followed the use of too much water, the addition of hoof, or the adoption of cool treatment to check growth. The varieties of tomatoes differ; those like Fillbasket that are adapted to rich soils suffer less from rankness than certain others. Again, the size of the plant at the time of planting out is apparently an important factor, a well-advanced plant being less liable to grow rank than a young plant.

The observations suffice to show that rankness is not a necessary accompaniment of steaming, and that good setting can be obtained when the proper conditions are maintained, even with strongly-growing plants.

Another test of rankness is susceptibility to disease; this is an important factor, because no nursery can hope to go scathless through the season. It is difficult to give quantitative data, but the results this season indicate that plants grown in steamed soil are certainly not more, and are probably less, susceptible to disease than those on untreated soil.*

The Crops.

Tomatoes.—During the second period, the growing of the fruit, the plant may receive as much water and food as it needs, and there is no longer any fear of rankness.

Tomatoes are measured in "strikes," a "strike" being the basket to which the market is accustomed and holding approximately 12 lb. The variation in the amount of fruit picked in individual houses is considerable, and one does not know how great is the error of experiments. The results obtained in the various nurseries where setting had been good were uniformly in favour of the steamed soil, but where the setting was bad the steamed soil was sometimes no better than the untreated, and occasionally worse. At one nursery the pickings were:—

	May.	June.	July.	Total at end of Season.
Steamed..	26	444	143	993 strikes per house.
Not steamed	11	348	214	987 strikes per house, reckoned to equal areas.

* Growers should note that partial sterilisation does not protect against diseases that are introduced after the soil has been treated, nor against pathological effects brought about by unfavourable conditions of soil or subsoil. Disease germs that escape death during the heating may also cause trouble afterwards.

At another nursery the pickings up to the middle of July were :—

Steamed ..	517 strikes per house	} Reckoned to equal areas.
Not steamed ..	410 " "	

In both cases the early pickings were higher on the steamed than the unsteamed soils, and of course it is the early results that pay.

At a third nursery the results were :—

Steamed ..	777 strikes per house	} Reckoned to equal areas.
Not steamed ..	639 " "	

At a fourth nursery the steamed house gave 18 per cent. increase over the unsteamed house, which, however, was not entirely untreated, having been dosed with carbolic acid; at a fifth there was no unsteamed house as control, but whereas the 1912 crop (before steaming) had failed, the 1913 crop (after steaming) was a success. The different nurseries are not comparable, the areas not being the same, but all the results agree in showing a higher return for the steamed than for the unsteamed soils. It is customary to supply manure as soon as the fruit begins to swell, and from that time onwards the difference between the plants on the steamed and the untreated soils begins to diminish. Towards the end of the season it was impossible to distinguish the plants by eye, although when they were pulled up their roots still showed characteristic differences, those on the heated soils being white and free from knots, while those on the untreated soils were brown and knotty.

As regards the manuring, in view of the large amount of plant food liberated as a result of partial sterilisation it would appear unnecessary to manure the heated soil as liberally as the untreated soil, at any rate during the early period. Several observations supported this view: at one nursery the steamed soil without manure or carbolic treatment had, by the middle of July, already given as large a crop as the unheated soil, and was at the time carrying more fruit. Yet the unheated soil had received 10 cwt. of rich artificial manure per house and carbolic treatment as well. At another nursery, the untreated house had two dressings more of manure than the steamed before it was brought to the same level.

The present indications are that the manure supplied to a heated soil should contain less of the expensive nitrogen compounds and more of the cheaper phosphate and potash compounds than would be given to an unsteamed soil, but on this point further experiment is necessary.

Summing up the tomato results, we find they are similar to those obtained in the pot experiments. A new difficulty arises in the borders, inasmuch as the "setting" may be interfered with, but the season's experiments show that this difficulty can be overcome.

Cucumbers.—Cucumber borders are made up of a mixture of turf and straw manure, and at the end of the year the soil is usually thrown out on account of the "sickness" and replaced by fresh turf and straw manure. Attention has been directed in the earlier reports* to the enormous manurial residues in the "sick" soil; nevertheless the grower considers he has no option but to reject it. The experiments at Rothamsted show that "sickness" can be removed by steaming, and also that a steamed sick soil allows of normal healthy plant development. The grower, however, is not particularly concerned with any comparison between steamed and unsteamed sick soils, but wants to know whether the steamed sick soil is as good as virgin turf or loam in making up the borders. The inquiry is naturally rather indefinite, but it represents the kind of information wanted. In several houses, therefore, trials of this kind were made, old steamed soil being used on some borders and virgin turf on others. During the spring and summer no difference in growth was observed as a rule between the old soil heated and the virgin turf; where there were any differences they were usually in favour of the latter. At two nurseries the virgin turf maintained its late summer and autumn yields better, so that on the whole it turned out more useful than the old soil heated. Elsewhere the old soil steamed was better than the new soil, whilst at one nursery it was at least as good and the house started better in the present season, being freer from wood lice. It should be observed that old cucumber soil steamed may be distinctly cheaper than virgin turf, and therefore its use may be more economical even when it gives no larger crops. In comparison with turf, however, it has one serious defect: it contains little or no fibre, which is extremely desirable in a cucumber border, to facilitate aeration and drainage and prevent the soil from sinking down into a sticky, sour condition. Probably the most useful method of procedure would be to make the borders with a mixture of turf and steamed old soil along with straw manure.

* *Journal*, January, 1912, p. 809, and January, 1913, p. 809; also *Journal of Agricultural Science*, 1912, Vol. 5, p. 86.

Chrysanthemums.—The production of chrysanthemums, like that of tomatoes and cucumbers, is a very specialised branch of the industry, but it has this in common with the rest: that the old compost which has once been used is not considered to be a good medium for another batch of plants. To some extent the old is inferior to new soil in that it contains the accumulation of detrimental and disease organisms inevitably accompanying a prolonged stay in a glasshouse, but as the conditions of growth are not as intense even as those of tomatoes the trouble is correspondingly less. The old compost has also lost much of its fibre, and after being steamed it is therefore more liable to pan down with constant watering. Nevertheless it is too good to waste, as is shown by the following analyses, in which composts thrown out from a large commercial nursery are compared with a good arable soil:—

—	Thrown out at end of 1911.	Thrown out at end of 1912.	Arable soil.
Organic matter	9.10	9.20	4.00
Nitrogen	.33	.41	.15
Phosphoric acid	.14	.40	.12
„ „ (available)	.05	.20	.02
Potash	.24	.32	.20
„ (available)	.06	.10	.02
Carbonates	.90	.50	.50

The earlier experiments are described in the 2nd Report* and discussed at greater length in the Transactions of the National Chrysanthemum Society for 1913: they showed that the old soil can safely be used again after it is steamed, and further brought out the fact that flowers produced on the steamed soil are larger and of greater substance than those on untreated soil.

The past year's experiments, carried out in conjunction with Mr. Buddin, were designed to test more completely this question of flower size. They were therefore confined to one variety only, H. W. Thorpe, which was grown in old compost treated in different ways: by heat, by toluol, formaldehyde, and calcium sulphide; a fifth lot was untreated. The plants were grown in the usual manner: the cuttings—which were kindly supplied to us by Mr. Cragg, of Merivale Nurseries—were potted up in “sixties” and finally transferred to 10-inch pots, where they were fed four times with $\frac{1}{4}$ oz. per plant of a mixture containing nearly equal parts of nitrate of soda, sulphate of ammonia, sulphate of potash and superphosphate.

* *Journal*, January, 1913, p. 809.

About the middle of June they made their “breaks” and the shoots were treated in the usual way.

The flowers on the heated soil were out first—two or three days before those on the untreated soil; the difference in earliness, however, was not very marked. The leaves and flowers were larger and heavier, as shown in Table 2 (p. 112). Chemical treatment did not cause any increased growth.*

The nutritive compounds available in the heated soil are not quite the same as those in the untreated soil, and the percentages of nitrogen, phosphoric acid and potash in the leaves, stems, roots, and especially in the flowers, of plants grown in heated soil are higher than in those raised on the untreated. This rule appears to be general; the same thing was found in the case of tomatoes.† How far the quality of the fruit or flower is affected cannot be determined at present owing to the difficulty of defining quality.

For practical purposes the steamed soil gave the best results, the plants carrying larger flowers than did the untreated. This is an obvious advantage in growing flowers for market; there is the further advantage that the old compost and its manurial residues need not be wasted but can be used again.

The amounts of plant food taken up from the heated and unheated soils respectively are shown in Fig. 3, the data for which are taken from Table 2 (p. 112). As only analyses of chrysanthemums have been published the full data are given here: the large amounts of potash present should be noted.

* These results were reflected in the chemical and bacteriological analyses, which were as follows:—

Treatment.	Bacteria, millions per gramme				Protozoa	N. as Ammonia, parts per million of dry soil			N. as Ammonia and Nitrate, parts per million		
	at start.	after 9 days.	after 38 days.	after 62 days.		at start.	after 9 days.	after 62 days.	at start.	after 9 days.	after 62 days.
Untreated ..	80	182	272	73	Ciliates amoebae monads. nonc.	53	33	7	188	197	195
Heated ..	—	265	54	416		55	75	130	184	219	265
Treated with formaldehyde 0.14 per cent.	2	44	56	67	none.	27	53	99	138	180	207

† See *Journal of Agricultural Science*, 1913, Vol. 5, pp. 248–287. It is reasonable to suppose that these differences in composition will be reflected in the quality of the fruit, but so many factors come into play that definite information is very difficult to obtain. Reference is made in the paper here quoted to the difference in taste. Some of the growers this year thought that tomatoes on heated soil were larger and less elegant than those on untreated soil.

Table 2. *Chrysanthemum* Results, 1913. *Weights of Plants.*

SOIL TREATMENT.	LEAF AND STEM. Average weight per plant in grammes.			FLOWERS. Average weight per plant in grammes.			ROOTS. Average weight per plant in grammes.	
	Green.	Dry.	Relative.	Green.	Dry.	Relative.	Dry.	Relative.
Untreated	296	74.5	100	134	14.7	100	13.3	100
Heated	342	90.3	121	176	17.3	118	15.8	119
Toluol	267	65.2	87.5	138	12.8	87	13.2	100
Formaldehyde	266	66.2	89	134	12.3	84	10.4	78
Calcium sulphide	278	65.5	88	133	13.2	90	12.4	93

Nitrogen in plants.

Soil Treatment.	LEAF AND STEM.			FLOWERS.			ROOTS.		
	Per cent. in dry matter.	Weight, grammes.	Relative weights.	Per cent. in dry matter.	Weight, grammes.	Relative weights.	Per cent. in dry matter.	Weight, grammes.	Relative weights.
Untreated	1.76	1.31	100	2.55	.375	100	2.52	.336	100
Heated	1.81	1.64	126	2.87	.497	133	2.79	.441	131
Toluol	1.83	1.19	91	3.12	.399	106	2.84	.375	112
Formaldehyde	1.89	1.25	95.5	3.02	.371	99	2.76	.287	85
Calcium sulphide	1.83	1.20	92	2.88	.380	101	2.56	.317	94

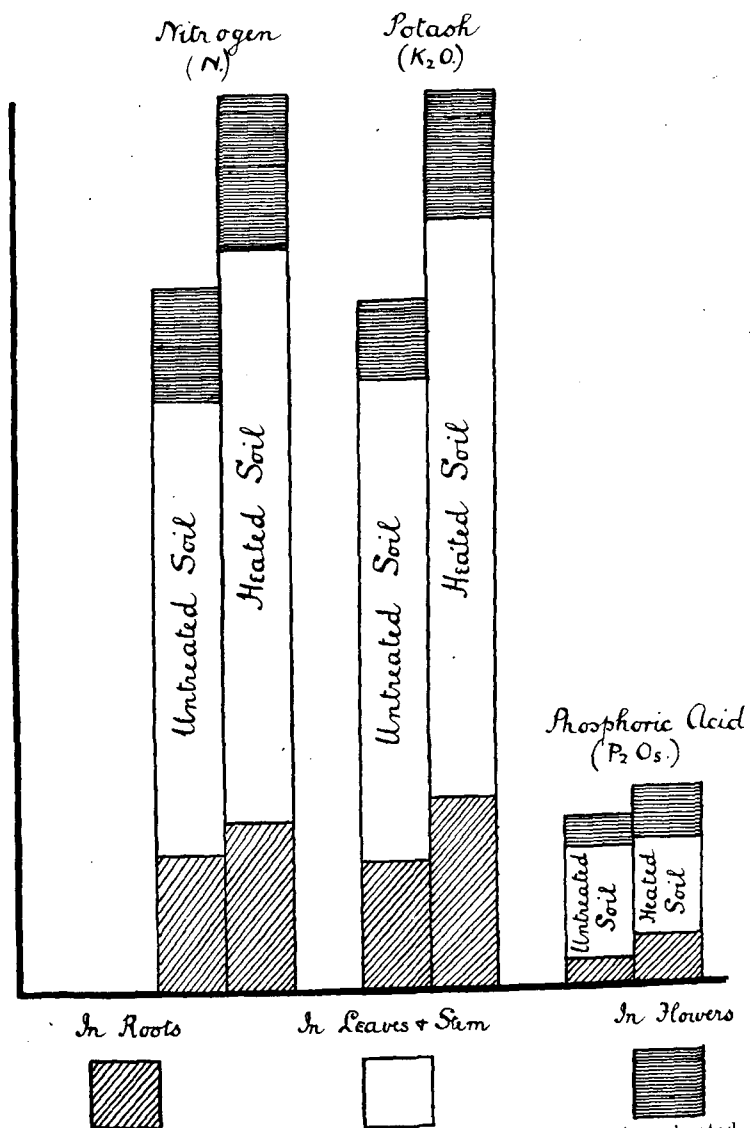


FIG. 3.—Amounts of plant food taken by chrysanthemums from heated and untreated soils respectively. (Var. H. W. Thorpe).

Potash (K_2O) in Plants.

	LEAVES AND STEM.				FLOWERS.				ROOTS.			
	Total Ash in dry matter, %	P_2O_5 in Ash, %	K_2O in dry matter, %	K_2O in leaves and stem. Grammes. Relative.	Total Ash in dry matter, %	K_2O in Ash, %	K_2O in dry matter, %	Relative.	Total Ash in dry matter, %	K_2O in Ash, %	K_2O in dry matter, %	Relative.
Untreated ..	8.07	22.9	1.85	1.38	6.46	40.6	2.62	100	15.8	10.7	1.69	100
Heated ..	7.96	22.5	1.79	1.65	6.81	48.0	3.27	147	18.6	12.3	2.29	160

Phosphoric Acid (P_2O_5) in Plants.

	LEAVES AND STEM.				FLOWERS.				ROOTS.			
	Total Ash in dry matter, %	P_2O_5 in Ash, %	P_2O_5 in dry matter, %	P_2O_5 in leaves and stems. Grammes. Relative.	Total Ash in dry matter, %	P_2O_5 in Ash, %	P_2O_5 in dry matter, %	Relative.	Total Ash in dry matter, %	P_2O_5 in Ash, %	P_2O_5 in dry matter, %	Relative.
Untreated ..	8.07	5.33	0.43	0.320	6.46	7.78	0.50	100	15.8	3.80	0.60	100
Heated ..	7.96	6.64	0.53	0.477	6.81	11.5	0.78	182	18.6	4.69	0.87	172

Weight in grammes of nutrients taken from the soil by the whole plant.

	NITROGEN.				POTASH (K_2O).				PHOSPHORIC ACID (P_2O_5).			
	In leaves and stems.	In flowers.	In roots.	Total.	In leaves and stems.	In flowers.	In roots.	Total.	In leaves and stems.	In flowers.	In roots.	Total.
Untreated ..	1.31	.375	.336	2.021	1.380	.386	.226	1.992	.320	.074	.080	.474
Heated ..	1.64	.497	.441	2.578	1.650	.566	.360	2.576	.477	.135	.138	.750

Outdoor Experiments.

The experiments set out above show that the effect of partial sterilisation in a commercial nursery is similar to that obtained in the laboratory investigations.

Some experiments have now been started to ascertain whether similar results could also be obtained in the field, or whether any new complicating factor comes into play. Once this important point is settled, the only problem remaining would be to find some partial sterilisation method cheap enough for use in practice, and this would merely be a matter of time if the reduction in cost already begun in the Lea Valley continued much further. It is probable that potato growers would be the first to be interested in the method, but potatoes have not been included in these experiments owing to their unsuitability for small plots; cereals have been used instead.

The heating methods are apparently out of the question in this country, although, as Mr. and Mrs. Howard have shown, tropical sunshine can be used in India.* These experiments have therefore been made with chemical antiseptics, and the object was to determine whether crop increases could be obtained in the field similar to those in the laboratory; questions of cost or convenience have not yet been considered. The method has been to inject the antiseptic six inches into the soil by means of a hand injector such as is used in Continental vineyards, the holes being ten inches apart each way.

The great difficulty experienced has been to make the distribution at all efficient, and to make the injections at the right time; if they were made too early the ground was usually so wet that the antiseptic vapours could not penetrate the water films and get to the particles; if, on the other hand, they were postponed till the ground was drier there was insufficient time for the antiseptic completely to disappear before sowing. These mechanical difficulties have not yet been overcome, and in the outdoor experiments antiseptics have failed to produce consistent and regular increases in crop. The results over three years are given in Table 3, p. 115.

* Hot dry summers exert a distinctly beneficial effect on the soil here as the writer has recently shown in the *Journ. Roy. Agric. Soc.* (1913, Vol. 74, pp. 12 *et seq.*). Mr. T. A. Dickson has pointed out how greatly the hot dry summer of 1911 benefited the grass land of the Midlands, and states "such a time for beasts doing well had hardly ever been known as the May and June of 1912. There were more beasts turned off fat from the grazing pastures of the Midlands than had been known for very many years before" (*Surveyors' Institution Trans.*, 1913, Vol. 46, p. 102). In like manner Mr. C. B. Fisher in the season of 1894 which succeeded the hot dry summer of 1893. Going still further back, Mr. R. M. Barrington states that in Ireland the season of 1871 following the hot dry year of 1870 was remarkable for the great growth of grass in the pastures.

Pot experiments with the same soils showed that increases of 20 to 50 per cent. could be obtained when the distribution of the antiseptic was more efficiently carried out, and we do not despair of reproducing these results in the field.

Table 3. *Results of Outdoor Experiments.*

Average Produce in lb. on 4 plots, each 3 poles in area.

	1911. Wheat, Stackyard Field.						1910. Swedes, Stackyard Field.			
	Series A.			Series B.			Farmyard Manure.		No Farmyard Manure.	
	Grain.	Straw.	Total produce.	Grain.	Straw.	Total produce.	Roots.	Total produce.	Roots.	Total produce.
Untreated ..	48.4	68.4	121.1	42.1	54.9	98.9	856	1043	807	978
Treated with Carbon disulphide ..	59.8	86.0	149.1	54.7	71.3	128.1	880	1076	—	—
Toluol ..	51.6	63.3	117.4	49.9	68.8	120.9	848	1031	776	923
Petrol ..	51.4	71.1	125.4	53.9	72.0	127.9	864	1050	—	—
Paraffin ..	50.1	71.8	124.2	57.8	71.5	128.9	846	1037	—	—

	1912.					
	Barley, Great Knotwood Field.			Oats, Little Knotwood Field.		
	Grain. bus.	Straw. lb.	Total produce. lb.	Grain. bus.	Straw. lb.	Total produce. lb.
Untreated ..	27.3	2075	3606	30.6	1872	3007
Treated with Carbon disulphide ..	30.9	2209	3924	28.0	1682	2782
Toluol ..	26.9	2075	3590	—	—	—
Formaldehyde ..	—	—	—	32.6	2138	3391

Conclusions.

Partial sterilisation of soil is found to give increased crops under the practical conditions of commercial nurseries, just as it did in the pot culture house at Rothamsted. The difficulties that arose could all be overcome, and the method proved perfectly feasible in tomato and cucumber growing, and can readily be combined with the ordinary routine of the nursery.

Three heating methods have been tried in the past season in various nurseries: high-pressure steam, low-pressure steam, and baking. Each proved workable in practice and each has its advantages; it is too early yet to judge between them. Low-pressure steam, however, is the simplest method

of heating soils *in situ*. The experiments with chemical antiseptics were conducted in the house at Rothamsted only.

Partial sterilisation effectually stamps out most of the diseases arising from the soil, including club-root.

It increases the supply of plant food, and so reduces the amount of nitrogenous manure needed in the early stages of the life of the plant.

Although it induces vigorous growth of tomatoes it does not necessarily interfere with the setting of the fruit; by adopting precautions as to varieties selected, size of plant at time of setting out, withholding water and manure, and keeping on the heat, some of the growers succeeded in getting as good a set, or better, on heated than on untreated soil.

After partial sterilisation old cucumber soil may be used again in making up borders, so that its valuable manurial residues need not be wasted. It may not be able entirely to replace virgin turf in the border, because it has lost much of its fibre and tends to pan down. Old chrysanthemum compost may in like manner be used again, but here also care must be taken to add fibrous material so as to prevent the soil panning down too much, though old soil after steaming may at any rate partly replace the turf.

SOME IRISH LARCH PLANTATIONS.

J. H. WADDINGHAM.

THE statistics brought together in the following article were collected with the object of determining the volume of timber produced by larch at different ages, and the effect of density on the volume. With this object in view, sample plots in woods of different ages and density were carefully laid out and accurately measured.

The country included in the watershed of the Suir and comprising the glens on the northern and southern slopes of the Galtee Mountains is one of the most favourable larch-growing districts in Ireland.

The larch grows remarkably well, and free from disease, and in the first twenty years of growth the height curve of some of these Irish larch plantations is about equal to the height of some Welsh larch plantations of which statistics were recently published by the Board of Agriculture and Fisheries.*

* *Journal Supplement*, Notes on Kerry Woods, No. 9, August, 1912.

1. *General Description of Sylvicultural Conditions.*

The woods described lie on the Shanbally Estate, Co. Tipperary, the property of Lady Beatrice Pole-Carew. All the plantations except one are situated in Glengarra, a glen in the Galtee Mountains. One plantation lies on the northern slopes of the Knockmealdown Mountains.

To the north and north-west of Glengarra lie Greenane (2,600 ft.) and Galtymore (3,018 ft.), and to the west Knockeenatoun (1,900 ft.), so that the glen is well sheltered from the north and west, but some of the higher parts are exposed to gales from the south-east and south-west. The rainfall is heavy, —about 60 inches, and snow and late frost are rare, the chief features of the climate being cool summers and warm winters, which are undoubtedly favourable to the growth of conifers.

The rocks exposed on the lower parts of the Galtees belong to the Old Red Sandstone, and owing to the dip of the strata the surface is full of springs, which greatly develop the growth of larch.

The soil is generally a reddish sandy loam, but no accurate information is available. It is generally of considerable depth, usually about four feet, but stony, and it is naturally well drained.

Larch, as the photographs show, everywhere grows clean and straight, and pruning is unknown. In Coolbaun plantation at 1,000 feet elevation, about 10 per cent. of the larch have their tops bent with the wind, and the limit for larch would appear to be about 1,200 feet.

2.—*Method of Measurement and Valuation.*

All the sample plots are in fully stocked woods of pure larch, of different ages and qualities. In every case the sample plots form the best part of the existing wood, and this is justified when the past history of the woods is considered. In Coolbaun plantation the areas carrying the best larch were felled over eight years ago. In Kerry Rae squirrels destroyed the most vigorous trees about the same time, while Fitzgerald's Rae up to ten years ago had the best trees taken out from time to time.

Most of the sample plots are 0.4 acre in extent. The trees were callipered in 1-inch classes at 4 ft. 3 in. from the ground, and a sample tree approximating to the mean diameter was felled, while in some cases two trees were felled.

The sample trees were cross cut at 5 ft., 15 ft., 25 ft., etc., the rings on each section being counted and the two diameters

at right angles measured. From these figures the volume of the sample tree was obtained, also the form factor and data for the height-growth curve.

The volume is calculated as

$$V = A \times h \times f.$$

where A = total basal area of sample plot at 4 ft. 3 in. ;

f = form factor of sample tree ; and

h = height of sample tree.

The method is not absolutely accurate, but is sufficient for the purpose. The volume given is the true volume, including bark, down to 3 in. diameter.

In arriving at the cost of production the cost of planting has been estimated from the known cost of planting similar land at the present time. The cost of maintenance is an estimate of the general cost in the South of Ireland, and includes rates, income tax, insurance, forester's salary and salary of caretakers, part of whose duty is always to destroy rabbits. This total amounts to about 3s. per acre per annum.

The value of the standing timber is purposely not stated, as everywhere the value of timber depends on the distance from a railway station, general accessibility and on local markets.

3.—Description of Sample Plots.

Sample Plot No. 1.—Grant's Wood : area 0.4 acre, elevation 480 ft., age 53 years. Part of a wood of 20 acres, slope gentle, aspect north-east, the Knockmealdown Mountains rising up abruptly behind.

The undergrowth consists of brambles ; the ground is stony, but grows larch of exceptionally fine quality ; the northern slope has a belt of silver fir, whose diameter at 4 ft. 3 in. is 23 inches ; the outside larch are 14 inches in diameter. This wood was thinned 14 years ago, and a few spars have been taken out from time to time since. The outer inch of radius on 5 ft. section contains 16 rings.

Number of dominant trees per acre (of mean diameter 9.5 in.) = 362.

Sample tree .. $h = 66$ ft. $d = 9.7$ in.
 $v = 15.64$ cub. ft. $f = 0.469$.

Volume per acre = $\frac{70.53 \times 66 \times 0.469}{0.4} = 5,458$ cub. ft.

Cost of planting, £5 10s. per acre at 3 per cent. for 50 years .. £ s. d.

Maintenance, 3s. per acre per annum for 50 years at 3 per cent. .. 24 2 0

Rent, 1s. per acre per annum for 50 years at 3 per cent. .. 16 18 0

Total cost £46 12



FIG. 1.—Sample Plot No. 2 ; 147 trees per acre.



FIG. 2.—Sample Plot No. 3 ; 212 trees per acre.

Sample Plot No. 2.—Fitzgerald's Rae : area 0.4 acre, elevation 400 ft., age 53 years. This plantation of seven acres of magnificent land lies on level ground at the foot of the Galtee Mountains, is well sheltered, and was formerly a grass field ; the soil is good and well drained, and the undergrowth consists of brambles. A heavy thinning was made 16 years ago, and some of the best trees have been taken out since. The present height-growth is seven inches per annum, and the outer inch of radius on 5 ft. section contains 12 rings.

Number of dominant trees per acre (of mean diameter 13.5 in.) = 147.
 Sample tree .. $h = 74$ ft. $d = 13.1$ in.
 $v = 32.02$ cub. ft. $f = 0.462$.
 $60.26 \times 74 \times 0.462 = 5,150$ cub. ft.
 Volume per acre = $\frac{5,150}{0.4} = 12,875$ cub. ft.

	£	s.	d.
Cost of planting and clearing for 2 years, = £4 15s.	4	15	0
per acre at 3 per cent. for 50 years	20	16	0
Maintenance, 3s. per acre per annum at 3 per cent.	16	18	0
for 50 years	28	3	0
Rent, 5s. per acre per annum at 3 per cent. for 50 years			
Total cost	£65	17	0

Sample Plot No. 3.—Fitzgerald's Rae : area 0.4 acre, elevation 400 ft., age 55 years. This is another part of the plantation described previously, but it has not been so heavily thinned, and the mean diameter is less, but the total volume per acre is greater. The present height-growth is nine inches per annum, and the outer inch of radius on 5 ft. section contains 13 rings.

Number of trees per acre (of mean diameter 12.3 in.) = 212.
 Sample tree .. $h = 76$ ft. $d = 12.3$ in.
 $v = 29.17$ cub. ft. $f = 0.465$.
 $70.04 \times 76 \times 0.465 = 6,188$ cub. ft.
 Volume per acre = $\frac{6,188}{0.4} = 15,470$ cub. ft.

	£	s.	d.
Cost of planting, £4 15s. per acre at 3 per cent. per annum for 52 years	22	1	0
Maintenance, 3s. per acre per annum at 3 per cent. for 52 years	18	5	0
Rent, 5s. per acre per annum at 3 per cent. for 52 years	30	8	0
Total cost	£70	14	0

Sample Plot No. 4.—Coolbaun Wood : area 0.4 acre, elevation 1,000 ft., age 63 years. This sample plot is part of a wood of 25 acres ; it lies on a steep slope, with north-east aspect, and is well sheltered from south-west gales, but rather exposed to north-west winds which come through a gap in the Galtees. The best part of this wood was felled about nine years ago, and the balance represents an inferior

quality and was thinned about 16 years ago. The outer inch of radius on 5 ft. section contains 14 rings.

Number of dominant trees per acre (of mean diameter 10.3 in.) = 275.

Sample tree .. $h = 68$ ft. $d = 10.4$ in.
 $v = 17.52$ cub. ft. $f = 0.449$.

Volume per acre = $\frac{64.45 \times 68 \times 0.449}{0.4} = 4,919$ cub. ft.

Cost of planting, £4 per acre at 3 per cent. for 60 years $\begin{matrix} £ & s. & d. \\ 23 & 11 & 0 \end{matrix}$

Maintenance, 3s. per acre per annum at 3 per cent. for 60 years .. $\begin{matrix} 24 & 9 & 0 \end{matrix}$

Rent, 5s. per acre per annum at 3 per cent. for 60 years $\begin{matrix} 40 & 15 & 0 \end{matrix}$

Total cost .. $\begin{matrix} £88 & 15 & 0 \end{matrix}$

This wood has been allowed to stand too long for pitwood. Had it been felled 10 years ago the total cost of production, calculating on the same basis, would be about £60. It has also suffered from want of thinning: some larch growing on an adjoining area at the same altitude, of the same age and height, have a diameter at 4 ft. 3 in. of 21 inches.

Sample Plot No. 5.—Lyremore: area 0.15 acre, elevation 700 ft., age 44 years. This plot is part of a wood of 70 acres of varying quality, on a medium slope with eastern aspect, well sheltered from all winds. This plantation contains a few spruce and silver fir, which all have a much greater girth than the larch; a thinning was made in 1907, up to which time the trees were dense. The outer inch of radius on 5 ft. section contains 16 rings.

Number of dominant trees per acre (of mean diameter 9.3 in.) = 326.

Sample tree .. $h = 72$ ft. $d = 9.0$ in.
 $v = 14.20$ cub. ft. $f = 0.446$.

Volume per acre = $\frac{23.34 \times 72 \times 0.446}{0.15} = 4,997$ cub. ft.

Sample Plot No. 6.—Kerry Rae: area 0.2 acre, elevation 600 ft., age 34 years. This plot forms part of an evenly stocked wood of 25 acres, well sheltered and grown under favourable conditions, with an undergrowth of grass. Some ten years ago squirrels did considerable damage to this plantation, ringing the most vigorous trees, which were afterwards felled. For many years a light thinning has been made annually. The outer inch of radius at 5 ft. contains 15 rings.

Number of dominant trees per acre (of mean diameter 7.3 in.) = 440.

Sample tree .. $h = 59$ ft. $d = 6.80$ in.
 $v = 7.90$ cub. ft. $f = 0.53$.

Volume per acre = $\frac{25.91 \times 59 \times 0.53}{0.2} = 4,051$ cub. ft.



FIG. 3.—Sample Plot No. 5. Larch at 700 ft. elevation 326 trees per acre.



FIG. 4.—Sample Plot No. 6. Larch at 600 ft. elevation; 440 trees per acre.

Summary.—The following table gives a summary of the sample plots:—

Sample Plot.	Age.	Elevation.	No. of trees per acre.	Mean height.	Mean diameter.	Volume per acre.
		ft.		ft.	in.	cub. ft.
1	53	480	362	66	9.5	5,458
2	53	400	147	74	13.5	5,150
3	55	400	212	76	12.3	6,188
4	63	1,000	275	68	10.3	4,919
5	44	700	326	72	9.3	4,997
6	34	600	440	59	7.3	4,051

These sample plots show very strikingly the effect of thinnings on the financial aspect of forestry. All these plantations have a slow diameter growth. Sample plots No. 1 and No. 3 have an equal basal area, the difference in volume being in proportion to the difference in height, yet one has 362 trees per acre and the other 212. Had plantation No. 1 been reduced by gradual thinnings to a density of 212 trees per acre, it could still have had a volume equal to what it has to-day, and the value of the 150 trees taken out would have increased the profit. Without detailed knowledge of thinnings it is impossible to know the correct density for first quality larch, but it is probably less than 150 trees per acre for 55 years. Even plantation No. 2, with 147 trees per acre, has only an annual increase in diameter of 0.16 inch, which cannot be considered satisfactory.

The writer desires to express his obligation to the Estate Woods Agent, Mr. Charles Hankins, of Cambridge, for permission to publish these statistics.

APPENDIX.

DETAILS OF MEASUREMENTS OF SAMPLE PLOTS.

DIAMETERS CALLIPERED AT 4 FT. 3 IN.

No. 1.—*Grant's Wood.* Area 0.4 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
in.		sq. ft.		sq. ft.
6	—	—	4	0.7852
7	11	2.9403	—	—
8	26	9.0766	—	—
9	41	18.1138	—	—
10	40	21.8160	—	—
11	22	14.5200	—	—
12	4	3.1416	—	—
13	1	0.9218	—	—
Total ..	145	70.5301	4	0.7852

No. 2.—Fitzgerald's Rae. Area 0.4 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
in.		sq. ft.		sq. ft.
10	4	2.1816	Nil	Nil
11	3	1.9800		
12	7	5.4978		
13	17	15.6706		
14	12	12.8280		
15	9	11.0448		
16	2	2.7926		
17	3	4.7289		
18	2	3.5342		
Total ..	59	60.2585	—	—

No. 3.—Fitzgerald's Rae. Area 0.4 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
in.		sq. ft.		sq. ft.
7	—	—	1	0.2673
8	—	—	1	0.3491
9	5	2.2090	—	—
10	8	4.3632	—	—
11	15	9.9000	—	—
12	20	15.7080	—	—
13	18	16.5924	—	—
14	14	14.9660	—	—
15	4	4.9088	—	—
16	1	1.3963	—	—
Total ..	85	70.0437	2	0.6164

No. 4.—Coolbaun. Area 0.4 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
in.		sq. ft.		sq. ft.
6	—	—	8	1.5704
7	4	1.0692	13	3.4749
8	14	4.8874	3	1.0473
9	18	7.9524	—	—
10	25	13.6350	—	—
11	30	19.8000	—	—
12	11	8.6394	—	—
13	4	3.6872	—	—
14	3	3.2070	—	—
17	1	1.5763	—	—
Total ..	110	64.4539	24	6.0926

No. 5.—Lyremore. Area 0.15 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
in.		sq. ft.		sq. ft.
5	—	—	1	0.1364
6	—	—	2	0.3926
7	5	1.3365	1	0.2673
8	13	4.5383	—	—
9	12	5.3016	—	—
10	11	5.9994	—	—
11	2	1.3200	—	—
12	5	3.9270	—	—
13	1	0.9218	—	—
Total ..	49	23.3446	4	0.7963

No. 6.—Kerry Rae. Area 0.2 acre.

Diameter Class.	Dominant Crop.		Minor Crop.	
	Number.	Basal Area.	Number.	Basal Area.
in.		sq. ft.		sq. ft.
4	—	—	1	0.0873
5	—	—	9	1.2276
6	30	5.8890	—	—
7	29	7.7517	—	—
8	16	5.5856	—	—
9	5	2.2090	—	—
10	7	3.8178	—	—
11	1	0.6600	—	—
Total ..	88	25.9131	10	1.3149

THE POLLINATION AND FERTILISATION OF HOPS; AND THE CHARACTERISTICS OF "SEEDED" AND "SEEDLESS" HOPS.*

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A CASE was investigated where some Bramling hops in one part of a garden near Canterbury had not "grown out." Fifty of these hops were analysed, and their characteristics tabulated (see Table XV.).

* Continued from the *Journal* for April, 1914, p. 22. The first article appeared in February, 1914, p. 953.

TABLE XV.

Number of Hop.	Length of Hop in inches.	Number of Seeded Bracteoles.	Number of Seedless Bracteoles.	Total Number of Bracteoles.
1	1 $\frac{1}{10}$	5	23	28
2	1	4	16	20
3	1 $\frac{2}{10}$	3	29	32
4	1	1	33	34
5	1 $\frac{3}{10}$	9	31	40
6	1 $\frac{4}{10}$	1	39	40
7	1 $\frac{5}{10}$	3	29	32
8	1 $\frac{6}{10}$	0	32	32
9	1 $\frac{7}{10}$	2	26	28
10	1	0	36	36
11	1	1	29	30
12	1 $\frac{1}{10}$	1	33	34
13	1 $\frac{2}{10}$	2	28	30
14	1	1	33	34
15	1 $\frac{4}{10}$	2	32	34
16	1 $\frac{5}{10}$	0	22	22
17	1 $\frac{6}{10}$	0	30	30
18	1	1	27	28
19	1 $\frac{2}{10}$	2	34	36
20	1	2	26	28
21	1 $\frac{1}{10}$	1	41	42
22	1	0	40	40
23	1 $\frac{1}{10}$	2	24	26
24	1	1	25	26
25	1 $\frac{7}{10}$	0	30	30
26	1 $\frac{2}{10}$	0	36	36
27	1 $\frac{5}{10}$	2	38	40
28	1	0	33	33
29	1 $\frac{3}{10}$	2	38	40
30	1 $\frac{4}{10}$	1	35	36
31	1 $\frac{5}{10}$	0	34	34
32	1	3	21	24
33	1 $\frac{2}{10}$	3	33	36
34	1 $\frac{5}{10}$	1	29	30
35	1 $\frac{3}{10}$	1	43	44
36	1	2	32	34
37	1 $\frac{1}{10}$	1	35	36
38	1 $\frac{8}{10}$	0	32	32
39	1 $\frac{7}{10}$	1	35	36
40	1 $\frac{5}{10}$	3	29	32
41	1 $\frac{8}{10}$	2	22	24
42	1 $\frac{6}{10}$	0	24	24
43	1	1	29	30
44	1 $\frac{1}{10}$	1	31	32
45	1 $\frac{1}{10}$	4	30	34
46	1	4	30	34
47	1 $\frac{8}{10}$	1	23	24
48	1 $\frac{2}{10}$	2	42	44
49	1 $\frac{5}{10}$	0	30	30
50	1 $\frac{6}{10}$	1	35	36
Total Average	53 $\frac{2}{10}$ 1.06	80 1.6	1,547 30.9	1,627 32.5

The average of these fifty hops shows 1.06 inch as the length of the hop, 1.6 as the number of seeds per hop, 32.5 as the number of bracteoles per hop, and 1 to 19 as the ratio of seeded to seedless bracteoles. Now the number 32 is above the average for the number of bracteoles per hop in the Golding varieties, the number being usually from 27 to 30. With such a high number of bracteoles per hop as 32, large, very well "grown out" Bramling hops are produced, *provided the "burr" is fertilised to ensure a fair amount of seed in the hops.* In the case of the above not "grown out" Bramling hops, the hops were practically seedless—the average number of seeds per hop being only 1.6, with the result that the average length of the hop was only 1.06 inch. It could be predicted with certainty that had the "burr" of these hops been fertilised, the hops would have been seeded, well grown out, and $1\frac{1}{4}$ to $1\frac{1}{2}$ inch long—involving an increase in yield of some 6 cwt. per acre. The reason why these Bramling hops were not "grown out" was that the ratio of "seeded" to "seedless" bracteoles was 1 to 19, instead of the proper ratio of about 1 to 2.

Fig. 15 is a photograph of six of the not "grown out" Bramling hops, and Fig. 16 a photograph of three Bramling hops, on the same scale, from another part of the same garden, where the hops did "grow out." These large, well grown out hops contained on the average no more bracteoles per hop than those shown in Fig. 15, and it is certain that the latter would have grown to the size of the former *if suitable male hops had been planted in their neighbourhood.*

In another case which was investigated—a garden of the Fuggles variety—considerable loss was caused through the hops not "growing out." Detailed examination of the hops showed that here again *the number of bracteoles present was sufficient for the building up of a large hop*, but that in the almost total absence of seed, the hops had not "grown out." Photographs of these hops are shown in Fig. 17. Some of the hops were quite seedless and one of these is shown at 1. Many, however, were of the irregular shape and "ragged" appearance shown in the two hops at 2 in Fig. 17; these were very narrow and seedless towards the stalk end, but broadened out in an irregular manner towards the other end, due to the presence there of one or two "seeded bracteoles." These facts show that there was a scarcity of pollen in the garden either during the whole time or during part of the time that the hops were in "burr." Had suitable male hops been present—so that the hops received sufficient pollen-dust throughout the period when they were in "burr"—these hops would have been large, well "grown out" and of regular shape.

Such cases as the above—and they are of not uncommon occurrence—show the necessity for emphasizing the point that *the supply of male hops in a garden must be looked upon as a point of primary importance*; and, further, that *the male hops planted must be selected to bloom during all the time the hops are producing "burr."*

Finally, to conclude this section of the subject, we may note the statistics which have been collected as to the amount of seed commonly grown in hop-gardens in Kent and Surrey.

Tables XVI. and XVII. show the analyses of samples of hops obtained from various sources. Table XVI. shows, for example, that in 1906, in the cases where the hops were "not grown out" or "medium," the ratio of seeded to seedless bracteoles was 10 to 235, 10 to 54, 10 to 44, or 10 to 40. When the hops were "grown out," the ratio became 10 to 24; when the hops were well "grown out" it was 10 to 15, 10 to 13, or 10 to 10; while in the case of selected large hops the ratio was 10 to 4. Similar evidence is shown in the table for the other seasons.

In typically well "grown out" Golding hops, such as are shown in Fig. 18, each hop will be composed of about 10 seeded bracteoles to every 15 seedless bracteoles. Some of the Golding hops analysed from some of the best gardens in Kent, and for which top prices were obtained, were found to show the ratio of 10 "seeded bracteoles" to 10 "seedless bracteoles." In the earlier days it was the general rule in England for growers to plant plenty of male hops, and the big prices that have been paid for hops in the past have been for those containing a good proportion of seed.

Table XVII. contains interesting statistics relative to Cobb's Goldings. In sample No. 3 the average number of bracteoles per hop was as low as 22, yet the hops were "grown out," reaching an average length of $1\frac{1}{2}$ inch, because each hop contained on an average 6 seeds (ratio of seeded to seedless bracteoles, 10 to 25). On the other hand, in sample No. 1, although the average number of bracteoles per hop was higher, viz., 26, the hops were small (averaging only 1 inch), and not "grown out," because they were nearly seedless (ratio of seeded to seedless bracteoles, 10 to 127). In sample No. 6 where the average number of bracteoles per hop rises to 28, the hops are still not "grown out," averaging only 1 inch in length, because they contain only 3.5 seeds per hop (ratio, 10 to 70). Contrast this, finally, with sample No. 7, where with an average of only 25 bracteoles per hop, the length of

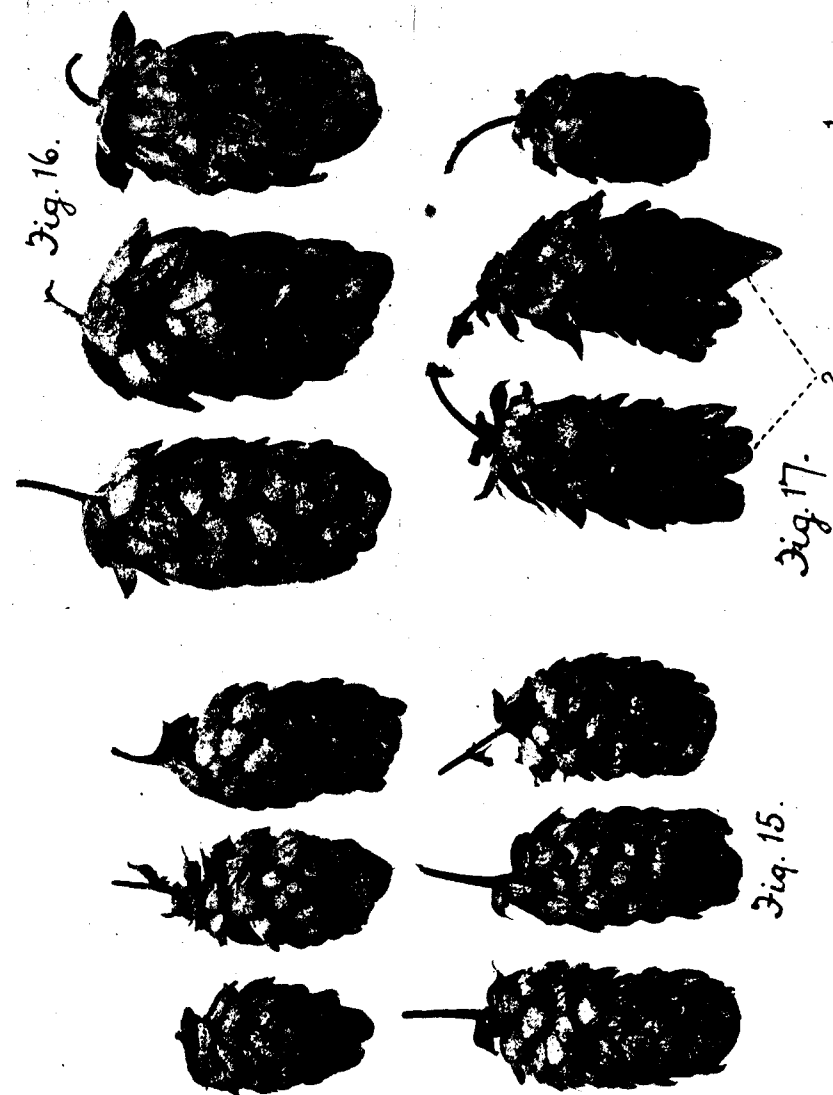


FIG. 15.—"Seedless" Brambling hops.

" 16.—"Seeded" Brambling hops (same scale as in Fig. 15).

" 17.—Fuggles hops not "grown out"—1, a "seedless" hop; 2, hops with a few seeded bracteoles at the tip.

TABLE XVI.—ENGLISH HOPS.—GOLDINGS.

District.	Variety.	Remarks.	Average No. of Bracteoles per Hop.	Average Length of Hop in Inches.	Ratio of Seeded to Seedless Bracteoles.	Average No. of Seeds per Hop.
1906						
1 Wye ..	Canterbury Whitebines	Not grown out; very poor crop	27	$1\frac{1}{16}$	10 to 235	1.1
2 Wye ..	Early Bird	Not grown out	27	$1\frac{1}{16}$	10 to 54	4.2
3 Faversham	Goldings	Medium	27	$1\frac{1}{16}$	10 to 44	5.0
4 Faversham	Goldings	Medium	28	$1\frac{1}{16}$	10 to 40	5.6
5 Wye ..	Goldings	Medium	27	$1\frac{1}{16}$	10 to 38	5.6
6 Petham	Petham Golding	Hops grown out	27	$1\frac{1}{16}$	10 to 24	7.9
7 Wye ..	Goldings	Selected hops; 2 in. long or over	53	$2\frac{1}{16}$	10 to 16	20.3
8 Faversham	Mercer's Golding	Hops well grown out	25	$1\frac{1}{16}$	10 to 15	9.9
9 Faversham	Goldings	Hops well grown out	26	$1\frac{1}{16}$	10 to 13	11.4
10 Faversham	Mathon	Hops well grown out	28	$1\frac{1}{16}$	10 to 10	14.2
11 Puttenham	Farnham Whitebine	Selected branch of large hops	26	$1\frac{1}{16}$	10 to 4	18.2
1907						
12 Wye ..	Goldings	Not grown out	28	$1\frac{1}{16}$	10 to 550	.5
13 Wye ..	Goldings	Hops small	28	$1\frac{1}{16}$	10 to 137	1.9
14 Maidstone	Goldings	Hops grown out	23	$1\frac{1}{16}$	10 to 78	2.6
15 Maidstone	Goldings	Hops well grown out	33	$1\frac{1}{16}$	10 to 26	9.2
16 Chilham	Goldings	Hops well grown out	33	$1\frac{1}{16}$	10 to 23	10.0
17 Wye ..	Goldings	Hops grown out	33	$1\frac{1}{16}$	10 to 25	9.4
18 Wye ..	Goldings	Hops grown out	27	$1\frac{1}{16}$	10 to 18	9.7
19 Wingham	Bramlings	Medium	25	$1\frac{1}{16}$	10 to 16	9.6
20 Farnham	Farnham Whitebine	Hops well grown out	30	$1\frac{1}{16}$	10 to 15	12.0
21 Bodiam	Mathon	Hops well grown out	28	$1\frac{1}{16}$	10 to 15	11.4
22 Farnham	Farnham Whitebine	One of the best gardens of year	35	$1\frac{1}{16}$	10 to 9	18.8
23 Puttenham	Farnham Whitebine	Hops well grown out	28	$1\frac{1}{16}$	10 to 5	18.6
1908						
24 Wye ..	Canterbury Whitebine	Not grown out	27	$1\frac{1}{16}$	10 to 98	2.5
25 Wye ..	Canterbury Whitebine	Medium to good	29	$1\frac{1}{16}$	10 to 30	7.2
26 Wye ..	Canterbury Whitebine	Well grown out	30	$1\frac{1}{16}$	10 to 19	10.2
1909						
27 Wye ..	Canterbury Whitebine	Well grown out	29	$1\frac{1}{16}$	10 to 11	13.6

TABLE XVII.—ENGLISH HOPS.—Cobb's Golding; Fuggles; "Wild" Hops.

District.	Variety.	Remarks.	Av. No. of Bracteoles per Hop.	Av. Length of Hop in Inches.	Ratio of Seeded to Seedless Bracteoles.	Av. No. of seeds per Hop.
1906						
1 Bodiam	Cobb's Golding ..	Not grown out ..	26	1	10 to 127	1.9
2 Ashford	Cobb's Golding ..	Moderately grown out ..	26	1 $\frac{1}{16}$	10 to 35	5.8
3 Selling	Cobb's Golding ..	Grown out ..	22	1 $\frac{1}{16}$	10 to 25	6.3
4 Ashford	Cobb's Golding ..	Large selected hops	44	2	10 to 10	22.2
1907						
5 Sheldwich	Cobb's Golding ..	Not grown out ..	23	1	10 to 72	2.8
6 Teynham	Cobb's Golding ..	Not grown out ..	28	1	10 to 70	3.5
7 Bodiam	Cobb's Golding ..	Medium ..	25	1 $\frac{1}{16}$	10 to 20	8.2
8 Teynham	Cobb's Golding ..	Very well grown out	35	1 $\frac{1}{16}$	10 to 11	16.5
1906						
9 Puttenham	Fuggles ..	Selected, well grown out hops	30	1 $\frac{1}{16}$	10 to 90	3.0
10 Bodiam	Fuggles ..	Well grown out ..	35	1 $\frac{1}{16}$	10 to 15	14.0
11 Ashford	Fuggles ..	Well grown out ..	24	1 $\frac{1}{16}$	10 to 3	19.0
1907						
12 Puttenham	Fuggles ..	Not grown out ..	19	1 $\frac{1}{16}$	10 to 44	3.5
13 Goudhurst	Fuggles ..	Well grown out ..	26	1 $\frac{1}{16}$	10 to 18	9.2
14 Farnham	Fuggles ..	Well grown out; one of best gardens of the year	23	1 $\frac{1}{16}$	10 to 16	8.9
15 Worcestershire	Fuggles ..	Not well grown out ..	22	1	10 to 12	9.8
16 Worcestershire	Fuggles ..	Well grown out ..	33	1 $\frac{1}{16}$	10 to 13	14.2
17 Bodiam	Fuggles ..	Well grown out ..	24	1 $\frac{1}{16}$	10 to 8	13.2
18 Puttenham	Fuggles ..	Well grown out ..	23	1 $\frac{1}{16}$	10 to 7	13.7
1906						
19 Wye ..	"Wild" hops (cultivated)	Medium ..	23	1	10 to 8	13.0
20 Chilham	Wild hop in hedgerow ..	..	21	1	10 to 1	18.6

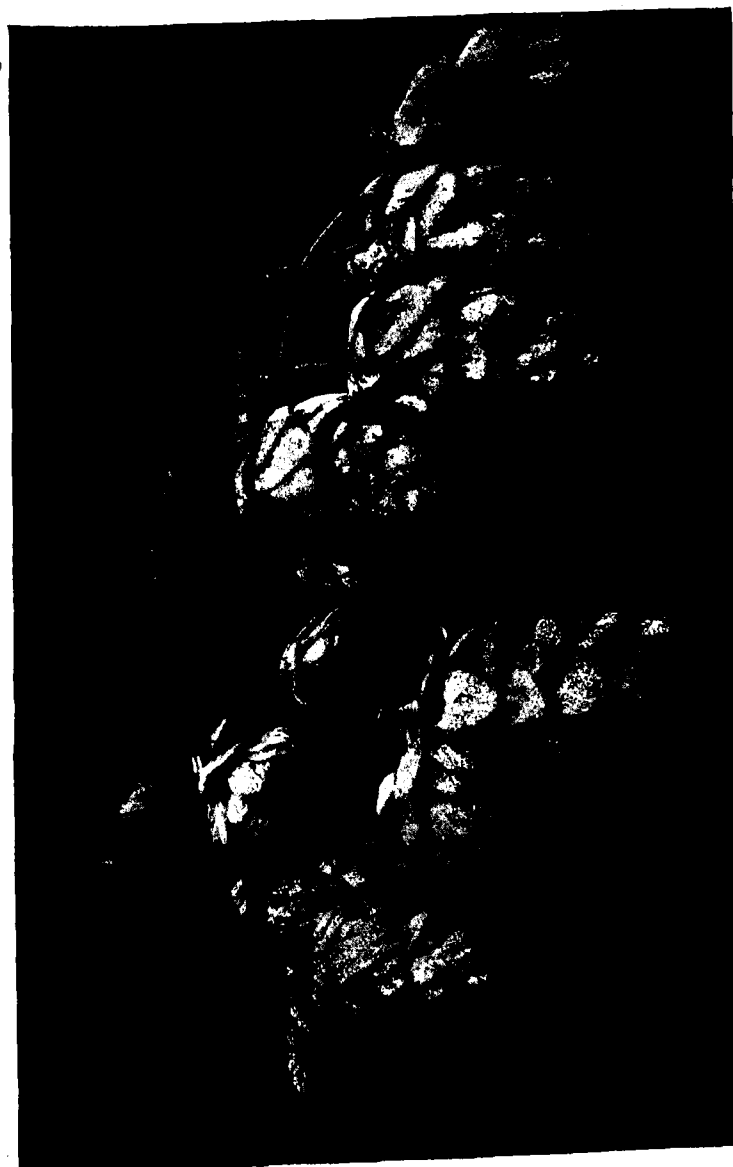


FIG. 18.—A branch of typical well "grown-out" Golding hops. The hops contain 10 to 12 seeds each.

the hop reaches to $1\frac{1}{10}$ inch, because the hop contains on an average 8.2 seeds (ratio, 10 to 20).

With regard to the Fuggles variety, while it is the case that hops with a certain number of bracteoles per hop will not "grow out" unless they are seeded, yet (unlike the Golding varieties) instances do occur where *nearly seedless well "grown out" hops are produced*. In cases where a strong growth is obtained, Fuggles hops do not require to the same extent the stimulus which fertilisation gives in order to "grow out" properly; a fact which is not surprising considering the greater constitutional vigour of this variety. Thus in sample 9, although there were only 3 seeds per hop, and the ratio of seeded to seedless bracteoles was 10 to 86, the hops (which were composed of an average of 30 bracteoles) were well "grown out" and averaged $1\frac{4}{10}$ inch long. Although the effect of seed production in increasing the size of the hop is often not so marked in Fuggles as in the Golding varieties, it is still noticeable. In sample 13, where the average number of bracteoles per hop is 26, the average length of the hop is $1\frac{2}{10}$ inch—here the number of seeds per hop is 9; in samples 17 and 18, where the average number of bracteoles per hop is, respectively, 24 and 23, the average length of the hop has increased to $1\frac{8}{10}$ inch, due to increased seed production (13 seeds per hop). Finally, in sample 11, the production of 19 seeds per hop, with an average of only 24 bracteoles per hop, results in a hop averaging $1\frac{4}{10}$ inch in length.

Investigations into the question of the relative market value of "nearly seedless" and "well seeded" Fuggles hops fail to show that anything like a proportionately higher price is paid for the former, taking into account the far heavier yield of the "seeded" hops.

Conclusions.—The greater the number of "petals" per hop—a character dependent chiefly on the variety of hop, but also to some extent on conditions of soil, cultivation and season—the less need there is of the presence of seed in order to obtain the "growing out" of the hop. English varieties of hops generally, and especially all Golding varieties, are so constructed botanically that a fair amount of seed is absolutely necessary to ensure the "growing out" of the hop. In hop-gardens where the hops "grow out" well season after season, no more male hops should be planted, as plenty of seed is already being grown; in gardens, however, where the hops do not "grow out" well, and particularly in planting up new gardens, in isolated districts, or where they are separated by high woods, or other obstacles, from neighbouring hop-gardens, the supply of suitable male hops is of the greatest practical importance.

Practical Considerations in the Planting of Male Hops.

In planting male hops it is necessary to make a selection among different kinds of males, since it is useless to plant up certain kinds, or to continue to propagate them in a garden. It is not necessary to obtain, e.g., a "Fuggles male" for a garden of Fuggles, or a "Cobb's male" for a garden of Cobb's Seedling—indeed, it is impossible to do so, since male hops cannot be distinguished as belonging to any particular variety. Further, the hop produced by pollination from any one kind of male does not differ in any commercial characters from that produced by pollination from any other kind of male hop. Besides the necessary vigour of growth, there is only one character which the male hop to be planted must have, viz., *it must bloom at the time when the hops among which it is planted are in "burr."* There is as much variation in the time of blooming among the varieties or forms of the male hop as in the time of coming into "burr" among the female varieties. Male hops which appear spontaneously in the garden, or the so-called "wild" hops that grow in the hedges, frequently bloom too early, and so have shed all their pollen before the surrounding hops are in "burr," or before they have completely passed through that stage. *Such male hops are either entirely useless or are nearly so.* Observations were made in 1908 as to the time of flowering of some seventy male hops of various kinds growing in the Experimental Hop-garden at Wye College. The earliest male began to flower on July 13th; the latest on August 14th; and 23 were completely out of flower by August 9th. Now the Canterbury Whitebines in the College hop-garden were in full "burr" on August 9th, consequently a stock raised from any one of the 23 males noted above would be useless for planting in such a garden. One of the later-flowering kinds of male hops, beginning to flower about August 1st, is the right kind of male to plant among late varieties like the Canterbury Whitebine.

When, in gardens well supplied with males, the hops do not "grow out," it is usually found* that these hops are nearly seedless, showing that the males did not bloom at the right time to fertilise the "burr"; and when in any garden in which male hops have been carefully extirpated by grubbing them up as soon as any appear, season after season, the hops still "grow out" well, and a heavy crop is obtained, it will be found that the hops are well seeded, the explanation being that the pollen has been blown into the garden from male

* In very rare cases the explanation is that through lack of vigour not enough "petals" per hop have been produced.

hops in neighbouring gardens or hedgerows. Pollen is extremely light, and it is certain that it is carried by the wind considerable distances, probably for miles; in districts, therefore, such as Paddock Wood, Sittingbourne or Faversham, where for miles there are areas of almost continuous hop-gardens, it is practically certain that the "burr" produced in any garden where there are no males (unless it is exceptionally early or late) will be fertilised by pollen carried into the garden on the wind from male hops in other gardens. Hop growers, however, should not depend upon such an outside source. Further, the planting up of gardens with the right kind of male hops is strongly recommended in order to ensure as far as possible against the ill effects of adverse seasons, when persistent washing for "blight" may injure some of the "burr," and when anything that tends to hasten the ripening of the crop is of importance. A very real danger in depending upon "wild" male hops in hedgerows is that such plants, which are not looked after and sulphured, are frequently the source of the first outbreaks of "mould." The writer has several times traced the infection of a hop-garden to spores which have blown into the garden from mouldy "wild hops" in the hedgerow. All "wild hops" in the neighbourhood of hop gardens should be grubbed up whenever seen.

That the cultivation of hops flourishes only in certain districts in England may possibly be accounted for by the fact that there alone, owing to the large acreage of hop-gardens and the practice of at any rate tolerating a certain number of male hops in the gardens and hedgerows, a sufficient quantity of pollen is produced. As Mr. A. D. Hall has pointed out,* 70 years ago "hops were grown in places like Cornwall, the Isle of Wight, Lincoln, Cambridge, Northampton, Essex; nowadays these outlying districts have grubbed their hops." Mr. Hall attributes "the shrinkage of the acreage under hops to the present well-defined centres" to the reasons that there "soil and climate are perhaps more favourable, and neighbourhood and intercourse seem to raise the standard of management." It may be pointed out that any extension of hop growing away from the present centres will require, for success, special attention being given to the planting of suitable male hops.

With regard to the actual planting of male hops, the proportion of 1 male to every 100 female hills is ample; if the male hill is vigorous and free-flowering, 1 to 200 or 250 is probably sufficient. The male hops should be planted regularly throughout the garden, and it is a good plan to plant a number

* In *Jour. Board of Agriculture*, VIII., March (1902).

of males in the lew row on the S. and W. sides of the garden, because the S.W. wind is the prevailing one at the time of year when hops are in "burr" and the male hop is scattering its pollen. The duration of the time of flowering of male hops varies from about 12 to 26 days. The grower should note carefully the period during which the varieties of hops grown by him produce "burr," and male hops should be planted which bloom *during the entire period when the surrounding hops are in "burr."*

As Mr. Howard has pointed out*: "Since the *stigmas* at the stalk end of the hop are ready for pollen first, after which those towards the free end become successively receptive, a considerable period elapses between the beginning and end of pollination in any particular hop." The result is that if the blooming period of the male hops which are planted does not coincide with the "burr" period, or if *too few* male hops are planted, with the result that insufficient pollen is available to fertilise all the "burr," there will be the danger of either the earliest or the latest "burr" not producing well "grown out" hops, or of hops being produced which are only half "grown out," such as those shown in Fig. 17; if, however, an adequate number of suitable male hops is planted, all the "burr" produced will develop into hop very quickly, and the risk of getting "mould" or "blight" into the "burr" will be greatly diminished.

Hop-growers in Kent, Surrey or Sussex are able, on application, to obtain, free of cost, cuts from the large number of different varieties of male hops—selected for vigour and time of blooming—which are being grown for this, and for breeding purposes, in the Experimental Hop-garden at Wye College. This work has been undertaken for two reasons. In the first place, through the co-operation of the majority of the growers who receive these "cuts," the characters of growth and the time of flowering of different selected male hops are being observed on all kinds of hop-growing soils and in all positions. It is probably as necessary to make a selection among the different varieties of male hops to suit certain soils as it is among the female varieties, e.g., many delicate varieties of male hops would probably die in the stiffest soils of the Weald where Fuggles are grown. Also, the time of flowering of the different varieties of males will be ascertained under different conditions of soil, aspect, etc. Such "observation stations" are now established in hop-

* Hop Experiments, 1904, p. 5.

gardens all over the hop-growing areas of Kent, and in many districts in Surrey and Sussex. It is hoped that by the collection of these data the exact suitability of the different varieties of male hops both for certain soils and for the various female hops grown will be finally determined.

In the second place, *male* sets selected to flower early, mid-season, or late, are not at present procurable on the market to any practical extent. In a comparatively few cases the raiser of sets of female varieties sells also male bedded sets, but their exact time of blooming is not guaranteed. Now, as has been shown, it is quite useless to plant, e.g., early-flowering males in Canterbury Whitebine gardens, or late-flowering males in a garden of "Early Birds." The plan has been, therefore, after first inducing the grower to note the period when his hops are in "burr," to supply him with a few cuts from selected male hops (of which there are now about 150 hills) *from which he can raise a stock*. The use which is being made of Wye College in this respect is shown by the following figures:—

In 1909—1,718 "cuts" were sent to 14 growers.

1910—1,826	"	"	27	"
1911—2,439	"	"	42	"
1912—2,694	"	"	58	"
1913—3,078	"	"	76	"

A number of hop-growers who have planted up their gardens with the selected male hops sent out from Wye College have written reporting that, on the growing up of the males, a marked improvement resulted in the "growing out" of the hops. This improvement has been particularly noticeable in seasons, such as 1913, unfavourable for the development of the crop; in such seasons many growers have reported with regard to some varieties—such as Bramlings—that only those hills which had males within a certain distance produced well "grown out" hops.

(To be continued.)

In connection with questions which have arisen as to short weight in manure carried by rail, experiments have recently been conducted by Mr. Spencer Pickering, Director of the Woburn Experimental Fruit Farm, Ridgmont, by arrangement with the Board, in order to estimate the loss in weight which may be expected to occur in town manure in course of transit.

Loss in Weight
of Town Manure
during Transit.

Director of the Woburn Experimental
Fruit Farm, Ridgmont, by arrangement
with the Board, in order to estimate the
loss in weight which may be expected to

Truck Experiments.—The manure, which was collected as formed, and not stacked, was very short, with little straw, and was almost entirely horse dung. This was loaded into two trucks at a London station, one truck (A) being piled as full as possible, and the other (B) being loaded flush with the sides. These were weighed, uncoupled, on the 12th June, 1913, and dispatched to Ridgmont, from which station they were returned to the same London station, three days nineteen hours having been spent on the whole journey of 120 miles. During most of the time there was a drying east wind and no appreciable amount of rain. It was found, on re-weighing the trucks at the end of the double journey, that a loss in weight of 2.39 per cent. had occurred in truck A, and a loss of 1.47 per cent. in truck B. The loss was, therefore, not great, being approximately $1\frac{1}{2}$ per cent. due to evaporation, and 1 per cent. due to mechanical loss when the manure was piled.

The trucks were then again dispatched to Ridgmont, where the manure was carefully loaded into carts and weighed in them. The loss of weight in truck A since the second weighing was 2.5 per cent., and in truck B 2.8 per cent. It is probable that the greater loss found after the second journey from London was due to (1) loss of water in unloading, (2) absorption of water by the trucks, and possibly (3) to some constant error in weighing the cartloads.

Cart Experiments.—In the first experiment manure was taken for about 14 days from stables. It was moist and contained plenty of straw. Heating occurred during the first few days of storage, and, if the average of the first five days be taken, the daily loss in weight was 2.7 per cent., equivalent to 10.2 per cent. for $3\frac{1}{2}$ days, a period similar to that occupied by the first journey in the truck experiments.

In the second cart experiment the manure from truck A (above) was taken at the end of the second journey from London and stored. With this manure the loss, which was constant, was, during $3\frac{1}{2}$ days, found to be 1.9 per cent., which agrees fairly well with the 1.47 per cent. lost by this same manure while in the truck A during a similar time, when allowance is made for the greater relative surface exposed in the cart. This, of course, is much less than the loss in the first cart experiment, where heating occurred.

Conclusions.—The following conclusions may be drawn. Town manure will rarely be sent more than 50 to 60 miles, such a journey occupying about two days. If the manure were in the condition of that in the first cart experiment, and such that the maximum heating occurred during the journey,

the loss would be 5.4 per cent. Further, if it were weighed out in carts at the receiving end, an additional loss of 1 per cent. might be expected, or if weighed in carts at the dispatching end also, an additional loss of 2 per cent., or possibly 3 per cent. if the loading was not done carefully. The total loss, as a possible maximum, would be about 8 per cent. The chances are that the manure would not be dispatched at a time exactly coinciding with its maximum heating, and, as carting the manure into trucks would check the heating, the maximum would not occur during the two days' journey. The loss by heating would probably be about half the above amount, namely, 2.7 per cent. Terminal losses of from 1 to 3 per cent., according to circumstances, thus give a total probable loss of 3.7 to 5.7 per cent. This result accords with the experience at the Fruit Farm as regards the manure received there in previous years: in 1911 the average loss was 4.7 per cent., and in 1912 it was 5.2 per cent.

THE following communication has been received from Professor Jakob Eriksson, Director of the Central Botanic Experimental Station, Stockholm:—

During the past year (1913) I made a successful experiment in killing the contagious matter in soil infected with Wart Disease of potatoes, which I wish to bring to the notice of potato growers, especially in England.

The trial was made on three small plots in the Experimental Garden of the Station at Stockholm, one plot being one square metre and the two others .3 square metre in size. The soil of each plot was isolated from the surrounding land by casings of zinc or cement, extending one metre below the surface of the ground. In the month of February of last year (1913), during a period of open weather, diseased potatoes, cut into small pieces, were mixed freely in the soil of the three plots. After some weeks the soil in the two smaller plots (.3 square metre) was watered with a solution of commercial formalin and water (1 in 100), ten litres of the solution being applied per square metre, *i.e.*, three litres per plot. The larger plot was not treated. The work was completed about two weeks before the tubers were planted, which was in the middle of May. In one of the smaller plots two tubers of Magnum Bonum were planted, and in the other two tubers of Up-to-Date; in the larger plot five tubers of Up-to-Date. All the tubers were perfectly free from disease. During the

summer and autumn the plants grew vigorously and apparently quite naturally. The crop was lifted on the 8th September, and gave the following results:—

A.—Plots treated with Formalin.

(1) Magnum Bonum.

Plant 1—9 tubers; weight 760 gr.; clean.

„ 2—4 tubers; weight 50 gr.; clean.

(2) Up-to-Date.

Plant 1—8 tubers; weight 700 gr.; clean.

„ 2—9 tubers; weight 318 gr.; clean.

B.—Control Plot—untreated.

			Tubers infected.		Tubers clean.	
			Number.	Weight in gr.	Number.	Weight in gr.
Plant 1	..	..	7	565	5	350
„ 2	..	..	5	525	3	150
„ 3	..	..	4	360	3	290
„ 4	..	..	7	405	2	46
„ 5	..	..	6	695	1	157
			—	—	—	—
			29		14	

The disease on the infected tubers was, it is true, small in amount, but was undoubtedly present. The slightness of the attack may probably be attributed in some degree to the fact that the infection took place as late as February instead of the preceding autumn. It may be the case that the infective matter had not permeated the soil sufficiently in the three months (from February to May). However, it seems evident from this experiment that a dilute solution of Formalin, 1 in 100, is capable of killing the infective matter in soil contaminated with Wart Disease of potatoes. I beg to propose that experiments should be arranged in England with this remedy. In very badly infected soil it would be better to make trials also with 2 and 3 per cent solutions. *If the remedy is really as good as it seems it will be possible to eradicate the disease in all gardens where it is now destructive.*

Of the various animal pests attacking the bulbs of Narcissi and related plants none are more injurious than the two Narcissus flies, *Merodon equestris* F. and *Narcissus Flies*. *Eumerus strigatus* Flin. The former, often known as "the Large Narcissus Fly," has been recorded in this country since 1869, and is now widely distributed in England and Wales, while it also occurs in many parts of Scotland and in Ireland. It is generally sup-

posed to have been brought to England from the Continent, probably from Holland, but in the opinion of at least one authority it is considered to be native, and only to have become noticeable as a pest when daffodil growing became general.

The second species, *Eumerus strigatus*, which may be known as "the Small Narcissus Fly," has only recently proved a serious pest to Narcissi. Though widely distributed on the Continent, it has usually been considered a scarce insect in this country; it has now, however, been recorded from several bulb-growing centres, and as it is an exceedingly destructive insect, is likely to prove as serious a pest even as *Merodon*.

THE LARGE NARCISSUS FLY.—The adult *Merodon equestris* (Fig. 1) is a large fly measuring about half-an-inch in length. The body is stout and very hairy, and the general shape is that of a small humble bee. In colour the insects vary considerably. The ground colour is black, but the hairs may be grey, yellow or brown, and the varieties therefore differ considerably from each other in appearance. The more common form is dark brown or black, banded with yellow or grey, when the fly much resembles a humble bee; in another form these bands are inconspicuous or absent, and the insect is very like a honey bee or a drone fly (*Eristalis*). Owing to this variation in appearance, bees, humble bees, and drone flies are frequently considered to be Narcissus flies, and it may therefore be well to give the simple distinguishing characters. From either honey or humble bees *Merodon* may at once be distinguished by the fact that it possesses only two wings, whereas bees always have four. From drone flies it may be known by being more hairy and by possessing a broad tooth-like process on the underside of the femora (thighs) of the hind legs, near the tip (Fig. 2, a). If a male it will also possess a sharp spur at the end of the tibia of the hind leg (Fig. 2, b). The Small Narcissus Fly has little resemblance to *Merodon* and is only about half the size (cf. Figs. 1 and 6), and the two are not likely to be confused.

The egg of *Merodon* is minute, but visible to the naked eye; it is oval in shape and white in colour.

The larva is a legless grub of a whitish or yellowish colour, and when full grown measures from $\frac{1}{2}$ to $\frac{3}{4}$ inch in length. Its general shape may be seen from Fig. 3. When first removed from the bulb it appears to be almost equally rounded at each end, but the hind end may be distinguished by a black horny projection,* carrying breathing pores, which is almost withdrawn into the body. If the larva is left untouched for a

* In the figures the head of the larva is directed downwards, the hind end upwards.

minute or two it extends itself so that the front end becomes more pointed, and on its underside the mouth may be seen, with two minute black hooks representing the jaws. The black structure at the tail end becomes more obvious and a minute projection may be seen on each side. The larva of *Merodon* when full grown is not likely to be confused with other larvæ to be found in bulbs, but when young it might be confused with that of the Small Narcissus fly, and the essential differences will be found under that species (page 139).

The pupa of *Merodon* (Figs. 4 and 5) is enveloped in a hard, horny skin, which is really the final skin of the larva; the black terminal projection can still be seen.

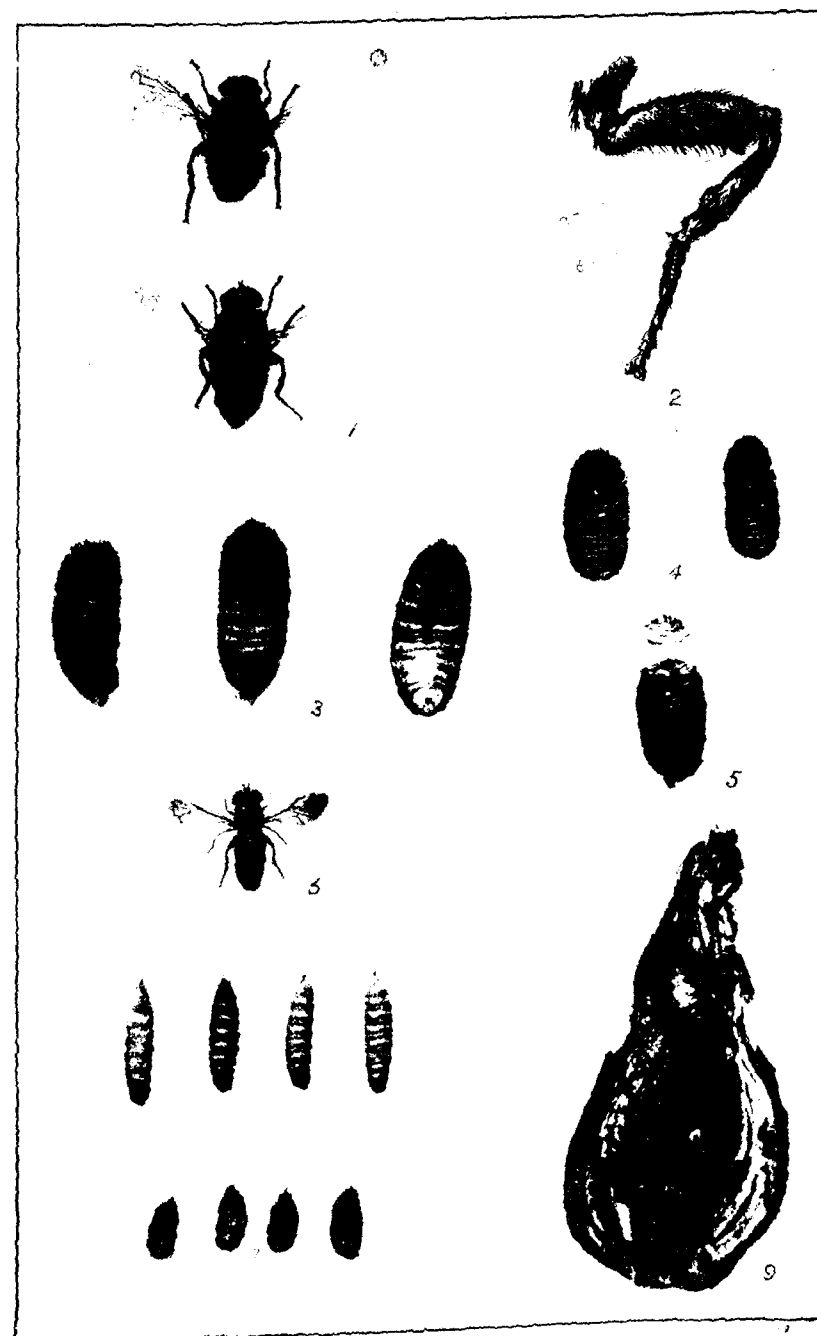
Life History.—The flies are found in spring and early summer flying actively in the sunshine. They then pair, and eggs are laid at or near the base of the leaves of Narcissi, or on the necks of the bulbs themselves when these are exposed. The larvæ which hatch from these eggs, according to some authorities, enter between the scales at the neck of the bulb and bore into the interior. Other authorities state that the larvæ pass down outside to the base of the bulb and then enter. Certainly the basal ring (which bears the rootlets) of bulbs which contain larvæ is frequently incomplete or damaged. Once inside the bulb the larvæ feed steadily, consuming the whole interior until full grown, when they are often found in the hollowed-out neck of the bulb (Fig. 9).

The length of life of the larvæ is still the subject of dispute. It seems probable that the majority feed rapidly and are full fed in the course of the autumn, when some may pupate, though most appear to remain in the larval state until early spring and then become pupæ. It is also said that larvæ may take two years to become full-grown, a view which is based on the fact that young larvæ have been found in the early months of the year. Since, however, flies have been observed as late as July it is probable that these small larvæ would still have time to complete their feeding in the spring and produce flies late in the season. As a rule only one larva occurs in each bulb, but two and sometimes three are occasionally found. The larvæ are able to migrate from one bulb to another in the soil.

The pupa is sometimes formed in the bulb, but more frequently in the earth outside.

Plants Attacked.—The bulbs attacked include the Narcissus, Hyacinth, Tulip,* *Amaryllis*, *Habranthus*, *Vallota*, *Galtonia*,

* The Tulip is always mentioned as one of the food-plants of *Merodon*, but appears to be rarely attacked, and in badly infected localities Tulips are often quite undamaged.



MERODON EQUESTRIS.—1. Adult fly $\times 1\frac{1}{2}$; 2. Hind leg $\times 5$, to show tooth (a) on femur, and spur (b) on tibia; 3. Full grown larvæ $\times 1\frac{1}{2}$; 4. Pupæ $\times 1\frac{1}{2}$; 5. Pupal skin from which fly has emerged; 6. Narcissus bulb cut in half to show *Merodon* larva in neck of bulb.
EUMERUS STRIGATUS.—7. Adult fly $\times 1\frac{1}{2}$; 8. Pupæ $\times 1\frac{1}{2}$.
 In 3, 4, 7 and 8 the heads of the larvæ or pupæ are pointing downwards.

Scylla, and Leucojum. As regards Narcissus, it has been considered by a leading grower and authority on *Merodon* that the hard bulbs of the *N. maximus* and *N. spurius* type are least attacked, while the most susceptible are the *N. poeticus* and *N. Leedsi* varieties, and further that varieties with coloured cups are more susceptible than those without.

Nature of Injury.—The interior of the bulb is hollowed out, a wet mass of frass and decayed matter only remaining. (Fig. 9.) The decay, however, does not cause such a complete breakdown of the bulb as in the case of an attack by *Eumerus*.

When the larvæ are large the infested bulbs can be detected after a little experience by gently pressing near the neck with the fingers—sound bulbs being hard and infested bulbs less resistant. When the larvæ are young it is much more difficult to be sure of their presence, but it is said that any bulb in which the basal ring is incomplete or damaged should be regarded with suspicion.

Treatment.—No complete remedy is known. The following methods have given good results, but in making a choice, the nature of the case to be treated must be considered :—

(1) When a number of bulbs in a row fail to appear in the spring, those which have missed should be searched for and destroyed.

(2) Bulbs should be lifted in summer and all found to be infected should be destroyed.

(3) Bulbs may be steeped in water for from 24 to 48 hours. The water should be just warm, and if possible should not be allowed to become very cold, as it is stated that the bulbs occasionally suffer damage through being chilled. The steeping seems to make the bulb swell so that the larvæ are forced out, or perhaps to some extent "drowned out," though they can live for many days when immersed. This treatment has been found very effective, though a few larvæ are always missed.

(4) Netting the flies with a butterfly net has been found quite successful in gardens.

THE SMALL NARCISSUS FLY.—The adult *Eumerus strigatus* is a fly about $\frac{1}{4}$ in. in length, the general appearance and shape of which is shown in the plate (Fig. 6). The general colour is black, but between the wings the thorax shows greenish metallic reflections, and there are white crescent-shaped marks along the sides of the abdomen, and a white line on each side of the thorax. The femora (thighs) of the hind legs are thickened, and are usually rather conspicuous.

The larva of *Eumerus* is a legless grub of a yellowish white colour, though it is usually stained dark brown by the decaying

material in which it lives. When full grown it measures from $\frac{1}{4}$ in. to $\frac{1}{3}$ in. in length. Its most marked characteristic is the possession at the tail end of a conspicuous chestnut-coloured horny tubercle, and on each side of this is a pointed projection which is also easily seen (Fig. 7). These characters will serve to distinguish the larva from that of *Merodon* at all ages, and from any other larvæ which might be found in bulbs. The fact that there are always a number of larvæ (usually 10 to 30) in attacked bulbs will also help to determine the presence of this species, but it must be remembered that both *Eumerus* and *Merodon* may be found in the same bulb.

The pupa (Fig. 8) is barely $\frac{1}{4}$ in. in length and is enclosed in a hard horny skin of a whitish colour. As in the case of *Merodon*, this skin is really the last skin of the larva and shows the marked characteristics mentioned above. It is usually found under the outer scales of the bulb, or in the neck, but may also occur in its interior or in the earth near the bulb.

Life History.—The life history has not yet been completely traced. The flies appear in May and June and are supposed to lay eggs near the base of the Narcissus leaves. The eggs hatch and the larvæ burrow into the necks of the bulbs. Of these larvæ some appear to feed rapidly and are full grown in August, when they pupate and produce flies in September and October. The remaining larvæ become full grown in the autumn and, as a rule, remain as larvæ until early spring, when they pupate, producing flies in late spring and early summer. What becomes of the flies which emerge in autumn is not yet known, but they do not appear to live long and almost certainly do not hibernate. Specimens have been observed pairing in September and October. In preliminary experiments carried out in 1913, bulbs in the ground and also uncovered in the store were exposed to flies of the second brood but were in no case attacked. The flies themselves may be found flying in the sun over the Narcissus beds; they do not seem to go far from the plot from which they have emerged, and fly close to the ground, frequently settling on the earth. They were not observed to frequent flowers.

Plants Attacked.—The plants attacked are the Narcissus, Hyacinth, Onion, and Shallot (the two last only on the Continent).

Nature of Damage.—In an advanced stage of the attack the interior of the bulb is entirely destroyed, and is full of a semi-liquid decaying mass. The attack seems to begin at the neck, and in mild cases the larvæ are found in the neck or under the

scales at one side. The presence of many larvæ and the complete decay produced distinguishes the damage of *Eumerus* from that of *Merodon*.

Remedies.—Until the life history is known little can be suggested in regard to remedial measures. The destruction of affected bulbs when lifting is obviously indicated, and since the decay produced is rapid there is little difficulty in their recognition. Early lifting also seems desirable to destroy the larvæ before the emergence of the second brood.

OTHER FLIES.—The larvæ of several other flies are frequently found in bulbs decaying from any cause, but they do not appear ever to start an attack on a healthy bulb.

The commonest species are *Lonchæa chorea*, of which the fly resembles a small "blue-bottle"; and species of *Scatopse* and *Sciara*, these being small gnat-like insects.

DURING the year 1913 visits were made to horse repositories, auctions, fairs, and railway stations, mostly to deal with complaints, received from the Continental Horse Board's Inspectors and the trade, as to Traffic. the condition of horses arriving at these places, and also in several cases to trace ownership of horses presented at the ports, which, apparently, should not have been exposed for public sale or accepted by the railway companies for transit.

SHIPMENTS AND CASUALTIES.

Amsterdam.—During the year 2,494 horses were shipped from the United Kingdom to this port for slaughter. The number of casualties during the year, due principally to the rough weather in crossing, was high.

From Leith 18 horses died and 7 were slaughtered.

From Grangemouth 11 horses died, 14 were killed at sea, and 2 were killed on arrival by order of the Inspector.

The Holland Steamship Company lost 9 by death and 11 by slaughter.

There were no losses on the boats of the General Steam Navigation Company.

Enquiry was made into all the losses, and in no case were the fittings reported to have been carried away.

Shipped.	Died.	Killed.
2,494	38	34

Rotterdam.—14,870 horses were exported to this port from Great Britain. The majority are carried by the Batavier Line

from London. Only 5 deaths occurred at sea on these vessels.

The casualties on the Hull and Netherlands boats were rather high during the year, *i.e.*, 18, these vessels having met with very bad weather during the crossing.

One thousand and eighty-four horses were shipped from King's Lynn, with the loss of 6 horses. The vessel chartered, ss. "Astra," was the only vessel during the year that had her fittings carried away; this probably would not have occurred had the instructions given been carried out.

Shipped.	Died.
14,870	29

Antwerp.—The majority of horses exported to Belgium are landed at the port of Antwerp. During the year 25,950 horses were exported. They are described in the Belgian returns as:—

- (1) Valuable horses, *i.e.*, horses between the age of four and six years and over £30 in value, that is, race horses and carriage horses, stud horses and army remounts for Belgium and Germany. These animals do not pass through quarantine.
- (2) Working horses, over six years of age and under £30 in value, that pass through quarantine and are subjected to the mallein test.
- (3) Horses for slaughter.

Table showing Class of Horses shipped to Antwerp and Port of Shipment.

	Valuable.	Workers.	For Slaughter.
Harwich	5,284	543	1,059
Goole	221	638	6,380
Hull	210	699	6,641
Newcastle	118	427	2,515
Leith	31	41	913
London	187	7	36
Total	6,051	2,355	17,544
	25,950		

From Hull 7,550 horses were exported. Of this number 7,499 were carried on the ss. Harrogate, the losses being 11 only, and no injuries.

Of the number of horses exported from Newcastle there were only 6 deaths and no injuries.

From Leith 985 horses were exported; 11 died at sea—the longer voyage probably accounting for the somewhat higher loss.

This year on the Harwich boat one horse had to be killed owing to the animal rearing and injuring its head. This was the first casualty on this line in four years.

Of the total of 25,950 exported to Antwerp, there were 32 deaths, no animal was seriously injured from accidents to the fittings, and there were no fittings carried away during bad weather. Twelve deaths occurred after the vessels arrived in smooth water, *i.e.*, after passing Flushing, from abdominal trouble.

There were no deaths among the very aged horses, and the ages of those that died were in eight cases under four years, and in the others the ages were from five to nine years. The animals that died were in good condition and all of over ten pounds in value.

Shipped.	Died.
25,950	32

Of all the horses, *i.e.*, 2,355, that passed through quarantine and were tested with mallein, 20 reacted; 14 horses showed clinical symptoms of glanders but no lesions on the nasal septum, and 5 only were really affected. One of the Board's Inspectors attended three post mortems out of the 14 held, and in each case found that the animal was not affected with glanders.

The few horses that may travel by road from Antwerp for Boom, Malines and Brussels are of high price. Horses of this description purchased for joint meat, if badly treated, would not dress out well, and it is to the butcher's interest that he should send good men to accompany them.

Before proceeding by road the horses are examined by the Director of the quarantine to see they are properly shod and fit to travel, as it is often found necessary by the Board's Inspectors to have the shoes removed previous to shipment.

Ghent.—The number of horses exported to this port from the United Kingdom during the year was 9,233. Forty-six asses were also exported.

Table showing Class of Horse shipped to Ghent and Port of Shipment.

	Working.	For Slaughter.
London	2,212	3,856
Hull	1,154	1,155
Goole	29	827
	3,395	5,838
	9,233	

The casualties during the year were, on the London vessels, 12 deaths and 2 injured, on the Hull boat, 5 deaths, and on the Goole boat, 7 deaths.

Enquiries were made and reports sent in upon all these losses.

Shipped.	Died.	Injured.
9,233	24	2

FRANCE.

From London to Boulogne 254 horses were exported with the loss of one horse.

From Goole, 205 horses were shipped, with no losses.

A few horses were exported from Southampton.

On account of the high duty on slaughter horses and the restrictions at the French ports the trade is not likely to develop to any extent.

The class of horses required is similar to that of horses shipped to Rotterdam, and the high prices in Holland effectually stop the French trade.

From the reports received the Board are of opinion that in those vessels regularly employed in the trade all that is possible is done for the comfort of the horses whilst on board.

There were 701 asses and 51 mules exported from Hull and Goole. There is an increasing demand for asses for work on small farms in Belgium and to take the place of dogs, high prices being realised.

THE question of the adequate protection of the respiratory organs of farm workers from the dust arising from threshing operations is an important one in view of the possible injury to health through the dust reaching the lungs.

**Protection from Dust
from Threshing
Machines.**

Threshing crops of almost all kinds is generally very dusty work, but the Board's attention has been called in particular, by a correspondent, to the harmfulness of the dust produced in the steam-threshing of field peas. The correspondent was engaged for an afternoon at clearing away the chaff and dust while the machine was at work, and was quite well at the time. On the next morning his temperature rose to 101° Fah., remaining at that point all day, and respiration was impeded for two days.

The Board are advised by the Home Office that workers could be protected from the injurious effects of the dust to a large extent by using suitable respirators. Certain types of

respirator have been found suitable, and on receipt of a post-card (which need not be stamped), the Board will be happy to inform correspondents where to obtain these. One type costs 1s. galvanised, or 1s. 6d. nickel plated, with a box of 50 refills, and another 2s. nickel plated, with 12 antiseptic filters.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Carbonate of Lime from Paper Works (*Jour. Soc. Chem. Ind., Feb. 16th, 1914; J. Hendrick, B.Sc., F.I.C.*).—It is estimated that the average loss of lime per acre per annum in this country is not less than 500 lb. of carbonate of lime. This quantity of carbonate of lime, or 280 lb. of quicklime per acre per annum, should therefore be applied to all cultivated land, or in other words, at least 1 ton of commercial burnt lime of good quality, or 1½ tons of good quality chalk or ground limestone, should be applied once in seven years merely to maintain the quantity of lime in the soil.

Large quantities of carbonate of lime, which is especially valuable on account of its very great fineness of division, are produced from causticising plant in paper works in this country and allowed to go to waste. Analyses were made of both wet and dried waste carbonate of lime from five different sources in each case. In the wet samples the proportion of moisture was, as a rule, nearly 50 per cent. and that of carbonate of lime varied from 37 to 52 per cent.; lime in other forms varied from 0.32 to 9.35 per cent.; the alkalinity (as NaOH) varied from 1.61 to 8.25 per cent. In the dried samples the amounts of carbonate of lime varied from 61 to 88 per cent., of lime in other forms from 1.45 to 13.89 per cent., and the alkalinity from 0.63 to 16.08 per cent. On the whole the dried samples were found to contain as much available lime (as carbonate and hydrate of lime) as ordinary commercial ground limestone and more than half as much as ordinary commercial burnt lime.

The value of this waste carbonate of lime from paper works was illustrated by trials of various forms of lime for the eradication of finger-and-toe in turnips. The experiments were carried out on soils which were known to be badly infected with the disease, and on which the last turnip crop had been badly diseased. When analysed the soils were found to be distinctly acid and to contain no appreciable quantity of carbonate of lime. Four tons of paper works lime was used as the dressing per acre and compared with two tons of good quality shell lime, the latter dressing containing about the same amount of available lime as the former. Gas lime was also tested at the rate of two and four tons per acre. At one centre, owing to the peaty nature of the soil, it was found that insufficient lime (in any form) had been used. At the other three centres at which the experiments were conducted the waste carbonate of lime proved superior to the other forms, both as regards weight of crop per acre and percentage of "sound" bulbs. Liming in all three forms proved efficacious against finger-and-toe.

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

FIELD CROPS.

Varieties and Manuring of Linseed (*Harper Adams Agric. Coll. Field Expts., Report for Season 1913*).—The objects of these trials, carried out in 1913 on a medium loam soil, dressed with 15 tons of farmyard manure, were to determine the most profitable variety, the value of manuring and the rate of seeding. The varieties tested were Algerian, Friesland and River Plate; the dressing of artificials consisted of 3 cwt. superphosphate and 1 cwt. sulphate of potash per acre; and the rates of seeding were 112 lb. and 70 lb. per acre. Sixteen plots in all were laid out, covering an area of 2 acres.

The seed was sown on 29th April and a good plant was obtained on all plots. Weeds were troublesome and the expenditure on hand weeding was heavy. The cost of cultivation, &c., amounted to £6 1s. 2d. per acre. The various items were as follows:—Deep ploughing, 15s.; two cultivations, 6s.; four harrowings (two before and two after sowing), 6s.; rolling, 3s.; preparing, carting and distributing manures, 2s. 10d.; rolling after seeding, 3s.; manures, £1 os. 3d.; weeding, 17s.; harvesting, £1 12s. 4d.; carting, 15s. 9d.

The plots were cut on 26th August by ordinary grass mower and tied by hand. The short-strawed Algerian and River Plate varieties were found to thresh much better than the long strawed and small seeded Friesland variety. The finest riddles have to be used in threshing, and even then many small weed seeds come through with the seed and require winnowing out afterwards.

The average results per acre from all plots for the various points tested were as follows:—

Varieties.—Algerian seed yielded 8 cwt. 67 lb. seed, 10 cwt. 21 lb. straw, 7 cwt. 86 lb. cavings; Friesland seed, 9 cwt. 74 lb. seed, 18 cwt. 14 lb. straw, 7 cwt. 77 lb. cavings; River Plate seed, 8 cwt. 97 lb. seed, 12 cwt. 1 lb. straw, 7 cwt. cavings. These figures are the averages of all plots, whether thick or thin seeded and manured or unmanured.

Rate of Seeding.—Seeding at the rate of 112 lb. per acre gave a yield of 9 cwt. 66 lb. seed, 14 cwt. 15 lb. straw, 7 cwt. 73 lb. cavings. Seeding at the rate of 70 lb. per acre gave a yield of 8 cwt. 54 lb. seed, 12 cwt. 84 lb. straw, 6 cwt. 109 lb. cavings. These figures are the averages for all varieties, manured and unmanured.

Manuring.—No increase in yield resulted from the mixture of artificials used.

Manuring of Potatoes (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1913*).—This series of experiments was brought to a close in 1911 after 11 years' work in seasons differing widely in character and on many varieties of soil, the results obtained throughout the period being remarkably uniform.

The complete results may be summarised as follows:—

(1) Reckoning the value of farmyard manure at 4s. per ton, a dressing of 20 tons per acre gave a profit of £5 16s. per acre, while one of 15 tons gave 13s. less, viz., £5 3s. per acre. No account was taken in these calculations of the residual values of the manure.

(2) The addition of 1 cwt. sulphate of ammonia to the 15 tons of farmyard manure gave a profitable return each year.

(3) The further addition of 4 cwt. superphosphate to the foregoing resulted in a profit in nine years out of eleven.

(4) The largest average yield and the highest average profit have been obtained from a complete dressing of artificials (1 cwt. sulphate of

ammonia, 4 cwt. superphosphate, and 1 cwt. muriate or sulphate of potash) with 15 tons farmyard manure. A slightly higher yield was obtained each year from muriate than from sulphate of potash in the mixture.

In a series of experiments commenced in 1908 the effect of varying the quantities of the artificials in the complete dressing with farmyard manure above-mentioned has been tested. The results up to 1913 show clearly that it is not advisable, as a rule, to apply any one of the three manures, superphosphate, sulphate of ammonia and muriate of potash, in greater quantities than those given above. Although the additional quantities used in these further experiments produced, on the average, a sufficient increase in yield to repay the extra expenditure, nevertheless, in many cases, the application of heavy dressings was not satisfactory. Reducing the quantities of artificials gave on the other hand lower yields and smaller profits.

Seaweed.—While definite conclusions cannot yet be drawn from these experiments on potatoes carried out in 1912 and 1913, it would appear, so far, that, weight for weight, seaweed seldom produces as heavy a crop of potatoes as does farmyard manure; that muriate of potash generally has less effect when used with seaweed than when applied with dung; and that seaweed gives the best results on light soils and, possibly, in a dry season.

Manuring of Turnips (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1914*).—Two series of experiments were commenced in 1901 and concluded in 1911 with the object of testing the effects of artificial manures alone and in combination with farmyard manure. The experiments were conducted at a large number of centres in every county in Ireland, on a great diversity of soils and with the leading varieties of swede turnips; and the results are specially noteworthy for their uniformity each season.

The average results, per acre, with farmyard manure were as follows:—

Manures.	Average Yield.	Value of Crop at 8s. per ton.	Cost of Manures.	Value of Crop less Cost of Manures.
	Tons cwt.	£ s. d.	£ s. d.	£ s. d.
No manure	6 5	2 10 0	—	2 10 0
10 tons farmyard manure ..	19 0	7 12 0	2 0 0	5 12 0
20 tons " " " " " "	23 0	9 4 0	4 0 0	5 4 0
10 tons farmyard manure and 4 cwt. superphosphate	23 16	9 10 5	2 12 4	6 18 1
10 tons farmyard manure, 4 cwt. super., and 1 cwt. sul. am.	24 19	9 19 7	3 6 0	6 13 7
10 tons farmyard manure, 4 cwt. super., 1 cwt. sul. am., and 3 cwt. kainit ..	26 0	10 8 0	3 14 0	6 14 0

In the "cost of manures" no allowance has been made for the "residual value" of the dung.

It will be seen that the heavy dressing of farmyard manure did not give such profitable results as the light dressing. The most profitable dressing proved to be 10 tons of farmyard manure and 4 cwt. superphosphate, the increases in the crop produced by further artificials not being financially remunerative.

The average results per acre without farmyard manure were as follows:—

Manures.	Average Yield.	Value of Crop at 8s. per ton.	Cost of Manures.	Value of Crop less Cost of Manures.
	Tons cwt.	£ s. d.	£ s. d.	£ s. d.
No manure ..	4 17	1 18 10	—	1 18 10
4 cwt. superphosphate ..	17 9	6 19 7	12 4	6 7 3
4 cwt. super. and 1 cwt. sul. am. ..	18 19	7 11 7	1 6 0	6 5 7
4 cwt. super., 1 cwt. sul. am., and 3 cwt. kainit ..	22 0	8 16 0	1 14 0	7 2 0

The heaviest average yield and the highest profit were obtained each season from the plot manured with a complete mixture of artificials.

Experiments were commenced in 1908 to ascertain the effect of varying the quantities of superphosphate, either in combination with farmyard manure or in the complete dressing of artificials given in the above tables. The results to the end of 1913 indicate that the quantity of superphosphate applied (either with dung or in the complete mixture) can be increased up to 6 cwt. per acre with returns more profitable than from the 4 cwt. dressing. The same held good if the same quantities of basic slag were used instead of superphosphate. The additional quantities of superphosphate and basic slag gave slightly more profitable returns when used with artificials than with farmyard manure. Used with farmyard manure, basic slag gave slightly better results than superphosphate; with artificials the position was reversed.

Sprouting Seed Potatoes (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1914*).—On the average of 1,399 tests carried out from 1903 to 1913, the gain in yield per acre due to sprouting seed potatoes has been 1 ton 19 cwt.

Varieties of Swedes (*Lancs. Educ. Com., Agric. Dept., Farmer's Bull. No. 25*).—Trials were arranged in 1912 and 1913 with a view to testing the comparative cropping power of 10 varieties of swedes at a number of centres, and comparing their disease-resisting characteristics. It was found that "Halewood" gave the highest yields and also suffered less in 1913 from green fly and mildew than any of the other varieties, but as regards yield it was closely followed by "Empire," "Gateacre," and "X.L. All." "Lord Derby" had a very large proportion of unsound roots at most of the centres in 1913, being the worst in this respect.

Change of Seed Potatoes (*Deut. Landw. Presse, 15th April, 1914*).—The value of the use of seed potatoes from another locality has been illustrated by some experiments carried out in Holland. Ten fields set aside for the experiments were on moor soils, in the province of Drenthe, and were treated alike as regards manuring, cultivation, &c., the seed used in every case being "Eigenheimer." In addition to seed from the same locality, Eigenheimer seed was obtained from sandy soils and from the Frisian "Marsh" district, and this "Marsh" seed grown one year in the locality was also tested.

On each of the experimental fields the best yields were given by the Frisian Marsh seed. Higher yields were also obtained from this seed grown one year in the district, but the differences were within the limits of error.

The following were the results per acre. It is explained that the superiority of the Frisian seed would have been much more marked but for the fact that the season (1912) was extremely favourable for the growth of potatoes:—

	Frisian Marsh Seed.	Marsh Seed grown one year.	Seed from the same District.	Seed from Sandy Soils.
Yield of tubers .. lb.	28,464	25,163	24,895	23,021
Starch content .. %	17.75	15.9	15.8	15.85
Yield of starch .. lb.	5,053	4,007	3,938	3,649

Cultivation of Carrots with Cereals as a Cover Crop (*Wiener Landw. Zeitung, April 1st, 1914*).—The Royal Hungarian Plant Breeding Station at Magyar-Ovár has during the past two years been investigating the possibility of growing carrots with one of the cereals as a cover crop. For the first experiment the carrot seed was drilled in on a rather poor calcareous loam at the beginning of April. To obviate the necessity for singling out the seedlings the seed was sown very thinly. The cover crop was winter wheat. After the wheat had been harvested the carrots were hoed by hand and eventually harvested at the beginning of November. The yield obtained was not very high, but this was chiefly due to the poor condition of the land used for the experiment. On land in a better condition it was considered that the yield would be greatly increased.

The second experiment was carried out on similar lines, but the carrots were not harvested until the beginning of March. It was found that the varieties, the root of which developed completely under the ground, did not suffer in any way from frost and could be used for feeding purposes as desired during the winter, except when the ground was frozen. It was also found that little injury was done to the crop if the carrots were lifted with the plough. The weather during the two years was wet, and it is admitted that the experiment might have been less successful in a dry year, but in view of the feeding value of the root it is considered that with the adoption of labour-saving devices this method of growing the carrots might be extended.

LIVE STOCK AND DAIRYING.

Cost of Milk Production (*Univ. Coll., Reading, Faculty of Agric. and Hort., Bull. XIX; J. Mackintosh, N.D.A., N.D.D.*).—An attempt was made during 1913 to ascertain the cost of milk production in Berkshire; the results are given in this bulletin and compared with those arrived at by similar methods in Surrey and Kent in 1910 and 1912.

The costs ascertained were those of food only, returns being obtained from twelve farms. Home-grown foods were charged at the cost of production, the actual price on each individual farm being taken as the basis of calculation. Purchased foods were charged at cost price, together with an allowance for cartage, etc. The foods fed to dry or fattening cows were not taken into account, as it was considered that the value or the sale price of the calf or the fat cow would equal the cost of the foods used when the cows were dry.

The average results for the five winter months, December, 1912, to April, 1913, were: Daily milk yield per cow, 2.18 gallons; cost of food

per cow per day, 12.75d.; cost of food per gallon of milk, 5.83d. One farm produced milk at less than 5d. per gallon, 7 farms at from 5d. to 6d., and 4 at above 6d. The high cost in these last four cases was due to the low average yield per cow.

In ascertaining the cost of food during the five summer months, May to September, 1913, the cost of the pasture was calculated from the acreage grazed by the cows and the value or rent per acre; the value was placed higher or lower than the rent, according as the quality of the pasture varied above or below the average for the farm. The aftermath was valued at 15 to 20 per cent. of the rent per acre and calculations based on this figure and the acreage grazed by the cows. Soiling crops were charged at the estimated cost per acre for cultivation, manure, seed, cutting and carting, rent, rates, etc. In the case of pasture and aftermath the residue which would be available for consumption during October and November was estimated, and deducted from the total value.

The average results for the five summer months were: Daily yield per cow, 2.31 gallons; cost of food per cow per day, 6.41d.; cost of food per gallon of milk, 2.77d. There were great variations in the costs of feeding and the daily yields of milk on the individual farms, the cost ranging from 3.94d. to 9.23d. per cow per day, and the yield from 1.92 to 2.82 gallons.

For the whole ten months of the investigation the cost of food per gallon of milk averaged practically 4½d., and ranged from 3.50d. to 5.64d.; the average cost of the daily ration was 9½d., and the average daily yield 2½ gallons per cow.

In order to compare the results with those previously obtained in Kent and Surrey, it was necessary to substitute "average" costs of production for the actual costs used above. The following were taken as average costs: Mangolds and swedes, 10s. per ton; turnips, 8s. per ton; hay, £3 per ton; oat straw, £2 per ton.

The following figures show the comparative results on this basis:—

District.	No. of Farms.	No. of Cows.	Daily Yield per Cow.	Cost of Food per Cow per Day.	Cost of Food per Gallon of Milk.
Winter Period.					
Surrey & Kent, 1910	60	1,957	gallons. 2.24	pence. 14.88	pence. 6.58
" 1912	20	730	2.11	14.68	6.96
Reading, 1913	12	431	2.18	13.06	5.97
Summer Period.					
Surrey & Kent, 1912	20	700	2.24	5.70	2.54
Reading, 1913	12	412	2.31	6.41	2.77

Cost of Rearing Draft Colts (*Pennsylvania Agric. Expt. Sta., Bull. No. 122*).—Ten grade Belgian and Percheron colts were purchased in October, 1910, and a record was kept of their initial cost, together with the cost of feeding and labour, and the gains in weight and value made by the animals up to April, 1912.

During the first winter the colts were divided into two lots, the first group receiving an average daily ration of 5 to 7½ lb. grain mixture per head, 8.2 lb. maize silage and 7.4 to 13.1 lb. hay, and

the other group the same quantity of grain and 10.6 to 13.1 lb. of hay without silage. The colts gained an average of 244 lb. per head during this period of 168 days, at a cost for food of £5 11s.

The summer feeding period included 196 days, during which time the colts were placed in the pasture, the stallions being separated from the fillies. The amount of grass was limited and was therefore supplemented with 160 lb. grain mixture, 262 lb. shelled maize, 894 lb. oats and 1,182 lb. hay per head. The cost of feeding for this period was £5 16s. per head, and the gain in weight 264 lb. It is stated to be desirable that draft horses should make the greatest possible growth when less than two years old, and that therefore colts on pasture should receive as much grain as they can consume.

During the first half of the second winter, grain was fed at the rate of 8.4 lb. and hay 16.6 lb. daily per animal, after which the ration was increased to 10 lb. grain and 17.5 lb. hay. The colts increased on the average 219 lb. in weight, while the cost of food per animal was £8 2s.

The initial weight per colt was 590 lb., and the final weight 1,317, thus showing a gain over the whole period of 727 lb. The total cost of food, including an allowance for pasture, was £193 17s., and the charge for labour £10 10s., giving a total expenditure, including the purchase price of the colts, of £394 9s. The value of the colts at the close of the experiment was £489 12s., giving a total profit of £95 3s., or £9 10s. per colt.

Loss in Weight of Cattle in Transit (*U.S. Dept. of Agric., Bull. No. 25*).—This investigation, which was begun in August, 1910, and extended over three years, was carried out in order to test the loss in weight of the different classes of cattle when conveyed by rail, and to discover the various factors causing a greater or smaller loss in the course of the journey. The chief conclusions reached may be summarised as follows:—

The loss in weight depends very materially upon: (a) The length of time the cattle were kept without food and water before being loaded; (b) The nature of the feed which the cattle had before loading—good hay was recommended as being superior to beet pulp or silage; (c) The weather conditions at the time of loading, during transit, and at the market; (d) The character of the journey—slow, rough journeys causing greater loss—and the treatment the cattle received at unloading stations; (e) The time of arrival at market—if the cattle arrived just before being sold, they had no time to have a good feed. It was found that cattle reaching the market early on the day of sale or the afternoon of the previous day fed better than those arriving during the night.

The tests showed that an exceedingly large feed at market was not desirable, as it detracted from the selling price.

The shrinkage in the case of calves held about the same proportion to their weight as was found with grown cattle. Steers usually shrank somewhat less than cows of the same weight.

The loss in weight over a long journey was greatest proportionately during the first 24 hours. The shrinkage during a journey of 36 hours was found to range from 3 to 4 per cent. of the live weight, and during a journey of 70 hours from 5 to 6 per cent.

Cattle fed on silage had a large gross shrinkage, but usually fed so well at the market that the net shrinkage was small. Animals fed on sugar-beet pulp lost more in weight than any other class and also presented a greater net shrinkage.

It was recommended that cars conveying cattle should be well bedded with sand or similar material. Poorly bedded cars cause the animals to slip or fall and tend to tire them unnecessarily.

Value of Hay and Silage obtained from Potato and Jerusalem Artichoke Tops (*Landwirtschaftliche Jahrbücher*, Bd. 46, Heft 1).—Experiments have recently been carried out at the Royal Agricultural High School at Berlin to ascertain the value of potato and artichoke tops for feeding dairy cows and sheep.

Potato Tops.—From the investigations made it was concluded that potato tops are equal in value both as regards chemical composition and digestibility to good meadow hay; if anything they are slightly superior to the latter in their proportion of digestible protein. The results of a feeding experiment with dairy cows confirmed this conclusion; the yield of milk and the proportion of fat and dry matter were at least as high as when good meadow hay was fed. If well harvested and made into hay or artificially dried the tops were found to be quite unobjectionable for feeding purposes from a hygienic point of view. When properly prepared they were also found to form good silage, which was willingly eaten.

To prevent any unnecessary disturbance of the tubers it is advised that the tops should be cut just before the potatoes are harvested in the normal course. Care should be taken not to include any roots as the adhering soil may lead to disturbances in the health of the animals.

Jerusalem Artichoke Tops.—As regards the proportion of crude nutrients and digestibility Jerusalem artichoke tops are about equal to good meadow hay. They have the disadvantage, however, when fed exclusively to sheep, of causing excessive fermentation in the digestive tract. For this reason it is recommended that Jerusalem artichoke tops should not form more than one-half of the fodder ration; fed in this proportion they are considered unobjectionable.

FORESTRY.

The Relative Growth of Various Willows—(*Quar. Jour. For.*, January, 1914).—The following table shows the growth of different varieties of willows, in good garden soil, in a sheltered position and under identical conditions:—

Variety.	Average Length of Shoots.	Tallest Shoot.
	in.	in.
<i>Salix viminalis</i>	100	123
<i>S. pulchra</i>	110	121
<i>S. Nicholsonii</i>	75	101
"Yellow osier"	50	98
"Black Maul"	70	92
<i>S. helix stipularis</i>	70	85
<i>S. helix pyramidalis</i>	60	84
<i>S. undulata</i>	45	79
<i>S. nigricans cotinifolia</i>	50	60
<i>S. cardinalis</i>	45	55

The effect of various artificial manures (each applied at a rate costing £2 per acre) on yearling shoots of *S. caerulea* (a) on low sandy soil, on the east of a wood, sheltered from the prevailing south-west winds, and (b) on pure peat soil, cultivated for 100 years and clayed about four times, is shown in the following table:—

	Average Length of Shoots.		Tallest Shoots.	
	(a) in.	(b) in.	(a) in.	(b) in.
Unmanured	84	78	105	99
Nitrate of Soda	96	66	114	84
Superphosphate of Lime	93	84	111	101
Kainit	90	60	108	84
Sulphate of Ammonia	72	70	102	98
Muriate of Potash	76	70	98	93
Bone Meal	72	70	92	93
Basic Slag	—	64	—	96

It should be explained in the case of soil (b) that in eight years' experiments by the Cambridge School of Agriculture superphosphate has proved better than all other manures for farm crops.

NOTES ON AGRICULTURAL CO-OPERATION AND SMALL HOLDINGS.

IN view of the unsatisfactory returns which farmers often secure by the breeding, rearing, and fattening of pigs, it may be well to consider whether the adoption of a scheme of organisation on co-operative lines might have the effect of improving matters in this respect. The following particulars on the organisation of this important industry will be of interest in this connection.

The Aims of Organisation.—Any scheme of organisation of the pig industry in the interests of the producers must have in view the following definite aims:—

(a) To place on the market an article of the quality and in the form demanded by the consumer.

(b) To eliminate any unnecessary profit between the producer and consumer with a view to obtaining a better price for the former.

Methods at present followed.—Before considering any scheme which might fulfil the above conditions it is desirable to review the methods at present generally in vogue in the pig industry.

Speaking generally, too little attention is paid to breeding with a view to producing a given quality of bacon or pork. It may be expected that the Board of Agriculture scheme of Live Stock Improvement may

* Contributed by the Agricultural Organisation Society.

improve matters in this direction. With regard to disposal one of the three following methods is adopted :—

(1) Pigs may be sent to local auction sales where they are bought by dealers or by agents for bacon-curing purposes. The principal objections to this method are: (a) there is nothing to prevent an occasional glut in the market; (b) there is no control of dealers or other purchasers to prevent the formation of a "ring," the object of which is to keep down prices to the lowest possible level; (c) there is unnecessary waste owing to the final journey of the pig to the slaughter-house occupying a day longer than would otherwise be the case; and (d) the purchaser is usually unable to distinguish between pigs which have been fed in the manner best suited to the production of bacon, and those with which no care has been taken in this respect.

(2) The second method is to send pigs to a salesman or agent in a town to be disposed of to the best advantage. In many respects this is an advance on the previous system, especially when a farmer is able to send consignments of not less than a truck load at a time. The chief objection is that the most convenient town is not always the best market, while it is obvious that a middleman's assistance is entailed, this involving a certain amount of delay and the payment of commission.

(3) A third method is for the farmer to send his pigs regularly to one or two retail customers. This may be the ideal plan, but it should be remembered that the most efficient marketing consists in selling produce where the greatest demand exists and prices rule highest, and any agency that can sell for the producer in this way must in the long run supplant any system of private exchange. Under the direct retail system it is also often difficult for arrangements to be made between producers and consumers which are entirely satisfactory to both parties for any length of time.

It is, however, not to be understood that the above methods are entirely condemned. Each is useful in its own way. For example, auction sales will always be popular with small farmers who feed only a few pigs and send them to market in batches of three or four at a time.

There are, however, two main alternative systems, co-operative in principle, which overcome the drawbacks inherent to the methods outlined above. These two systems are (a) the erection of co-operative bacon factories, and (b) the sale of live pigs through a co-operative society.

(a) *The Erection of Bacon Factories.*—The erection of bacon factories which are owned and managed by farmers is perhaps the ideal system, as, through such an organisation, the products of the pig would be placed before the consumer in the most inviting form, and at the minimum expense, and all unnecessary profits from first to last would be eliminated. It will, however, be useful at this stage to give five essential points which must be taken into account in the establishment of a bacon factory.

1. In order to conduct a bacon factory on profitable lines a supply of about 500 pigs a week is required. The expenses attached to the working of a factory having a supply of 100 pigs per week would be very much more per pig than the expenses in dealing with a larger number. Not only is an adequate supply necessary, but the quality of the pigs available should be suitable. The best class of pig for the manufacture of bacon is large in the back, with light shoulders and heavy flank.

2. It is most important that there should be good facilities for the satisfactory disposal of the by-products or offal, as a large proportion of the profits is usually dependent on such by-products.

3. In order to erect and equip thoroughly a factory capable of dealing with 500 pigs per week a working capital of about £15,000 to £20,000 would be necessary to ensure success, provided, of course, that the two previous essentials have been secured. The building and equipment of the factory would require at least £7,000.

4. Good management is essential. The manager should be thoroughly conversant with all branches of the pig industry and bacon trade, and he should also be thoroughly informed as to the most remunerative method of dealing with the by-products of the pig.

5. Finally, the factory should have the guidance of a capable and businesslike management committee, with some members who are farmers having a knowledge of the pig trade.

The main difficulties to a scheme such as this are: (1) The large amount of capital that it is necessary to raise, and the risk which is thereby involved; and (2) the difficulty of insuring an adequate supply of suitable pigs to permit the factory to be run on a profitable basis. Loyalty among the members is essential, as if this diminishes so also will the supply of pigs, and it is possible that failure might ensue through this factor alone.

(b) *The Sale of Live Pigs through Co-operative Societies.*—In consideration of the foregoing factors the Governors of the Agricultural Organisation Society advocate, under present conditions, the alternative co-operative system, namely, "the sale of live pigs through co-operative societies." The establishment of these societies in the first instance, for the sale of live pigs on behalf of their members, will probably be more satisfactory to the producer than the erection of co-operative bacon factories, and they would in no way militate against the erection of factories, should the need for such be felt by farmers in the future.

The amount of capital required is, comparatively, very small, and the risk negligible, and yet important advantages may be enjoyed by the producer through a co-operative method such as this.

The Eastern Counties Farmers' Co-operative Association, which is affiliated to the Agricultural Organisation Society, is already accomplishing good work. The services of an expert manager have been obtained by the Society, and members having pigs for sale inform him of the fact either by letter or by personal intimation, a note being made of the number of pigs and approximate dead weight on a special printed sheet which is termed the "visible supply sheet." In the course of a day or two the manager pays a visit to the district where the pigs are ready for sale, and arrangements are made for their disposal. If he has an order in hand for a consignment similar to those which are ready for sale, and at a price which the farmer is willing to accept, he carefully selects the animals which are most suitable for his buyer, and advises the farmer when they are to be put on rail, and what licences it is necessary for him to procure. Should he have no order to fulfil at the time, he still takes particulars as to the weight and general condition of the pigs, and arranges a sale of them at the first opportunity. The Society both buys and sells to customers, either by live or dead weight, whichever the member concerned prefers. Payment to members is made as quickly as possible. In the case of pigs which are sold by live

weight payment is made on the first Monday morning following delivery, and those sold by dead weight are paid for as soon as returns are received. The Society charges a commission for the work undertaken, a deduction being made from the cheque sent to the member. The charges made are as follows:—

- 6d. per pig for pigs of £4 and under in value;
- 1s. per pig for pigs over £4 in value; and
- 2s. 6d. for the sale of each sow.

The charges have always been found to be sufficient to cover expenses and to enable the Society to make a small profit. There is also an insurance scheme worked in conjunction with this trade, whereby for the small sum of 1d. per pig the Society undertakes to make good any loss that occurs in transit by rail, provided the pigs have not been fed on the morning before taking their final journey.

In the adoption of a scheme such as this it is essential that great care should be taken to secure the services of a capable and reliable manager, as the success of the scheme will depend to a large extent upon his ability to carry out duties tactfully and thoroughly. He should have a considerable experience in pig dealing, be a good judge of pigs, and quick at figures, and should have had a better education than the average man who adopts pig dealing as a livelihood. The business involves a large amount of correspondence, and calls for the use of a considerable amount of tact in keeping together the connection of both buyer and seller.

The business such as outlined above can be made to pay well or merely to cover expenses, according to the amount of commission the members of the society are prepared to pay. It would probably not be advisable for any society to start with a smaller commission than that charged by the Eastern Counties Farmers' Co-operative Association, Ltd.

Improving the Industry.—If any surplus profit is made it can be very well utilised in developing the industry, and thus paving the way for the establishment of a bacon factory, if at any time the conditions of the district demand it. In addition to carrying out the sale of pigs on behalf of its members, a co-operative society is also able to assist them in other directions, especially in regard to negotiations for better facilities and taking combined action in any way to improve the conditions of the industry.

Improving the Local Breeds.—It has already been mentioned that a society might allocate any surplus profits to the improvement of the pigs in the district, and there is already one society affiliated to the Agricultural Organisation Society which has undertaken this important work in connection with its trading operations by providing for the use of its members a number of well-bred and suitable boars. These animals are sent out to members in different parts of the district which is covered by the society, and are available for the use of members at a nominal fee; the district of each boar is changed each year. The good effects of this scheme are already marked. The amount of capital which is needed in carrying this out is very small, and it is confidently anticipated that the ultimate result will be the production of a class of pig that will satisfy the demand of the consuming public, and at the same time prove profitable to the industry.

The total quantity of land acquired or agreed to be acquired for small holdings under the Small Holdings Act up to 31st December last was 182,022 acres, 125,971 acres having been purchased for £4,126,421, and 56,051 acres leased for rents of £68,291 a year. Of this land 157,883 acres had been actually let by County Councils to 11,021 individual small holders, and 476 acres sold to 42 small holders, and the Councils of County Boroughs have let 994 acres to 209 individual tenants. In addition 8,037 acres have been let to 61 Co-operative Small Holdings Associations, who have sub-let the land to 1,424 of their members, and 3,314 applicants have been provided with over 44,000 acres by private landowners direct. The land which has been acquired by County Councils, but which is not yet let in small holdings, amounts to 14,255 acres, which it is estimated will provide for 817 applicants and one Association, and the Councils of County Boroughs have about 700 acres not yet allotted, which will probably provide for at least another 100 applicants. It appears, therefore, that the Act has resulted in the provision of small holdings for 17,005 applicants in six years.

Applications.—During the six years since the Act came into operation, applications for small holdings have been made to County Councils by 43,245 individuals and 89 Associations, and the total quantity applied for amounts to 723,497 acres. Of the individual applicants 25,567 were provisionally approved as suitable, and 17,005 of them have obtained holdings.

The proportion of applicants who express any desire to purchase holdings shows no sign of increasing, the percentage remaining at less than 2 per cent. of the applicants who express any definite preference in the matter.

The number of applicants in 1913 who were described as agricultural labourers was 988, which is nearly 24 per cent. of the total number. This is a smaller proportion than was the case in previous years, but the classification is necessarily not very exact and the figures can only be regarded as an approximate estimate. In the majority of cases an agricultural labourer in regular work has neither the time nor the capital to cultivate a small holding, and the needs of men of this class are more suitably met by the provision of small allotments, which they can cultivate in their spare time, than by small holdings. The majority of the applicants for small holdings are either men who have small quantities of land already and want more, or men who have some business of their own which does not occupy the whole of their time.

Land Acquired.—The average price of land purchased by County Councils in the six years was £32 12s. 5d. per acre (£33 4s. in 1913), and the average rent of the land leased £1 4s. an acre (£1 7s. 6d. in 1913).

The quantity of land acquired or agreed to be acquired by County Councils in 1913 was 24,493 acres, of which 20,622 acres were purchased for £684,417, and 3,871 acres were leased for rents amounting to £5,295 a year. These figures show a decrease of 9,000 acres as compared

* Report of the Board on Small Holdings in 1913 [Cd. 7328], price 3d.

with the quantity acquired during 1912, and the following statement shows the quantity of land acquired or agreed to be acquired in each year since the Act came into operation.

Year.	No. of acres acquired.
1908	21,417
1909	39,472
1910	33,335
1911	36,358
1912	33,493
1913	24,493

It will be observed that the largest quantity of land was acquired in 1909, and that since then there has been a continuous decline every year with the exception of 1911, in which year the additional Commissioners were appointed. The decline appears to be due mainly to the fact that in the earlier years the Councils were occupied in acquiring land for those applicants whose needs were most easy to satisfy, and that at the present time they are left with all the difficult cases. The demand for self-supporting holdings from men who are prepared to move to any part of the county has been almost entirely satisfied, and the Councils have now to deal principally with the applications of men whose requirements can only be satisfied by the acquisition of land in close proximity to their present homes. It is obvious that this must necessarily be a slow and difficult task. It involves a number of inquiries and negotiations for the acquisition of quite small quantities of land in a large number of different parishes, and the time and trouble occupied in providing for one applicant in a village may be even greater than would be needed for the purchase of an estate of several hundred acres. Another reason for the decline is to be found in the fact that the business of subdividing the land already acquired, preparing plans and specifications for the necessary equipment, obtaining tenders and supervising the execution of the work, together with the ordinary duties of managing a large and scattered estate has occupied so much of the energies of the county land agents that they cannot devote so much time and attention as might be desirable to the business of acquiring additional land. Moreover, the increased prosperity of agriculture in recent years has caused keener competition for any land that comes into the market, with a consequent rise in prices, and the tendency of vendors to put up their land for sale in small lots has also increased the competition which Councils have to face.

The Unsatisfied Demand.—At the end of 1912 there were 8,508 unsatisfied approved applicants, and during 1913 2,445 additional applicants were approved, and yet the number of unsatisfied approved applicants at the end of 1913 was only 6,271. As the number of applicants for whom holdings were provided during 1913 was 2,870, it is clear that a revision of the lists has been carried out by County Councils and has resulted in a reduction of 1,812 in the number of unsatisfied applicants. At the present time the unsatisfied approved demand is less than it has been at any time since the Act came into operation. At the same time the quantity of land still required is estimated at over 90,000 acres, which represents a considerable volume of arrears to be made up, though it is 40,000 acres less than the estimated quantity required at the end of 1912.

Condition of Holdings.—The Board have made inquiries as to whether the rents charged for the small holdings established under the Act have been paid punctually, and, with few exceptions, the replies received have been in the affirmative. Many of the Councils now have a very considerable area of land under their management, and it is not unnatural that there should be some arrears, especially in view of the fact that it is customary with agricultural tenancies not to require payment on the actual dates when the rents are due, but to allow one or two months' grace. The information received by the Board shows, however, that the position as regards arrears of rent from the statutory small holders compares very favourably with the position on most large estates. Taking the country as a whole, it may be said that the amount of the arrears which must be regarded as irrecoverable is quite negligible.

The number of tenants whose tenancies were determined during 1913 by notice to quit from the Councils was 90 in England and none in Wales. This represents a proportion of unsatisfactory tenants of less than one per cent. In addition 174 tenants in England and 9 in Wales gave up their holdings at their own request, in some cases in order to move to larger holdings.

FROM an agricultural co-operative point of view the Co-operative Farm Mortgage Association Act of Saskatchewan, recently passed, is of general interest, as it enables Saskatchewan farmers to obtain loans at a low rate of interest, by giving a Government guarantee to bonds or debentures issued by an association of Saskatchewan farmers set up under the Act, so that these bonds may be disposed of in the money markets of the world.

The Co-operative Mortgage of Farms in Saskatchewan.*

The Act provides for the formation of the "Saskatchewan Co-operative Farm Mortgage Association," which will consist of three commissioners, appointed by the Government, and of those who become members. The Association will be an aggregation of groups or units not less than twenty-five in number, each of which must have at least ten members. Each member must be an applicant for a loan, and must be willing to join with other members and the Association in pledging his credit and security for the loans of other members of his group, to an amount not more than 50 per cent. of his own loan. New members may join upon being accepted by at least two-thirds of those already constituting a group. Should any member default in his payments, and the property upon being sold fail to realise the amount of his indebtedness to the Association, the other members of his group might be called upon to make good their contingent liability on a *pro rata* basis. Loans may be made upon first mortgages only, and the Association is forbidden to advance more than 40 per cent. of the value of the land taken in security. The Association may, at no time, loan more money than it holds mortgage security for.

The above-mentioned provision that the Government may guarantee the Association's bonds or debentures was made as it was recognised that it would be almost if not quite, impossible to raise any large sum

* Saskatchewan Public Service Monthly, Legislation Supplement, February, 1914.

of money, either within the province itself or in Canada, on the security of mortgage bonds bearing a low rate of interest.

The scheme differs from the German Landschaften system in that the Landschaft does no banking business, but gives the borrower a bond in return for his mortgage, and it is the borrower who has to negotiate this bond in the open market. Another difference is that the new Saskatchewan Act makes provision for a reserve fund, which will give an added security to the bonds when they are offered for sale, and which will be available in time of failure of crops.

The benefits which it is hoped will accrue to Saskatchewan farmers under the Act are the obtaining of loans for a long period of time at a low rate of interest; the possibility of repaying a loan at any time under easy conditions; the impossibility of overburdening farms with debt owing to limitation of the amount available to 40 per cent. of the valuation of the farm, and the consequent incentive to increasing its value.

The date on which the Act will come into force has not yet been determined.

NAMES AND ROUTES OF THE KING'S PREMIUM STALLIONS.

PARTICULARS of the Routes of the Stallions to which King's Premiums and Super-Premiums were awarded at the Show held at the Royal Agricultural Hall, Islington, London, N., on March 10th, 11th and 12th, 1914, together with the names and addresses of the owners of the Stallions, and of the members of the Stallion Committees which have been appointed to supervise the service arrangements, are given below. The Routes are subject to some alteration by arrangement between the owners and the Stallion Committees.

The District Classes for England and Wales are as follows:—

District Class.	Counties.	Number of King's Premiums.
I.	DURHAM NORTHUMBERLAND YORK, N. RIDING	Four King's Premiums.
II.	CUMBERLAND LANCASTER WESTMORLAND	Three King's Premiums.
III.	YORK, E. RIDING YORK, W. RIDING	Six King's Premiums.
IV.	LINCOLN, Parts of HOLLAND " " KESTIVEN " " LINDSEY NOTTS	Two King's Premiums.

District Class.	Counties.	Number of King's Premiums.
V.	DERBY STAFFORD	Two King's Premiums.
VI.	CHESTER HEREFORD SALOP	Three King's Premiums.
VII.	ANGLESEY CARDIGAN CARNARVON DENBIGH FLINT MERIONETH MONTGOMERY	Two King's Premiums.
VIII.	BRECKNOCK CARMARTHEN GLAMORGAN MONMOUTH PEMBROKE RADNOR	Three King's Premiums.
IX.	GLOUCESTER OXFORD WARWICK WORCESTER	Four King's Premiums.
X.	BEDFORD HUNTS LEICESTER NORTHAMPTON RUTLAND SOKE OF PETERBORO	Three King's Premiums.
XI.	CAMBS. ISLE OF ELY NORFOLK SUFFOLK	Two King's Premiums.
XII.	BUCKS ESSEX HERTS MIDDLESEX	Three King's Premiums.
XIII.	KENT SURREY SUSSEX, EAST " WEST	Three King's Premiums.
XIV.	BERKS HANTS ISLE OF WIGHT	Three King's Premiums.
XV.	DORSET SOMERSET WILTS	Four King's Premiums.
XVI.	CORNWALL DEVON	Three King's Premiums.

District Class.	Stallion and Owner.	Free Nominations.		Route.	Stallion Committee.
		Counties to which allotted.	Number allotted.		
I.	Ray's Cross. Mr. W. J. Corbett, Willbrook House, Corofin, Co. Clare, Ireland.	Northumber-land	25	Headquarters:—Alnwick Travels Howick, Doxford, Chat- ton, Doddington, Lowick, Ford, Cornhill, Wooler and Alnham.	Mr. B. Clayhills, Estates Offices, Callaby, Whittingham. Mr. J. S. Fawcus, Dunstan Steads, Lesbury. Mr. G. G. Rea, Middleton, Wooler. Mr. R. S. Wright, Estates Office, Alnwick Castle.
	Renown. The Compton Stud, Sandley, Gillingham, Dorset.	Yorks (North Riding). Durham	15 10	Headquarters:—Langton Hall Travels Thirsk, Pickhill, Bedale, Northallerton, Trenholme Bar, Darlington, Piercebridge, Scotch Corner, and Richmond.	Mr. A. C. Lupton, Ainderby Hall, Northal- lerton. Capt. F. Reynard, Camp Hill, Bedale. Mr. W. M. Corbett, Moulton Hall, Darling- ton. Mr. T. Clark, Winton House, Northallerton.
	Lord of the Valley. Messrs. T. & W. Walton, Stud Farm, Guisborough, Yorks.	Yorks (North Riding).	25	Headquarters:—Guisborough... Travels Easington, Hinderwell, Whitby, and Stokesley.	Mr. Joseph Hutchinson, Bank House, Guisborough. Mr. F. Wilson Horsfall, Potto Grange, Northallerton. Major R. B. Turton, Kildale Hall, Grosmont.
	William Rex. Messrs. T. L. Wickham Boynton and H. A. Cholmondeley, Burton Agnes Hall, Driffield.	Yorks (North Riding).	25	Headquarters:—Pickering Travels Snalton, Malton, Gilling, and Helmsley.	Capt. the Hon. J. Dawnay, Ruston, Wyke- ham, Yorks. Capt. Clive Behrens, Swinton Grange, Malton. Mr. J. Peters, Duncombe Park Estate Office, Helmsley.

II.	*Drummond's Pride. Mr. R. Rimmer, M.R.C.V.S., 52, Stramongate, Kendal.	Westmorland	25	Headquarters:—Kendal Travels Appleby, Askham, Shap, Windermere, Kirkby Lonsdale, and Milnthorpe.	Mr. G. G. Robinson, Underley Farm, Kirkby Lonsdale. Mr. T. H. Walton, Windermere. Mr. J. Wilson, Victoria Road, Penrith.
	Elector. Mr. A. McMahon, Colt Stud Farm, Abbeylax, Queen's County, Ireland.	Cumberland	25	Headquarters:—Aspatia. Travels Cockermouth, Penrith- dock, Penrith, High Hesketh, Brampton, Carlisle, and Wig- ton.	Mr. G. M. Bell, Land Agent, 1, Lonsdale Street, Carlisle. Mr. R. Edwin James, Manor House, Ough- terside, Carlisle. Mr. W. R. Mounsey, 20, King Street, Penrith. Mr. A. H. Macan, Greystoke, Cumberland.
	Hon. Jummy. Mr. W. S. Ridehalgh, Broughton Lodge, Grange-over-Sands.	Lancaster	25	Headquarters:—Grange-over- Sands. Travels Lindale, Flookburgh, Barrow-in-Furness, Roose, Dalton, Ulverston, Carnforth, and Lancaster.	Mr. John Blundell, Lower Burrow, Scot- forth, Lancaster. Mr. W. F. Egerton, Gawithfield, Ulverston. Mr. E. Whinnerah, Warton, Carnforth.
III.	*Birk Gill. Mr. E. Barlow, Sigsforth Pateley Bridge, Yorks.	Yorks (West Riding).	25	Headquarters:—Pateley Bridge. Travels Ripley, Harrogate, Knaresborough, Wetherby, Boroughbridge, and Ripon.	Mr. T. A. Hudson, Ridding House, Pannal, Harrogate. Mr. B. North, 31, Market Place, Ripon. Mr. T. Robinson, The Laurels, Wetherby.
	*Kilbrook. Messrs. E. & P. Hodg- son, Riding Fields Stud, Beverley.	Yorks (East Riding).	25	Headquarters:—Beverley Travels Lockington, Cranswick, Skirlaugh, Hessele, Swanland, and Bishop Burton.	Mr. E. C. Bainton, Red House, Beverley. Mr. J. Simons Harrison, Hurn Lodge, Beverley. Mr. F. Reynard, Sunderlandwick, Driffield.

* Indicates the award of a Super-Premium.
† Indicates the award of the King's Champion Challenge Cup.

District Class.	Stallion and Owner.	Free Nominations.		Route.	Stallion Committee.
		Countries to which allotted.	Number allotted.		
III. cont.	Wales. The Lord Middleton, Birdsall, Malton.	Yorks (East Riding).	25	Headquarters:—Birdsall .. Travels Seamer, Flixton, Ganton, Sherburn, and Weaverthorpe.	Mr. F. Reynard, Sunderlandwick, Driffeld. The Hon. T. Willoughby, Howsham Hall, York. Mr. E. Parsons, Birdsall, Malton.
	Bachelor's Lodge. Messrs. T. L. Wickham Boynton and H. A. Cholmondeley, Burton Agnes Hall, Driffeld.	Yorks (East Riding).	25	Headquarters:—Burton Agnes .. Travels Bridlington and Driffeld.	Mr. J. S. Chubb, Sledmere, York. Mr. B. C. Pennington, Estate Office, Burton Agnes, Driffeld. Mr. F. Reynard, Sunderlandwick, Driffeld.
	Tyldes. Dr. A. O. Haslewood, Fairfield Stud, Buxton.	Yorks (West Riding).	25	Headquarters:—Doncaster .. Travels Barnsley, Darfield, Selby, Pontefract, and Sheffield.	Mr. C. H. Taylor, Hampole Priory, Don- caster. Mr. Gordon B. Foster, M.F.H., White House, Carleton, Pontefract. Mr. E. A. Lycett-Green, Darrington Hall, Pontefract.
	Crathorne. The Lord Middleton, Birdsall, Malton.	Yorks (East Riding).	25	Headquarters:—Birdsall .. Travels Bossall, Stamford .. Bridge, Escrick, Market .. Weighton, and Pocklington.	Mr. F. Reynard, Sunderlandwick, Driffeld. The Hon. T. Willoughby, Howsham Hall, York. Mr. E. Parsons, Birdsall, Malton.
IV.	Indian Runner. Messrs. E. Barlow and D. Fraser, Sigsforth, Pateley Bridge, Yorks.	Nottingham Lincoln (Kesteven).	20 5	Headquarters:—Kelham .. Travels Grantham, Bottesford, .. Elton, Kinoulton, Plumtree, Fledborough, Tuxford, Oller- ton, Clipstone, and Winkburn.	Mr. F. Hardy, Staunton Hall, Nottingham. Mr. F. O. Thurman, Welldale, East Leake, Loughborough. Mr. O. Quibell, Shalem Lodge, Newark. Mr. T. Ellerby, Fiedborough, Newark.

IV. cont.	Ipswich. The Southwold Hunt Sire Association, Claythorpe Manor, Alford.	Lincoln (Lindsey)	25	Headquarters:—Alford. Travels Louth, Brocklesby, Horncastle, and Spilsby.	Mr. H. D. Addey, Claythorpe Manor, Alford. Mr. E. Crowder, Langton Manor, Horn- castle. Mr. W. B. Swallow, The Lawn, Wootton, Ulceby.
	King Crouse. Dr. A. O. Haslewood, Fairfield Stud, Buxton.	Derby	25	Headquarters:—Buxton .. Travels Bakewell, Derby, and Ashbourne.	Mr. A. P. Payne-Gallwey, Castle Hill, Bakewell. Messrs. Hampson Bros., 3, The Quadrant, Buxton. Major F. W. Peacock, Vernons Oak, Somersall Herbert, Derby.
V.	Origo. Dr. A. O. Haslewood, Fairfield Stud, Buxton.	Stafford	25	Headquarters:—Madeley .. Travels Trentham, Newcastle, .. Longton, Stone, Longdon, .. Penkridge, Stafford, Eccleshall, and Whitmore.	Mr. R. Carless, M.R.C.V.S., Stafford. Mr. J. Keen, Orgreave Gorse, Lichfield. Mr. J. H. Knight, Barr Hill, Madeley, Newcastle, Staffs. Mr. E. Woodcock, M.R.C.V.S., Eccleshall, Stafford.
	*Neyland. Capt. H. Heywood, Lonsdale, Shavington, Market Drayton.	Salop	25	Headquarters:—Market Drayton .. Travels High Ercall, Shrewsbury, Oswestry, Ellesmere, and Whitchurch.	Mr. T. Whitfield, Jnr., 12, Talbot Chambers, Shrewsbury. Mr. T. M. Parker, M.R.C.V.S., Whitchurch, Salop. Mr. H. W. Fell, Shavington Grange, Market Drayton. Mr. A. Mackenzie, F.R.C.V.S., Market Drayton. Mr. R. Hughes, F.R.C.V.S., Oswestry.

* Indicates the award of a Super-Premium.

District Class	Stallion and Owner.	Free Nominations.		Route.	Stallion Committee.
		Counties to which allotted.	Number allotted.		
VI. cont.	Royal Bow. Messrs. Flannery Bros., Churchtown, Buttevant, Co. Cork, Ireland.	Hereford ..	25	Headquarters:—Hereford Travels Ledbury, Ross, Leominster, and Bromyard.	Capt. E. L. Heygate, Buckland, Leominster. Mr. J. Bird, Ocle, Hereford. Mr. E. H. Landon, Bullingham, Hereford.
	Commodore. Dr. A. O. Haslewood, Fairfield Stud, Buxton.	Chester ..	25	Headquarters:—Nantwich Travels Crewe, Sandbach, Middlewich, Tarporley, Tarvin, Buxton, Bunbury, Hartford, Northwich, and Minshall Vernon.	The Rev. Canon J. R. Armitstead, The Vicarage, Sandbach. Mr. E. C. Griffiths, Broken Cross, Northwich. Sir Gilbert Greenall, Bart., Walton Hall, Warrington. Mr. J. J. Jersey de Knoop, Calverley Hall, Tarporley. Mr. J. W. Mackie, Rowton Hall, Chester. Mr. G. Norris Midwood, The Grange, North Rodé, Congleton. Mr. C. E. Parton, Haughton Hall Farm, Tarporley. Mr. B. D. Poole, Marbury Hall, Whitechurch.
VII.	*Red Sahib. Mr. David Davies, M.P., M.F.H., "Broneirion," Llandinam, Montgomery.	Montgomery	25	Headquarters:—Llandinam Travels Newtown, Kerry, Montgomery, Forde, Welshpool, Pool Quay, Llanymynech, Garthmyl, and Abermule.	Mr. T. Green, Bank, Pool Quay, Welshpool. Mr. R. F. Morgan, Snowfield, Kerry, Mont. Mr. E. R. Owen, Nag's Head, Garthmyl, Mont. Mr. E. C. Morgan, Crown Chambers, Newtown.

VII. cont.	Bachelor's Charm. Mr. D. Davies, M.P., M.F.H., "Broneirion," Llandinam, Montgomery.	Cardigan ..	25	Headquarters:—Lampeter Travels Aberystwyth, Tregaron, Llandysul, Newcastle Emlyn, and Cardigan.	Col. H. W. H. Brechley, Glaneirw, Cardigan. Mr. R. F. Rowland, The Garth, Llanio Road, Cardiganshire. Mr. J. Jones, Cwmere, Felinfach, Cardiganshire.
	Pedlar Brand. Mr. D. Davies, M.P., M.F.H., "Broneirion," Llandinam, Montgomery.	Glamorgan	25	Headquarters:—Cowbridge Travels Wenvoe, St. Fagans, Caerphilly, Merthyr, and Abercynnon.	Mr. E. T. Lloyd, West House, Llantwit Major, Cardiff. Mr. Ilyd Williams, Castleton, St. Athan, Cardiff. Col. W. Forrest, D.S.O., Plymouth Estate Office, St. Fagans, Cardiff.
VIII.	Just Cause. Mr. J. Griffiths, Jameston Court, Manorbier, Pembrokeshire.	Pembroke ..	25	Headquarters:—Haverfordwest Travels Boncath, Narberth, and Pembroke.	Mr. T. G. Phelps, Cresselly, Begelly, Pembro. Mr. R. H. B. Summers, Summerhill, Haverfordwest. Mr. J. Walters, Southwood, Roch, Pembro.
	Eglinton. Mr. John Griffiths, Jameston Court, Manorbier, Pembrokeshire.	Cardmarthen	25	Headquarters:—Cardmarthen. Travels Nantcareidig, Llanarney, Kidwelly, St. Clears, Whitland, Llanboidy, and Myddrum.	Capt. D. C. S. Gwynne, Cilgwyn, Llangadock, Cardmarthen. Mr. D. G. Protheroe, Glyntaf, Hebron, Cardmarthen. Mr. D. H. Thomas, Starling Park, Cardmarthen.
IX.	*Cilgandra. The Compton Stud, Sandley, Gillingham, Dorset.	Gloucester ..	25	Headquarters:—Gloucester Travels Stroud, Tetbury, Chip-ping Sodbury, and Berkeley Road.	Mr. M. G. Lloyd Baker, The Cottage, Hardwicke, Gloucester. Major the Hon. L. Byng, Avening, Stroud. Col. F. Henry, Elmstree, Tetbury.

* Indicates the award of a Super-Premium.

† Indicates the award of Reserve to King's Champion Challenge Cup.

District Class.	Stallion and Owner.	Free Nominations.		Route	Stallion Committee.
		Counties to which allotted.	Number allotted.		
IX. <i>cont.</i>	*Puro Caster. Lord Willoughby de Broke, Compton Verney, Warwick.	Warwick ..	25	Headquarters:—Kineton .. Travels Wellesbourne, Hamp- ton Lucy, Stratford-on-Avon, Oxhill, Fenny Compton, and Radway.	Lord Willoughby de Broke, Compton Verney, Warwick. Mr. C. Kendal, Mount Pleasant, Walton, Warwick. Mr. J. Lea, Charlecote, Warwick. Mr. J. Wilkes, Tredington, Shipston-on- Stour.
	Akbar. The Compton Stud, Sandley, Gillingham, Dorset.	Gloucester ..	25	Headquarters:—Northleach .. Travels Fairford, Cirencester, Tewkesbury, Cheltenham, and Kingham.	Mr. E. T. Prichard, Donnington Manor, Moreton-in-Marsh, Gloucester. Mr. A. Palmer, Fairford Park, Fairford. Mr. H. Dent Brocklehurst, Sudeley Castle, Winchcombe.
	Gold Medallist. Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.	Warwick .. Worcester ..	10 15	Headquarters:—Moreton Morrell. Travels Warwick, Kenilworth, Knowle, Alvechurch, Broms- grove, Droitwich, Studley, and Henley-in-Arden.	Mr. J. P. Arkwright, Hatton House, Hatton, Warwick. Mr. R. Cottrill, Sandal Lodge, Droitwich. Mr. E. Ringer, M.R.C.V.S., Guy Street, Leamington.
X.	*Chanteur. Mr. J. Drage, Chapel Brampton, Northampton.	Northampton	25	Headquarters:—Chapel Bramp- ton. Travels Northampton, Wellin- borough, Kettering, and Mar- ket Harborough.	Mr. J. Brown, Earls Barton House, North- ampton. Mr. E. Messinger, Chapel Brampton, Northampton. Mr. H. R. Roe, Cranoe, Market Harborough.

X. <i>cont.</i>	Royal Minister. Mr. M. J. Morrissey, Ballyneil Castle, Carrick-on-Suir, Co. Tipperary, Ireland.	Northampton	25	Headquarters:—Cothertone Paddocks, Althorpe Park. Travels Harlestone, Blisworth, Towcester, Brackley, Daven- try, and West Haddon.	Mr. W. Murland, Badby House, Daventry. Mr. W. George, Gayton, Blisworth, North- ampton. Mr. J. G. Lawrence, Newnham, Daventry. Capt. F. D. Alexander, Chapel Brampton, Northampton.
	Lord Harry. The Earl of Lonsdale, Barley Thorpe, . Oakham.	Rutland .. Leicester ..	10 15	Headquarters:—Oakham .. Travels Stamford, Uppingham, Melton Mowbray, and Lough- borough.	Mr. H. S. Black, Frisby-on-Wreake, Leicester. Mr. J. Northen, Thorpe-by-Water, Upping- ham. Mr. G. Underwood, Barley Thorpe, Oakham. Mr. D. Ward, Bescaby House, Melton Mowbray.
XI.	*Ulpian. Messrs. Eustace Barlow and D. Fraser, Sigsworth, Yorks. Pateley Bridge, Yorks.	Suffolk ..	25	Headquarters:—Hasketon, Woodbridge. Travels Ipswich, Manningtree, Stowmarket, and Saxmund- ham.	Mr. M. M. Barlow, Hasketon, Woodbridge. Mr. J. Keeble, Brantham Hall, Manning- tree. Mr. F. Stearn, Old Newton, Stowmarket.
	Faithful Don. Mr. Washington Charters, Horringer Manor, Bury St. Edmunds.	Suffolk .. Cambridge ..	15 10	Headquarters:—Nowton .. Travels Bury St. Edmunds, Long Melford, Haverhill, Mil- denhall, and Cambridge.	Mr. S. Jaggard, The Queech, Pakenham, Bury St. Edmunds. Mr. P. Brown, Rushbrooke, Bury St. Edmunds. Mr. H. Westrop, Long Melford. Mr. D. B. Ginn, Seatoller, Hills Road, Cambridge.
XII.	*Stortford. Sir Walter Gilbey, Bt., Elsenham, Stansted, Essex.	Essex ..	25	Headquarters:—Elsenham .. Travels Colchester, Chelmsford, and Romford.	Mr. T. Christy, Roxwell, Chelmsford. Mr. G. A. Newman, Panfield Hall, Braintree. Mr. H. Starling, The Paddocks, Elsenham, Stanstead, Essex. Mr. J. B. Young, F.R.C.V.S., Braintree.

* Indicates the award of a Super-Premium.

District Class.	Stallion and Owner.	Free Nominations.		Route.	Stallion Committee.
		Counties to which allotted.	Number allotted.		
XII. <i>cont.</i>	Vedanta. Mr. C. M. Prior, Adstock Manor, Winslow.	Buckingham	25	Headquarters:—Adstock Travels Winslow, Buckingham, Bletchley, Aylesbury, and Marsh Gibbon.	Mr. J. Varney, M.R.C.V.S., Winslow. Mr. W. C. Hazleton, M.R.C.V.S., Bucking- ham. Mr. T. W. Lepper, M.R.C.V.S., Aylesbury.
	Captain Jack. Mr. A. S. Bowlby, Gilston Park, Harlow.	Essex Herts	5 20	Headquarters:—Gilston Park Travels Harlow, Epping, Wal- tham, Hatfield, Hertford, and Much Hadham.	Mr. J. C. McCowan, Hatfield. Mr. J. Kirkby, Tharbies, Sawbridgeworth. Mr. E. Pigg, Chipping Hall, Buntingford. Mr. J. Hughes, Gilston Park, Harlow.
XIII.	*Hanover Square. Sir Merrik R. Burrell, Bart., Knepp Castle Stud, West Grinstead.	Sussex, West	25	Headquarters:—Knepp Castle Travels West Grinstead, Steyn- ing, Washington, Storrington, Petworth, and Billingshurst.	Mr. E. Brown, Stud Farm, Knepp Castle, West Grinstead. Mr. A. G. Hecks, Manor Farm, Sullington, Pulborough. Mr. J. B. Watson, Estate Office, Petworth.
	Rockaway. Mr. C. Kelway, Bamber, "Priestlands Stud," Martyrs, Crawley.	Kent Surrey	20 5	Headquarters:—Crawley Travels Redhill, Sevenoaks, Maidstone, Tonbridge, and Tunbridge Wells.	Mr. G. C. G. Leveson-Gower, Titsey Place, Limpsfield, Surrey. Mr. W. G. Lambardie, Bradbourne Hall, Sevenoaks. Mr. C. Murdoch, Wester Hill, Linton, Maidstone.

XIII. <i>cont.</i>	Gallas. Mr. R. C. Irving, Mr. S. F.R.C.V.S., 5, Halkin Place, Belgrave Square, London, S.W.	Sussex, East	25	Headquarters:—Lewes Travels Hassocks, Hayward's Heath, East Grinstead, Uck- field, Heathfield, Battle, and Polegate.	Mr. T. Kirby Stapley, M.F.H., Poynings, Ashburnham Gardens, Eastbourne. Mr. Watkin James, Fir Grove, Burgess Hill. Mr. H. T. Simmons, Wychmour, Battle. Mr. J. Hodson, Kingston Road, Lewes. Mr. J. E. Muggieridge, New Place, Fram- field, Uckfield.
	General Stössel. Mr. S. Mumford, Stud Farm, Moreton Morrell, Warwick.	Berks Hants	15 10	Headquarters:—Arborfield Travels Twyford, Maidenhead, Windsor, Ascot, Bracknell, Wokingham, Stratfieldsaye, Hartley Row, Odiham, and Yateley.	Mr. E. M. Sturges, Barkham Square, Wokingham. Mr. R. C. Tennant, F.R.C.V.S., 67, Thames Street, Windsor. Mr. R. H. Gosling, M.F.H., Hawthorn Hill, Bracknell. Mr. E. Bridger, Grey Well, Odiham.
XIV.	Magnum Charter. The Compton Stud, Sandley, Gillingham, Dorset.	Berks	25	Headquarters:—Wantage Travels Shrovenham, Faringdon, Kingsdon Bagpuze, and Abingdon.	Col. G. C. Ricardo, Donnington, Newbury. Major H. G. Henderson, M.P., Kiremore, Faringdon. Mr. E. Robson, Stockham, Wantage.
	Banquet. Messrs. Flannery Bros., Churchtown, Buttevant, Co. Cork, Ireland.	Hants	25	Headquarters:—Bishop's Wal- tham. Travels Titchborne, Alton, Basingstoke, Whitechurch, and Winchester.	Mr. J. F. Complin, Holybourne, Alton. Mr. F. Coryton, The Manor House, Greatham, Liss, Hants. Mr. R. Austin, Bishop's Waltham. Mr. T. A. Edney-Hayter, The Mount, Whitchurch. Sir Richard Rycroft, Bart., Dummer House, Basingstoke.

* Indicates the award of a Super-Premium.

District Class.	Stallion and Owner.	Free Nominations		Route.	Stallion Committee.
		Counties to which allotted.	Number allotted.		
XV.	*Darigal. The Compton Stud, Sandley, Gillingham, Dorset.	Dorset .. Somerset ..	10 15	Headquarters:—Sandley .. Travels Yeovil, Frome, and Shepton Mallet.	Mr. A. C. Clarke, Red Lion Hotel, Shepton Mallet. Mr. L. B. Beauchamp, Norton Hall, Bath. Major A. L. Langman, C.M.G., North Cadbury, Bath.
	Thistledown. The Compton Stud, Sandley, Gillingham, Dorset.	Wilts ..	25	Headquarters:—Chippenham Travels Melksham, Westbury, Devizes and Calne.	Mr. H. Mann, Semington, Trowbridge. Mr. F. Doble, Berwick Bassett, Swindon. Mr. V. T. Taylor, Steinbrook House, Chippenham.
	Bagotstown. The Compton Stud, Sandley, Gillingham, Dorset.	Somerset ..	25	Headquarters:—Taunton .. Travels Curry Rivel, Kingsdon, Glastonbury, Highbridge, and Worle.	Capt. M. Boyle, Staple Fitzpaine Manor, Taunton. Mr. G. Ford Tilley, Alstone Court, Huntspill, Bridgwater. Mr. H. A. Tiarks, Webbington House, Axbridge. Mr. T. F. Neal, Kingsdon, Taunton.
	Christmas Greeting. Mr. T. J. Hillman, Stud Farm, Stock Wood, Redditch.	Somerset ..	25	Headquarters:—Bishopsworth Travels Keynsham, Bath, Bridgegate, Filton, Avon- mouth, Long Ashton, Portis- head, Clevedon, and Wring- ton.	Mr. R. A. Bowring, Rockhill, Keynsham, Bristol. Mr. E. A. Hardwick, Springfield, Charlton Road, Weston-super-Mare. Mr. T. H. Pearce, Parsonage Farm, Long Ashton, Bristol.

XVI.	Golden Grebe. Messrs. W. and H. Whitley, Primley Farm, Paignton.	Cornwall ..	25	Travels Liskeard, Lostwithiel, St. Austell, Truro, St. Columb, Wadebridge, and Bodmin.	Mr. Coulter Hancock, 12, Princes Street, Truro. Mr. H. G. P. Hoblyn, Colquite, Washaway, Cornwall. Mr. C. Burleigh, Sportsman's Arms, Menheniot Station, Liskeard.
	Marzio. Mr. M. J. Taylor, Ermington, Ivybridge, Devon.	Devon ..	25	Headquarters:—Ermington .. Travels Plympton, Ivybridge, Brent, Totnes, Newton Abbott, Dawlish, and Exeter.	Mr. P. G. Bond, M.R.C.V.S., 105, Union Street, Plymouth. Mr. H. Brunskill, Buckland, Tout Saints, Kingsbridge, Devon. Mr. A. Hingston, Bridgetown, Totnes.
	Kano. Messrs. T. Yelverton and Sons, Otter Vale Stud, Venn Ottery, Ottery St. Mary, Devon.	Devon ..	25	Headquarters:—Venn Ottery .. Travels Honiton, Exeter, Crediton, Tiverton, and Cul- lampton.	The Hon. H. B. Money-Coutts, Stoodleigh Court, Tiverton. Major L. C. Garrett, Clyst St. Mary, Exeter. Mr. R. J. Brown, West End, Honiton.

* Indicates the award of a Super-Premium.

OFFICIAL NOTICES AND CIRCULARS.

For some years past the Board have had a stand at the principal Agricultural Shows in this country for the purpose of bringing to the notice of farmers and others the duties which the Board are called upon to perform, and the extent to which they are able to give assistance to all who are interested in farming, gardening and the allied industries. An exhibit is shown on these stands consisting mainly of descriptive and statistical diagrams, photographs, mounted specimens and models, together with the various publications issued by the Board. An important feature of the exhibit is the display of supplies of all the Board's leaflets arranged in racks for ready inspection by visitors who may take copies of any which specially interest them. During last year no fewer than 140,000 copies of the leaflets were distributed in this manner.

An officer of the Board is placed in charge of the stand and explains the work of the Board to visitors, or deals with enquiries. The number of shows visited has considerably increased during the past few years, for whereas only 3 shows were attended in 1906, the Board are now represented at 19 or 20 every season.

Arrangements are being made for the Board to have a stand at the following shows during the present year:—

DATE.	SOCIETY.	HELD AT.
1914.		
May 13-15 ..	Somerset County	Weston-super-Mare.
" 19-21 ..	Devon County	Totnes.
" 20-21 ..	Oxfordshire	Wallingford.
" 28 to June 2	Bath and West and Southern Counties.	Swansea.
June 4-5 ..	Suffolk	Bury St. Edmunds.
" 10-13 ..	Royal Counties	Portsmouth.
" 30 to July 4	Royal Agricultural Society of England.	Shrewsbury.
July 7-9 ..	Peterborough	Peterborough.
" 15-17 ..	Lincolnshire	Boston.
" 21-23 ..	Welsh National	Newport, Mon.
" 22-24 ..	Yorkshire	Bradford.
" 30 to Aug. 3	Royal Lancashire	Liverpool.
Aug. 6 ..	Madresfield	Madresfield.
" 12 ..	United Counties	Carmarthen.
" 26-27 ..	Warwickshire	Rugby.
Sept. 4 ..	Merioneth	Towyn.
" 5 ..	Mid-Cheshire	Knutsford.
" 23 ..	Altrincham	Altrincham.
Nov. 28 to Dec. 3	Birmingham Fat Stock ..	Birmingham.

No case of Foot-and-Mouth Disease has been confirmed on any premises in Great Britain since the 20th March last. The Board made

Foot-and-Mouth Disease.

an Order on the 16th April, withdrawing as from the 18th April all the restrictions then remaining on the movement of animals which had been imposed by them in connection with the outbreaks of Foot-and-Mouth Disease in Great Britain in February and March.

As regards the landing of cattle, sheep, goats or swine from Ireland, the Board have made Orders:—

(a) Permitting the landing, for the purpose of slaughter within the Landing Place within 96 hours after landing, of animals brought from any of the following ports, namely, Ballina, Belfast, Coleraine, Drogheda, Dundalk, Londonderry, Milford, Mulroy, Newry, Portrush, Sligo, and Westport, to the authorised Landing Place at Wallasey (Liverpool); and permitting the landing, for similar purposes only, of animals brought from Dublin or Wexford to any of the authorised Landing Places at Bristol (Avonmouth Dock), Cardiff, Deptford, Manchester, and Woodside (Liverpool);

(b) Permitting the landing of animals, not intended for slaughter within the Landing Places, brought from any of the following ports, namely, Ballina, Belfast, Coleraine, Dundalk, Greenore, Larne, Londonderry, Milford, Mulroy, Portrush, Sligo, and Westport to any of the authorised Landing Places at Ayr, Barrow-in-Furness, Fleetwood, Glasgow, Greenock, Heysham, Holyhead, and Stranraer.

Animals landed under the conditions (b) are required to be quarantined, under the supervision of Veterinary Inspectors of the Board, for a period of four days in the Landing Place, after which, if found free from a scheduled disease, they may be licensed from the Landing Place to a slaughter-house for slaughter, or to a place of detention at which they must be detained and isolated, under the supervision of a Veterinary Inspector of the Local Authority, for a further period of fourteen days unless previously slaughtered in the place of detention. Movement from the Landing Place into the District of a particular Local Authority is, however, subject to any Regulations made by such Local Authority for prohibiting or regulating the movement of animals into their District.

From June 1st to September 30th the Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of the cost of the telegrams. The forecasts are drawn up each week-day at 2.30 p.m., and refer to the probable weather during the fifteen hours from

Harvest Weather Forecasts.

6 a.m. to 9 p.m. on the next day. A note as to the further outlook is given when possible. Forecasts are also prepared at 9.30 a.m. and 7 p.m., and can be sent in lieu of the afternoon telegrams on payment of 1s. 6d. per week for either service in addition to the cost of the telegrams.

Applications for the forecasts should be sent to the Director, Meteorological Office, South Kensington, London, S.W., with a cheque or postal order to cover the cost of the telegrams for the period, which should not be less than six consecutive days, during which the forecasts are to be sent. The telegrams are estimated to consist of sixteen words, exclusive of the address.

The office is also prepared to send notification by telegram of the expected commencement of spells of fine weather, and such further telegraphic notifications as may be necessary in order to keep the recipient informed of any further alterations in the outlook. For such a service a fee of 5s., which includes the cost of the telegrams, is payable in advance for each series of telegrams.

Report on Allotments in 1913.—Part II. of the Annual Report of the Proceedings of the Board under the Small Holdings and Allotments Act 1908, and other Acts, for the year 1913 [Cd. 7336, price 3d.] deals with the provision of allotments during 1913, and with the proceedings undertaken in connection with the Light Railways Act, 1896, the Universities and College Estates Acts, 1858 to 1898, the Glebe Lands Act, 1888, the Improvement of Land Acts, the Settled Land Acts, and the Agricultural Holdings Acts.

Report on the Tithe, &c., Acts in 1913.—The Annual Report of the Proceedings of the Board under the Tithe, &c., Acts in 1913 [Cd. 7333, price 2½d.], is concerned with the work accomplished by the Board during 1913 under the Tithe Acts, 1836 to 1891, the Copyhold Act, 1894, the Conveyancing and Law of Property Act, 1881, the Inclosure and Commons Acts, 1845 to 1899, and the Commons Act, 1908.

Report of the Commercial Control Branch for 1913.—The Commercial Control Branch of the Board undertakes inquiries and correspondence as to the administration of the Sale of Food and Drugs Acts, 1875 to 1907; the administration of the Fertilisers and Feeding Stuffs Act, 1906; prosecutions under the Merchandise Marks Acts, 1887 to 1894; and questions as to the transport and marketing of agricultural produce and the produce of any fishing industry. The recently issued Report of this Branch for 1913 [Cd. 7354, price 4d.] deals with the proceedings under these various Acts during that year.

Report on Small Holdings in 1913.—This Report [Cd. 7328, price 3d.] is referred to at p. 157.

Acreage and Live Stock Returns, 1913.—This Report [Cd. 7325, price 6d.] has been issued, and forms Part I. of the Agricultural Statistics for 1913.

MISCELLANEOUS NOTES.

Importation of Animals into Greece.—The Board have received information, through the Foreign Office, of a Royal Decree, dated March 2nd, 1914, regulating the importation of animals into Greece.

Importation Regulations.

The Decree provides that animals entering Greece from any country where glanders, cattle plague, pleuro-pneumonia, swine fever, swine erysipelas, foot-and-mouth disease, sheep pox, sheep scab, anthrax or rabies exist will be detained and examined at the quarantine stations. This examination is carried out only in the case of those species of animals which are liable to communicate contagion or to be attacked by the disease prevalent in their country of origin. The importation of animals from places infected with cattle plague, swine fever and anthrax is prohibited. Animals visibly suffering from any contagious disease, together with any other animals shipped at the same time, will be refused entry. Goats and sheep attacked by sheep pox may be imported through quarantine stations only, and must be examined by a veterinary surgeon and slaughtered on the spot within a short time for public sale.

Export of Animals to New Zealand.—The Board have been informed, by the High Commissioner for New Zealand, that a reduction has been made in the fees charged for the examination of animals at the ship's

side prior to shipment to the Dominion. The new scale of charges, which came into force on April 1st last, is as follows:—

	£	s.	d.
Any number of animals up to 4, of any kind or kinds, in one consignment	1	1	0
Any number over 4 and up to 8, each additional animal	5	0	
Any number over 8, each additional animal	2	6	
Maximum charge	3	3	0

"Certified" Milk in the United States.—This movement originated in New Jersey, where the first medical milk commission was founded in 1893. Its objects were to establish correct clinical standards of purity for cows' milk, to become responsible for a periodical inspection of the dairies under its patronage,

to provide for chemical and bacteriological examinations of the product, and to arrange for the frequent scrutiny of the stock by competent veterinarians. The three general requirements as to the milk produced by the controlled dairies were: (1) absence of large numbers of micro-organisms, and the entire freedom of the milk from pathogenic species; (2) unvarying resistance of the milk to early fermentative changes, so that it may be kept under ordinary conditions; (3) a constant nutritive value of known chemical composition, and a uniform relation between the percentage of fat, proteids and carbohydrates. A chemist and a bacteriologist examined samples of the milk, which they obtained themselves, twice each month, while a veterinarian examined the cows at a similar interval, reports being made to the commission on their findings. In addition to this, representatives of the commission made a monthly inspection of the dairies and reported the result to the main body. The commission certified the milk only when these reports were satisfactory.

In 1904 the term "certified milk" was registered as a patent, in order that it might be applied exclusively to milk produced by dairies under the supervision of a medical milk commission. The standard to which "certified milk" was required to conform varied considerably at first in the case of different commissions, and for this reason a fixed standard was adopted in 1912 by the American Association of Medical Milk Commissions. The most important provisions were as follows: The milk should reach the consumer within 30 hours after milking; it must contain from 3.5—4.5 per cent. of fat, between 3 and 4 per cent. of protein, and be free from colouring matter and preservatives. It must contain less than 10,000 bacteria per cubic centimetre when delivered, and every possible precaution should be taken to exclude pathogenic micro-organisms. The purity of the milk must be safeguarded by a medical guarantee of the health and personal hygiene of every employee handling the milk, and by the veterinary supervision of the herd, which must be free from tuberculosis, as shown by the proper application of the tuberculin test. Elaborate rules were drawn up to ensure the cleanliness of the dairy, and all utensils used in connection with the production of milk, as well as of all the employees who take part in the dairying operations.

In 1912 an effort was made to obtain correct data as to the medical milk commissions then in existence. Replies were received from 63 commissions, and it was found that 20 had become inactive, either through lack of demand for certified milk or because of their inability

to find dairymen who would submit to the regulations. The number of dairies producing milk for any one commission varied from 1 to 20, while the total number connected with the 63 commissions was 126. The smallest amount of milk passed by any one commission was 75 to 100 quarts a day, while the largest amount was 10,750 quarts. Ninety-two certified dairies reported the total quantity of milk produced as 16,630 gallons daily, and as there were 126 certified dairies in all, the total daily production probably reached 25,000 gallons. A former investigation, carried out in 1907, showed a daily output of 6,000 gallons, so that in the five years from 1907 to 1912 there was an increase in the production of certified milk of about 300 per cent.

From the figures obtained in the 1912 investigation it appeared that only about 0.5 per cent. of the total milk supply of the United States was certified. It has been found very difficult to impress the public with the importance of securing a pure milk supply, the chief obstacle being the considerably higher cost of certified milk. The price varied in different cities from 5d. to 10d. per quart, the average price being about 7d., while the cost of ordinary market milk in the same cities was between 2½d. and 6d. per quart, with an average of about 4d. (*U.S. Dept. of Agriculture, Bulletin No. 1.*)

Third International Congress of Tropical Agriculture.—With reference to the note in this *Journal* for January, 1914, p. 928, regarding this Congress, which is to be held at the Imperial Institute, London, S.W., from 23rd. to 30th June, 1914, the Board have received a copy of the Members' Circular describing arrangements for the Congress.

The Congress is being supported by British, colonial and foreign governments, and by numerous British and foreign associations and institutions interested in tropical agriculture or colonial development. A large number of papers on cotton, fibres, rubber, cocoa, and other important tropical products have already been promised by well-known authorities on these subjects, so that the success of the Congress on the technical side is already held to be assured.

Communications should be addressed to the Organising Secretaries, Third International Congress of Tropical Agriculture, Imperial Institute, London, S.W.

Exhibition of Horses and Donkeys in Paris.—The Board of Agriculture and Fisheries are informed that an Exhibition of native breeding horses and donkeys will be held on the Champ de Mars, Paris, from the 17th to the 21st June, under the direction of the French Ministry of Agriculture.

The *Bulletin of Agricultural and Commercial Statistics* for April, 1914, issued by the International Institute of Agriculture, gives the

Notes on Crop Prospects Abroad.

condition of winter cereals on April 1st as follows (100 being taken to represent the prospect of an average crop):—*Wheat*—Denmark, 101; Spain and Scotland, 100; Luxemburg, 93; Rumania, 125; Switzerland, 99; United States, 112; Egypt, 95; Tunis, 70. *Rye*—Denmark, 109; Spain, 100; Luxemburg, 94; Rumania, 125; Switzerland, 97; United States, 102. *Barley*—Spain, 100; Luxemburg, 106; Rumania, 125; Switzerland, 98; Egypt, 93; Tunis, 65. *Oats*—Spain, 100; Tunis, 75.

Spain.—The final figures of the harvest of 1913 place the production of wheat at 14,046,000 qr., which is equal to an increase of 2.4 per cent. as compared with 1912. Rye amounted to 3,256,000 qr., an increase

of 48.0 per cent.; barley to 8,250,000 qr., an increase of 14.6 per cent.; oats to 2,598,000 qr., an increase of 10.0 per cent.; and maize to 2,932,000 qr., an increase of 0.3 per cent.

Algeria.—The final results of the cereal harvest give the production of wheat in 1913 as 4,605,000 qr., or 35.6 per cent. more than in 1912. Barley totalled 6,002,000 qr., an increase of 52.1 per cent.; oats 1,843,000 qr., an increase of 45.5 per cent.; and maize 46,000 qr., an increase of 5.3 per cent.

Argentina.—The second estimate of the cereal harvest in 1913-14 gives the estimated production of wheat as 14,693,000 qr., which shows a decrease of 37.3 per cent. as compared with 1912-13. The crop of oats is estimated at 5,227,000 qr., a decrease of 32.7 per cent.; and maize at 37,694,000 qr., an increase of 66.2 per cent.

Holland.—An official report relating to the condition of winter crops on April 10th stated that the weather during the autumn of 1913 was favourable for sowing and the generally mild winter enabled the crops to develop satisfactorily. Cold wet weather in March, however, somewhat hindered growth, but a noticeable improvement had taken place at the date of the report. The condition of winter wheat and barley was generally good, although in the west of North Brabant prospects were only moderate, while the condition of winter rye was very good in the northern provinces and good elsewhere. Clover was everywhere good or very good.

A similar report of April 15th stated that strawberries were fairly good in the Westland and in the Ysselmonde district, and good elsewhere. (*H.M. Acting Consul General at Rotterdam.*)

France.—The *Journal Officiel* of April 9th gives the condition of the cereals on April 1st as follows:—Winter wheat, 70 compared with 74 at the same date in 1913; spring wheat, 72 compared with 73; and rye, 73 compared with 76. (80 = very good, 60 = good.)

Germany.—The weekly report of the German Agricultural Council, dated May 2nd, states that at the beginning of the week rain fell in many districts, but in most the amount was insignificant. In some districts no rain fell at all. On the 26th and 27th April slight night frosts were frequent. In most districts vegetation has progressed but little, and where no rain fell growth was at a standstill. Nevertheless, the condition of winter wheat is reported good, neither night frosts nor drought having, so far, had an adverse effect. Winter rye, especially on light soils is, however, frequently unsatisfactory and requires rain. Rain is also needed for the spring crops.

Prussia.—An official report relating to the beginning of May gives the condition of winter wheat as 2.6 compared with 2.6 in April, 1914, and May, 1913; winter rye as 2.6 compared with 2.4 and 2.7; winter barley as 2.8 compared with 2.8 and 2.7; and clover as 2.6 compared with 2.6 and 2.5 respectively (2 = good, 3 = average). Of the area sown with winter wheat, 4.17 per cent. (101,305 acres) have been ploughed up. The proportion of barley ploughed up was 7.94 per cent. (6,170 acres); of rye, 0.79 per cent. (90,555 acres); and of clover, 1.31 per cent. (41,069 acres). (*Statistische Correspondenz*, May 5th.)

Austria.—The production of hops in Bohemia in 1913 is officially estimated at 124,428 cwt. compared with 324,303 cwt. in 1912 and 181,126 cwt. the average of the ten years, 1903-12. The area under the crop was 37,984 acres, compared with 37,280 acres in 1912, and 38,036 acres the average of the ten years, 1903-12.

Hungary.—The official report of April 6th stated that variable weather was experienced during the month under review, and spring work had proceeded slowly. The sowing of spring barley and oats, however, although interrupted by rain, was mostly completed, except in the hill districts. That sown early had everywhere germinated well and was healthy, but the weather had adversely affected the later sown crops. Autumn-sown wheat, rye and barley, which had germinated before the winter frosts set in, are healthy, even crops; but much of that sown late did not germinate till the spring, and a thin plant has been obtained. All corn crops now require warm, dry weather.

New Zealand.—The Government Statistician estimated on February 24th the yield of this season's (1913-14) crops as follows:—Wheat, 673,596 qr., oats 1,863,532 qr., barley 149,596 qr., potatoes 192,636 tons, turnips 7,705,991 tons, and mangolds 286,352 tons.

The final estimates for 1912-13 were as follows:—Wheat 713,237 qr., oats 1,858,806 qr., barley 170,819 qr., potatoes 155,835 tons, turnips 6,496,213 tons, and mangolds 428,142 tons.

Western Australia.—The February issue of the *Monthly Statistical Abstract* of this colony publishes the following estimates of the production of the 1913-14 cereal crops (in bushels, with 1912-13 figures in brackets):—Wheat, 14,005,994 (9,168,594); barley, 263,858 (93,418); and oats, 2,327,624 (2,105,812).

The supply of agricultural labour in England and Wales during April was, according to statements in the Board's Monthly Agricultural Report (May 1st, 1914), on the whole not deficient, although very few districts reported any abundance. At those hirings which took place since the last report, some increase in wages continued to be reported. The following summaries give particulars of the increases and refer also to those districts of the country in which the supply of labour was insufficient.

Northumberland and Durham.—In east Northumberland wages rose about 1s. per week. In Durham the supply was quite sufficient, taking the county as a whole, and at the recent hirings hinds' wages generally rose, except in the south-west, the rise varying from 1s. to 3s. per week. An increase of wages for farm servants is expected at the May hirings.

Lancashire and Cheshire.—In Lancashire the supply of labour was deficient in the south, and rather scarce in the south-west, the west, and in North Lonsdale, and extra men were rather scarce in the middle of the county. In the south-east wages rose by about 2s. a week. All classes of labour were scarce in north-east Cheshire.

Yorkshire.—Some scarcity was mentioned in an eastern district of the East Riding, in the Cleveland district, around Leeds, and in the east of the West Riding.

Shropshire and Stafford.—Skilled men were hard to obtain as a rule. In north Shropshire, however, shortage was more especially noticeable among temporary hands.

Derby, Nottingham, Leicester and Rutland.—In most districts the supply was rather deficient, chiefly as regards skilled men. Good milkers were difficult to obtain in south Notts.

Lincoln and Norfolk.—In north-west Lincoln the supply of labour for planting potatoes was rather short and wages tend to rise. In north-east Lincoln wages were raised 3d. per day as from April 6th. The

supply was rather short in South Kesteven, east Holland, and in one part of east Norfolk. In west Holland wages were about 1s.6d. per week higher than a year ago.

Bedford, Northampton, Warwick, Buckingham and Oxford.—In east Northants labour was deficient, and boy labour was scarce in north-west Bedford. In north-east Warwick there was a dearth of temporary men as well as of good permanent labourers. The supply was deficient in south Bucks; and in north Oxford stockmen were difficult to obtain.

Cornwall and Devon.—There was some shortage in mid-Cornwall and in south and west Devon.

Surrey, Kent and Hertford.—The supply was deficient in parts of Surrey and Kent, and in north, and parts of south-east Hertford.

Wales.—The supply, especially of skilled labour, was short of requirements in many districts.

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on May 1st, report that, "after the first week or ten days of April, the country very generally experienced a dry and warm spell that lasted till the end of the month. The change to warmer weather mostly suited the winter crops, which are nearly everywhere looking quite satisfactory and promising. But the droughty conditions, accompanied as they generally were by cool nights, effected a rather too sudden change in conditions, and the land, more particularly in the south of England and on heavy soils, quickly became baked. Cultivation of the land was consequently much hindered, and the sowing of spring crops interrupted. Where showing, the young crops are looking well, but are in need of rain."

Potato planting has generally made good progress, and in some districts is nearly completed. Conditions were favourable in Lancashire, Lincolnshire, and the north generally, but in the south the dry state of the ground has impeded progress on heavy land.

The progress of mangold sowing varies: on the whole, this work is probably rather late, as many farmers are waiting for rain, either for the proper preparation of the land or for the actual sowing. In the north, conditions have been more favourable, and in some districts sowing is nearly completed.

There is everywhere abundance of blossom on the fruit trees, and prospects, up to the present, are generally promising. Although cold nights during April gave rise to some apprehension, comparatively little damage appears to have been done, on the whole, by frost; but the present time is critical, and frost now would materially alter the situation.

Seeds, on the whole, are poor, being often thin and patchy, although in almost all parts of the country there are many satisfactory fields. In the north and in Wales, the position is much better. Not much growth was made during the month, owing to the dry weather and cold nights, and rain is wanted. This applies also, and perhaps with greater force, to permanent grass, which is very backward, and in many places pastures are very bare. The fine weather during the month has suited all classes of stock, which are thriving.

Lambing is now practically over, and the results may be regarded as satisfactory. In the north and other late districts the fall of lambs

was generally over average, while in the south it has been, with few exceptions, quite up to the average. Ewes and lambs are reported strong and healthy, and losses have been less than usual, though there are instances to the contrary."

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on May 1st, 1914, certain diseases of animals existed in the countries specified:—

Austria (on April 22nd).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 298 Höfe infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period April 1st—15th).

Anthrax, Blackleg, Rabies.

Bulgaria (for the period April 6th—14th).

Anthrax, Foot-and-Mouth Disease, Glanders, Sheep-pox, Sheep-scab, Swine Fever.

Denmark (month of March).

Anthrax, Swine Erysipelas, Swine Fever.

France (for the period April 12th—18th).

Anthrax, Blackleg, Foot-and-Mouth Disease (23 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period April 1st—15th).

Foot-and-Mouth Disease (109 infected places in 60 parishes), Glanders and Farcy, Swine Fever.

Holland (month of March).

Anthrax, Foot-and-Mouth Disease (2 outbreaks in 2 provinces), Foot-rot, Glanders, Swine Erysipelas.

Hungary (on April 8th).

Anthrax, Dourine, Foot-and-Mouth Disease (total of 458 "cours" infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period April 6th—12th).

Anthrax, Blackleg, Foot-and-Mouth Disease (366 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Montenegro (for the period March 1st—15th).

Glanders, Sheep-pox.

Norway (month of March).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period March 29th—April 5th).

Anthrax, Dourine, Foot-and-Mouth Disease (15,491 animals), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas.

Russia (month of December).

Anthrax, Foot-and-Mouth Disease (79,082 animals in 750 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period March 28th—April 4th).

Glanders, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Spain (month of February).

Anthrax, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of March).

Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (for the period April 6th—12th).

Anthrax, Blackleg, Foot-and-Mouth Disease (145 "étables" entailing 1,638 animals, of which 27 "étables" were declared infected during the period), Swine Fever.

The Weather in England during April.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
<i>Week ending Apr. 4th:</i>	°F.	°F.	Inches.	Inches.		Hours.	Hours.
England, N.E. ...	48.9	+7.1	0.25	-0.13	3	4.2	-0.6
England, E. ...	49.3	+6.5	0.31	-0.08	4	3.5	-1.3
Midland Counties ...	49.3	+6.6	0.48	+0.09	5	3.3	-1.0
England, S.E. ...	49.5	+5.5	0.40	+0.04	4	3.8	-0.9
England, N.W. ...	48.5	+5.9	0.51	-0.05	5	4.2	+0.1
England, S.W. ...	49.7	+5.5	0.94	+0.35	5	4.0	-0.8
English Channel ...	50.3	+3.7	0.64	+0.17	4	4.9	-0.7
<i>Week ending Apr. 11th:</i>							
England, N.E. ...	46.3	+3.8	0.42	+0.04	6	5.4	+0.3
England, E. ...	47.6	+3.8	0.39	+0.05	5	5.4	+0.3
Midland Counties ...	46.6	+2.8	0.68	+0.27	6	5.0	+0.3
England, S.E. ...	47.8	+2.6	0.79	+0.47	6	5.4	+0.4
England, N.W. ...	46.1	+2.4	0.50	-0.02	5	4.6	+0.4
England, S.W. ...	46.8	+1.5	1.26	+0.72	6	4.7	-0.4
English Channel ...	49.4	+2.8	0.76	+0.34	6	5.2	-0.8
<i>Week ending Apr. 18th:</i>							
England, N.E. ...	46.7	+3.3	0.00	-0.35	0	10.1	+5.1
England, E. ...	46.7	+2.1	0.00	-0.35	0	10.7	+5.6
Midland Counties ...	46.8	+2.2	0.00	-0.40	0	10.7	+6.0
England, S.E. ...	47.9	+1.9	0.00	-0.33	0	10.3	+5.2
England, N.W. ...	47.7	+3.1	0.07	-0.40	1	9.8	+5.1
England, S.W. ...	47.7	+1.7	0.00	-0.50	0	10.2	+4.9
English Channel ...	50.3	+2.1	0.00	-0.42	0	9.6	+3.4
<i>Week ending Apr. 25th:</i>							
England, N.E. ...	51.4	+6.9	0.11	-0.25	2	8.6	+3.7
England, E. ...	51.3	+5.5	0.10	-0.26	1	7.8	+2.6
Midland Counties ...	52.4	+6.6	0.01	-0.39	1	8.5	+3.7
England, S.E. ...	52.7	+5.7	0.04	-0.36	1	8.5	+3.2
England, N.W. ...	52.1	+6.3	0.17	-0.28	2	8.4	+3.3
England, S.W. ...	53.0	+6.1	0.02	-0.52	1	9.3	+3.8
English Channel ...	53.7	+4.8	0.04	-0.43	1	9.1	+2.7
<i>Week ending May 2nd:</i>							
England, N.E. ...	48.3	+2.4	0.05	-0.32	1	7.6	+2.4
England, E. ...	47.8	+0.6	0.00	-0.39	0	8.0	+2.4
Midland Counties ...	48.9	+1.6	0.01	-0.43	1	7.1	+2.0
England, S.E. ...	49.3	+0.9	0.02	-0.44	1	8.8	+3.1
England, N.W. ...	47.7	+0.6	0.02	-0.48	1	7.3	+2.1
England, S.W. ...	50.9	+2.8	0.05	-0.57	1	8.9	+3.2
English Channel ...	53.5	+3.6	0.07	-0.45	1	9.0	+2.3

Unit Prices of
Artificial Manures.Statement of cost to the purchaser of 1 per
cent. per ton of Nitrogen, Soluble and In-
soluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d.	s. d.	s. d.	s. d.
Nitrogen from:				
Sulphate of Ammonia } 95% pure	13 3	13 1	12 10	12 10
Calcium Cyanamide ...	11 10	11 10	11 10	12 1
Nitrate of Soda } 95% pure... .. } 90%	15 0	14 5	14 0	14 8
Nitrate of Lime	15 10½	16 3	15 3	15 4
Soluble Phosphates from:				
Superphosphate 35%	1 8	1 7	1 9	1 10
" 33%	1 8½	—	1 9	1 10
" 30%	1 8½	1 8	1 9½	1 11
" 26%	1 10	1 9	1 10½	2 1
Dissolved Bones	2 6	2 8	2 4	2 5
Allowed for Nitrogen	18 1	18 11	16 4	16 11
Allowed for Insol. Phos.	1 10	2 0	1 9	1 9
Insoluble Phosphates from:				
Basic Slag	1 6	—	1 6	1 3
Bone Meal	1 7½	1 7	1 6	1 6
Allowed for Nitrogen	15 9	15 3	13 9	14 5
Steamed Bone Flour ...	1 4	1 6	1 3	1 4½
Allowed for Nitrogen	12 9	14 0	12 1	13 3
Potash from:				
Kainit	4 0½	3 11	4 0	4 3
Sulphate of Potash ...	4 8	4 3	4 5	4 8
Muriate of Potash ...	3 11	3 7½	3 6	4 0
Potash Salts	—	—	3 2½	—

NOTE.—These unit prices are based on the probable retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified. They are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the per-

various sources, at certain Ports and Manufacturing Centres, for May, 1914.

Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
13 2	{ 12 8 93% pure.	{ 12 8 93% pure.	13 5	12 11	13 8
—	11 10	—	11 11	11 10	11 10
14 3	13 3	13 5	15 6	14 6	14 6
—	13 3	—	15 8	15 8	15 6
—	—	—	—	—	—
1 10½	1 9½	1 8½	1 10	1 9½	1 10
—	1 9½	1 8½	1 10½	1 10	1 10½
1 11	1 9½	1 8½	1 10½	1 10	1 10½
2 1	1 11	1 10	2 0	2 0	2 0
2 6	2 6½	2 6	2 7	2 7	2 8
17 7	18 3	18 4	18 7	18 6	18 10
1 10	1 11	1 11	2 0	1 11	2 0
—	—	—	—	—	—
1 6½	1 3	1 1	1 5	1 8	1 7½
14 11	1 6½	1 6	1 6	1 5	1 8
1 4	14 7	14 7	13 7	14 0	15 6
13 3	—	—	1 3	1 4½	1 5
—	—	—	13 2	13 5	13 10
4 3	4 4½	4 3	4 3	4 4½	4 4½
4 9	4 5	4 6	4 9½	4 10	4 9
4 0	3 8	3 8½	—	4 2½	4 4
3 3½	—	—	—	—	—

centages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and re-bagging the ingredients, bags, and loss of weight.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in April and March, 1914.

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

Description.	APRIL.		MARCH.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots ...	9 2	8 11	9 4	9 2
Herefords ...	9 2	8 8	9 3	8 9
Shorthorns ...	9 0	8 4	9 1	8 6
Devons ...	9 0	8 3	9 0	8 4
Welsh Runts ...	9 2	8 8	9 5	9 0
	per lb.*	per lb.*	per lb.*	per lb.*
Veal Calves ...	d.	d.	d.	d.
	10½	9½	10	8½
Sheep:—				
Downs ...	10	9½	10½	9½
Longwools ...	9	8	9½	8½
Cheviots ...	11½	10½	10½	10
Blackfaced ...	11½	10½	10½	10
Welsh ...	10	9	10	9½
Cross-breds ...	9½	9	10	9½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs ...	8 0	7 7	8 4	7 10
Porkers ...	8 7	8 1	8 11	8 5
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	23 4	19 8	23 12	19 17
„ —Calvers ...	22 1	18 9	22 7	18 17
Other Breeds—In Milk ...	21 13	17 10	21 10	17 18
„ —Calvers ...	—	15 17	18 0	16 5
Calves for Rearing ...	2 12	2 1	2 13	2 0
Store Cattle:—				
Shorthorns—Yearlings ...	12 6	10 12	12 8	10 17
„ —Two-year-olds... ..	16 15	14 18	16 12	14 13
„ —Three-year-olds... ..	21 1	18 7	19 16	17 10
Herefords —Two-year-olds... ..	18 19	16 5	18 15	16 11
Devons— „	17 8	15 5	17 4	15 1
Welsh Runts— „	16 17	14 5	18 5	16 2
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	53 3	47 2	50 11	44 10
Store Pigs:—				
8 to 12 weeks old ...	28 4	22 0	28 7	22 3
12 to 16 weeks old ...	40 10	31 8	40 7	31 9

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in April, 1914.

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

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF:—						
English ...	1st	61 0	59 6	59 6	60 6	62 6
	2nd	56 0	57 0	56 6	57 0	59 6
Cow and Bull ...	1st	53 0	53 6	50 0	48 0	52 0
	2nd	48 0	49 0	44 6	43 6	47 0
Irish: Port Killed ...	1st	58 6	56 6	56 0	56 6	58 0
	2nd	56 0	54 0	52 6	53 6	53 0
Argentine Frozen— Hind Quarters ...	1st	43 0	44 0	43 0	43 0	43 0
Fore „	1st	38 0	38 0	38 0	36 6	38 0
Argentine Chilled— Hind Quarters ...	1st	47 0	46 6	45 6	46 6	45 6
Fore „	1st	37 0	37 0	35 6	34 6	36 0
Australian Frozen— Hind Quarters ...	1st	41 6	41 0	42 0	40 6	41 0
Fore „	1st	36 6	36 6	35 6	33 6	36 0
VEAL:—						
British ...	1st	80 6	80 6	87 6	76 6	85 6
	2nd	75 6	73 6	77 0	69 6	79 0
Foreign... ..	1st	—	74 0	—	77 0	—
MUTTON:—						
Scotch ...	1st	—	—	80 6	86 6	90 0
	2nd	—	—	83 6	77 0	85 6
English... ..	1st	76 0	79 0	83 0	77 0	80 6
	2nd	68 0	74 0	78 6	67 6	70 6
Irish: Port Killed ...	1st	78 0	—	77 0	—	—
	2nd	70 0	—	70 0	—	—
Argentine Frozen ...	1st	40 0	41 6	41 6	39 0	41 6
Australian „	1st	38 6	38 6	36 6	38 0	36 6
New Zealand „	1st	—	—	—	44 6	—
LAMB:—						
British ...	1st	100 0	114 0	103 6	112 0	108 6
	2nd	93 6	106 0	93 6	102 6	98 0
New Zealand ...	1st	59 6	60 0	57 0	60 0	57 6
Australian ...	1st	56 0	52 6	53 6	53 6	52 6
Argentine ...	1st	53 6	53 0	53 6	51 6	54 6
PORK:—						
British ...	1st	76 0	70 0	74 6	66 0	76 6
	2nd	70 0	67 0	65 6	58 0	71 0
Foreign... ..	1st	67 0	65 6	65 6	61 6	66 0

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 1912, 1913 and 1914.

Weeks ended (in 1914).	WHEAT.			BARLEY.			OATS.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Jan. 3...	s. d. 33 2	s. d. 30 5	s. d. 31 1	s. d. 33 3	s. d. 28 6	s. d. 26 2	s. d. 20 7	s. d. 19 10	s. d. 18 2
" 10...	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
" 17...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
" 24...	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
" 31...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb. 7...	34 0	31 0	31 0	33 2	28 10	26 7	21 4	20 1	18 9
" 14...	34 4	30 9	31 0	32 10	29 1	26 7	21 7	20 2	18 11
" 21...	34 6	30 11	31 0	32 8	28 8	26 7	21 9	20 7	18 11
" 28...	34 1	31 0	31 0	32 0	28 6	26 6	21 6	20 4	18 11
Mar. 7...	34 1	31 3	31 5	31 7	28 5	26 2	21 8	20 0	18 9
" 14...	34 0	31 1	31 6	31 2	27 11	26 0	21 8	20 2	18 7
" 21...	34 1	31 1	31 5	31 10	28 6	25 8	21 9	19 11	18 6
" 28...	34 4	31 3	31 4	30 3	27 6	25 7	21 8	19 7	18 8
Apl. 4...	34 10	31 4	31 6	30 9	27 0	25 6	21 11	19 2	18 5
" 11...	35 4	31 3	31 5	30 2	27 8	26 8	22 1	19 2	18 4
" 18...	36 7	31 6	31 7	29 11	26 11	25 4	22 4	18 10	18 4
" 25...	37 10	31 8	31 9	30 4	26 7	26 6	22 9	19 3	18 5
May 2...	38 1	32 2	31 9	30 2	25 11	26 0	23 1	19 6	18 5
" 9...	37 11	32 6	32 2	31 1	25 9	25 6	23 7	19 6	18 9
" 16...	37 8	32 10		31 2	25 4		23 7	19 9	
" 23...	37 2	32 10		31 1	25 3		23 7	19 11	
" 30...	36 10	32 7		30 0	26 1		23 9	20 1	
June 6...	36 11	32 10		29 11	26 2		24 0	19 8	
" 13...	37 0	32 8		30 8	24 7		23 10	20 2	
" 20...	37 5	32 8		30 8	23 10		24 0	19 8	
" 27...	37 10	32 8		30 2	24 3		23 11	19 1	
July 4...	38 2	33 1		31 7	25 2		23 11	21 0	
" 11...	38 3	33 4		30 2	25 10		24 1	19 4	
" 18...	38 10	33 6		30 9	24 9		24 8	20 5	
" 25...	38 9	33 10		30 9	24 1		23 4	20 8	
Aug. 1...	38 4	34 1		28 6	24 5		22 2	20 3	
" 8...	39 2	34 1		30 7	24 9		22 4	19 0	
" 15...	38 2	34 3		28 3	24 7		21 8	18 7	
" 22...	35 6	33 7		28 1	26 5		20 10	18 8	
" 29...	34 10	32 7		28 6	29 0		20 8	17 10	
Sept. 5...	35 1	31 11		29 9	30 11		21 8	17 8	
" 12...	33 5	31 9		29 0	31 5		20 5	18 0	
" 19...	32 7	31 7		29 6	30 9		19 10	17 11	
" 26...	31 7	31 6		29 9	30 1		19 5	17 9	
Oct. 3...	31 8	31 3		29 7	29 9		19 8	17 10	
" 10...	31 10	31 0		30 4	29 1		19 5	17 10	
" 17...	32 2	30 11		30 11	28 8		19 9	17 9	
" 24...	33 1	30 7		31 6	28 7		19 10	18 0	
" 31...	33 4	30 1		31 10	28 2		20 1	17 9	
Nov. 7...	33 1	30 0		31 11	28 1		19 11	17 9	
" 14...	32 10	30 1		31 2	27 8		19 9	17 11	
" 21...	32 1	30 4		30 11	27 5		19 11	18 1	
" 28...	31 9	30 9		30 8	27 0		19 8	18 4	
Dec. 5...	31 0	31 2		29 11	26 8		19 6	18 4	
" 12...	30 8	31 2		29 2	26 5		19 3	18 6	
" 19...	30 7	31 2		28 11	25 11		19 1	18 5	
" 26...	29 10	31 0		28 6	25 10		19 2	18 4	

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.

AVERAGE PRICES of **Wheat, Barley, and Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

	WHEAT.		BARLEY.		OATS.	
	1913.	1914.	1913.	1914.	1913.	1914.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France: March ...	47 7	45 8	30 1	28 5	23 10	22 3
April ...	48 9	45 10	30 1	28 5	24 0	22 4
Paris: March ...	48 11	46 7	30 6	29 0	22 10	21 9
April ...	50 10	45 4	30 6	29 0	23 9	22 1
Belgium: February ...	34 5	32 8	30 5	25 6	23 2	20 4
March ...	34 5	32 5	30 2	25 4	22 9	20 3
Berlin: February ...	42 10	41 2	—	—	23 5	21 1
March ...	43 1	41 7	—	—	22 8	20 11
Breslau: February ...	37 8	38 7	29 2*	27 5*	21 7	19 11
March ...	37 4	38 7	26 5†	25 3†	20 9	19 11
			27 1*	27 5*		
			25 8†	24 5†		

* Brewing.

† Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of April, 1913 and 1914.

	WHEAT.		BARLEY.		OATS.	
	1913.	1914.	1913.	1914.	1913.	1914.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	33 3	32 5	24 2	25 4	18 11	19 10
Norwich ...	32 9	31 3	26 2	25 2	19 10	17 10
Peterborough ...	29 10	31 0	25 3	26 0	17 1	18 6
Lincoln ...	29 0	31 11	28 3	25 9	19 6	18 10
Doncaster ...	28 11	31 5	26 9	25 5	18 7	18 5
Salisbury ...	31 4	30 6	26 11	23 10	19 6	17 11

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in April, 1914.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER:—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
British ...	per 12 lb. 15 0	per 12 lb. 14 0	per 12 lb. —	per 12 lb. —	per 12 lb. 13 9	per 12 lb. 12 9
Irish Creamery—Fresh	per cwt. —	per cwt. —	per cwt. 107 0	per cwt. 105 0	per cwt. 112 0	per cwt. 108 0
" Factory ...	—	—	100 0	95 0	105 6	98 0
Danish ...	—	—	122 0	118 6	120 0	118 0
French ...	—	—	—	—	127 0	123 0
Russian ...	109 0	105 6	106 0	103 6	106 0	102 0
Australian ...	111 0	108 0	107 0	104 6	109 0	105 0
New Zealand ...	113 0	109 6	109 6	107 0	114 6	108 0
Argentine ...	109 6	106 0	107 0	105 0	108 0	103 6
CHEESE:—						
British—						
Cheddar ...	84 0	76 0	83 0	79 6	84 0	78 0
Cheshire ...	—	—	120 lb. 73 6*	120 lb. 69 0*	120 lb. 87 0	120 lb. 81 0
Canadian ...	70 6	67 0	per cwt. 70 0	per cwt. 66 6	per cwt. 71 0	per cwt. 68 0
BACON:—						
Irish (Green) ...	79 6	74 6	75 6	70 0	79 0	75 0
Canadian (Green sides)	69 0	67 0	67 6	65 6	70 0	67 0
HAMS:—						
York (Dried or Smoked) ...	123 0	117 0	—	—	119 0	113 0
Irish (Dried or Smoked)	—	—	—	—	119 0	114 6
American (Green) (long cut) ...	71 0	68 6	70 0	67 6	76 0	72 0
EGGS:—	<i>per 120.</i>	<i>per 120.</i>	<i>per 120.</i>	<i>per 120.</i>	<i>per 120.</i>	<i>per 120.</i>
British ...	8 9	—	—	—	10 0	9 2
Irish ...	8 10	8 7	8 8	7 11	9 0	8 6
Danish ...	—	—	9 0	8 3	10 6	9 2
POTATOES:—	<i>per ton.</i>	<i>per ton.</i>	<i>per ton.</i>	<i>per ton.</i>	<i>per ton.</i>	<i>per ton.</i>
Edward VII. ...	101 0	83 0	60 0	55 0	90 0	80 0
Langworthy ...	90 0	85 0	81 6	75 0	94 0	84 0
Up-to-Date ...	77 6	64 6	55 0	51 6	79 6	70 0
HAY:—						
Clover ...	—	—	87 6	65 0	78 6	71 0
Meadow ...	—	—	—	—	71 0	63 6

* New.

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	APRIL.		FOUR MONTHS ENDED APRIL.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks ...	72	60	315	234
Animals attacked ...	76	60	337	251
Foot-and-Mouth Disease:—				
Outbreaks ...	—	—	11	—
Animals attacked ...	—	—	74	—
Glanders (including Farcy):—				
Outbreaks ...	7	13	32	59
Animals attacked ...	8	57	77	193
Parasitic Mange:—				
Outbreaks ...	152	227	1,109	1,243
Animals attacked ...	224	450	2,023	2,598
Sheep-Scab:—				
Outbreaks ...	5	7	139	112
Swine Fever:—				
Outbreaks ...	384	223	1,165	690
Swine Slaughtered as diseased or exposed to infection ...	4,080	3,511	11,358	9,330
Tuberculosis:—				
Number of Premises notified...	471	—	1,878	—
Number of bovine animals notified as for slaughter ...	501	—	1,994	—

* The Tuberculosis Order came into operation on 1st May, 1913.

IRELAND.

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

DISEASE.	APRIL.		FOUR MONTHS ENDED APRIL.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks ...	—	—	—	—
Animals attacked ...	—	—	—	—
Foot-and-Mouth Disease:—				
Outbreaks ...	15	—	67	—
Animals attacked ...	372	—	892	—
Glanders (including Farcy):—				
Outbreaks ...	—	—	—	—
Animals attacked ...	—	—	—	—
Parasitic Mange:—				
Outbreaks ...	10	6	39	79
Sheep-Scab:—				
Outbreaks ...	23	35	311	245
Swine Fever:—				
Outbreaks ...	28	10	91	48
Swine Slaughtered as diseased or exposed to infection ...	74	88	391	294

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THE DETERMINATION OF THE COST OF PRODUCTION.

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It is becoming daily more apparent that few investigations are more urgently needed or are of greater importance to the agricultural industry than those which will lead to the determination of the cost of production. Not only is information on this point absolutely necessary in the study of the economics of farming, but those responsible for the initiation and conduct of experimental work are beginning to look to book-keeping to assist them in the interpretation of results. It is therefore satisfactory to note that considerable attention is being directed to the problem in most countries.

The inquiries that reach the Institute for Research in Agricultural Economics in the University of Oxford, from every class of the agricultural community, both as to what is being done in regard to the determination of cost, and for advice as to methods of investigation, are very numerous, and they come not only from every part of the United Kingdom but also from the colonies and from foreign countries. It was recognised from the outset a year ago, that the determination of the cost of production would form the main part of the work of the Institute, for, with the industrialising of agriculture, has come the need for the application to it of the methods by which industry has been developed. Knowledge of cost must be the foundation of any productive enterprise; by it the manufacturer regulates his selling price, and though it is sometimes argued that in this respect the farmer can derive no benefit from cost accounting, since his prices are largely fixed by his foreign and colonial competitors, yet this is true

only to a very limited extent. The extraordinary changes in agricultural practice which have swept over certain districts of England and Scotland within a generation are evidence of the adaptability of the industry to changing circumstances, and suggest the advantage which might have been gained, and the loss and consequent suffering which would have been saved in making these changes, if only the skill and enterprise of the farmers of the last generation could have been combined with a sounder knowledge of the fundamental principles of business.

Not only will a knowledge of cost serve to inform those in a district, or even a whole community, when certain enterprises have reached an unprofitable level, but the ability both to determine costs and to analyse them should often be the means of restoring an unprofitable industry, or an unsuccessful individual, to a sound financial position, by directing the attention to possible economies or to alternate methods of production. Suppose a dairy farmer finds that the cost to him of producing a gallon of milk is as follows :—

	d.
Foods	1.73
Grazing	.76
Labour	.95
Interest on Capital ..	.23
General expenses ..	.60
	4.27

and suppose it can be demonstrated to him that the average cost to several representative men in his district for labour is only .45*d.* per gall., he may take it for granted that his labour is badly organised or badly supervised, and should endeavour to remedy the defect.

With the co-operation of farmers in all parts this work on the determination of cost is being developed at Oxford as rapidly as the means at the disposal of the Institute permit. A study of the principles of cost accountancy has not hitherto formed a part of the training of the farmer, and whilst an appreciation of the subject, and some insight into the processes by which it is followed up would undoubtedly be advantageous to him, it is fairly certain that just as, for example, it is his function to participate only to a limited extent in research in agricultural chemistry, so the bulk of the investigation and study of the science of farm management, as it is sometimes called, must of necessity be undertaken by research institutions in various parts of the country. On the continent of Europe agricultural book-keeping offices are to be

met with literally by the dozen, particularly in Switzerland, in Germany, and in Austria, whilst in America, too, most of the agricultural teaching centres and research stations include the investigation of cost within their scope. The continental offices are for the most part subsidised by their various Governments, and their object is to determine costs for individuals, for specified farming districts, and for comparison between districts.

The prominence to which the question of cost of production has now attained emphasises the need for uniformity in the methods adopted in its determination. If the records of research are to have any comparative value the first essential is that they should have been reached by the same methods. The great majority of those who keep farm accounts have not recognised the need for determinations of cost, but are content with some record, simple or elaborate, of receipts and payments, whilst it has also been noticed that not a few of those who seek to make their book-keeping more informative have failed to grasp the principles which are engaged in the laborious compilation of statistics which are of little or no value. Several of both classes have been led to abandon their old methods when the objects and principles of cost accountancy have been explained to them.

The importance of uniformity, and the uselessness of results arrived at by differing methods has been recognised in other countries, where steps have already been taken to determine the best lines upon which to develop the work. In Germany a Society entitled the "Association for Agricultural Book-keeping, and for Furthering the Science of Farm Management" was formed in February, 1913. A somewhat similar body had been constituted in America some three years earlier under the title of "The American Farm Management Association." Both of these associations exist largely for the discussion of scope and method, so as to ensure sufficient uniformity to make comparable the results of investigations at the many centres. This need for uniformity is emphasised by Professor Ernst Laur in an article entitled *The Basis of International Statistics of Agricultural Book-keeping*.* Dr. Laur points out that the value of the results obtained increases in proportion as they are capable of comparison. "The sooner uniformity is introduced . . . the more easily will the final aim be reached, for as long as this work is in its initial stages it will be much easier to prevail upon the book-keeping offices

* *Monthly Bulletin of Agricultural Intelligence*, February, 1914.

to adopt uniform methods, while later any modification of methods would complicate matters and interfere with the comparison of later and earlier results."

Dr. Laur's plea for uniformity and for the careful consideration of method is timely, and should receive the attention of those engaged in cost determination. In this connection attention may be drawn to investigations into the cost of food in the production of milk which have recently been undertaken at three centres in this country, the results of which suggest that there is room for a good deal of further consideration of the principles which underlie the determination.

In the Report issued by the University of Leeds (No. 88) a deeply interesting record is presented of work amongst eight dairy herds. The cost of the food per cow, and per gallon of milk, are shown for each herd, and other tables, based on these costs, show the number of gallons of milk required from each cow to pay for this food, and also the number of individual cows in each herd whose milk yield was insufficient to cover the cost of feeding. Work on these lines should prove of the utmost value to the dairy farmer, but in order to justify the conclusions, the methods employed in the estimation of cost must stand the closest scrutiny. The Report states that the outstanding difficulty was the estimation of the cost of the home-grown foods, and that the prices used in the calculation were as follows:—

Hay	55s. per ton.	Swedes	10s. per ton.
Oat straw ..	30s. "	Mangolds ..	10s. 6d. "
Barley straw ..	25s. "	Turnips	8s. "
Grass 3s. 6d. per week for spring calvers.			

How these figures were arrived at does not appear, but it would seem that they are intended to represent the *cost* of the various foods, though the use of the word "price" raises the doubt that possibly market price, and not cost, was the basis. A cursory examination of the figures seems to confirm this latter view, for it is difficult to reconcile such things as oat straw priced at 30s. per ton with anything in experience derived from other records. A high figure for the cost of the oat crop might be about £5 per acre, with a yield of about 30 cwt. of straw and 7 qr. of corn. This cost should be divided between the straw and the corn by a comparison of their prices on the market; if the corn is worth £1 per quarter and the straw £2 per ton, the cost of the straw is obviously three-tenths of the total cost, that is, 30s. per 30 cwt. or 20s. per ton as against 30s. charged in the calculation. The swedes, which are valued at 10s. per ton, suggest a cost per acre far in excess of figures obtained on other farms in the

country, and here again it seems likely that the local market price (less, probably, certain allowances for marketing) may have determined the figure at which the swedes are calculated. Analysing the whole list in the same way in the light of experience gained on many farms, it is difficult to avoid concluding that in most cases the prices charged are very considerably in excess of the average cost of producing the various commodities in an average year.

The practice of valuing home-grown foods at their market price in calculations of cost of feeding is not unusual, but a full appreciation of the facts must lead to its abandonment. The man who sets out to calculate the cost of an article must calculate that cost right through. The milk producer takes grassland not to exploit it in the market but because he wants to buy food for his own cows in that particular form, and the price of this food is its total cost to him; similarly, he will grow mangolds not to enable him to do a fictitious trade in mangolds between himself and his cows, but because he believes he can produce this food to greater advantage than by buying it in the market. The error which may arise from the valuation of home-grown foods at market prices is well illustrated in the case of a man who grows a certain acreage of grass to provide hay for his cows. In a wet summer the cost of producing the hay will far exceed that to which it will amount in a favourable season, whilst at the same time the market value will be relatively low. Suppose that the inferior hay cost the farmer 60s. per ton, whilst on the market it is worth 40s. Is the farmer therefore to charge it to his cows at this latter figure, and thereby appear to produce milk at a cheaper rate than has actually been the fact? If so, how will he recover the 20s. per ton he appears to have lost on the hay, and which has really been spent in milk production? If a farmer buys a quantity of cake at a certain figure and the market price falls subsequently by 10s. per ton, no one would expect him, when making his determination of cost, to depart from the actual figure he paid for the cake, and the same principle of pricing foods at cost must be applied equally to those home-grown as to those purchased, if the determination is to be of any real value.

The experience of a manufacturer of superphosphate affords an analogy. He found that, owing to the high market price of sulphuric acid, the cost of production of "super" was so high as to leave him no profit when selling in the open market. He therefore put down a sulphuric acid plant and the reduction in the cost of the acid immediately enabled him to reduce

his selling price to a figure at which he could meet competition very satisfactorily. Had he adopted the market value of the acid in his determination of cost, the price of the resultant artificial manure would still have been too high, and the only logical conclusion to which he could have come from a study of his accounts kept on this principle would have been that he ought to drop the manufacture of "super" and set up as a sulphuric acid merchant, although he knew quite well that there was no market for the stuff outside his own factory.

By completing the figures appearing in the Leeds Report it will more readily appear that the farmers concerned are somewhat in the same position. The cost of foods as given in the Report run from 5*d.* to about 8*d.* per gall., and when it is remembered that milk usually has to be delivered somewhere, often at a cost of 1*d.* per gall. for rail charges, without allowing for carting to the station, these figures become 6*d.* to 9*d.* Add to these a sum to cover labour, interest on capital, depreciation of stock, insurance of stock, depreciation and replacement of dairy equipment, proportion of the "overhead" charges on the farm, &c., and it would seem beyond doubt that each one of the farmers participating in this investigation is producing milk at a loss—provided that the food costs have been calculated with accuracy.

The argument in favour of using market prices instead of cost in the determination is, of course, that thereby a comparison can be made of the relative advantages of selling and feeding home-grown produce. But so long as the cost of producing the various foods is determined, this comparison can be made at any moment without the introduction of fictitious values into the account, for it must not be forgotten that most home-grown foods have *no* value on the market.

Referring now to a Report upon similar investigations from the South Eastern Agricultural College it appears that the necessity for adhering to the principle of valuing home-grown foods at cost has not escaped the organisers of the investigation, and the case is very well put in the Report (pp. 8 and 9). At the same time they do not appear always to have adhered to the principle they state so clearly. In the case of pasture they follow what would seem to be the only proper course, namely, the calculation of the cost of the grazing, combined with the observation of its stock-carrying capacity; soiling crops, again, are charged at the cost of rent, labour, seeds, and manure, that is to say, at the cost of production; but when they come to deal with hay, straw and roots they abandon

this principle and substitute for it "averages agreed on by principal farmers in the district."

It may be suggested, without any disparagement, that few farmers are in a position to do more than hazard an opinion on the question of the cost of production, and there can be little doubt that the figures they have arrived at as fair average costs have been fixed by reference, consciously or subconsciously, to market prices:—

Mangolds and swedes	..	..	10s. per ton.
Turnips	..	..	8s. "
Hay	..	..	60s. "
Oat straw	..	..	40s. "
Barley straw	..	..	25s. "

Assuming, as above, that the cost of the oat crop will not exceed £5, and that the produce may amount to about 30 cwt. of straw and 7 qr. of corn, the above estimate of 40s. per ton for the cost of the straw leaves the farmer with oats at a cost of about 5s. 9*d.* per qr. Apart from this, however, it must be evident that, whatever their respective feeding values may be, if oat straw costs 40s. per ton to produce, barley straw cannot be produced for 25s. per ton, or *vice versa*, if barley straw can be produced for 25s. per ton, oat straw cannot cost 40s. As regards hay, too, a cost of 60s. per ton is surely rarely realised even in the wettest summers, and swedes at 10s. and turnips at 8s. are very much higher than any costs within the experience derived from the records of many farms, when it is taken into account that a large part of the cultivations, &c., performed on these crops is for cleaning the land for the benefit of the whole rotation and not for the growing of roots.

The costs per gallon on the 19 farms included in the Wye investigations range from 3.37*d.* to 5.57*d.*, which contrasts with a minimum of 5.0*d.*, and a maximum of 7.9*d.* on the farms included in the Leeds Report, and the analysis of the methods of food pricing seems to indicate that the difference is more likely due to differences in the principles of cost calculation than to local variations in the conditions of the industry.

The Reading University College also conducted an enquiry into the cost of foods in the production of milk, through the agency of the same investigator responsible for the work done in Kent and Surrey by the South Eastern Agricultural College, but the method of cost calculation differs, and calls for consideration. It is conceded, as in the Wye Report, that the cost of production should be the basis of the valuation of home-grown foods, but a step in advance is marked in that it is further recognised that in place of applying the

estimated average costs of the district to the calculation on each farm the cost to each individual farmer should be determined, for the experience of one man is not necessarily that of his neighbour. This, of course, can only be done by keeping a complete set of cost accounts on each farm, and regret may be expressed that anything less was decided upon in this investigation. The difficulty (one is tempted to say the impossibility) of determining the costs on individual farms in any other way is admitted in the Report (p. 8), and is demonstrated by the figures arrived at:—Mangolds, 5s. to 10s. per ton; hay, 57s. 6d. to 80s. per ton; and straw, 40s. to 50s. per ton. The price of the mangolds is wide, and will pass without question, but as regards hay and straw there must be some serious miscalculation. Contrasting the figures with other results it seems almost incredible that anyone can have spent in rent, rates, labour and manures so much as 80s. per ton of hay produced, even though the value of the aftermath be ignored; indeed, the lower figure given, 57s. 6d., seems excessive for most seasons, and with good hay realising about 45s. in the stack any time during the recent winter, farmers producing it at a cost of 57s. 6d. to 80s. have had no reason to congratulate themselves. As regards the cost of straw, given as varying from 40s. to 50s. per ton, it is not necessary to repeat what has been said on this point in connection with the Leeds and Wye Reports; the estimate of 50s. per ton appears to be something like 150 per cent. too high.

There are other points which arise, as for example, the value of food residues. The cows are entitled to credit for these upon the local valuers' scale of allowances, or better, upon Voelcker and Hall's scale where the two are not identical, and there is nothing in any of these Reports to indicate whether the foods were priced at the full estimated cost, or at the cost less manurial value. Enough has been said, however, to make the point that there is urgent need for further consideration amongst investigators as to the principles upon which the determination of cost is based, and that uniformity of method is indispensable if the results are to be of the maximum advantage to the agricultural community. The value of the determination lies in the conclusions which are to be drawn from it for the framing of policy and the development of an enterprise, and any error in principle will lead to disaster instead of success.

It is doubtful if it is possible to determine the cost of any one commodity produced on the farm, without a complete

calculation of all costs. This fact is recognised in the Report of the South Eastern Agricultural College (p. 9), where it is stated that the figures will be open to criticism until actual costs of production (*i.e.*, of foods) are available over a series of years, and the Reading Report contains a similar statement. It is only then that conclusions as to the profitability of the individual cows in any herd can be drawn with safety.

It should be unnecessary to add that the criticisms here offered are made with the sole object of bringing about uniformity and agreement as to principles amongst those who are now embarking on the study of cost. The subject requires ventilation and discussion and the difficulties which confronted the authors of the Reports under review add to the great value of the work upon which they are engaged, a work which will be cordially appreciated, for it marks a step along a line of investigation which has not received in this country the attention to which its importance entitles it. The need for uniformity and the consequent ability to compare results has been partly recognised, and whilst the investigations are still in their early stages there should be no difficulty in attaining this object.

THE WAGNER TEST AS A MEASURE OF THE AVAILABILITY OF THE PHOSPHATE IN BASIC SLAG.

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BASIC slag is frequently sold on the basis of its "citric solubility," *i.e.*, the percentage of phosphate which passes into solution when the slag is shaken with a 2 per cent. solution of citric acid under conditions defined by Wagner, who first proposed the test. The utility of this method of valuation has been called in question in recent years. It has been urged by the opponents of the Wagner test that the phosphate which does not dissolve in dilute citric acid has considerable fertilising value and should therefore be taken into account in the valuation. This is a question of commercial and practical importance which can only be settled by trial, and with a view to the elucidation of the problem a series of

preliminary investigations has been carried out in the laboratory of the Department of Agriculture, University College, Bangor, and on a field scale at various centres in North Wales.

The Chemical Nature of Basic Slag.

During recent years numerous researches have been carried out on the chemical composition and nature of the phosphatic ingredients of basic slag, with a view to the discovery of any factors of a chemical nature which might influence the solubility. This work has shown that several of the statements commonly made regarding the chemical composition of basic slag are erroneous.

It has been conclusively proved that the amount of free lime in modern slags is much smaller than is usually supposed. Statements are frequently made that basic slag contains 15 to 20 per cent. of uncombined lime. This may have been approximately true of the slags produced years ago, although the methods used for the quantitative estimation were not very satisfactory, but in slags of modern origin the amount of free lime present is, on an average, approximately 2 per cent., and very seldom exceeds 5 per cent. This fact, however, is not of such great importance from an agricultural point of view as it might appear to be at first sight, for there is strong evidence to show that, although the amount of caustic lime present is small, a large proportion of the combined lime in basic slag is present in such a loose form of combination that it is capable of acting as a base in the presence of acids.

A more important aspect of recent investigations is that which deals with the nature of the phosphatic compounds present in basic slag. In 1883 Hilgenstock discovered in basic slag large crystals having a composition agreeing with the formula $(\text{CaO})_4, \text{P}_2\text{O}_5$, and this discovery led him to suggest his well-known theory of tetrabasicity to account for the fact that in basic slag, in spite of the large amount of lime present, the phosphate is soluble to a considerable extent in dilute acid solvents. This theory, which seemed to be a very plausible one, became widely accepted, and is still given in the majority of textbooks on agriculture.

In the case of modern slags, however, it has been found that the tetracalcium phosphate, if present at all, occurs only in very small quantities. The phosphoric oxide exists rather in combination with a number of other oxides, of which silica is usually one. These complex compounds differ widely from one another in their solubility in dilute acids, some possessing

the same order of solubility as tricalcium phosphate, while others dissolve with readiness. Thus Morison obtained from basic slag crystals of a compound containing lime, ferrous oxide, silica and phosphoric oxide, in which 93 per cent. of the phosphoric acid dissolved in a .1 per cent. solution of citric acid, *i.e.*, in a solvent of one-twentieth the concentration employed in the Wagner test. Fineness of grinding would probably have little effect on the solubility of such a highly soluble compound as measured by the Wagner method. In the case of slags rich in such soluble constituents fineness of grinding therefore may not be a factor of such great importance as is commonly supposed. Thus in the case of slag B (see Table) 93 per cent. of the phosphate dissolves when the slag is extracted by the Wagner method, although less than 70 per cent. passes through the standard Amandus Kahl sieve. In the case of slag A, although the fineness is nearly 80 per cent., only a little over 50 per cent. of the phosphate is extracted. On the other hand, in the case of less soluble phosphates of slags and of mineral phosphates, fineness of division would probably play an important part in accelerating solution. There are therefore at least two factors which influence the solubility of the phosphoric acid of slag:—

- (a) A chemical factor: the actual form of combination in which the phosphoric acid exists in the slag.
- (b) A physical factor: the extent of surface exposed to the solvent by the slag particles.

	Fine- ness.*	Total phosphate ($\text{Ca}_3\text{P}_2\text{O}_8$) Per cent.	Phosphate extracted by 2 per cent. citric acid.†					
			First Ex- traction.	Second Ex- traction.	Third Ex- traction.	Fourth Ex- traction.	Fifth Ex- traction.	Sixth Ex- traction.
Mineral Phosphate	89.4	62.37	22.39	18.74	13.05	3.60	.23	trace
Slag A	79.4	24.01	12.41	3.42	2.38	1.39	1.11	.56
Slag B	69.3	36.14	33.45	2.32	trace	—	—	—

* The "fineness" gives the percentage of the fertiliser which passes through the standard basic slag sieve.

† The first citric extraction was carried out according to the ordinary Wagner method, thus, 5 grammes were shaken with 500 c.c. of 2 per cent. citric acid for half-an-hour in an "end-over-end" shaker, and the phosphate present in an aliquot portion of the filtrate was estimated.

For the second extraction the mixture after the first shaking was filtered, getting as little as possible of the residue on the paper. The residue and paper were washed with carbon-dioxide-free water until free from acid. The paper was then put back into the flask and again extracted for half-an-hour with 500 c.c. of 2 per cent. citric acid solution.

This process was repeated in the subsequent extractions.

The physical factor would be of greatest importance in the case of those slags which contain their phosphoric acid in the most insoluble form, and *vice versa*.

It is probable that the changes which appear to have taken place in the chemical composition of basic slag in recent years are connected with modifications which have been introduced into the dephosphorisation process in steel manufacture, *e.g.*, the use of smaller quantities of lime. This suggests that it might be possible to introduce further modifications which would result in the formation in the slag of higher proportions of the soluble phosphates. An investigation of this problem by metallurgical chemists is desirable.

The Wagner Test.

The Wagner method cannot be said to rest on a reliable theoretical basis. In 1894 Dyer proposed the use of a 1 per cent. solution of citric acid as a solvent which would enable the analyst to differentiate with a fair degree of accuracy between "dormant" and "available" plant food in soils. The choice of this solvent by Dyer was a result of his investigations on the acidity of the sap exuded by plant roots. The acidity was supposed to be due to the presence in the sap of organic acids of a similar nature to citric acid, and, by a large number of quantitative estimations, Dyer showed that, although the acidity varied considerably in different natural orders of plants, it was on an average approximately equivalent to a 1 per cent. solution of citric acid.

At the present time plant physiologists are agreed that the sole cause of the acidity of the root sap is the carbon dioxide dissolved therein. In neutral soils the availability of plant food is determined by its solubility in the dilute solution of carbonic acid exuded by the roots. It would appear, therefore, that a solution of carbon dioxide in water would be a more suitable solvent than citric acid for the determination of available plant food in soils and fertilisers. It has been found, however, that the results obtained by the use of carbon dioxide solution are very irregular. This irregularity is probably due to the difficulty experienced in obtaining a solution of constant strength, and to the disturbing influence of the lime present in the soil or fertiliser. Citric acid is, therefore, still retained as a solvent on the ground of practical convenience. In the Wagner method for basic slag examination, a 2 per cent. solution of citric acid is used in order to allow for the neutralising effect of the basic lime present.

Not only is the use of citric acid as the solvent to a great extent empirical, but, further, the actual method of procedure adopted in carrying out the Wagner test cannot be regarded as an accurate imitation of the natural solution processes taking place in the soil. When basic slag is shaken with the dilute citric acid solution a state of equilibrium is soon set up between the phosphates in the solution and the phosphates remaining undissolved. If the solution is filtered off and the residue is treated in the same manner with a fresh amount of citric acid solution a further quantity of phosphate passes into solution; and by repeating such extractions indefinitely it is probable that the whole of the phosphate would be dissolved. Thus in the case of slag A (Table, p. 203), although only a little over 50 per cent. of the phosphate dissolved in a 2 per cent. citric acid solution when extracted by the conventional Wagner method, nearly 90 per cent. had dissolved after six extractions, and the expression of the results in the form of a curve indicated that by further extraction practically the whole of the phosphate could be dissolved out.

In the natural processes the dissolved phosphate would enter the plant by osmosis and would probably be so quickly removed from the sphere of influence that a state of equilibrium would not be set up and the passage of the phosphate into solution would be continuous. It is, therefore, possible that the phosphate which dissolves in the second and subsequent citric acid extractions is just as available to the plant as that which dissolves in the first extraction. It is conceivable that a slag which yields only a low percentage of its phosphate when extracted by the Wagner method may be quite as valuable to the plant as a slag yielding a high percentage, provided that in the case of the former slag the phosphate by continuous extraction would pass into solution at a rate quick enough to meet the requirements of the plant. The whole matter is one that can only be settled by actual experiments with plants, and in order to throw some light on the question, preliminary investigations were commenced at different centres in North Wales last year.

The fertilisers used were a mineral phosphate and two slags, referred to as A and B respectively, differing widely as regards the solubility of their phosphate. Data regarding the fertilisers are given in the table on p. 203. They were applied to different plots in such quantities that each plot received the same weight of "total phosphate," though, of course, the quantities of "citric-soluble phosphate" supplied were widely

different. The plots were laid out in duplicate at each centre, and, though it is impossible to draw definite conclusions from one season's experiments, it may safely be said that the results obtained in 1913 clearly indicate that the percentage of "citric-soluble phosphate" in a slag is, at least, a better indication of the value of the slag than the percentage of "total phosphate." This, of course, does not necessarily imply that it is the best test. Results obtained with the mineral phosphate suggest the possibility that even a better measure of the availability of the phosphate to the plant is the amount dissolved in two or three extractions. Further investigations, however, are required before a definite opinion can be expressed on this point.

THE ECONOMIC IMPORTANCE OF WOODLICE.

WALTER E. COLLINGE, M.Sc., F.L.S.

In the early part of 1913 the writer published a paper dealing with the species of woodlice known to occur on the Midland Plateau (2), and included therein a short account of their economic importance and habits. This brought such a considerable volume of correspondence from growers in all parts of the British Isles that during the past year further attention has been devoted to the subject, and the results are here set forth.

Such seasons as those of 1912 and 1913 proved exceedingly favourable to a rapid increase of woodlice, and consequently, complaints of the damage they have occasioned have been more numerous than for many years past.

The economic importance of these animals has hitherto only been studied very casually, both in this country and abroad, but there are a few published observations which will be referred to later. As will be shown, woodlice may become a source of very serious loss to horticulturists and others, unless they are systematically destroyed.

Zoological Position.—Woodlice belong to a large group of invertebrate animals the bodies of which are divided into ring-like segments and provided with many-jointed appendages. This group, known as the *Arthropoda*, contains the Crustacea, Centipedes and Millepedes, Mites, Spiders, Scorpions and Insects. The woodlice belong to a division of the Crustacea known as *Isopoda*. There are many thousands of species of *Isopoda*, the majority of which live in marine or fresh water, but a number are terrestrial in their habits, and it is

these that are generally referred to as woodlice, pill-bugs, slaters, sow-bugs, and a host of other local names.

Notes on their Life-history.—The eggs are laid early in the summer, and are retained by the female in a special brood-pouch formed by a series of overlapping plates on the second and three succeeding segments of the thorax. Unlike many of their marine relatives woodlice produce no free embryo, the whole larval period being passed within the egg. The period of incubation varies in different species. Pierce (4) states that in *Armadillidium vulgare*, Latr., it is between fifty-six and ninety-three days. He writes: "The development of the eggs may be watched from the exterior. The females should be treated very carefully, but with a lens one may see on the ventral side, in the marsupium, the distinct form of the eggs, and may notice the increase in size and finally note the young embryos and the little white young. One experiment with ten females was most fruitful in giving data on this point. On May 8, June 16, and July 8 young had been produced, and on examination on July 26 all were found to be unfertilised except one, which had eggs apparent. On August 7 the fertile female produced a brood of young. This was ninety-three days after being placed in captivity. A male was admitted on July 26, and on September 30 a brood of young was produced. This would indicate a period of incubation of, at the most, sixty-seven days. In another experiment a female which had just produced a brood of young was placed with three males on August 7. On October 2 a brood of young was produced, making the period of incubation fifty-seven days. The number of young in a brood varied from 29 to 79."

"The little isopods are pure white when they leave the marsupium. They have six pairs of legs. Within twenty-four hours of birth they moult, and still have only six pairs of legs. Between the fourteenth and eighteenth days another moult takes place, and the resulting third instar has seven pairs of legs. The young continue to grow and moult, having been observed in the act of moulting on the twenty-eighth, thirty-sixth, fifty-eighth, and sixty-eighth days. After the first moult there is no regularity as to times of moulting in the brood, all depending on the food supply. After the first moult a slight darkening of the intestines is noted, and by the twenty-first day the sow-bugs are of a grey colour throughout and under 3 mm. in length. The greatest size of any found was 15 mm. This specimen was probably several years old. Females not over 7 mm. are capable of reproduction.

"Before moulting, the body of all sow-bugs becomes a very dirty grey colour. The act of moulting is peculiar. At first a white border indicating the loosening of the old skin appears at the front edge of the fifth free thoracic segment, then another on the sixth, and still another on the seventh. Finally, the entire posterior half of the skin is free and the isopod steps out of it. This process consumes about twenty-four hours, and when completed the posterior part of the body is of fresh slate colour, while the old anterior part appears very dull. Following the first stage of the moult the anterior segments commence to loosen and are slid forward. The dorsum of the third and fourth thoracic segments is loosened before the legs of these segments are released. From then on the last two pairs of legs in the very young and the last three in later stages are used to hold the animal in position. The anterior legs are not available for use for some time after they are free. The antennæ are withdrawn last.

"Regeneration of parts takes place in the antennæ and legs. Several times individuals with aborted members were noticed. These latter would gradually attain full length, then budding of the succeeding segment would be noted, and finally this member would be normal. The regenerated part is white for some time."

Casserley (1) has made many interesting observations on the moulting of the same species.

Specimens of *Porcellio scaber*, Latr., which the writer has kept in captivity for some time, had broods of twelve to thirty young. The moulting is similar to that described by Pierce, but the metamorphosis is more rapid. In *Porcellionides pruinosus*, Brandt, Pierce mentions that "reproduction and development is very rapid, much more so than in either *Armadillidium* or *Porcellio*. One pair produced four broods of young in sixty-two days, there being seventeen, sixteen, and twenty-one days between broods. The broods are small. The young grow so rapidly that in two months they are one-half as large as their parents. They moult frequently."

Habits and Habitat.—Woodlice are only found where moisture exists, e.g., in almost any dark and damp situations in the vicinity of dwelling houses, such as cellars, outhouses around walls, cisterns, water barrels, and under boards, stones, and rubbish. In greenhouses, conservatories, and potting sheds they are usually plentiful. Rockeries are a favourite haunt. They also occur beneath the bark of dead and decaying trees, and amongst decaying vegetable matter, or moss.

They feed, usually, during the night. In the winter many species seek the protection of potting sheds, outhouses, cold frames and so forth. The writer has noticed in an outhouse that both *Oniscus asellus*, Linn., and *Porcellio scaber*, Latr., were much more plentiful here during the winter than in the summer, and once in the dusk of the day, early in the spring, large numbers of both species were observed making their way into the garden. On examining the edging tiles around the flower beds, numerous specimens were found which were certainly not there a few days before. Previous to this a few dead examples had frequently been noticed on the path; these had probably come out too soon and been killed either by the frost or wet.

Armadillidium vulgare, Linn., on the other hand, remains at the roots of plants seven and eight inches below the surface, rolled up all through the winter, the writer's earliest record for a specimen on the surface being April 12th.

Economic Importance.—Of the thirty-five species of woodlice found in the British Isles not more than nine or ten are sufficiently common to be of any economic importance. The commonest and most numerous of these are:—

<i>Trichomiscus roseus</i> , Koch.	<i>Porcellio lævis</i> , Latr.
<i>Oniscus asellus</i> , Linn.	<i>Porcellionides pruinosus</i> , Brandt.
<i>Porcellio scaber</i> , Latr.	<i>Armadillidium vulgare</i> , Linn.
<i>Porcellio pictus</i> , Brandt.	

Isolated cases of injury by other species have been observed, but none of them are numerous enough to constitute pests. *Trichomiscus roseus*, Koch.—This is a small species, measuring about 5 mm. in length. It is easily distinguished by its coral pink colour and a broken light-yellowish mid-dorsal stripe, whilst on most segments there are three or more transverse rows of tubercles.

In greenhouses and conservatories it frequently does considerable damage. In one case which was inspected this species partly ruined a fernery, and the whole of the rockery work had to be taken down and rebuilt, all the old soil, etc., being removed. In another case a number of choice ferns were almost entirely eaten away, whilst in a third case orchids were attacked.

Oniscus asellus, Linn.—This species (Fig. 1) and that following are the two commonest in this country. Adult examples measure 16 mm. in length.

Numerous plants under glass are attacked by this species, which is a common pest in cold frames and potting sheds, and also in flower borders and vegetable gardens. Like other species it is frequently carried in plant pots from potting sheds to

conservatories, where it finds congenial surroundings, reproduces, and soon becomes a pest. Theobald (7) records this species as doing much harm in hot-houses and to soft wall-fruit; it also eats strawberry roots. The same observer also reports this species as devouring corks, both when in bottles and loose (8).

Porcellio scaber, Latr.—This species (Fig. 2) is as common as *O. asellus*. The well-developed lateral plates of the body and the produced lobes of the head clearly serve to separate it from any other species. Length of adult 14 mm.

This woodlouse is present in gardens in thousands, and the writer has had it forwarded from lime trees where it was stated to be damaging the bark. It is frequently found in orchid houses, as also in ferneries, in each case causing considerable damage. Bate and Westwood mention that it appears to possess a strong partiality for nearly ripe wall-fruit. Growers in the Channel Islands state that they frequently suffer from the depredations of this species and the allied *P. dilatatus*, Brandt (Fig. 3), and *P. pictus*, Brandt (Fig. 4), in cold frames.

A border of violas has been ruined by this species in the early summer. Quite a large number of cases have been reported with reference to the damage to flower borders, and in most of these the beds have been faced or surrounded with tiles, which afford an admirable shelter during the daytime. Potatoes are frequently injured by this species.

Porcellio pictus, Brandt.—This species (Fig. 4) may be readily distinguished from the last by the greatly depressed body, the broadly rounded frontal lobe of the head, the slender antennæ, and the peculiar colouring. Length of adult 14 mm.

It is frequently found with the former species, although by no means so common and never so plentiful.

Porcellio lævis, Latr.—This species may be distinguished from its allies by the broad smooth body, the form of the lateral plates of the first seven body segments, and the greatly produced tail (uropoda). It is very variable in colour. Length of adult 15 mm.

Popenoe (5) records this species as attacking mushrooms, and the writer has found it at the roots of strawberry plants, doing considerable damage. From the Channel Islands it has been received from cold frames.

Porcellionides pruinosus, Brandt.—The oblong, flattened body and the two-jointed flagellum of the antennæ serve to distinguish this species (Fig. 5) from any of the former ones. Length of adult 9 mm.

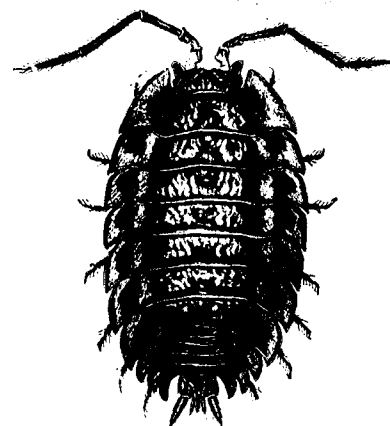


Fig. 1.

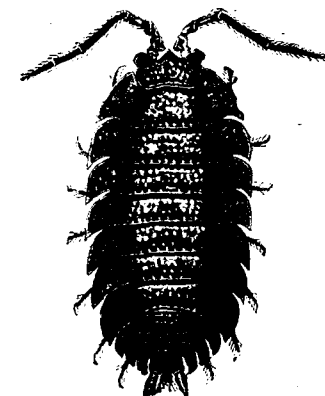


Fig. 2.

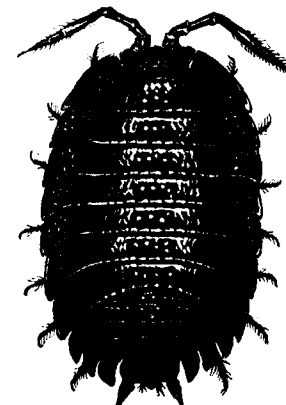


Fig. 3.

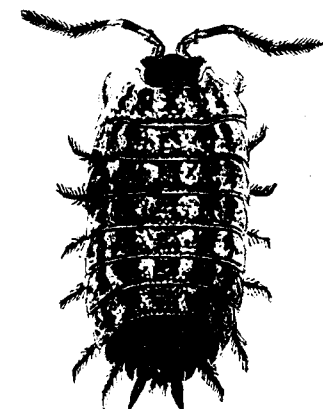


Fig. 4.

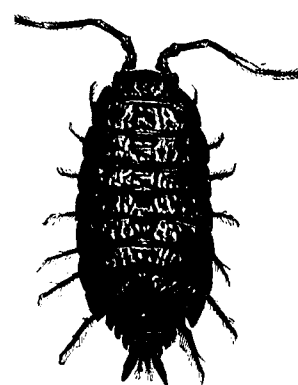


Fig. 5.

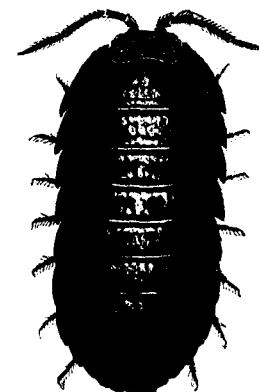


Fig. 6.

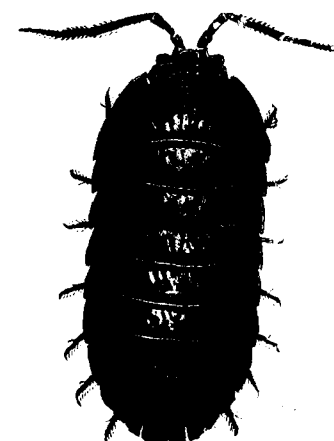


Fig. 7.

WOODLICE.—FIG. 1. *Oniscus asellus*, Linn.; FIG. 2. *Porcellio scaber*, Latr.; FIG. 3. *Porcellio dilatatus*, Brandt; FIG. 4. *Porcellio pictus*, Brandt; FIG. 5. *Porcellionides pruinosus*, Brandt; FIG. 6. *Armadillidium vulgare*, Linn.; FIG. 7. *Armadillidium nasatum*, B.-L.

A number of examples have been taken from conservatories and greenhouses. Pierce (4) records it as damaging cotton plants, honeysuckle and various trees. The writer has twice taken it from small rounded pits in potatoes, and it is also reported as damaging lettuce grown under glass.

Armadillidium vulgare, Linn.—This (Fig. 6) is the common pill woodlouse, so called from the fact that it can roll itself up into a ball.

Pierce (4) states that at Dallas, U.S.A., cotton plants were damaged and many of the seedlings of the second planting were killed by this species. Many gardens had suffered through attacks on the young sprouts of beans, peas, and tomatoes, and on rose bushes and other cultivated plants. Correspondents informed him of damage by the same species to roots of palmetto, butter beans, radishes, lettuce, mustard, potted plants, and also flower seeds. He also observed it on honeysuckle at various heights up to three feet, and on different trees to greater heights.

In flower borders it frequently does an enormous amount of damage, which is often put down to slugs. The writer once met with this species in an old garden in thousands; so plentiful were the woodlice that it was almost impossible to cultivate any plants in the borders, which extended over a considerable area. There was no difficulty in filling a one pound tin canister, which could have been filled many times over. Like *Porcellionides pruinosus*, Brandt, this species has been taken in potatoes. Some years ago in Warwickshire it was remarkably plentiful, and was frequently reported as damaging potatoes and field beans. An allied species, *A. nasatum*, Budde-Lund (Fig. 7), was also received with a complaint that it was found in the seed cotyledon of a field bean.

Miss Richardson (6) records injuries by these woodlice to cucumbers, hot-house vegetables, date palms and mushrooms in the United States. Garman (3) also remarks upon the damage they do to young cucumbers and lettuce under glass. Popenoe (5) also mentions them as attacking mushrooms, stating that they are "carried into the mushroom house in compost which has been allowed to stand aside. The heat of the manure is relished by them, and they collect in numbers, remaining there throughout the growth of the spawn, but becoming injurious with the first growth of the mushrooms." In manure heaps he has seen sow-bugs collected to such an extent that numbers, aggregating a pint or more in quantity, might have been collected from a shovelful of material.

Preventive and Remedial Measures.—There is no doubt that neglect to clean out outhouses, potting sheds, and similar

places, from time to time, has much to do with the increase of woodlice. Again, rubbish heaps are frequently left to afford admirable breeding places.

Pierce (4) made a large series of outdoor tests with baits in order to find out what substances might be used to attract the woodlice, and another series to ascertain the most advisable poison. He also made a series of tests with repellents.

He found that sliced potatoes given a thin covering of Paris green or London purple proved most effective. London purple also proved the best repellent. Kerosene emulsion as a contact spray was fatal.

The writer has tried all the above and can confirm their efficacy.

In a greenhouse it was found that sprinkling Paris green on the floor and covering it with damp boards was very effective. On the first morning there were 137 dead specimens, on the second 59, and on the third 21.

Dusting the soil, especially along the sides of tiles surrounding flower beds, with equal parts of Paris green and ground unslaked lime is an excellent remedy.

In gardens the ground should be kept well broken up, free from clods, and well raked to prevent cracking. Accumulations of old boards and rubbish should be avoided, as these afford protection to the woodlice.

The loose straw and rubbish that collect around manure heaps should be raked together and burnt before the manure heap is opened for use. In this way many hundreds of woodlice may be collected and destroyed.

The writer is indebted to the kindness of Mr. Wilfred Mark Webb for the loan of the original blocks illustrating this paper.

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THE POLLINATION AND FERTILISATION OF HOPS; AND THE CHARACTERISTICS OF "SEEDED" AND "SEEDLESS" HOPS. *

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The Practice in Foreign Countries with regard to growing Male Hops.

The practice at different times in England with regard to the growing of male hops has already been mentioned; it will be of interest now to note what the practice is, at the present time, in the hop-growing districts of foreign countries.

In America the value of the male hop is already fully appreciated. In a Bulletin of the United States Department of Agriculture on "Hop Culture in California," published in 1900, it is stated that: "In America a small proportion of the plants planted in every garden are male—the presence of seeds in the hop being considered by the grower an advantage." In a book called "The Hop," published by H. Myrick in 1899, the statement is made: "In America a male hill is planted for every 100 female hills." Judging from the samples seen in this country, the great majority of American hops are well seeded, and it appears to be a fact that American brewers do not object to the seed in the brewing.

On the Continent there is some diversity of opinion, viewing the matter from the grower's standpoint, but it seems clear that for making the beers of the Continent seedless hops are strongly preferred by the brewers. In an interesting paper† published in 1907, the subject is reviewed from the Continental standpoint. The value of fertilisation in increasing the crop is fully admitted; it is stated, for instance, that in some cases it was found that seeded hops attained double the size of those of the same variety which had not been fertilised and were therefore seedless. In certain hop-growing districts on the Continent, the official opinion is that the presence of the male hop is injurious, and consequently we find that laws have been passed for the express purpose of exterminating male hops. Thus in the Spalt district—the most famous hop-growing district in Bavaria—any grower who allows a male

* Concluded from the *Journal* for May, 1914, p. 123. Previous articles also appeared in February, 1914, p. 953, and April, 1914, p. 22.
† "Faut-il planter du houblon male?" (*Journ. d'agric. prat.*, 1907, p. 166).

sample of East Kent Fuggles possessed exactly the same amount; on examining a sample of Spalt hops he found it contained only 0.8 per cent. Oregon and Californians sometimes contained upwards of 20 per cent. Prof. R. Braungart, in his monograph on Hops and Brewing, states that Saaz hops show 0.2 to 0.5 per cent. of seed, Spalt hops 0.3 to 1 per cent., Red Auscha hops 3 to 4 per cent., the choicest East Kent hops 10 to 20 per cent., and American hops 15 to 25 per cent. Prof. A. J. Brown carried out experiments with seeds of East Kent Goldings, East Kent Fuggles and Oregon to ascertain whether the seeds contained an objectionable bitter principle. The results obtained led him to conclude that practically no flavour was derivable from hop seed, and that it might safely be concluded that the old idea that the seeds might communicate an objectionable bitter flavour to beer was fallacious. Some brewers are indifferent as to the presence or absence of seed; some look upon the presence of seed as a "nuisance," as being liable to get in the way in some of the processes of brewing; while some firms of well-known brewers prefer to see plenty of seed as an indication of a well-developed, sound hop. As one of the most eminent of the brewers' chemists in London expressed it, there are no reliable data on the subject from the brewing standpoint, and it is at present a matter of personal opinion or conjecture or even of prejudice.

Prof. R. Braungart states* that "whilst the brewers of mid-Europe look upon seed in hops as very undesirable, the brewers of Belgium, England, America, Australia, &c., do not mind the presence of a considerable amount of seed."

The Botanical Characteristics of Foreign "Seedless" Hops.

The essential characteristics of foreign seedless hops may now be noted. In some parts of Germany and elsewhere on the Continent, there are State regulations forbidding the growing of male hops, with the result that in these districts hops are grown practically or even absolutely seedless. From the fact that with certain Continental varieties of hops it is possible to grow seedless hops of a fair size, the totally wrong conclusion has been drawn that the same type of hop can be produced with English varieties. The English hop-grower has in recent years been urged by many factors, merchants and brewers, personally and by letters in the press, to extirpate the male hop and so grow seedless hops. The following quotation from a letter, signed "Farmer and Brewer,"

* *Der Hopfen aller Hopfenbauenden Länder der Erde als Braumaterial* (1901), pp. 203, 211.

which appeared a few years ago in one of the London papers, illustrates the nature of the argument which is still often advanced: "Why should not hop-growers in this country copy the example of their Bavarian competitors, and by expelling all male plants from their gardens, produce a crop of greater value per cwt.?"

The answer to this is that it is not possible, for the reasons already given in detail, to produce with English varieties of hops (and especially with all Golding varieties) a crop of seedless



FIG. 19. — An English and a German hop cut in half to show the difference in the structure. The German hop is on the left.

hops which are "grown out," and buyers will not look at small English hops which are not properly "grown out." The large Bavarian hops which are grown practically without seed are *very different botanically* from the English varieties. A fair-sized hop without seeds requires a very large number of bracteoles; the German hop possesses this large number, but the English hop does not. The number of bracteoles per hop in the English varieties is usually from 27 to 30; in those German varieties which produce seedless hops of over one inch in length the number of bracteoles per hop appears to be from 35 to 54.

The difference in the structure of a typical English and a German hop is shown in Fig. 19. The German hop is denser and more compact, with more numerous closely-packed "petals," and is seedless; the English hop is composed of fewer "petals" arranged more laxly, and is seeded.

An examination of various samples of German hops supplies some instructive facts. Samples of seven different kinds of hops grown in Germany were analysed botanically, each hop being picked to pieces and the results tabulated (see Table XVIII.).

hop to exist in his garden is liable to a severe penalty. In other districts, however, German hops are produced which are seeded to some extent. In Belgium a law ordering the destruction of the male hop was passed in 1887. In France, too, at various times, in different districts, the extirpation of the male hop has been attempted by the Government. The evidence collected by a Commission, composed of growers and brewers, to investigate hop-growing in the north of France, was considered to show that the influence of the male hop was not injurious to the "white-bine" and "green-bine" varieties as grown in France, but that in the case of the "red-bine" variety the production of seed "spoil the look of the hop." It was pointed out that in Belgium some growers favour the planting of one male hop to every 150 or 200 hills, believing that both the quality and the quantity of the crop are improved, and that in England it is regarded as advantageous to have one male hop to every 100 hills. The author, finally, comes to the conclusion that it will be best for the French grower, too, to have a few male hops scattered through the garden.

*The Characteristics of "Seeded" and "Seedless" Hops
from the Brewing Standpoint*

Seedless hops contain a higher percentage of resins than "seeded" hops of the same variety, owing chiefly to the weight of the seeds of the latter. The difference in this respect was investigated in the case of Wye College Hop-garden, mentioned previously. Analyses were made of the seeded and seedless hops gathered from the two areas in the garden and the results obtained were as follows:

	Percentage of soft resins.	Percentage of total resins.
Hops from "seeded" area...	10	15
Hops from "seedless" area	12	17.2

It must be noted, however, that through the increase of crop due to the "growing out" of the seeded hops, the total amount of resin produced was greater in the seeded than in the seedless area. Calculations based on the crop produced in the two areas ($9\frac{1}{4}$ cwt. per acre from the "seeded," and $5\frac{1}{4}$ cwt. per acre from the "seedless") and on the percentage of total resins, show that the amounts of resins per acre produced by the seeded and seedless hops were 156 lb. and 100 lb. respectively; or, in other words, the result of fertilisation was, in this case, to increase the amount of resin by more than one half.

Further calculations showed that the ratio of total resins between the seeded and seedless hops was 100 to 115, so that in this case 100 lb. of seedless hops were equivalent to 115 lb. of seeded hops so far as their resin contents were concerned. (It is interesting to find that these ratios approximate closely to those given by Prof. Schroder for the "Lupulin Content" of German seeded and seedless hops. Prof. Schroder's figures showed that the ratio between the seeded and seedless hops was 100 to 116.)

Even if disregarding their other valuable characteristics, hops were to be bought on their resin contents alone, it would, in such a case as the above, still be profitable to plant males to ensure the "growing out" of the hops, since a much larger quantity of resins per acre is thereby produced. There are, however, many other characteristics of seeded and seedless hops to be considered. An important point is that, for brewing purposes, a fairly large well-grown-out and whole hop is preferred to a small hop. Now it is a fact, as pointed out above, that the large well-grown-out Golding hop must always contain a fair amount of seed. Again, "seeded" hops are certainly brighter in colour than "seedless" hops. With regard to the all-important point of aroma, or flavour, it is believed that this is identical in seeded and seedless hops of the same variety.

In order to obtain first-hand information from brewers a paper on this subject was compiled by Mr. Arthur Amos and the writer and read to members of the Brewers' Institute at meetings held during the winter of 1907-8 at London, Birmingham, Manchester and Leeds. In the full discussion evoked by the reading of this paper* the opinion of both brewers and brewers' chemists in this country as to the comparative value of "seeded" and "seedless" hops for use in brewing was ascertained. The information obtained may be summarised as follows: Whilst it is clear that brewers and brewers' chemists do not know very definitely what they want to find in hops, they believe that the "resins" form one of the most important constituents. With regard to the question of the advantage of the presence or absence of seed in the hop, opinion is very much divided.

It seems clear that no chemically deleterious substance is contained in the seed itself. Prof. A. J. Brown has stated† that, taking a few samples at haphazard, he found in a first-class East Kent Golding about 12 per cent. of seed, while a

* *Journal of the Institute of Brewing*, Vol. XIV., p. 331 (1908).
† *Journal of the Institute of Brewing*, Vol. XIV., p. 342 (1908).

sample of East Kent Fuggles possessed exactly the same amount; on examining a sample of Spalt hops he found it contained only 0.8 per cent. Oregon and Californians sometimes contained upwards of 20 per cent. Prof. R. Braungart, in his monograph on Hops and Brewing, states that Saaz hops show 0.2 to 0.5 per cent. of seeds, Spalt hops 0.3 to 1 per cent., Red Auscha hops 3 to 4 per cent., the choicest East Kent hops 10 to 20 per cent., and American hops 15 to 25 per cent. Prof. A. J. Brown carried out experiments with seeds of East Kent Goldings, East Kent Fuggles and Oregons to ascertain whether the seeds contained an objectionable bitter principle. The results obtained led him to conclude that practically no flavour was derivable from hop seed, and that it might safely be concluded that the old idea that the seeds might communicate an objectionable bitter flavour to beer was fallacious. Some brewers are indifferent as to the presence or absence of seed; some look upon the presence of seed as a "nuisance," as being liable to get in the way in some of the processes of brewing; while some firms of well-known brewers prefer to see plenty of seed as an indication of a well-developed, sound hop. As one of the most eminent of the brewers' chemists in London expressed it, there are no reliable data on the subject from the brewing standpoint, and it is at present a matter of personal opinion or conjecture or even of prejudice.

Prof. R. Braungart states* that "whilst the brewers of mid-Europe look upon seed in hops as very undesirable, the brewers of Belgium, England, America, Australia, &c., do not mind the presence of a considerable amount of seed."

The Botanical Characteristics of Foreign "Seedless" Hops.

The essential characteristics of foreign seedless hops may now be noted. In some parts of Germany and elsewhere on the Continent, there are State regulations forbidding the growing of male hops, with the result that in these districts hops are grown practically or even absolutely seedless. From the fact that with certain Continental varieties of hops it is possible to grow seedless hops of a fair size, the totally wrong conclusion has been drawn that the same type of hop can be produced with English varieties. The English hop-grower has in recent years been urged by many factors, merchants and brewers, personally and by letters in the press, to extirpate the male hop and so grow seedless hops. The following quotation from a letter, signed "Farmer and Brewer,"

* *Der Hopfen aller Hopfenbauenden Länder der Erde als Braumaterial* (1901), pp. 203, 211.

which appeared a few years ago in one of the London papers, illustrates the nature of the argument which is still often advanced: "Why should not hop-growers in this country copy the example of their Bavarian competitors, and by expelling all male plants from their gardens, produce a crop of greater value per cwt.?"

The answer to this is that it is not possible, for the reasons already given in detail, to produce with English varieties of hops (and especially with all Golding varieties) a crop of seedless



FIG. 19. — An English and a German hop cut in half to show the difference in the structure. The German hop is on the left.

hops which are "grown out," and buyers will not look at small English hops which are not properly "grown out." The large Bavarian hops which are grown practically without seed are *very different botanically* from the English varieties. A fair-sized hop without seeds requires a very large number of bracteoles; the German hop possesses this large number, but the English hop does not. The number of bracteoles per hop in the English varieties is usually from 27 to 30; in those German varieties which produce seedless hops of over one inch in length the number of bracteoles per hop appears to be from 35 to 54.

The difference in the structure of a typical English and a German hop is shown in Fig. 19. The German hop is denser and more compact, with more numerous closely-packed "petals," and is seedless; the English hop is composed of fewer "petals" arranged more laxly, and is seeded.

An examination of various samples of German hops supplies some instructive facts. Samples of seven different kinds of hops grown in Germany were analysed botanically, each hop being picked to pieces and the results tabulated (see Table XVIII.).

TABLE XVIII.
GERMAN HOPS.

Description.	Average No. of Bracteoles per Hop.	Average Length of Hop in Inches.	Average No. of Seeds per Hop.	Ratio of Seeded to Seedless Bracteoles.
Sample—				
1. Bavarian	49	1 $\frac{1}{10}$	.8	10 to 602
2. Unspecified German variety from "low class ground" ..	28	$\frac{7}{10}$	.2	10 to 1,100
3. Hallertau	54	1 $\frac{1}{10}$	.3	10 to 1,700
4. Hersbrucker	33	1 $\frac{1}{10}$	5.1	10 to 52
5. Striesselpalter	35	1 $\frac{1}{10}$	1.0	10 to 340
6. Hallertau (Marzell) ..	38	1 $\frac{1}{10}$	1.0	10 to 141
7. English Goldings grown in Bavaria, Germany	35	1 $\frac{1}{10}$	1.1	10 to 108
8. Prakenbeier	33	1 $\frac{1}{10}$	4.0	10 to 57

Sample 1 consisted of 25 Bavarian hops. The average length of the hop was $1\frac{1}{10}$ inch; the number of bracteoles per hop was 49; the number of seeds per hop was .8 (i.e., 4 seeds to every 5 hops). This is what may be called the typical "seedless" German hop, and it is to be noted that the size of the hop, $1\frac{1}{10}$ inch long, is only obtained in the almost total absence of seed, by the production, on an average, of 49 bracteoles per hop.

Sample 2 consisted of 25 hops of an unspecified German variety from "a low class ground." The average length of the hop was $\frac{7}{10}$ inch; the number of bracteoles per hop was 28; the number of seeds per hop .2 (i.e., 1 seed to every 5 hops). The interesting fact here is that when the German variety is one which produces on an average only 28 bracteoles per hop—which is about the average number found in the English Golding varieties—and the hops are kept seedless, a small hop only $\frac{7}{10}$ inch long is produced, i.e., the hop is not grown out according to the English standard, and for such a hop on the English market a very inferior price would be paid.

Sample 3 consisted of 25 hops, labelled "prime Hallertaus." The average length of the hop was $1\frac{1}{10}$ inch; the number of bracteoles per hop was 54; the number of seeds per hop .3 (i.e., 3 seeds to every 10 hops). These large, practically seedless hops, composed of a very large number of bracteoles per hop, are typical of the best German hops, and are strikingly different from the seeded English Golding hop of about 29 bracteoles. It is possible that the 25 hops of this sample may have been selected for their large size, and that this variety

does not produce on an average so great a number as 54 bracteoles per hop; but at any rate these hops demonstrate the fact very clearly that if a large seedless hop is desired it can only be obtained if a variety of hop is grown which is capable of producing a much larger number of bracteoles per hop than any variety at present cultivated in England.

Sample 4 consisted of 25 hops, labelled "Hersbrucker später Gelingshopfen." The average length of the hop was $1\frac{1}{10}$ inch; the number of bracteoles per hop was 33; the number of seeds per hop 5. The comparison of these hops with the last sample is very instructive. The hops of the two samples are of the same size, and yet in the present case the average number of bracteoles per hop is only 33 as against 54 in sample 3. The explanation is found in the fact that whereas the Hallertaus hops were "seedless," containing only 3 seeds to every 10 hops, these "Hersbrucker" hops are slightly seeded, containing 53 seeds to every 10 hops. From the statistics collected as to the influence of seed on the length of the hop, it can be asserted that had these hops been seedless, they would have averaged less than an inch in length. The amount of seed present in this sample of German hops is the same as is sometimes found in English hops, usually, it is to be noted, in hops that are not well-grown-out; the slightly greater number of bracteoles per hop in the German variety favoured the better growing out of these hops. Such German hops as these approximate in structure to the English type of hop; among German hops they rank among the coarser inferior kinds.

Sample 5 consisted of 25 hops, labelled "Striesselpalter." The average length of the hop was $1\frac{1}{10}$ inch; the average number of bracteoles per hop was 35; the number of seeds per hop 1. This is an interesting case to compare with the last, as here the hops, notwithstanding an increase in the number of bracteoles per hop, show a decrease in length; this is due to the production of less seed, viz., 1 seed per hop instead of 5 seeds. This may be taken (like samples 1 and 3) as a characteristic "seedless" German hop, and in the absence (practically) of seed, 35 bracteoles per hop are required to build up a hop $1\frac{1}{10}$ inch long.

Sample 6 consisted of 50 hops, labelled "Hallertaus," from Marzell, Bavaria. The average length of the hop was $1\frac{1}{10}$ inch; the average number of bracteoles per hop was 38; the number of seeds per hop 3. Here, notwithstanding the considerable number of bracteoles per hop, and also the presence of some seed, the length of the hop is only $1\frac{1}{10}$ inch.

Sample 7 consisted of 50 hops of the English Golding variety, but grown in Bavaria, Germany, since 1893. The average length of these hops was $1\frac{1}{10}$ inch, the average number of bracteoles per hop 35; the number of seeds per hop 1. This sample forms one of the most interesting cases examined. The small size of the hops, which on the English market would be classed as not properly grown-out hops, and which consequently would realise an inferior price, is the direct result of the almost total absence of seed. The hops have been able to attain the average length of $1\frac{1}{10}$ inch owing to the number of bracteoles per hop being 35; in this country the same variety of hop produces as a rule only from 27 to 30 bracteoles per hop, and when grown seedless attains an average length of only $\frac{3}{4}$ inch, or when seeded to the extent of the German sample described above, an average length of $\frac{3}{4}$ inch.

The evidence supplied by the above samples shows that the ability of the German grower to grow large seedless hops is dependent on his growing certain varieties which produce a considerably greater number of bracteoles per hop than the varieties grown in England. For English growers to attempt to grow at the present time "seedless" Golding hops would be the most disastrous step they could take.

CHICKEN REARING DEMONSTRATION AT MORDEN HALL, Nr. ASHWELL, CAMBS.

THE Board of Agriculture and Fisheries have made arrangements for a demonstration to be carried out at Morden Hall, near Ashwell, with a view to showing in practice the methods of raising chickens for table purposes adopted by Mr. F. G. Paynter. The demonstration is being conducted under Mr. Paynter's personal supervision and management, and forms a continuation of that conducted in 1913 at Haslington Hall, near Crewe.

A description of the object of the demonstration and of the methods adopted is given below, together with some hints for the guidance of persons wishing to make a trial of the system.

Object of the Demonstration.

The object of the present demonstration is to give a practical illustration of the methods by which a regular supply of table chickens may be produced on a small holding, during those months of the year in which the conditions are favourable both to rearing and marketing. The raising of chickens by this

method should occupy only a portion of the small holder's time, while the area of land devoted to the chickens would form only a portion of the total area of the holding. The demand for table poultry is constant, and at certain seasons of the year the supply of birds of suitable quality is meagre, so that there is little difficulty in securing satisfactory markets for a steady supply of uniform quality.

Mr. Paynter's aim is to raise during the season from 3,000 to 4,000 chickens weighing from $3\frac{1}{2}$ to 4 lb., and, in order to accomplish this, incubation commences at the beginning of December and continues until the end of June. The birds reach marketable size in from 12 to 16 weeks, and thus the last batch of chickens is ready for sale about the middle of October.

Area of Land required for Chicken Rearing.

In order to raise 3,000 to 4,000 chickens during the period indicated it has been found necessary to utilise 4 acres of land. The land selected should be fairly light and it should not have been occupied by poultry for some considerable time previous to its use as a rearing ground. The chickens should not be raised year after year on the same ground, but arrangements should be made to change the site every year so that each plot of four acres carries poultry once in three or four years. The land occupied by the birds will receive a considerable amount of manure during the season, and advantage should be taken of this fact in planning a rotation of crops on the holding.

Capital Required.

The initial capital required for raising chickens on the scale undertaken by Mr. Paynter is from £250 to £300, and a considerable portion of this amount is devoted to the purchase of the necessary appliances. The minimum equipment required for an output of 3,000 chickens, is given on p. 222.

Laying out the Ground.

The method of laying out the ground and of utilising the appliances will be readily appreciated by those who visit the demonstration. A small portion of ground near the dwelling house is set aside for the reception of two or three brooders, into which the chickens are placed when they leave the incubator, and in which they remain for two weeks in order that they may be under constant observation and may be trained to run up to the hover of the brooder when they feel cold and so avoid the risk of "packing" or crowding.

The remainder of the ground is laid out for the reception of the brooders and Sussex arks into which these chickens are

gradually drafted. Each brooder is placed in a run enclosed by wire netting 2 ft. high supported by light stakes placed at intervals. These runs may conveniently measure 9 yds. by 40 yds., and are used for the chickens up to the age of seven weeks.

Each Sussex ark is placed in a run measuring 40 yds. by 20 yds., enclosed by wire netting 4 ft. high supported by stakes. Access is gained to the larger runs by an arrangement which

List of Appliances -Minimum Equipment.

	£	s.	d.
4 incubators at 65s. od.	25	0	0
14 brooders at 3s. 10s. od.	42	0	0
24 houses at 1s. 10s. od.	16	0	0
31 rolls 4-foot netting at 9s. od.	14	14	6
12 rolls 2-foot netting at 9s. od.	5	14	0
300 stakes at 4d.	1	0	10
Hamboo	1	0	0
Pens	1	0	0
24 water pans at 7d.	14	0	0
24 grit pans at 7d.	14	0	0
24 feeding tins at 4d.	8	0	0
14 grit tins for brooders at 1s.	14	0	0
48 food tins at 2d.	8	0	0
12 food boxes at 1s.	12	0	0
2 barrows at 16s.	1	12	0
1 water barrow	1	10	0
6 tins for mixing food at 1s. 10s.	12	0	0
2 corn bins at 7s. 6d.	15	0	0
4 corn bins at 4s.	16	0	0
6 market baskets at 8s. 6d.	2	11	0
1 food baskets at 1s. 6d.	4	6	0
60 food tins at 4d.	1	2	6
1 weighing machine	1	10	0
1 weighing machine	1	0	0
Buckets, etc.	1	0	0
Kettles and sundries	6	0	0
	£150	5	10

permits of a short length of the wire netting between two posts being swung aside. When seven weeks old, the chickens are transferred to these arks in lots of 40. The plan followed at Morden Hall is to lay out the runs for the younger chickens near the centre of the ground, while those of the older chickens are placed outside and extend to the limits of the area. Paths are provided which give access to the pens and permit of the food being conveyed to the birds with the least expenditure of labour; galvanised iron food tins containing grain and grit are placed in convenient positions near the runs. The object in selecting and arranging the appliances and in planning the runs has been to secure efficiency and economy, and to facilitate the adoption of a standardised method of management which is calculated to produce uniform results.

Supply of Eggs for Hatching.

The eggs bought for hatching should be selected from breeds which are suitable for table purposes, and eggs of pure Sussex, pure Faverolles, and first crosses of these breeds may be recommended. The eggs should be the produce of hens in their second year and the pens from which the eggs are obtained should be judiciously mated. It is of the utmost importance that the breeding stock should be vigorous and healthy. The eggs used for artificial incubation should be as fresh as possible, and should preferably be not more than a week old when placed in the incubator. There are great advantages in securing a local supply of eggs, and there is likely to be a definite gain in the percentage of chickens hatched when the eggs are procured locally as compared with eggs obtained from a distance. In this connection attention may be directed to the possibility of co-operation among several poultry-keepers, some of whom might devote their attention to producing the eggs and others to rearing the chickens.

In the case of the Morden demonstration from 300 to 400 eggs for hatching are bought each week from the 1st December to the 7th June, and the approximate prices paid per dozen by Mr. Paynter are as follows:—December, 3s.; January, 2s. 6d.; February, 2s. 3d.; March, 2s.; April and May, 1s. 6d.

Incubators.

The eggs are hatched in incubators of the hot-air type, which vary in capacity from 240 to 390 eggs; at least one incubator is started each week during the hatching period. Mr. Paynter keeps three or four incubators constantly at work and holds additional machines in reserve in case of need or accident, and to allow for the necessary cleaning and overhauling of the machines after each hatching period.

The weekly supply of eggs is received on Saturday and the eggs are prepared for placing in the incubator next day. This is found to be a convenient arrangement, as the chickens are then taken out of the machine on a Monday morning.

The eggs are turned twice daily until the eighteenth day; on the seventh day they are tested and the infertiles are set aside for feeding the chickens in the second week.

There are several reliable makes of both hot-water and hot-air incubators on the market, and the operator is advised to follow carefully the instructions provided by the maker for working the particular machine selected.

The room in which the incubators are placed should be one in which a fairly equable temperature can be maintained,

it should be free from vibration, and, while adequately ventilated, it should be free from draughts.

Rearing (Total period 12 to 16 weeks)

The chickens are left in the incubator until the twenty-second day, when they are transferred to the brooders. For the first two weeks, as has already been pointed out, they remain in a portion of the rearing ground where they can be kept under constant observation. The brooders selected for use are of the hot-air type. Those used for raising chickens on the scale undertaken by Mr. Paynter must be capable of giving satisfactory results when worked in the open under the severe conditions of mid-winter, and also under the very different conditions which prevail in the late spring. They must be simple in construction and should not demand incessant attention. The brooders used at Morden Hall are capable of accommodating 60 chickens up to the age of from 5 to 7 weeks, and hence a hatch of 120 chickens will require the use of two brooders. Two lamps are provided for each machine in order that one may be cleaned and filled while the other is in use. The brooders are cleaned out regularly once a week until the chicks are four weeks old and twice a week afterwards. Sand is used for covering the floors of the brooders.

Feeding and Management

First Week.—During the first week the birds are provided at frequent intervals with just as much food as they will clear up. The food consists of the following mixture:—

Chick Feed.	
Wheat (cracked)	50 per cent.
Millet	15 "
Canary seed	15 "
Best meat	10 "
Maize (cracked)	5 "
Rice	5 "

An unlimited supply of pure water is always provided, and grit is scattered on the floor of the brooder, and is constantly available throughout the whole process of rearing.

Second Week.—During the second week the birds are fed in the following way:—

At daybreak	Chick feed.
At 9 a.m.	Hard-boiled egg.
At 12.30 p.m.	Chick feed.
At 6 p.m. (or half an hour before sunset, according to the season)	Chick feed.

When the chickens are two weeks old they are moved to a brooder in the centre of the rearing field, and are confined for one day in a small wire run attached to the end of the

machine. This small run is then removed, and the chickens have access to the larger run in which the brooder is placed.

Third and Fourth Weeks. Three tins containing chick feed, and fitted with wire guards to prevent the birds scratching out the food, are placed overnight in the brooder so that the first feed may be obtained at daybreak. These tins are removed when the birds are let out of the brooder, and a tin of groats is provided for them. At 9 a.m. soft food is given, consisting of biscuit meal and 10 per cent. of meat. The biscuit meal and meat meal are mixed with boiling water and are dried off with equal parts of sifted barley meal and sharps. The mixture when prepared should be crumbly, the utmost care being taken to mix the ingredients thoroughly and to avoid the use of "sloppy" food, which is a frequent cause of trouble. At the same time any groats which have not been cleared up are removed and a tin of meat scrap is placed in the run. At 1 p.m. soft food prepared as described above is again given to the chickens, and the tin of meat scrap is removed. About 6 p.m., or earlier according to the season, the birds receive as much dry chick feed as they will eat.

When four weeks old the chickens may be divided into lots of 40, and each lot may be provided with a separate brooder and an enclosed wire run.

Fifth, Sixth and Seventh Weeks.—At the beginning of the fifth week after hatching, and until they are seven weeks old, the chickens are fed as in the fourth week, but instead of the chick feed they receive a mixture consisting of:—

90 per cent. whole wheat,
10 per cent. chick feed.

When the chicks are seven weeks old they are moved to the larger runs and are housed in Sussex arks. The Sussex arks are provided with slatted floors through which the manure falls. Wooden floors are placed on the ground below the arks in order that the manure may be collected and utilised.

Eighth to Sixteenth Week.—At 7 a.m. the birds receive a mixture composed of:—

Meat meal	1 lb.	= 4 lb.
Biscuit meal	2 "	
Bran	1 1/2 "	

This amount is soaked in 1 1/2 gallons of boiling water and dried off with:—

Barley meal	2 lb.
Fine sharps	9 "

This ration is given to the birds again at 1 p.m. The evening feed consists of 90 per cent. of whole wheat and 10 per cent. of cracked maize.

An alternative system of feeding which has proved advantageous is as follows:—

- 7. 0 a.m. Soft food, as described above.
- 10.30 a.m. A half level of mixed grain.
- 1.30 p.m. A half level of the soft food.
- 6. 0 p.m. As much mixed grain as the birds will eat.

The Quality of Foods used

The quality of the meals and grain used for feeding is a matter of considerable importance. All the feeding-stuffs should be sweet, and freshly-milled meals should be used when possible. If the feeding-stuffs are bought in quantity they should be stored in suitable bins so that they may not deteriorate. The ingredients used by Mr. Paynter are such as can be obtained everywhere, but care should be taken in selecting them, as experience has proved that the health, and consequently the rapid growth and development of the birds, is largely dependent on the care exercised in this matter.

Marketing

When the birds are between 12 and 16 weeks old they weigh from 3½ lb. to 4 lb. and are sold by contract at prices varying from 3s. 9d. each in April to 2s. 6d. each in September. They are sent away alive in crates containing 12 birds, the purchaser paying carriage. This method has the advantages that it saves the rearer a considerable amount of trouble, and removes anxiety regarding market fluctuations, for the season's output is sold beforehand at fixed rates for the different months.

On the other hand "finished" birds, while their preparation involves additional expense in food and skilled labour, command a better market and would possibly yield a higher return. With the object of testing the possibilities in this direction arrangements have been made to trough feed and cram a certain proportion of Mr. Paynter's birds during the present season, and to compare the results with those obtained by the sale of "unfinished" birds.

Result of Previous Demonstration

The result of the demonstration carried out in 1913 by Mr. Paynter indicates that success is largely dependent on the quality and proximity of the egg supply, and that the amount of profit on the season's work is to a large extent determined by the number of birds which can be placed on the market in April, May and June (see also *Journal*, March, 1914, p. 1049).

During the season 1913 Mr. Paynter purchased 9,807 eggs for incubation and hatched 4,028 chickens, or 41 per cent. of the total. The number of birds which reached a marketable age was 3,471, and these were sold at an average weight of

slightly over 4 lb., realising on the average 8½d. per lb. The cost of food amounted to £275 7s. 5d. The net profit on the season's output, after deducting all expenses—rent, interest on capital and depreciation, amounted to £55 1s. 2d.

It would be unwise at the outset for anyone *without* considerable experience to undertake chicken raising on the scale indicated above, but the methods adopted by Mr. Paynter may be applied with advantage to raising a much smaller number of birds.

As experience is gained additional appliances can be purchased and the output of chickens gradually increased from year to year.

The Danish People's or Peasants' High Schools (Folkhøjskoler) owe their origin to the propagandist work of the Danish ecclesiastical reformer, poet, and historian, Bishop Grundtvig (1783–1872). The move-

ment leading to their foundation was chiefly of a religious and national character.

Object of the Schools. The schools were intended to continue the education of young men from the age of 18 or thereabouts, not so much, however, in the direction of the acquisition of knowledge in special subjects as in the extension of their intellectual and moral perspective, the idea being to remove these youths for a brief space from the working world with its material considerations into the realm of the ideal. The ideals it was sought to awaken within them were both religious and national. This is well brought out in the programme laid down at the opening of the first peasant school at Rødding in North Schleswig in 1844 by Christian Flor, the founder: "The aim towards which we are striving is the foundation of an institute where peasants and townsmen can obtain such knowledge and skill as will be of advantage not so much with regard to their particular occupations and trades, but rather as to their position as sons of the Fatherland and citizens of the State. The institute will have a beneficial influence not only on domestic and private life, but also on public and civic life. We call the institute a *high school* because it is not an ordinary "boys' school," but an institute partly for young people and partly for adults. We call it a *people's high school* because people of all classes will have access to it, although it has been founded principally for peasants and expects to draw its students chiefly from this class."^{*}

* Schröder: Der nordiske Folkhøjskole (quoted by Hollmann, *Die ärmliche Volkshochschule*, Berlin, 1909).

The subjects taught in this first school were the Danish language and literature, local government, law, geometry, drawing, surveying, German, Swedish, natural sciences, singing, and gymnastics. The instruction lasted over six winter months in each year, and the course was of two years' duration. The cost per scholar for instruction, board and lodging was £8 18s. a half-year. The school commenced with 20 pupils.

Seven years elapsed before the next school, opened by Kristen Kold at Ryslinge in Funen in 1851, was founded. The instruction here lasted five months (November 1st to April 1st), and the cost for instruction, board and lodging was £3 7s.; the course was of two winters' duration. In 1862 a three months' summer course for women was started, a feature which was common to practically all subsequent people's high schools.

Growth of the Schools.—The people's high school movement increased but slowly until after the war with Prussia in 1864; but there are in existence at the present time about 80 such schools scattered over rural Denmark, often at some considerable distance from a railway station and attended by students of the peasant or yeoman class for the most part, the greater number between the ages of 18 and 25, though many are older. Practically all these schools have been founded as private undertakings and by private individuals. Most of them began in a very small way with a few rooms and have gradually developed into institutions for hundreds of students.

The following table* shows the development of the People's High Schools, and also of the Agricultural Schools, which are similar institutions having a bias which is either wholly or partly agricultural and horticultural:

YEAR.	PEOPLE'S HIGH SCHOOLS. No.	AGRICULTURAL SCHOOLS. No.
1851	1	4
1861	11	5
1871	50	7
1881	64	10
1891	67	13
1901	71	11
1906	74	15
1911	80	19

Of the 80 High Schools in existence in 1911, 64 were for both sexes, seven were for women only, one was for men only, and seven others were for both sexes, but had no women attending (one is not specified).

* These and subsequent statistics quoted have been recently published by the Danish Bureau of Statistics.—*Statistiske Meddelelser*, 1913.

Subjects of Instruction.—Although the aim of the schools may be said to have remained more or less the same from their foundation until the present day, the curricula have been widely extended. Each school is divided into a certain number of sections or "sides." The total number of such sections in existence in 1910-11, both in the High Schools and in the Agricultural Schools, was as follows:

SECTIONS.	PEOPLE'S HIGH SCHOOLS.		AGRICULTURAL SCHOOLS.	
	Men.	Women.	Men.	Women.
General Instruction	70	70	—	—
Trades	26	—	1	—
Gymnastics	2	1	—	—
Continuation subjects	2	3	—	—
Agriculture	4	1	16	7
Horticulture	—	—	3	2
Dairying	—	—	2	—
"Control" and food	—	—	2	—
Total Number of Sections	104	75	24	9

Numbers of Pupils. The extent to which these schools attract pupils is shown by the fact that in 1910-11 the total number of students at the People's Schools was 6,707 (3,603 men, 3,104 women), and at the Agricultural Schools 1,550 (1,361 men, 189 women). Thus, taking the People's Schools alone, 46 per cent. of the students were women; but it must be remembered that women and girls stay, as a rule, three months only (from May to July) while men attend for five months (from November to March).

The number of students at the schools during the various months of the year (1910-11) is brought out by the following table:

	AT PEOPLE'S HIGH SCHOOLS.	AT AGRICULTURAL SCHOOLS.
April	328	318
May	2,761	345
June	2,755	340
July	2,744	335
August	48	77
September	129	160
October	161	104
November	3,643	1,223
December	3,684	1,231
January	3,914	1,265
February	3,893	1,287
March	3,779	1,232

The numbers of students taking the various courses in 1911 were as follows:—

SECTION	AT PEOPLE'S HIGH SCHOOLS.		AT AGRICULTURAL SCHOOLS.	
	Men.	Women.	Men.	Women.
General Instruction ..	2,831	3,047	—	—
Agriculture ..	101	9	1,146	161
Trades ..	534	—	11	—
Gymnastics ..	55	21	—	—
Continuation subjects ..	62	17	—	—
Horticulture ..	—	—	57	6
Dairying ..	—	—	118	—
"Control" and Food ..	—	—	7	—
Totals ..	3,603	3,104	1,351	167

Of the total number of 8,257 students in all schools, both People's and Agricultural, 43 were under 16 years of age, 515 were between 16 and 18, 6,541 were between 18 and 25, and 1,158 were over 25. That these students are drawn from the peasant class is shown by the fact that the parents of 4,428 students were peasant proprietors (*gaardmænd*), and those of 1,675 students were cottagers (*husmænd*), while as regards the remaining students the parents of 250 were labourers, those of 798 were artisans, and of 1,106 of other occupations.

In addition to Danish students these schools attract pupils from Germany, Norway, Sweden, Faroe Islands, Iceland, England and America. Many students have to travel long distances in order to reach the school.

Hours of Instruction. As regards the time table followed the average number of hours per subject in the courses of ordinary length at the People's High Schools, in the case of (a) men (five months' course) and (b) women (three months' course) is as follows: Danish, (a) 152, (b) 92; writing, (a) 21, (b) 10; reading aloud, (a) 63, (b) 46; history, (a) 201, (b) 136; geography, (a) 46, (b) 28; physics, (a) 38, (b) 16; zoology and botany, (a) 11, (b) 10; chemistry, (a) 13, (b) 4; hygiene, (a) 18, (b) 15; arithmetic, (a) 95, (b) 43; drawing, (a) 48, (b) 10; singing, (a) 20, (b) 15; gymnastics, (a) 103, (b) 67; law, (a) 15, (b) 3; surveying, (a) 20; agriculture, (a) 59; manual training, (b) 115; book-keeping, (b) 2; and domestic economy, (b) 6.

In the Agricultural Schools the average number of hours given to various subjects in the five months' course in the case

of men is as follows:—Natural sciences, 211; crops, 159; live stock, 143; other agricultural subjects, 97; and general education, 295. In some schools there is a six months' course for men, in which case the number of hours given per course to various subjects averages as follows:—Natural sciences, 237; crops, 181; live stock, 176; other agricultural subjects, 136; and general education, 251.

The curriculum of the six months' winter course at the *Tune Landboskole**, one of the most advanced schools of this type in the country, includes the following subjects:—Danish history, literature, arithmetic, geometry, book-keeping, surveying, chemistry, physics, anatomy, geology, botany; agriculture (including manuring, crops and plant cultivation), animal physiology, management of live stock, agricultural history; and gymnastics.

At the less advanced type of Agricultural School at *Hong** the following subjects are taught during the winter course:—Danish, Danish history, arithmetic, chemistry, physics, botany, drawing and surveying, agricultural book-keeping, soils, the rotation and manuring of crops, management of live stock, poultry-keeping, production and treatment of milk, and gymnastics.

The five months winter agricultural course at the *Ladlund Landbrugsskole**, which is an institution of considerable importance, having extensive laboratories and conducting the analysis of fertilizers and feeding stuffs among other work, embraces the following subjects: Danish (60 hours during course), arithmetic (60), chemistry (70), physics (70), botany (10), geology (8), drawing (20), agricultural history (15), national economy (12), surveying (20), agriculture (including rotation and manuring, soils, plant cultivation, plant diseases and moon culture) (150), bacteriology (15), dairy work (12), management of live stock and poultry (180), book-keeping (30), machinery and implements (18), and gymnastics (1 hour daily).

The farms which are attached to the Agricultural Schools are, as a rule, owned by the directors of the schools, and are managed on business lines. The work is done by ordinary labourers and not by the pupils as in the German farm schools.

Cost of Instruction, &c. The expenses of a student for the five months' winter course including board, lodging, tuition,

* The particulars as to these three schools are taken from the Report of the Departmental Committee on Agricultural Education in England and Wales [Cd. 4206.]

books, and illness insurance contributions, are ordinarily about £10 to £12, but the student has to bring everything with him except his bedding. The expenses for the three months' summer course are proportionately less, while those at the advanced high school at Askov are about 25 per cent. higher. These sums would prove prohibitive to the poorer class of students were not bursaries, which cover most of their expenses, readily available from the State. In the financial year 1910-11 2,658 of the 8,257 students received such aid; 2,276 of these aided students attended the People's High Schools, and the aid received was £10,215 (average £4.95); 382 of the aided students attended the Agricultural Schools and the aid given amounted to £2,661 (average £7). These bursaries in 1910-11 were found to average per month of study, 22s. 3d. in the case of People's Schools and 27s. 9d. in the case of Agricultural Schools. The assistance given to agricultural students is conditional either upon the students having passed their 22nd year or upon their showing that they have already acquired sufficient knowledge to benefit from the instruction provided.

Number of Teachers.—Bearing in mind the ideals which the schools strive to attain, it is obvious that the success of the instruction given must depend in an unusual degree on the personality of the teachers. The ordinary institution is, in fact, as much a home as a school, and the teacher is usually as much a friend as an instructor. In 1910-11 the instructors in the eighty People's High Schools numbered 589, viz., 76 male directors, 6 female directors, 14 directors' wives, 229 permanent male teachers, 88 permanent female teachers, and 126 male and 50 female teachers engaged for special subjects. In the nineteen Agricultural Schools the instructors numbered 168, viz., 19 male directors, 2 directors' wives, 65 permanent male and 13 permanent female teachers, and 61 male and 8 female teachers for special subjects.

State Aid.—The relations between these schools and the State are regulated by a law of 1902. Schools which seek aid from the State must be "recognised," and to obtain recognition they must have worked for two years and must have been frequented by at least 10 pupils for a year or 20 for 6 months or 40 for 3 months. No scholar must be under 16 years of age, and not more than one-fourth of all the scholars must be between 16 and 18 years old. The aid given by the State in the period 1867 to 1879 (in which most schools were founded) was only £1,222 per annum for all schools (people's as well as agricultural). In the period 1879-1886 the sum rose to

£3,955, but had dropped again by 1886-1890 to £2,222. In 1892 the State assistance was raised to £6,000 for schools, and £10,000 for bursaries for scholars. The law of 1902 further raised these sums to £7,777 for all schools, and £13,888 for scholars.

The grants to schools are about £28 each per annum, together with a sum in aid of various expenses incurred in the preceding year, but which must not, in any case, exceed one-third of these. Bursaries to scholars have already been mentioned (p. 232), but it must be mentioned that not more than half the students in the schools can receive such aid in any year, and then only if the available funds permit.

In addition to the ordinary State grants the schools received various other subsidies in 1910-11. Thus 38 high schools received £554 and 11 agricultural schools £250 in all from State school funds; for manual and technical work three high schools received £159 in all from the Ministry of the Interior; three high schools received £46 in all from municipal funds; and 10 high schools received £310 in all from other sources.

Notwithstanding the aid received by these schools from the State they are left practically uncontrolled by the latter, except that the Government is kept informed year by year of their condition and progress by the reports of inspectors. The question of the introduction of examinations has been brought forward at various times in the history of the schools, but has always been strenuously opposed. The competition between school and school would seem to have been found sufficient guarantee for the efficiency of the staff. There is no element of compulsion about attendance at these schools. Most of the students' previous education has been simply that acquired at an elementary school, the time between leaving this and attendance at a People's High School being spent at business, or in employment on the land. Thus, by the time a student attends one of these schools his occupation in life has already been determined.

"While at the school students do not give merely the lag end of the day to study, but are set free for five or six months together to devote their whole time and thoughts to their work and to their intercourse with one another, and the schools may, in the aggregate, be well called the best poor man's university the world has yet seen.

"Their success is due to the simple, inexpensive way in which the schools have been carried on, and to the fact that the farm

labourers of Denmark own for the most part the land which they till. It is the self-reliant independence of these Danish yeomen, rather than any peculiar excellence in their education at the elementary school, or any ease in their worldly lot, which accounts for the avidity with which they seek knowledge for its own sake." *

The great influence of these schools on the economic well-being of the country, and more especially agriculture, is undeniable, although as the development of Danish agriculture has gone hand-in-hand with the development of these schools the two have probably acted and reacted on each other.

The inquiry into the quality of farm seeds, commenced in 1912† was continued during the sowing period of 1913, and 295 samples of clover and grass seeds were procured by the Board's Inspectors. The samples were obtained from three districts, situated respectively in North Wales, the West of England and Midland and South Midland Counties, and consisted of 246 samples of unmixed seeds and 49 samples of mixed seeds. Of the samples of unmixed seeds 197 were purchased by the Board's Inspectors from various seed warehouses and shops in the three districts, and 49 were procured from farmers who had already purchased them from merchants.

Of the mixed seeds 44 samples were obtained from farmers who, with two exceptions, had purchased ready-made mixtures, and five were purchased by the Board.

The unmixed seeds comprised 42 samples sold as English or Welsh red clover, 30 white Dutch clover, 29 sainfoin, 21 alsike, 17 cowgrass or red clover, 15 trefoil, 24 Italian rye grass, 23 perennial rye grass, 16 cocksfoot, 15 foxtail, 13 timothy, and 1 meadow fescue. The mixed seeds consisted of 8 samples intended for one-year ley, 29 for temporary pasture, and 12 for permanent pasture. All the samples were forwarded to the School of Agriculture, Cambridge University, and tested for their purity and germination, with the following results:—

I. 42 Samples English or Welsh Red Clover

Average Germination, 61·5 % Highest, 92·1 % Lowest, 30·3 %
Average Purity, 94·5 % .. 99·8 % .. 79·15 %
Average Real Value, 58·1 %

* Special Reports on Educational Subjects, 1896-97.

† Reported in the *Journal*, Feb., 1911 p. 910.

‡ The calculation for ascertaining the percentage of real value is
Percentage Germination × Percentage Purity.

Of these samples 28 contained seeds of dodder, viz.: 12 European dodder; 12 both European and Chilian dodders; and 4 Chilian dodder; 4 samples contained oiled seeds.

In 1912 the Real Value figure for 56 samples was 67·3 per cent. and 30 contained dodder seeds.

II. 30 Samples of White Dutch Clover

Average Germination, 76·6 % Highest, 98·6 % Lowest, 4·6 %
Average Purity, 80·6 % .. 99·6 % .. 25·4 %
Average Real Value, 61·3 %

Of these samples 8 contained dodder, and one a small percentage of *Trifolium parviflorum*.

In 1912 the Real Value for 31 samples was 50·6 % and 18 samples contained dodder.

III. 29 Samples of Sainfoin

Average Germination, 36 % Highest, 89 % Lowest, 9 %
Average Purity, 98·5 % .. 100 % .. 96 %
Average Real Value, 35·5 %

Of these samples 5 were milled seed, and the remainder were samples of seeds in husk.

In 1912 the average Real Value for 10 samples was 45·8 %.

IV. 21 Samples of Alsike

Average Germination, 65·5 % Highest, 93 % Lowest, 30·6 %
Average Purity, 88·5 % .. 98 % .. 6 %
Average Real Value, 58 %

Of these samples 8 contained seeds of European dodder.

In 1912, 20 samples of Alsike gave an average Real Value of 54·5 % and 10 samples contained dodder.

V. 17 Samples of Cowgrass

Average Germination, 72·7 % Highest, 91·6 % Lowest, 3 %
Average Purity, 94·6 % .. 98·3 % .. 83·8 %
Average Real Value, 68·8 %

Of these samples 9 contained dodder, viz.: 6 European, 2 Chilian, and 1 both Chilian and European. One sample contained oiled seeds.

VI. 15 Samples of Trefoil

Average Germination, 70 % Highest, 92 % Lowest, 14 %
Average Purity, 97 % .. 100 % .. 93 %
Average Real Value, 67·9 %

VII. 24 Samples of Italian Rye Grass

Average Germination, 78 % Highest, 91 % Lowest, 40 %
Average Purity, 93 % .. 99 % .. 65 %
Average Real Value, 72·5 %

In 1912 the average Real Value for 37 samples was 70·2 %.

VIII. 23 Samples of Perennial Rye Grass.

Average Germination,	78%	Highest,	91%	Lowest,	46%
Average Purity,	92%	"	100%	"	75%
Average Real Value, 71.8%					

In 1912 the average Real Value was 72.5 % for the same number of samples.

IX. 16 Samples of Cocksfoot.

Average Germination,	71%	Highest,	90%	Lowest,	44%
Average Purity,	93%	"	99%	"	75%
Average Real Value, 66.0%					

X. 15 Samples of Foxtail.

Average Germination,	53%	Highest,	81.9%	Lowest,	0%
Average Purity,	88.5 %	"	98%	"	8.7 %
Average Real Value, 46.9 %					

XI. 13 Samples of Timothy.

Average Germination,	94%	Highest,	99%	Lowest,	90.3 %
Average Purity,	98.5 %	"	100%	"	95%
Average Real Value, 92.6%					

XII. 1 Sample of Meadow Fescue.

Germination, 95.3% Purity, 97.8% Real Value, 93.2%

On two occasions tall fescue seed was sold for cocksfoot, and in one instance some worthless perennial rye grass was sold as Italian rye grass seed.

49 Samples of Mixed Seeds.

The majority of these samples were procured from farmers who had purchased ready-made mixtures. All the samples were analysed for purity, but not for germination, the average purity being 96.3 per cent.

This high percentage of purity is probably accounted for by the fact that most of the samples were taken from seeds supplied by well known firms in the trade.

One sample intended for a four-years' ley and priced at 21s. per acre contained approximately 2 per cent. of *Trifolium parviflorum*.

LIVER OF SULPHUR, as sold commercially, is a mixture of several chemical compounds. It is obvious that its value as a spraying material will depend upon

Purchase and Use of its content of such substances as have a Liver of Sulphur. fungicidal action; and it is also clear that the proportion of these substances present might possibly vary according to the method of preparation of the liver of sulphur by the manufacturers and also

according to the way in which the liver of sulphur is stored subsequent to manufacture, as other compounds may be expected to be formed on exposure to the air.

Foreman's experiments* with weak solutions of each of the various compounds found in liver of sulphur on the germination of spores of *Botrytis Cinerea* and *Sphaerotheca mors-uvæ* appear to show that sulphur in the form of sulphides (hydro-sulphide, sulphide and polysulphide) is the valuable fungicidal agent in liver of sulphur. On this assumption,† it has been shown, as the result of analyses conducted at the Government Laboratory on behalf of the Board, that the efficiency of liver of sulphur may vary widely and that the term may mean anything from a worthless to a very valuable article. Some of the samples analysed were obtained by the Government Laboratory direct from large chemical manufacturers, but the bulk were purchased for the Board in different parts of the country during June and July, the season in which liver of sulphur is required for spraying purposes. The results of the analyses are all the more interesting, since, owing to the divergence in the method of packing the samples for dispatch to the Government Laboratory, the degree of exposure to the air differed greatly. To test the conclusions as to the effect of exposure due to inefficient storage, investigations on the point were also carried out at the Government Laboratory. It will be convenient, however, to consider first the variation due to differences in the method of preparation.

Variation in Content of "Sulphide" Sulphur due to Differences in the Method of Preparation.

The following were the results of the analyses of the samples purchased by the Government Laboratory direct from large chemical manufacturers:—

Origin.	Price per lb.	Content of "Sulphide" Sulphur. Per cent.
Berlin	s. d. 1 6	21.53
Berlin	0 8	19.83
London	0 6	26.07
London	0 4	27.64
London	0 4½	30.08
London	0 4	23.57

These figures show fairly wide variation in "sulphide" sulphur content.

* *Journal of Agricultural Science*, Volume III., page 400.

† Apart from this, the proportion of "sulphide" sulphur gives the best indication as to whether liver of sulphur has been prepared according to the usual method and is in a fresh condition (see later).

In the case of the samples purchased for the Board locally, taking only those samples which were dispatched properly packed in tins or bottles, the "sulphide" sulphur content of 12 samples was found to vary from 4.90 per cent. to 37.94 per cent. Two of these samples contained 6.71 and 4.90 per cent. respectively of "sulphide" sulphur and while one of these was insecurely closed it is quite possible that the other was "weathered" before purchase. However, the fact that the remaining ten samples varied from 25 to 38 per cent. in content of "sulphide" sulphur (these ten samples being all among those most nearly resembling freshly-made liver of sulphur) taken in conjunction with the results obtained from the samples purchased direct from large chemical manufacturers, makes the conclusion tolerably certain that, as manufactured, liver of sulphur varies widely in value.

Although it is possible that the results of the analysis of samples which were forwarded to the Government Laboratory packed in paper have not the same value, the evidence afforded by them corroborates the above results. Thus the "sulphide" sulphur content of 23 samples so dispatched varied from 0.88 per cent. to 31.44 per cent.

The absence of any connection between the price and the efficacy of the fungicide which is evident from the figures in the above table, was also found in the samples purchased in different parts of the country, the prices of which varied from 5d. to 4s. per lb.

Variation in Content of "Sulphide" Sulphur due to Differences in Method of Storage.

Exposed to the air in a solid form, liver of sulphur rapidly absorbs water and carbonic acid, turns from a liver brown to a greenish yellow colour, and evolves sulphuretted hydrogen. The change can be seen by breaking a lump of the substance that has been exposed to the air. The face of the fracture shows on the extreme outside a ring of greenish grey colour, within this a band of yellow, and in the centre the liver brown colour of the original substance. Exposed to the air for a longer time, the whole of the substance becomes of a grey colour, crumbles readily to a powder, and no longer evolves sulphuretted hydrogen. When a solution of liver of sulphur is allowed to stand in contact with the air, sulphur soon begins to separate and gas is produced. These reactions appear ultimately to convert the sulphides into sulphur, carbonates, and sulphates.

This effect of exposure to the air was actually found in the analyses of the samples purchased for the Board locally, the content of "sulphide" sulphur varying, as already stated, from 4.90 to 37.94 per cent. in the case of samples properly packed, and from 0.88 per cent. to 31.44 per cent. in the case of samples packed in paper. A complete statement of the results of the analyses, however, gives a much better idea of the difference in the sulphide content in the two cases.

"Sulphide" Sulphur Content.

Packed in Bottles and Tins. Per cent.	Packed in Paper. Per cent.
(1) 37.94	(1) *31.44 (13) 4.45
(2) 37.90	(2) *26.48 (14) 4.13
(3) 34.51	(3) 24.85 (15) 3.37
(4) 30.16	(4) 24.62 (16) 2.24
(5) 29.82	(5) 23.47 (17) 2.05
(6) 28.83	(6) 22.57 (18) 1.94
(7) 28.79	(7) 12.89 (19) 1.85
(8) 27.87	(8) 10.64 (20) 1.42
(9) 26.77	(9) 7.87 (21) 1.41
(10) 25.38	(10) 7.12 (22) 1.35
(11) †6.71	(11) 7.00 (23) 0.88
(12) †4.90	(12) 5.74

With a view of obtaining further information as to the rate at which liver of sulphur undergoes decomposition, ten samples were selected from those examined in the first investigation, these samples being representative of different varieties of liver of sulphur and of different conditions of storage. Some of these samples were in the original receptacles in which they were forwarded to the Laboratory; others were in screw-capped bottles in which they were placed after removal from the original paper packet on receipt. It was necessary in the first place to make a re-examination of the selected samples to ascertain what change had occurred since the first examination; after which, the samples were exposed in open bottles for various periods of time.

The following table shows the amounts of sulphur as sulphide in the samples (1) as originally examined in the first investigation, (2) at the time of the re-examination in January after storage of from four to seven months, and (3) after exposure to air in open bottles.

* It might be thought that in these cases paper had afforded sufficient protection against air, but this was not so. The samples consisted of large lumps of liver of sulphur, and only the outside of the lumps had become "weathered." Usually, samples were in the form of small pieces or of coarse powder.

† (11) and (12) should probably be ignored.

Content of "Sulphide" Sulphur.

Sample.	(1) Results of Original Examination.		(2) Results of Re-examination in January.		(3) Results of Third Examination after exposure to air in open bottles.	
	Date.	Sulphur as Sulphide.	Time since 1st exam.	Sulphur as Sulphide.	Time since 2nd exam.	Sulphur as Sulphide.
		Per cent.	months.	Per cent.	days.	Per cent.
(a)	Sept. 20	21.53	4	23.28	17	nil.
(b)	" 20	26.07	4	23.93	14	0.75
(c)	" 28	30.08	4	28.56	15	nil.
(d)	July 11	37.94	6	nil.	not examined.	
(e)	June 10	31.44	7	30.27	23	nil.
(f)	July 15	30.16	6	29.68	16	4.98
(g)	July 11	26.48	6	0.88	not examined.	
(h)	Aug. 1	24.85	5½	16.57	15	nil.
(i)	June 10	7.12	6	1.95	21	nil.
(k)	July 11	1.41	5	nil.	not examined.	

(a), (b) and (c) were from the samples purchased by the Government Laboratory; (d) and (f) were forwarded from various districts in bottles, while (e), (g), (h), (i) and (k) were forwarded in paper packets.

The conclusions to be drawn from this last investigation are that storage for a prolonged period of from four to seven months produces no change in liver of sulphur provided the receptacle is airtight and completely full. These conditions obtained in the case of samples (a), (b), (c), (e) and (f), while sample (d) lost all its sulphide because stored in a corked bottle only about one-third full.

As fresh air is admitted each time a bottle or tin is opened it would obviously be an advantage to horticulturists to pack and store the liver of sulphur in bottles or lever-topped tins of small capacity, of say ½ lb. to 1 lb.

It will be seen that the result of direct exposure to the air was a rapid loss of "sulphide" sulphur. At the end of 14 to 23 days no "sulphide" sulphur remained except in the case of sample (f) and a trace in sample (b).

The point to be emphasised from the foregoing results is that *great care must be exercised in storing liver of sulphur, otherwise its fungicidal value may fall to a very low point.*

A good sample of liver of sulphur should dissolve in water without separation of sulphur. If it does not smell of sulphuretted hydrogen, decomposition has proceeded so far that no "sulphide" sulphur remains.

Solutions of Liver of Sulphur.

Further experiments were made at the Government Laboratory to ascertain whether solutions of liver of sulphur could be kept without undergoing change. Solutions of the samples were prepared and the "sulphide" sulphur estimated. The solutions were then placed in vessels and covered over, but not corked. The vessels were allowed to stand on a shelf for 8 to 18 days, the liquid not being stirred during the time. Sulphur was deposited from all the liquids and ultimately no "sulphide" sulphur remained in solution.

It is evident, therefore, that *solutions of liver of sulphur should be prepared just before use, or the solutions if made beforehand should be kept in full, tightly corked bottles.*

In a note in this *Journal* for October, 1913, page 613, attention was directed to the results of the examination in Norway of

"American" (i.e., from Canada and the United States) apples, containing, in the hollow near the stalk, a visible layer of green powder. Examination showed this

green powder to contain amounts of copper and arsenic more than sufficient to cause symptoms of poisoning if the apples were carelessly peeled. It was also stated that there were traces of Paris green on all these poisonous apples where they were uneven, and that some of the arsenic had possibly penetrated into the flesh of the apple.

The attention of the Board was again directed, in March of this year, to the subject of poisoning from apples, by the receipt from the Chief Sanitary Inspector of the County Borough of Bournemouth of an imported "American" apple, and from a correspondent at Seven Kings of three Nova Scotia apples, all four apples being similarly affected to those mentioned above. Enquiry was made as to whether the apples could be considered injurious to health. The apples were sent by the Board to the Government Laboratory for analysis, and it was evident from the results of the analyses that in these cases there was no cause for apprehension as to any poisonous effects following the eating of the fruit.

The analyses showed copper to be present in all cases, but no arsenic, so that the copper was probably due to the use of Bordeaux mixture. It was found entirely on the outside of the apples and amounted altogether to 0.0008 grammes

(0.012 grain) as metallic copper in the case of the Bournemouth apple, and to 0.0006 gramme, 0.0005 gramme, and 0.0007 gramme respectively in the case of the three Seven Kings apples. Calculated on the entire apple, the quantity was 0.0004 per cent. (or 0.028 grain per lb.) in the case of the Bournemouth apple, and 0.0005 per cent. (or 0.035 grain per lb.), 0.0004 per cent. (or 0.028 grain per lb.), and 0.0005 per cent. (or 0.035 grain per lb.) respectively in the case of the three Seven Kings apples. The Board have been informed by the Local Government Board that in the early part of the present year their attention was called to the arrival in this country of apples from the United States of America having on their skins a bluish deposit, evidently the remains of an insecticide wash. Analysis showed that copper in small amounts and arsenic in minute traces were present in this deposit.

The presence of these poisonous substances on marketed apples tends to show some carelessness in spraying at too late a date preceding picking. The Board would again warn growers in this country against careless spraying, as the presence of even small amounts of arsenic and copper on apples cannot be regarded as negligible from the public health point of view. Any deposit of the kind found to remain on apples should be removed before the fruit is sent to market.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Duration of the Action of Manures (*Jour. Roy. Agric. Soc. Eng.*, 1913, A. D. Hall, M.A., F.R.S.).—The facts already brought to light by the experiments upon the Little Hoos Field at Rothamsted may be summed up as follows. As regards farmyard manure, the nitrogenous compounds introduced by the consumption of cakes and other concentrated feeding stuffs have to be distinguished from the compounds derived from the straw and the undigested residues of such coarse foods as hay. The former will have an immediate effect on the first crop, and to a much smaller extent on the second crop, after which they disappear; the latter compounds act slowly, do not waste, and have a measurable value for many years, though for practical purposes their action after the fourth year may be neglected.

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Among nitrogenous fertilisers, ammonium compounds and nitrate of soda have no perceptible action after the first year. Peruvian guano, rape cake, and similar fertilisers containing proteins leave very little residue after the first year, and none after the second. On the other hand, nitrogenous fertilisers of the wool, hair, and bone class are slow-acting and non-wasting, and their effect may be expected to persist for at least four years.

Phosphatic fertilisers, even when soluble like superphosphate, do not waste in the soil, and their residues continue to be effective until they have been exhausted by the crops.

In view of the fact that the wastage in the residues of active nitrogenous fertilisers takes place during the winter, it would be of great advantage, especially on rich soils, to grow a catch crop before the winter and so convert these nitrates, etc., into insoluble plant material to be afterwards ploughed in to become available for another crop.

Green Manuring (*Jour. Roy. Agric. Soc. Eng.*, 1913, Dr. J. A. Voelcker).—Tares, rape and mustard were grown at Woburn in 1911 and ploughed in. Wheat was grown in 1912, and the effect of mineral manures was compared with that of lime in the case of each green crop. The greatest yield was obtained after mustard, and the limed plots did not exceed the mineral manured ones.

In 1913 a second corn crop (Banner oats) was taken without any further manuring. The crops from the mineral manured plots were greater than those from the limed plots in the case of tares and rape but not in the case of mustard. On the mineral manured plots the oat crop from the tares plot was heaviest and that after mustard the lightest, whereas on the limed plots the mustard plot gave the best return and rape the poorest.

Nitrate of Ammonia (*Jour. Roy. Agric. Soc. Eng.*, 1913, Dr. J. A. Voelcker).—A newly introduced fertiliser, nitrate of ammonia, was compared with other nitrogenous manures as a top dressing on wheat at Woburn in 1913. The manures were applied in such quantity as to supply 30 lb. ammonia per acre, the actual amounts applied per acre being 119 lb. sulphate of ammonia, 153 lb. nitrate of soda and 71 lb. nitrate of ammonia. The nitrate of ammonia produced the highest yield—about one bushel per acre in excess of nitrate of soda, the latter, however, producing more straw. Sulphate of ammonia was not so effective, producing about 1½ bushels less corn and 4 cwt. less straw per acre than nitrate of soda. The wheat from all three manures was valued at the same price.

The Woburn Pot Culture Experiments, 1913 (*Jour. Roy. Agric. Soc. Eng.*, 1913, Dr. J. A. Voelcker).—From the experiments with zinc and copper salts on wheat in 1913 it is concluded that the addition of zinc to the soil in amount up to .01 per cent. will have, on the whole, a stimulating result and will produce better tillering, but that above this amount the influence will be one of a toxic nature; the metal proved more active in the form of nitrate than in that of carbonate or phosphate. With regard to copper it was concluded that quantities not exceeding .02 per cent. will have a stimulating effect, but that above this amount the influence will be a toxic one. Further, in amounts less than .01 per cent. of copper the results were negative. This is in contrast to the results obtained from water culture methods, where much smaller quantities than this have been found to have a poisonous effect, indicating, apparently, that what is found to be the case in

water culture is not necessarily reproduced in the case of plants growing naturally in the soil.

Salts of manganese and cerium in various quantities were also tried on wheat, but without either stimulating or toxic effect.

It was shown in 1913 that the addition of lime to a soil in which magnesia was originally in excess of the lime was very advantageous to the crop and that no harm, but rather benefit, resulted from the presence of lime in excess; whereas it has been shown from previous experiments that the addition of magnesia in excess would, on the contrary, have a deleterious effect.

Dressings of flowers of sulphur equivalent to 3, 6 and 12 cwt. per acre in the case of mustard, rape and clover had no effect whatever on the crops.

The influence of lithium phosphate and magnesia on tomatoes was tested in 1913, both in heated and unheated soils. The tests included heated soils, as it has been suggested that the toxic properties of lithium phosphate and magnesia are due to their harmful effect on the bacteria in the soil, and heating might be expected to remedy the toxic effects. From the results it would appear that the toxic effects of both lithium phosphate and magnesia are more decided with tomatoes than with wheat. In no case was there anything like the increase in crop which mere heating of the soil effected. A remarkable feature in the addition of magnesia was that there was very little advantage from using heated soil as compared with normal soil.

Distribution of Manure (*Bull. of Agric. Intell. and Plant Diseases*, March, 1914).—In examining various types of mixed seed and manure drills, the National Society of Hungarian Agriculturists carried out experiments to test the relative advantages of depositing manure in the drills and distributing it broadcast. The experiments were supervised by the Royal Agricultural Experiment Station of Magyar-Ovár. No definite conclusion could be drawn from the first experiment with barley, as owing to a heavy rainfall there was considerable lodging of the crop. It was noticed, however, that a moderate application of superphosphate and nitrate produced no ill effects on the germination of the seed and rather hastened the first development of the young plants.

More successful results were obtained with sugar beet, manuring in the drills leading to better development of the crop, and, while there were no great differences in the sugar content of the beets, the yield obtained was greatly in favour of this method. Even where the amount of superphosphate and nitrate of soda applied in the drill was only half that broadcasted, the surplus over the control plot was more than double that obtained after broadcasting the manure. Not only was this found to be true for well-cultivated land rich in humus, but it also held good for poor, exhausted land.

The Action of Manganese in Soils (*U.S. Dept. of Agric., Bull. 42*).—The effect of manganese on poor and good soils was studied by growing wheat in pots. Manganese chloride, sulphate, nitrate, carbonate, and dioxide had a stimulating effect in the case of an unproductive sandy loam soil. The best results were obtained when the salt was applied in amounts from 5 to 50 parts of manganese per million. Quantities higher than this gave no correspondingly larger increase and in some cases were even harmful. On a productive loam the various salts of manganese had no stimulating effect.

Further work was done by growing the crop in treated aqueous extracts of soils and studying the oxidizing power of the plants. The oxidation was tested after the plants had been growing for two weeks. The effect of manganese on the oxidizing power of the plant roots and on growth gave different results with different soils. With poor, unproductive soils manganese salts increased oxidation and growth. This was especially true in extremely poor soils and in a soil in which were found several harmful organic compounds. Oxidation was increased in productive soils; the growth, however, was decreased; the plants gave indications of excessive oxidation, and as the oxidation processes in these soils were already good the harmful action is attributed to excessive oxidation.

It is explained that the beneficial action of manganese may be due to its function of aiding and increasing the oxidation processes and other vital processes in the plant as well as in the soil, and by this means changing or destroying some noxious products detrimental to plant growth.

A five-year field test with manganese sulphate at the rate of 50 lb. per acre was carried out on a silty clay loam soil, the crops grown being wheat, rye, maize, cowpeas and potatoes. The crop yield was decreased and the oxidizing power of the soil (which was not very strong) was lessened. The catalytic power of the experimental plots was slightly, if at all, increased. The soil was, however, of an acid nature, and was therefore unfavourable to oxidation and catalysis. It is concluded that manganese is not profitable on soil of this nature in need of liming.

FIELD CROPS.

Rothamsted Experimental Plots in 1913 (*Annual Report of the Rothamsted Expt. Sta. for 1913, Dr. E. J. Russell*).—The outstanding feature of these plots in 1913 was the extraordinarily large crop of barley in Hoos Field (continuous growth of barley since 1852). Several of the plots yielded over 60 bushels of grain and 30 cwt. of straw, or 7,000 lb. of total produce per acre, a result which has had no parallel for nearly 60 years. The season was, of course, favourable for barley, but another circumstance which appears to have contributed to the high yield is the fact that the field was fallowed in 1912 for the first time in 60 years and thoroughly cleaned from weeds. Dr. Russell states that it is difficult to account for this result on present views as to the effect of fallowing. Something more seems to be involved than the accumulation of nitrate over the winter; laboratory work would, in fact, appear to indicate that growing crops have an effect on bacterial decompositions in the soil, this effect not being exerted during a fallow period.

The barley on the Agdell Field (four course rotation since 1848) did not yield nearly so heavily as on the Hoos continuous plots, the highest crop being 33 bushels of grain, 15 cwt. of straw and 3,500 lb. of total produce. The difference is presumably the result of the fallow in Hoos Field, all other conditions being the same, and this view is strengthened by the fact that the unmanured plot on Agdell Field (which had virtually been fallowed during the preceding year, the turnip crop having failed) gave 18.5 bushels of grain and 8 cwt. of straw, nearly the same yield as the unmanured Hoos Field plot, viz., 21 bushels of grain and 10 cwt. of straw.

In addition to the results of the continuous growth of barley trials and the rotation experiments the Report gives the results in 1913 as

regards continuous growth of wheat (Broadbalk Field), wheat after fallow (Hoos Field), manuring of mangolds (Barn Field), grass for hay (the Park), and the residual value of various manures (Little Hoos Field).

Continuous Growth of Wheat and Barley (*Jour. Roy. Agric. Soc. Eng.*, 1913, Dr. J. A. Voelcker).—Wheat and barley have now been continuously grown at Woburn for 37 seasons.

Wheat.—One of the unmanured plots in 1913 gave 14.7 bushels per acre of corn as against 8.2 bushels in 1912. The straw amounted to 10½ cwt. per acre.

Mineral manure plots gave, as usual, a rather lower return than the unmanured plot. Nitrate of soda, when used alone, produced a better crop than sulphate of ammonia, even where lime had been used with the latter. Doubling the dressing of nitrate of soda (viz., to equal 50 lb. ammonia) produced 2 to 3 bushels of corn more than the single dressing, while the addition of mineral manures to nitrate of soda gave an increase of 4 to 5 bushels per acre. Sulphate of ammonia, used by itself, gave, as usual, no crop where lime had not been applied; and the yields from the two sulphate of ammonia plots, which received respectively 4 dressings each of 5 cwt. of lime and two dressings each of 2 tons of lime, were below those from the unmanured plots; there was a gain, however, from the sulphate of ammonia plot which received a dressing of 2 tons of lime in December, 1897. The yields from the plots on which 10 cwt. per acre of lime had been applied in 1905 showed that the effect of the dressing was dying out, but where the quantity of lime applied in 1905 was 1 ton per acre 8.6 bushels more of corn were obtained than on the unmanured plot.

There was nothing to show the superiority of potash over phosphoric acid or *vice versa*, as a mineral dressing.

The farmyard manure plot gave 3½ bushels more of corn per acre than the rape cake plot, and produced 26 cwt. of straw per acre, the highest yield in the series.

Nitrate of soda, generally, produced the most straw, but gave the lowest weight per bushel in the corn.

Barley.—The general results in 1913 were distinctly superior to those obtained in 1912. The average of the two unmanured plots was 6.7 bushels per acre of corn, which was less than in 1912.

Mineral manures alone produced 12.2 bushels of corn per acre.

Nitrate of soda alone (=25 lb. ammonia) gave 15.1 bushels of barley, and doubling the amount only produced 1.3 bushels per acre more; but the addition of minerals raised the crop to 22.6 bushels when the single dressing of nitrate of soda was used, and to 30.6 bushels with the double dressing. The omission, for a single year, of the nitrate made a difference of nearly 11 bushels.

Sulphate of ammonia by itself gave as usual no crop, as was also the case when minerals only were used with it, but no lime. Sulphate of ammonia along with 1 ton of lime (in four separate applications) gave 11.9 bushels of corn, and with 4 tons of lime (in two separate applications in 1897 and 1905) 16.3 bushels, while with 4 tons of lime (in two dressings in 1897 and 1912) as much as 34.3 bushels per acre was obtained, this being rather more than followed the use of the same amount of sulphate of ammonia along with minerals and 1 ton of lime per acre in 1905 (31.5 bushels per acre). The same amount (4 tons per acre) of lime with the double dressing of sulphate of ammonia gave no higher produce, viz., 34.1 bushels per acre.

As in 1912 potash proved better than phosphate.

Farmyard manure gave decidedly the highest yield of all, viz., 40.2 bushels of corn and 23½ cwt. of straw per acre, this being much in excess of the return from rape dust.

Manuring of Mangolds (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1914*).—These experiments were carried out from 1901 to 1911 with the principal varieties of mangolds and on a great diversity of soils, the seasons during this period differing widely in character. The results on the different soils and in the different seasons were remarkably uniform throughout. As the quantities of farmyard manure and kainit used were increased from 1906 onwards, the results for the two periods 1901-5 and 1906-11 are shown separately.

Average Results per Acre for Period 1901-5.

Plot.	Manures.	Yield.	Cost of Manures.		Value of Crop less Cost of Manures (Mangolds 10s. a ton).
		Tons cwt.	£	s. d.	
1	No manure	7 6	—	—	3 13 0
2	15 tons farmyard manure	19 14	3 0	0	6 17 0
3	As in 2, plus 4 cwt. super.	21 17	3 12	4	7 6 2
4	As in 3, plus 2 cwt. sul. am.	24 19	4 17	2	7 12 4
5	As in 4, plus 2 cwt. kainit	27 2	5 2	2	8 8 10
6	As in 4, plus 4 cwt. salt ..	28 13	5 1	2	9 5 4

Average Results per Acre for Period 1906-11.

Plot.	Manures.	Yield.	Cost of Manures.		Value of Crop less Cost of Manures (Mangolds 10s. a ton).
		Tons cwt.	£	s. d.	
1	No manure	9 9	—	—	4 14 6
2	20 tons farmyard manure	25 2	4 0	0	8 11 0
3	As in 2, plus 4 cwt. super.	26 15	4 12	4	8 15 2
4	As in 3, plus 2 cwt. sul. am.	29 16	6 1	8	8 16 4
5	As in 4, plus 4 cwt. kainit	32 12	6 12	8	9 12 10
6	As in 4, plus 4 cwt. salt ..	33 19	6 7	8	10 11 10
7	As in 6, but replacing sul. am. by 2 cwt. nitrate of soda	33 8	6 2	8	10 11 4

The results per acre are summarised as follows:—A dressing of 20 tons of farmyard manure was more profitable than one of 15 tons. The application of 4 cwt. superphosphate resulted in an average profit over the whole period of 6s. 6d. per annum. The addition of 2 cwt. sulphate of ammonia resulted in an average annual profit of 3s. 6d. for the entire period. Dressings of 2 cwt. kainit in the first period and 4 cwt. in the second gave identical results, viz., a profit of 16s. 6d. per acre. The addition of 4 cwt. salt to the dung, superphosphate and sulphate of ammonia increased the profit by £1 13s. and £1 15s. 6d. per acre per annum in the two periods. Two top dressings of 1 cwt. nitrate of soda (see 7) produced practically the same results as the same quantity of sulphate of ammonia applied in the drills (see 6).

The above experiments having shown the dressing of artificials consisting of 4 cwt. superphosphate, 2 cwt. sulphate of ammonia, and 4 cwt. salt to give the best results in conjunction with farmyard manure, experiments were commenced in 1908 to ascertain whether the quantities of each artificial could be increased or decreased with financial advantage. So far the results of these further tests indicate that no advantage is to be gained from altering the quantities of superphosphate and salt, but there seems some doubt as to whether 1 cwt. sulphate of ammonia is not more profitable than 2 cwt.

Tests carried out on pronounced peaty soils in 1913 at seven centres seem to indicate that sulphate of ammonia, especially if applied in quantity above 1 cwt. per acre, may fail to give a profitable return on many peaty soils.

Varieties of Mangolds (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1914*).—In each of the four seasons 1910 to 1913 Prize Winner and Yellow Globe have given appreciably heavier crops than Long Red and Golden Tankard.

Varieties of Swedes and Turnips (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1914*).—In experiments carried out with swedes at a large number of centres from 1910 to 1913 the varieties Triumph, Magnum Bonum, and Best of All gave the highest average yields throughout, the other varieties tested being Abundance, Whitsuntide Bronze Top, Incomparable Green Top, Improved Purple Top, and Elephant. Of the two kinds of yellow turnip tried, Centenary proved better than Aberdeen Green Top.

Manuring of Oats (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, Jan., 1914*).—The experiments were commenced in 1901 and concluded in 1911, and were carried out at 150 centres with the most commonly grown varieties of oats, on a great diversity of soils, and during seasons differing widely in character. The different treatments, the average yields per acre in the whole eleven years, and the financial results, are shown in the following table:—

Manures (per acre).	Average yield per acre, 1901-11.		Average Cost of Manures.	Value of Crop,* less Cost of Manures.
	Grain.	Straw.		
	Cwt. qr.	Cwt.	£ s. d.	£ s. d.
No manure	15 3	26	—	6 13 6
1 cwt. sulph. ammonia ..	18 1	31	13 8	7 2 4
3 cwt. superphosphate ..	18 1	30	9 3	7 5 3
1 cwt. sulph. ammonia ..	21 0	36	1 2 11	7 17 1
3 cwt. superphosphate ..	21 0	36	1 2 11	7 17 1
1 cwt. sulph. ammonia ..	22 2	39	1 10 11	8 2 7
3 cwt. superphosphate ..	22 2	39	1 10 11	8 2 7
3 cwt. kainit	22 2	39	1 10 11	8 2 7

The complete dressing having given the best results, further experiments were commenced in 1908, and carried out during six years, to test the effect of varying the quantities of superphosphate and kainit in this

* Grain at 9d. per stone: straw at 1s. 6d. per cwt.

dressing, it being assumed that 1 cwt. sulphate of ammonia per acre is a suitable dressing of nitrogenous manure for oats.

As regards superphosphate, 3 cwt. per acre was found to be the most generally suitable quantity of this manure in the dressing; in many cases 2 cwt. was too light a dressing, while, on the other hand, as much as 4 cwt. was apparently unnecessary on land in average condition.

As regards kainit, 2 cwt. per acre of this manure in the complete mixture was found sufficient to meet the potash requirement of the oat crop, and the Department are now recommending this quantity in place of the 3 cwt. dressing formerly advocated.

The mixture of 1 cwt. sulphate of ammonia, 3 cwt. superphosphate, and 2 cwt. kainit per acre is recommended chiefly for oats grown on poor lea land, or for oats following a corn crop. It might also be applied to oats sown after a root crop to which no farmyard manure had been applied.

Experiments with Potatoes (*Herts. C. C., Agric. Sub-Committee, Report on Field Expts. in 1913*).—Varieties of potatoes were grown under the more important main crop varieties of potatoes were grown under identical conditions on a well-drained gravelly loam overlying chalk in plots of $\frac{1}{16}$ th acre each. The plots were manured at the rate per acre of 10 tons farmyard manure, 1 cwt. sulphate of ammonia, 3 cwt. superphosphate and 1 cwt. sulphate of potash. The potatoes were planted at the rate of 15 cwt. per acre.

The highest yield in ware was given by Factor with 9 tons 8 cwt. 84 lb., while Dalhousie produced 8 tons 17 cwt. 94 lb. and President 8 tons 6 cwt. 48 lb. The other varieties arranged in order of yield of ware were as follows:—Arran Chief, Northern Star, Evergood, King Edward and Langworthy. The last-named variety produced the most seed, viz., 3 tons 6 cwt. 28 lb., King Edward coming second with 2 tons 12 cwt. 16 lb.

Manuring of Potatoes.—Ten plots, each similar in size to the variety plots and lying adjacent to them, were planted with Up-to-date potatoes at the rate of 15 cwt. per acre, and manured as follows, the yields being also given:—

Plot.	Manure per Acre.	Ware.	Setts.	Chats.
		tons cwt. lb.	tons cwt. lb.	cwt. lb.
1	Unmanured	0 13 84	1 9 92	11 48
2	10 tons dung	6 1 88	1 14 72	7 56
3	20 tons dung	8 3 104	1 19 6	8 104
4	10 tons dung + 1 cwt. sulph. pot.	5 18 24	1 14 72	7 96
5	As plot 4 + 1 cwt. sulph. amm.	9 2 16	1 6 68	6 88
6	As plot 4 + 3 cwt. superphos.	7 5 0	1 19 72	7 96
7	As plot 6 + 1 cwt. sulph. amm.	8 7 16	1 18 78	8 24
8	10 tons dung + 1 cwt. sulph. amm.	6 1 8	1 18 38	8 24
9	As plot 8 + 3 cwt. superphos.	5 13 104	2 1 96	9 72
10	10 tons dung + 3 cwt. superphos.	6 8 4	1 13 104	7 96

LIVE STOCK AND DAIRYING.

The Spread of Diphtheria by Milk (*Reports to the Local Government Board on Public Health and Medical Subjects, New Series, No. 94*).—In an outbreak of diphtheria in South London which occurred on November 21st, 1913, and in which 119 cases were notified, the evidence pointed to the milk supplied by a large dairy in the district as the source of infection. The supply at this dairy was obtained from some seventeen farms, and the milk was mixed after receipt. On one of these farms (at Horsham) a milker was reported to be suffering from "milker's finger," and on a visit being paid to this farm three milkers were discovered with sores on their hands, virulent diphtheria bacilli being obtained from the lesions on bacteriological examination in two of these cases, while in the third case, although a negative result was obtained, there was a possibility that the bacillus had been previously present.

On careful inspection of the cows at the farm, five were found with irregularly-shaped sores on the udder and teats. These sores, which varied in size from that of a threepenny bit to a shilling or larger, were covered with brownish black scabs raised above the surface. They were situated on the upper half of the teats, sometimes at the junction between the teat and the udder, and resembled the sores on the milkers' hands. At the date of examination, however, the healing process was practically complete so that the causative micro-organism could not be discovered.

It was tolerably certain that sores had been observed on the cows' teats before the first milker's finger was affected. The probability was that the cows, by means of diphtheria bacilli contained in the sores, were the means of transmitting infection to the milkers and it was possible also that diphtheria bacilli contributed by the cows added to the infectivity which the milk obtained from the diphtheria bacilli in the sores on the milkers' fingers.

The efficiency of pasteurization, when properly carried out, in rendering harmless milk contaminated with an easily killed organism, such as the diphtheria bacillus, appears to have been well illustrated by this outbreak. The epidemic commenced on 21st November and gradually ascended until December 1st; pasteurization of all milk at the London dairy was carried out after December 12th with the result that from the 14th the epidemic fell away and the milk of the dairy practically ceased to be infective after December 18th, although there was no difference in the conditions obtaining on the Horsham farm for several weeks afterwards (*i.e.*, until after the source of infection was discovered).

Disposal of Creamery Refuse (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, January, 1914*).—The refuse from a creamery is a highly putrescible liquid, which, if discharged into a river is liable to cause extensive pollution. Since 1893 a number of attempts have been made to find a means of purifying the refuse. Filtration through sand, ashes, etc., precipitation of the suspended matter in the refuse by means of lime, oxidation by the aid of bacteria and manganese compounds were all tried and found to be unsatisfactory. Irrigation on a large scale alone gave successful results.

In 1902 the Department commenced experiments with the object of finding a satisfactory method of purifying refuse where irrigation was not possible owing to the proximity of houses or to other reasons.

The most effective method proved to be the septic tank treatment, and the efforts of the Department have been directed to the improvement of this system.

The septic tank may be open or closed; if it is certain that a nuisance will not be caused by the smell from the decomposing refuse there is no necessity to cover the tank. The tank may be merely an excavation in the ground, provided there is no considerable leakage, or it may be desirable to construct it of concrete finished off with cement plaster; this is especially the case when the tank is above the ground level, when any leakage would cause a nuisance. It should be capable of containing at least five days' flow of refuse in the case of a cream-separating station and seven days' flow for a creamery without separating stations. The most satisfactory dimensions so far tried are 6 ft. wide by 6 ft. deep from the water line, and of sufficient length to give the required capacity. The sides should be 18 in. above the water line to allow for the scum. If no further treatment is to be given to the refuse, a quantity of limestone should be placed in the tank near the outlet in order to neutralise, as far as possible, the acidity of the liquid. The scum and sludge which accumulate in the tank should be removed in the winter, deodorised with chloride of lime, and when nearly dry used as manure in the following summer. Comparing the effluent from the septic tank with the original sewage, a purification of 80 to 90 per cent. will have been effected. A good sewage valve should be fitted to the tank in order to regulate the outflow of the liquid.

If further treatment of the effluent is necessary, as is usually the case, it should be run into a contact bacterial bed, filled with broken limestone, gravel, hard clinkers or stone chippings. The bed may be an excavation in the ground, but should be constructed so as to hold the liquid in contact with the material in the bed; if above ground it should be watertight. The effluent should be run through pipes leading into the bottom of the bed, allowed to remain for a period in contact with the material in the bed, and then discharged. Further purification may be obtained by the similar use of a second bacterial bed, made precisely as the first, but containing material of a finer gauge. Instead of this second contact bed, a percolating bed may be employed. In this case the bed is not watertight; the effluent is spread over the surface by a mechanical distributor, percolates through the material of the bed and drains away.

Yield and Moisture Content of Cheddar Cheese (*Cornell Univ., Agric. Expt. Sta., Bull. 334*).—As a result of investigations into the factors influencing the yield and moisture content of cheddar cheese the following conclusions were reached:—

Cutting the curd fine causes a larger loss of fat in the whey than cutting the curd coarse. Coarse-cut curd increases the yield of green and of cured cheese and increases the moisture content of the cheese. If great care is not taken and the pieces of curd are broken, the result will be the same as a fine cut.

Setting the milk at a high temperature reduces the loss of fat in the whey more than setting the milk at a low temperature. Setting at a high temperature increases the yield of the green and the cured cheese. This increase is probably due to the increased moisture content of the cheese.

A low acidity at the time of removing the whey increases the yield of the green and the cured cheese and also increases the percentage of

moisture in the cheese. If a high acidity is developed it not only reduces the yield and moisture content, but also injures the quality of the cheese.

Stirring the curd with the hand as the last of the whey is removed reduces the percentage of moisture in the green and the cured cheese; it reduces the yield and causes a larger loss of fat in the whey.

Applying full pressure at once to the curd reduces the yield because more fat is squeezed out of the curd. This loss of fat makes the cheese so pressed appear to contain more moisture.

If the curds are piled deep more moisture is retained in the green and the cured cheese. Piling the curds deep increases the yield of cheese.

An increase of salt in the curd results in the reduction of moisture in the cheese.

Holding the curd at a low temperature after the whey is removed increases the percentage of moisture in the green and the cured cheese and increases the yield.

An increase of rennet to a certain point increases the moisture content of the cheese. This is due to greater coagulation, and has the same effect as setting at a high temperature or cutting the curd hard.

Cutting the curd soft reduces the percentage of moisture and the yield of the green cheese, and also increases the loss of fat in the whey. Cutting soft has the same effect as setting at a low temperature or as a small amount of rennet.

Cost of Rearing and Fattening Beef Calves in Alabama (*U.S. Dept. of Agric., Bull. No. 73*).—The objects of the test were to ascertain the cost of rearing beef calves to an age of about 9½ months under average farm conditions, and to determine the profit in finishing these young calves for the market during the winter months and selling them when about 12 months old.

From a herd of 80 cows, mostly grade Aberdeen-Angus, 64 calves were reared during 1911. The calves were born during the spring months and ran with their dams on pasture until late autumn, when they were weaned and prepared for the fattening period, which lasted from January 17th, 1912, to April 1st, 1912.

At 9½ months the 64 calves had attained an average weight of 460 lb. at a cost for rearing of £3 per head (or 13s. per 100 lb.). This cost included all possible expenses, viz., cost of food eaten by both cows and calves, interest on capital, rent, taxes, depreciation, etc.

Only 49 of the 64 calves were fattened, the remaining 15 being heifers kept for breeding. These 49 calves increased from an average live weight of 456 lb. at the beginning of the fattening period to 560 lb. at the end, the average daily gain per head being 1·37 lb. Each calf during the fattening period ate daily 4·4 lb. cotton seed meal, 23·9 lb. maize silage and 2·76 lb. poor quality hay; so that 100 lb. increase in live weight was produced by 323 lb. cotton seed meal, 1,741 lb. maize silage and 201 lb. hay, costing altogether £1 10s. 5d.

The 49 calves when sold realised £1 4s. 5d. per 100 lb. live weight or £6 17s. 1d. each. The net profit per calf from 76 days fattening was £1 17s.

The total expenses during the year were £270 or £4 4s. 4d. for each of the 64 calves, i.e., the cost of rearing and fattening each calf was 13s. per 100 lb. live weight. The 49 calves sold realised £314, and if the value of the 15 heifers retained for breeding is reckoned at £47 it will be seen that the income from the herd during the year was £361. The profit was therefore £91.

Oxidation of Arsenical Dipping Fluids (*Rhodesia Agric. Jour., April, 1914*).—The oxidation of arsenites to arsenates in dipping tanks has the effect of impairing the efficacy of arsenical dipping fluids. These investigations were undertaken to determine whether in practice it was necessary to change the dip on account of oxidation. The sodium-arsenite and sodium-arsenate contained in three dipping tanks in almost continuous use were determined at frequent intervals over two or three months. In each case during these periods fresh dip was added to replace that removed during dipping. From the results it was concluded that there is no necessity to renew a dip, in which a fair number of animals are constantly dipped at short intervals, until it has become too dirty for use.

POULTRY.

Preservation of Eggs (*Agric. Gazette of Canada, March, 1914*).—Experiments in the preservation of eggs have been conducted by the Division of Chemistry of the Canadian Department of Agriculture during the past 15 years. Of the large number of preservatives so far tested, the two best have been found to be lime water and a solution of water-glass (sodium silicate), lime water having constantly shown itself the more effective of the two. Eggs have been kept in lime water, quite sound and fit for cooking purposes, for more than a year; and they have been repeatedly used for consumption after preservation from six to nine months without there being any unpleasant flavour or odour. It is stated that the three essentials to success are absolute freshness of the eggs when placed in the lime water, protection of the surface of the lime water from the atmosphere (or occasional removal of the lime water) and the keeping of the vessel containing the eggs at a moderately low temperature.

Utility Poultry Club's Twelve Months' Laying Competition.—The seventh period of four weeks of this competition, which is being held at the Harper Adams Agricultural College, ended on May 8th, the egg production during these 28 days averaging 19·48 eggs per bird, or 116·96 eggs per pen of six birds. This is a slight decrease compared with the results for the previous 28 days and is due to the large amount of broodiness experienced, 98 out of the 198 birds of the sitting breeds having been broody. The fact that the decrease was only a slight one is taken to show that, by suitable treatment, broodiness can be quickly allayed. The method adopted is immediately to put a bird which shows signs of becoming broody into a coop with a raised floor made of wooden bars. This allows a free circulation of air all round the bird, and in from four to eight days she commences to lay again.

The following are the results in the case of the leading pens for the whole 28 weeks:—

Order.	No. of Pen.	Breed.	Total Eggs for 28 weeks.	Value.
1	18	White Wyandottes	839	£ s. d. 4 19 10½
2	6	" " " " " " " " " " " "	784	4 13 8
3	46	White "Leghorns	784	4 11 4½
4	12	White Wyandottes	777	4 7 3½
5	2	" " " " " " " " " " " "	798	4 6 5½
6	38	White "Leghorns	756	4 4 9½

NOTES ON AGRICULTURAL CO-OPERATION.

A REPORT by the Board of Trade on Profit-Sharing and Labour Co-partnership Abroad [Cd. 7283, price 8½d.] contains a very interesting account of the working of agricultural co-partnership schemes on four large estates in Germany.

Agricultural Co-partnership Schemes in Germany.

Tellow Estate (Mecklenburg).—The scheme on this estate is the earliest recorded instance of profit-sharing in any industry in Germany. It was introduced by Herr von Thünen, the owner, in 1847 and remained in operation until 1896, when the estate passed into other hands. The objects, as set forth in the regulations made by von Thünen in 1848, may be quoted:—

"(1) That the inhabitants may directly participate in the good and bad fortune of the landlord, and form with him, as it were, one family;

"(2) That the workpeople should benefit in income by receiving interest yearly increasing in amount;

"(3) Above all, that an old age peaceful and free from care may be assured to the workman, so that, after he has passed the prime of his life in strenuous work, he may not be a burden to his family or neighbours when his health and strength decline, but that rather he may be placed in a position to leave something to his children."

The regulations specified that the inhabitants of Tellow were to participate in the net receipts from the estate, when these rose above £825 (later £900) in the proportion of one half per cent. of such surplus to each eligible inhabitant. (When the net profits did not reach this sum the deficit was to be made good in the next profitable year.) There were 21 such inhabitants in 1848, and they included all able-bodied persons employed on the estate and occupying a dwelling with a wife, or in her place with a servant, and all farm hands whose wives occupied a house in the village and worked on the estate, in addition to the manager, head ploughman, forester, wheelwright, cowherd (later also the smith), schoolmaster, shepherd, and weaver.

The way in which the net receipts were to be calculated was very carefully set forth. From the gross receipts from crops, live stock and dairying were to be deducted the sums spent in the purchase of seed, live stock, feeding stuffs and manures (added later), and in taxes, various losses, etc. (cost of labour is not mentioned); any depreciation in stock was to be deducted and any appreciation added.

The net receipts on the estate during the 14 years preceding 1847 averaged £1,125; so that the share of each inhabitant in 1848 was presumably about 30s. Herr von Thünen was most careful to point out in his regulations, however, the interest of the workmen in increasing the production, as the greater the receipts the greater, proportionately, would be their share.

Every eligible inhabitant was given a savings book in which his share was entered; interest was allowed at the rate of 4½ per cent. (subsequently reduced to 4 per cent.). It was provided that the capital entered in the savings books could not be withdrawn until the depositor reached his sixtieth year; in the case of death before reaching this age the money was handed to the widow (or children).

The average annual payment per participant in the 49 years 1848-1896 amounted to £3 7s. 10d. As to the results, Herr von Thünen, the grandson of the founder of the scheme, wrote in 1901:—

"I can only say that they were up to the end favourable, and what my grandfather aimed at was fully attained. The interests of the employer and the employed were identical; the latter worked with good will, even at times, as at harvest, when it has been necessary to lengthen the day or to work on Sundays. Despite the great emigration of the rural population of Mecklenburg the same families remained with us. The sons or sons-in-law succeeded the fathers as workmen. Thrift was awakened; almost all the younger people, when they were able to save, brought me their savings, on which I paid 4 per cent. interest. I am of opinion that on both sides benefit was derived from this institution. I had willing and industrious workmen, and the knowledge that they did their duty loyally and cheerfully. The workmen knew that their landlord meant well by them, and they did their work gladly and willingly."

Jürgensdorf Estate (Mecklenburg-Schwerin).—A system of profit-sharing was introduced by the proprietor, Herr von Blücher, in 1874, in order to establish a closer union than had hitherto existed between the interests of the owner and of those employed upon the estate, and to afford to the latter the possibility of accumulating savings for their children or for their own old age.

Under this system a certain proportion of the net profits, after a deduction of 3½ per cent. on the purchase price of the property, was distributed each year among the regular staff employed on the estate. Up to the year 1891 this proportion fluctuated between 6 and 8 per cent., and from 1892 to 1912 between 9 and 10 per cent.

Under the original arrangement one "full" bonus was paid to each family supplying two workpeople; under the present arrangement one half-bonus is payable to each family providing one workman, and a second half-bonus for a grown-up boy or girl. The full bonus paid to the salaried staff from 1874-1900 ranged from £10 to £15; those of the workmen ranged from £1 to £8, the average being about 70s. or 75s., or about 15 per cent. of the average cash wages. Since 1900 the bonus has ranged from £5 to £9 per family.

The bonuses are not paid in cash, but are entered in savings bank accounts kept by the employer, on which 3½ per cent. interest is paid; and no draft may be made on the account until after the lapse of ten years. The savings are guaranteed by the estate.

The scheme is administered by the estate steward in consultation with the owner, the staff having no voice ("nor claiming to have a voice") in the matter.

In 1900 95 persons were permanently employed on this estate, of whom 61 were adult workmen, the remainder being composed of 5 salaried men, 4 women, 15 boys, and 10 girls. An additional 45 to 50 workpeople were employed that year during the beetroot season.

Herr von Blücher stated in 1901 that his relations with his men had been very good, and that during the 28 years of profit-sharing there had never been a lack of workmen on the estate. In a recent communication to the Board of Trade Herr von Blücher observed that the scheme continued to give proof of its value.

Komorowen Estate, near Biella (Prussia).—In 1899 a profit-sharing scheme was introduced on this estate by Herr Ebhardt "in order to interest the workpeople in the better working of the undertaking and

to prevent their leaving the locality." Five per cent. of the net profits are distributed in cash among all those employed, except the distillery manager; the bonuses of married persons are double those of unmarried persons. The owner has sole control of the administration of the scheme. In 1899 and 1900 the sums distributed amounted to £88 and £69 respectively, the married men receiving £2 in 1899 and 30s. in 1900. Herr Ebhardt reported in 1906 that married men received under the scheme £2 each.

At the end of 1900 there were employed on the estate and in the distillery 46 men, 60 women, and 4 boys and 10 girls under sixteen years of age.

Wulfshagen Estate, near Gettorf.—In 1900 profit-sharing was introduced for the workpeople (about 40 men and 6 women) on this estate by Count Reventlow in order to improve their status, "to make them collaborators instead of mere wage-earners, to increase their earnings, to intensify their interest in the stock, machinery, &c., and to make it the basis on which they might build up an organisation of their own." Eight per cent. of the net profits is assigned to the workpeople, other than those who receive old age or invalidity annuities. Six per cent. is paid in cash, and 2 per cent. to the Wulfshagen Benefit Society. As members of the Society the workpeople participate in the administration of the scheme, and in the fixing of the year's profits out of which the bonus is to be paid. The participants are given a legal right to their share, paragraph 5 of the trust-deed providing that "This profit-sharing bonus is granted to the workpeople jointly and severally, not as a revocable favour, but as a legal right. It may not be cancelled except after a year's notice shall have been given from May 2nd."

As to the results of the scheme the only information available relates to the year 1900, which is described as a "highly unfavourable year." In that year there was distributed a total of £49 as follows:—

(a) Regular workpeople—men, 17s. 8d. each, and women, 13s. 3d. each; (b) temporarily employed—adults, 7s. 1d. each, and children, 3s. 6d. each.

Count Reventlow died in 1906; but according to M. Trombert, the profit-sharing scheme has been maintained on the estate with satisfactory results.

SOME particulars of the system of loans on agricultural produce by the Russian State Bank appeared in the *Journal* for July, 1913, page 354. The following information, extracted from the *Bull. Econ. and Soc. Int.*

Loans on Agricultural Produce by the Russian State Bank. for March, 1914, is given in amplification of the previous note.

The Russian farmers, especially the small farmers, are unable to take advantage of good crops, as they are forced to sell immediately after harvest, when the conditions of the market are unfavourable, in order to obtain ready money.

It was with the idea of remedying this state of things that the Russian State Bank was authorised as far back as 1860 to make loans on the security of grain. The formalities which had to be gone through by the borrowers, however, were so complicated that very little advantage was taken of this opportunity of borrowing money.

In 1885, however, the branches of the Bank were authorised to grant loans on the following conditions:—The borrowers were to deposit

their security in the buildings specified by the Bank, which would keep the keys; the amount of the loan was to be fixed in accordance with the value of the security, the ease with which it could be realised, and the confidence which was placed in the borrower; the rate of interest was not to exceed the ordinary rate of discount. As the rate of interest proved too high for the peasants to pay the scheme progressed but slowly.

As a result of the abundant harvest of 1893 further modifications of the conditions were made in that and the succeeding year. The formalities were simplified; the borrower himself was allowed to keep the grain given as security, or deposit it with the various State officials or in the buildings of co-operative societies. The maximum amount of the loan varied from 60 to 75 per cent. of the value of the security. The loans had to be repaid in instalments within a maximum period of nine months, the interest varying from 4½ to 6 per cent. Both threshed and unthreshed grain were accepted as security, together with other agricultural produce. The result was a large increase in the annual amount of the loans.

Since 1896 the greatest prudence has been exercised in the granting of loans to farmers retaining possession of their produce; and the term for repayment has been reduced to six months (with a possible extension of two months in certain special cases).

In recent years the Russian Government has attempted to develop the movement chiefly by lending through the medium of Zemstvos, co-operative credit societies, private credit institutions, and railways, considerably reducing the rates for loans so granted as compared with loans to individuals.

Various other steps have been taken to diminish the cost of keeping the produce; the borrowers have received considerable facilities for depositing their produce with various officials or with the Zemstvos; new branches of the Bank have been opened, and storehouses for the grain, etc., have been established by the State.

The total amount of the loans on the security of agricultural produce granted by the State Bank in 1911 was £28,331,000, and the produce accepted as security included wheat, rye, oats, barley, maize, flour, potatoes, buckwheat, peas, millet, cotton, flax, tobacco, wines and timber. An unsatisfactory aspect of the case is the fact that hitherto dealers have made more use of the facilities than the peasants and landholders for whose benefit the scheme was originally intended.

THE very great advantage to farmers of being able to obtain the services of a motor waggon for the haulage of coals, lime, manures, feeding stuffs and heavy goods generally is

Co-operative Carriage by Motor Waggon. pointed out in a memorandum on the combined purchase and use of commercial motor waggons published in the Annual Report for the year 1913 of the Scottish Agricultural Organisation Society.

It is stated that the most convenient size of motor waggon for a country district is one which carries three tons at a load and weighs slightly under six tons when loaded. The price of such a motor waggon would be about £600, but this cost would be reduced by purchasing a type of motor which would pass the War Office Specification, and so would earn a grant from the War Office of £110.

It has been found from experience on estate work that the actual cost of running such a motor would be approximately as follows, assuming that a mileage of at least 10,000 per annum is attained. (The cost would, of course, decrease with increase in mileage) :—

	Cost per mile.
	d.
Petrol	2'5
Oil, furnishings, repairs, sundries ..	1'5
Wages	2'5
Tyres	1'75
Depreciation (excluding tyres) ..	2'00
Interest on Capital	75
Total	11'00

In practice it is found desirable to have two men with the motor, as the extra wages are well repaid in the time saved in loading and unloading. It would probably be found that, owing to the demands on the motor, these two men could be kept constantly at work.

With a full load the cost per ton per mile would be about 4d., a rate far below horse carriage, but as in country districts about half the mileage would probably be run empty the cost per ton per mile would be slightly over 7d.

Motor waggons have the advantage over steam waggons in that the latter can go no great distance without water, a great deal of time being thus lost, even if water is available along the roads.

OFFICIAL NOTICES AND CIRCULARS.

1. THE Board have provided a Testing Station with accommodation for 100 head of cattle at Pirbright, Surrey, for the reception of cattle for the purpose of being tested for tuberculosis, or being immunised against Red Water, prior to exportation abroad. The Board hope to provide further facilities as necessity arises, both as regards accommodation and also the tests and immunisation to be carried out at the Testing Station.

Cattle Testing Station.

2. A fee of £6 per head will be charged for the tuberculin test, a fee of £5 per head for immunisation against Red Water, and a fee of £10 for the tuberculin test and immunisation combined. The fact that an animal has passed the tuberculin test or has been successfully immunised against Red Water will be certified under the seal of the Board.

3. The fees include all charges for testing or immunisation, for food and attendance during the time required to carry out the operations, and for conveyance between the Testing Station and Brookwood Railway Station (L. & S. W. Rly.).

4. Payment of fees is to be made prior to the despatch of an animal to the Testing Station, by cheque, or by postal or money order, payable to the order of the Board of Agriculture and Fisheries and crossed Bank of England, and is to be forwarded to *The Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.* A form to accompany the remittance will be furnished by the Board, when notifying an owner that an animal can be received at the Station. The Board do not

undertake to accept delivery of an animal until the fee for it has been received.

5. Owners are responsible for the carriage of animals by rail to Brookwood Railway Station and thence after testing or immunisation to ports of embarkation.

6. Animals will be kept under observation at the Testing Station prior to the tuberculin test for 28 days, and an animal will be tested and available for removal after 31 days from the time of its arrival at the station, unless the test has to be postponed owing to some unforeseen circumstance. An animal received for immunisation only, will, in the ordinary course, be available for removal after 28 days. Where both operations are to be carried out the animal will have to be at the Testing Station for about 56 days. Animals should not be sent to the Station for longer periods prior to shipment than will suffice for their being tested or immunised, as the case may be.

7. If an animal is kept for a longer period than is necessary at the Testing Station to suit the convenience of an owner, an additional charge at the rate of 30s. per week will be payable by the owner on demand by the Board, but if the excess period is owing to any unforeseen and unavoidable circumstances, this charge may be reduced by the Board.

8. Animals with respect to which certificates of immunisation have been issued are to be moved from Brookwood Station by rail, in sealed vans if required by the Board, direct to the port from which they are to be exported.

9. Applications for the testing or immunisation of cattle should be made at least a month before the date on which it is proposed to send the cattle to the Cattle Testing Station. Forms of application can be obtained from *The Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.*

10. An undertaking is to be given that an animal which has been immunised will not be removed from the Testing Station except direct to the vessel on which it is to be exported.

11. The Board reserve power to refuse acceptance of an animal or at any time to return to the owner an animal if its retention in the Testing Station is, in the opinion of the Board, undesirable from any cause.

12. Every animal sent to the Testing Station must be provided with a strong head-stall or halter, and notification is to be given in respect of any animal that has at any time proved to be vicious or dangerous.

13. Where more than one animal is consigned to the Testing Station by an owner each animal is to be marked for the purpose of identification by affixing an ear-tag or otherwise.

14. The animals whilst under the charge of the Board will be under the care and supervision of their Veterinary Officers, but the Board shall not be liable, nor shall compensation be paid, for any loss occasioned by the death, slaughter, injury, or illness of an animal, or by an accident to an animal, whilst under their charge or subsequently.

15. The Board reserve power, where they consider it to be necessary or desirable, to slaughter injured animals and dispose of their carcasses. The proceeds will be paid to the owner.

16. Should an animal re-act to the tuberculin test, it will be disposed of in accordance with the directions (if any) given by the owner on the application form. If no such directions have been given, the animal will be consigned at owner's risk and cost to the premises from which it was sent to the Testing Station.

17. For the purpose of identification every animal in respect of which a Certificate is issued will be marked on the hoof or otherwise with a number by which the animal will be described on the Certificate.

18. All communications should be addressed to *The Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.*, except notifications as to the time of arrival of animals. The latter should be sent direct to *The Inspector in charge, The Cattle Testing Station, Pirbright, Surrey.*

THE American Gooseberry Mildew (Fruit) Order of 1914 of the Board of Agriculture and Fisheries, which came into operation on 28th May, 1914, and which applies to England and Wales, revokes the American Gooseberry Mildew (Fruit) Order of 1912 and makes the following (among

other) provisions:—

Prohibition of Sale of Diseased* Gooseberries.—The sale or exposure for sale of diseased gooseberries is prohibited, and any person who sells or exposes for sale diseased gooseberries or causes or permits any such sale or exposure shall be liable on conviction to a penalty not exceeding ten pounds, unless he proves that he did not know that the gooseberries were diseased.

Regulation of Importation of Gooseberries.—(1.) The landing in England or Wales of any gooseberries brought from any place outside Great Britain (except the Channel Islands) is prohibited except where there is attached to the package in which the fruit is imported a label bearing the words "Imported Gooseberries," and stating the country and district in which the fruit was produced, and either the name of the consignor, or a distinctive name or mark previously registered with the Board for the purposes of this Article.

(2.) The label required by this Article shall not be erased or obliterated or detached from the package so long as any of the imported gooseberries remain therein.

Information to be given as to Imported Gooseberries.—Every person who has or has had in his possession any imported gooseberries, and every person who as auctioneer, salesman or otherwise has sold or offered for sale any imported gooseberries, shall, if so required in writing by the Board, or the Local Authority, or an Inspector of the Board or of the Local Authority, give the Board, or the Local Authority, or the Inspector as the case may be, all such information as he possesses as to the country and district in which the fruit was produced and the consignor by whom, and the consignee to whom, the fruit was consigned to England or Wales. Provided that any information given under this Article shall not be available as evidence against the person giving the same in any proceedings under this Order, except in respect of an alleged failure to comply with this Article.

Cleansing of Packages containing Diseased Gooseberries.—A package which has contained diseased gooseberries shall, after the removal of all gooseberries therefrom, and before the package is used for packing gooseberries or any other description of fruit, be thoroughly cleansed by washing, or other suitable method, by the owner or person in charge of the package.

* In this Order the word "disease" means American Gooseberry Mildew (*Sphaerotheca mors-uvæ*).

Powers of Inspectors to Enforce Cleansing of Packages.—An Inspector of the Board or of the Local Authority may by notice served on any person who has in his possession or under his charge a package which contains or has contained any imported gooseberries or any diseased gooseberries, whether imported or not, require such person to cleanse the package thoroughly to his satisfaction by washing or other suitable method, or if such person so prefer, to destroy the same forthwith in the presence of the Inspector, and for the purpose of cleansing to remove from the package any fruit therein.

Power to Prohibit Removal of Packages containing Diseased Gooseberries.—An Inspector of the Board or of the Local Authority may, by notice served on any person who has in his possession or under his charge a package which contains any diseased gooseberries, prohibit the removal of the package from the premises where it is, until the diseased gooseberries are removed therefrom.

Powers of Entry.—Any Inspector or other officer appointed in that behalf by the Local Authority, or by the Board, may upon production if so required of his appointment or authority enter any premises on which he has reason to believe that there are any imported or diseased gooseberries or is any package which contains or has contained any such gooseberries and examine the gooseberries and packages on such premises.

No outbreak of Foot-and-Mouth Disease has been confirmed in Great Britain since March 20th last.

Foot-and-Mouth Disease.

During May, four outbreaks of the disease were confirmed in Ireland by the Department of Agriculture and Technical Instruction for Ireland—all near Fermoy, County Cork.

All these outbreaks were well within an area out of which the movement of animals had already been prohibited by Order of that Department on account of previous outbreaks. Another outbreak was confirmed on the 2nd inst. in the same locality.

The Board made a new Order, on May 29th, operating on June 4th, modifying the restrictions then existing against the landing in Great Britain of animals from Ireland. Under this Order cattle, sheep, goats or swine shipped at Ballina, Belfast, Coleraine, Dundalk, Drogheda, Larne, Londonderry, Milford, Mulroy, Newry, Portrush, Sligo, or Westport, may be landed only at the Landing Places at Ayr, Barrow-in-Furness, Fleetwood, Glasgow, Greenock, Heysham, Stranraer, or Wallasey Lairages (Birkenhead). Animals shipped at Dublin, Greenore, Rosslare, Waterford, or Wexford, may be landed only at the Landing Places at Bristol (Avonmouth Dock and Cumberland Basin), Cardiff, Deptford, Fishguard, Holyhead, Manchester, Sillith, and Woodside Lairages (Birkenhead).

On landing at any Landing Place a period of only ten hours detention in the Landing Place is required, after which the animals may, if found on examination to be free from disease, be either slaughtered in, or with the permission of an Inspector of the Board be moved out of, the Landing Place, as the owner of the animals may desire. No licences for movement out of the Landing Place are required and no subsequent detention or isolation of the animals is imposed by the Order.

The movement of the animals into the District of any particular Local Authority in Great Britain is, however, subject to any Regula-

tions which may have been made by the Local Authority prohibiting or regulating the entry of such animals into their District.

Animals landed before the commencement of the Order become as from that date free from the conditions as to slaughter, detention or isolation imposed by the Order previously in force.

Fream Memorial Prize.

The Board of Agriculture and Fisheries have awarded a Fream Memorial Prize, of the value of £7 2s. 1d., to Mr. Harry Muir McCreath, a student of the West of Scotland Agricultural College, Glasgow, who obtained the highest marks in this year's examination for the National Diploma in Agriculture.

The Board desire to bring to the attention of the public the arrangement now established at the Royal Botanic Gardens, Kew, whereby a competent guide accompanies visitors on week days through the Gardens and explains the many objects of botanical interest. A small charge is made for the services of the guide, 6d. for each person attending a morning tour and 3d. for each person attending an afternoon tour. The present arrangements are of the nature of an experiment, and their continuance beyond September next will depend on the extent of the public demand for the services of the guide.

A leaflet giving detailed information on the subject can be obtained on application to the Director, Royal Botanic Gardens, Kew.

The President of the Board of Agriculture and Fisheries has appointed a Departmental Committee to consider and report upon the effect of the present arrangements for the sale of the small scale maps of the Ordnance Survey, and to make recommendations in regard to the continuance or modification of these arrangements or for any alternative arrangement to be substituted for them.

Sale of Ordnance Survey Small Scale Maps.

The Committee is constituted as follows:—
Sir Sydney Olivier, K.C.M.G. (Permanent Secretary of the Board of Agriculture and Fisheries), Chairman.
Mr. F. Atterbury, C.B. (Controller of His Majesty's Stationery Office).
Col. C. F. Close, C.M.G., R.E. (Director-General of the Ordnance Survey).
Mr. J. L. Bryan of the Board of Agriculture and Fisheries will act as Secretary to the Committee.

Since the beginning of the year new leaflets have been issued by the Board on the following subjects:—No. 267, *Basic Slag*; No. 276, *Mushrooms*; No. 278, *Growing of Linseed for Feeding Purposes*; No. 280, *Sainfoin*; and No. 284, *Preservation of Outdoor Timber*.

New Editions of both bound volumes have been published, viz., the 11th edition of bound volume 1-100, and the 4th edition of bound volume 101-200.

The information contained in the following leaflets has been revised and brought up to date:—

No. 8. *Assessments to Local Rates*.

No. 23. *Potato Disease*.—A paragraph has been inserted recommending the use of Burgundy mixture as a substitute for Bordeaux mixture where it is difficult to obtain good fresh lime free from grit. A note as to dry spraying has also been added.

No. 93. *Farmyard Manure*.—A paragraph has been added suggesting that, with the present high prices of feeding stuffs and store cattle, it may be more profitable on some farms to use dung from hay- and root-fed bullocks, supplemented by suitable artificials, than to feed large quantities of cake for this purpose.

No. 108. *Epizootic Abortion*.

No. 131. *Apple and Pear Scab*.

No. 164. *Potato Leaf Curl and Black Stripe in Tomatoes*.

No. 175. *The Use of Waste Organic Substances as Manures*.

No. 201. *Marketing of Poultry*.

No. 224. *Narcissus Cultivation*.—The prices and other figures in the leaflet have been brought up to date.

No. 277. *Tuberculosis in Farm Stock*.

MISCELLANEOUS NOTES.

The following note on the use of sprouted grain as a food for poultry has been received from Capt. F. P. Peirson-Webber, county instructor in poultry keeping to the Warwickshire and Northamptonshire County Councils:—

Sprouted Grain as a Food for Poultry.

Sprouted grains provide a valuable and inexpensive feed for poultry, promoting rapid growth in young stock, healthy fecundity in breeding stock, and a good egg production, especially where the hens are kept in close confinement.

Sprouting occurs most quickly, and is best undertaken, in the case of oats and wheat, but barley and maize can also be sprouted with advantage at times. For sprouting, half-a-gallon of the grain, preferably a good sample of the best seed oats, should be taken and soaked in a bucket of water, a sack being placed over the bucket to ensure darkness. The seeds should occasionally be gently stirred with the hand, and in about two days it will be found that they have "chitted," when the water should be poured off and the seeds put into a sprouting box (obtainable from makers of poultry appliances). The seeds should be spread evenly in the box and watered three times daily, the box being covered with sacking; where several boxes are used they may be placed one above the other in order to save space. In a few days it will be observed that short, succulent shoots will have sprouted all over the surface of the seeds, while the roots will have so intertwined as to form a strong matted turf. The sprouts may now be given to laying hens, but if it is wished to use the sprouted grain chiefly as a green food the seed turf should not be utilised until the thick green covering is about 2 inches long.

In feeding, broken pieces of the turf should be placed in a water-trough. Chickens will be found to eat it, including the roots, with avidity.

A sprouting box of the usual pattern takes half a gallon of seed, and this quantity, at a cost of about 3d., provides sufficient green food for one meal for about 50 hens or 100 chickens.

In the Report of the Animals Division of the Board for 1913 [Cd. 7321, price 5½d.], an account is given of the work accomplished under the Board's Tuberculosis Order of 1913, between 1st May (the date when the Order came into operation) and 31st December, 1913.

Tuberculosis in Cattle.

During that period, 4,346 outbreaks, involving 4,720 cattle, were notified by Local Authorities in Great Britain, namely, 3,552 outbreaks in 49 counties in England, 617 outbreaks in 30 counties in Scotland, and 177 outbreaks in 10 counties in Wales. It must be explained, however, that it was not until November that the Order came into general operation in Scotland.

Although some exception was taken at the time the Board drew up their estimate of the number of animals that would fall to be dealt with under the Order on the ground that it was probably too low, the returns obtained up to the present point to its having been much too high. On the basis of those returns, the number of animals which have to be dealt with under the Order is less than 600 per month, whereas the Board's estimate, which was made on the basis of 1 per cent. of the cows and heifers in milk or in calf in Great Britain, would have given an average of about 2,300 animals per month. The estimated cost of compensation for Great Britain as a whole on this last basis was £120,000, of which it was calculated that a sum of £60,000 might possibly fall to be defrayed from Exchequer funds in the course of the first year's operations.

The difference between the estimate and the result is probably due to several causes. In the first place there is considerable evidence that during the weeks that intervened between the publication of the Order and the date upon which it took effect, a number of animals suffering from advanced tuberculosis were disposed of by their owners for slaughter as knacker meat. Again there is also reason for believing that since the Order has been in operation many farmers have had their suspected cows slaughtered at their own expense and risk without availing themselves of the provisions of the Order. Further, it is probable that some farmers may have failed to report cases of suspected tuberculosis owing to ignorance of the requirements of the Order.

To these causes must possibly be added a considerable number of cases in which the farmer knowingly fails to report his suspicions to the Local Authority so as to avoid allowing the fact that he has a suspected animal on his premises becoming public property. In such cases, however, there is reason to believe that the owner himself often disposes of the cow to the knacker so that, from the point of view of the danger of the spread of the disease to animals and of that of the protection of the public health, the Order has indirectly the effect of ridding the country of these animals.

The smallness of the number of outbreaks has, of course, led to the amount payable in compensation being very much lower than was anticipated. A further cause has, however, operated to diminish the actual expenditure under the Order. It was originally estimated that only 50 per cent. of the confirmed cases would prove to be cases of advanced tuberculosis with compensation at the rate of one-quarter of the valuation as compared with compensation equal to three-quarters of the valuation for the remaining 50 per cent. of non-advanced cases. As far as information is at present available, however, the proportion of

advanced cases is about 75 per cent., so that the cost of the Order from this point of view has also been less than was anticipated.

Although the actual effect of the Order in reducing the prevalence of tuberculosis in animals cannot be gauged for some time to come, it would seem that the destruction of so many tuberculous cattle must have a beneficial effect in reducing the prevalence of the disease.

With a view to encouraging breeders to put their mares to sound and suitable stallions the Board are expending approximately £14,000 a year, in subsidising high-class thoroughbred stallions to travel the country at a low fee, and arrangements are made for the *free service* by these stallions of about 1,800 selected mares. Every possible inducement is also given to owners to have their stallions examined annually free of charge, and certificates are issued in favour of those that are sound and suitable for breeding purposes. Arrangements are also made to lease brood mares of the hunter type, at an annual rental of £2, to farmers who desire to have them for breeding purposes.

The pony breeding industry is also recognised, and premiums are given to mountain and moorland pony stallions that are turned out in districts which have been cleared under the Commons Act, 1908, of immature or undesirable sires. Assistance is also given for the purpose of encouraging the breeding of the Old Welsh Cob.

The Operation of the Scheme during 1912-13.

Service Season, 1912.—Foaling particulars were received for 3,271 of the mares served in 1912, showing that 1,929 foals were bred from them, an average foal-getting percentage of 58·97 per stallion, which, though not very high, yet compares favourably with the percentage (53·66) for 1911. The average amount paid by the Board for the service season of 1912 in respect of a King's premium stallion was £250 3s., and the maximum amount £371 5s. These amounts, with the fee of £2 for each service that is payable by the owner of a mare, bring the average earnings of these stallions up to £359 16s. 7d. and £523 3s. was earned in a few instances.

In addition to the super-premiums and King's premiums to which the above figures relate, 25 premiums, known as Board's premiums, were awarded in 1912 to stallions recommended by county committees, and the percentage of foals got by them was 49 as compared with a percentage of 44 in 1911. The average payment by the Board in respect of these premiums works out at £109 3s. 4d. and the maximum at £138 5s. With the addition of the service fee of £1 chargeable to the owner of a mare, the average earnings of a Board's premium was £163 2s. 6d. and the maximum £214 15s.

Service Season, 1913.—The show of thoroughbred stallions was held at the Royal Agricultural Hall, Islington, on March 11th-13th, 1913, when, owing to the transfer of the light horse-breeding operations in Scotland to the Board of Agriculture for Scotland, the number of premiums available for England and Wales was 44 as compared with 50 for Great Britain in 1912.

The number of entries was 114 as compared with 111 in 1912.

In the opinion of the judges at the Show the improvement in the stallions exhibited in 1912 was well maintained, the ten horses to which

super-premiums were awarded being "horses of exceedingly high calibre."

The results of the service season were very satisfactory: 3,280 mares being served, an average of 75 per stallion, as compared with 69 in 1912.

The payments made by the Board in respect of the stallions (exclusive of foal fees) averaged £251 4s. 6d. per horse, with a maximum of £354 10s. The corresponding figures for 1912 were £226 and £334 10s. With the addition of the service fees of £2 payable by owners of mares, the average earnings of a stallion can amount to £356 4s. 6d., and the maximum to £484 10s. (exclusive of foal fees).

Board's Premiums.—On the recommendation of the county committees, twenty-five Board's premiums were awarded to registered stallions to travel in England and Wales. The stallions comprised 19 Thoroughbreds, 4 Hunter Sires, 1 Yorkshire Coach, and 1 Cleveland Bay. Three of the stallions travelled in Wales.

The number of mares served was 1,581, being an average of 63 per stallion. The average for 1912 was 66, and although a slight diminution is shown, the results may be considered to be satisfactory. The average amount paid by the Board to the owners of the stallions was £106 5s. 8d., which, with the fee of £1 payable by the owners of the mares, makes the average earnings of the stallions £107 5s. 8d., exclusive of the foal fees of 5s. per foal which fall to be paid after the close of the foaling season of 1914. The maximum earnings of one of these stallions was £204 10s., of which £139 10s. was paid by the Board.

Premiums to Welsh Cob and Pony Stallions.—The assistance given in 1912 to the breeding of cobs of the old Welsh stamp was much appreciated, and in 1913 the number of premiums was increased from 5 to 8. The average value of the premiums is approximately £50, and the stallions, to which awards are made on the recommendation of county committees, are required to serve 25 mares of the old Welsh type. The mares must be entered or accepted for entry in the Welsh Stud Book, and free nominations are awarded to them, on the authority of the Board, by the county committees concerned. Two of the premium stallions were allotted to Cardigan, and two to Montgomery, whilst Brecon, Carmarthen, Merioneth and Radnor were provided with one stallion each.

The premium of £20 given to Fell Ponies in 1912 was found to be inadequate to secure the best pony stallions, and it was increased in 1913 to £30. Five of these premiums were given.

Premiums of £5 were again awarded to six selected pony stallions in the New Forest, and the number of premiums of the same value awarded to Welsh Mountain pony stallions to roam the hills at Church Stretton was increased from 4 to 6. Five premiums were awarded to pony stallions turned out on the Eppynt Hills in Breconshire, and three to pony stallions on Fairwood and Pengwern Commons in Glamorgan-shire.

Premiums to pony stallions which roam the hills are only given in districts where local associations are formed to supervise the rounding up of the ponies and to prevent the use of unsound and immature sires under regulations made under the Commons Act, 1908. It is hoped that good results will reward the efforts of these associations to improve the breed of the mountain and moorland ponies.

Free Nominations for Mares.—Free nominations are issued by county committees for the service of mares by premium stallions. A free nomination is issued only in favour of a mare which has been examined by a veterinary surgeon and passed as sound for breeding purposes. The value of a free nomination to a King's premium stallion is £2, and to a Board's premium stallion £1.

The number of free nominations authorised for issue to King's and Board's premium stallions in England and Wales was increased in 1913 from 15 to 25 per stallion. The total number of nominations issued to King's premium stallions was 1,025, of which 970 were used. The corresponding figure for Board's premium stallions was 539.

Practically all the free nominations are issued to tenant farmers and small holders, and in most districts they are well taken up.

Purchase of Brood Mares.—Up to the present grants amounting to £26,642 have been made to 38 county committees for the purchase of brood mares of the hunter type, for leasing to custodians for breeding purposes at an annual rental of £2 for each mare.

The number of mares purchased is 539, and the majority of them have been reported by the Board's Inspectors to be suitable for the purpose in view.

Registration of Stallions.—The object of the registration scheme is to rid the country of the unsound stallion, to the use of which is due the breeding of so many horses affected with hereditary diseases. It is not contended for a moment that the sire alone is responsible for perpetuating inherent diseases and defects; the dam is equally capable of doing so, but she cannot produce more than one foal a year, and as a stallion can get annually more than fifty times that number, its soundness is of far more importance than that of the mare. The elimination of the unsound sire is, therefore, the first concern of the Board, and of the scheme they have initiated for the purpose is voluntary in its operations. Every facility is offered to owners to have their stallions examined by veterinary surgeons who have been very carefully selected for the purpose; but the examination is not obligatory at present.

It is evident from the results of the registration year (November 1st, 1912–October 31st, 1913) that the scheme is beginning to be more widely taken up by owners of stallions, possibly because they are beginning to obtain some commercial advantage from having their horses on the Board's register. In the first year of the scheme 313 stallions were registered and 44 rejected. In 1911–12 (November 1st–October 31st) 715 were registered and 90 refused. In the year under review 837 have been accepted for registration—445 of which had been registered in the previous year—and 65 refused, and of the latter 23 had been registered in 1912.

Of the numbered registered in 1912–1913, 388 were Shires, 178 Thoroughbreds, 117 Ponies, 60 Hackneys, 40 Suffolk Punches, 27 Clydesdales, 17 Hunters, 6 Yorkshire Coach Horses, 2 Cleveland Bays and 2 American Trotters.

Of the number rejected 34 were Shires, 17 Thoroughbreds, 6 Ponies, 4 Hackneys, 3 Suffolk Punches, and 1 Clydesdale. The diseases on account of which these 65 stallions were refused registration were whistling (19), sidebone (12), roaring (11), bone spavin (6), cataract (6), ringbone (4), defective genital organs (3), stringhalt (2), and the remaining two were rejected because their conformation was so bad as to render them unsuitable for breeding purposes.

In the Board's Report on the Acreage and Live Stock Returns for 1913 [Cd. 7325, price 6d.] a more detailed classification of agricultural holdings according to size has been made, as compared with previous years, the numbers of holdings being given in groups of seven different sizes. The numbers in each group together with the acreage, are shown in the following table:—

Size-group.	No.	Per cent. of Total.	Total Acreage.	Per cent. of Total.
Over 1 and not over 5 acres	92,302	21.18	284,945	1.05
Over 5 and not over 20 acres	122,117	28.03	1,373,277	5.06
Over 20 and not over 50 acres	78,027	17.91	2,623,304	9.67
Over 50 and not over 100 acres	59,287	13.61	4,324,724	15.94
Over 100 and not over 150 acres	31,838	7.31	3,942,165	14.53
Over 150 and not over 300 acres	37,593	8.63	7,844,200	28.92
Over 300 acres	14,513	3.33	6,736,767	24.83
Total	435,677	100.00	27,129,382	100.00

It will be observed that rather more than half the agricultural area of the country is farmed in holdings of over 150 acres, and about one-fourth in holdings of over 300 acres. The occupiers of holdings above 150 acres are few in comparison with the total number of persons who occupy agricultural land, being only 52,000 or 12 per cent. of the total. Nearly one-third of the agricultural area is farmed in holdings of from 50 to 150 acres, the number of occupiers of these holdings being 91,000, or 21 per cent. of the total. It may fairly be reckoned that among these are many who might be described as small holders, in the sense that they are occupiers who cultivate their holdings mainly by the labour of themselves and their families, and employ little outside labour in the regular work of the farm. This would especially apply to the 50 to 100 acre class, in which would fall the small holding of grass land characteristic of Cumberland, Westmorland, Devon and some of the Welsh counties. An interesting group is that of 20 to 50 acres, wherein it may be assumed would fall the bulk of the typical small holdings on which mixed farming is practised, i.e., those which contain a proportion of both arable and pasture. They number 78,000 and form 18 per cent. of the total, and represent nearly 10 per cent. of the land under cultivation. Below the 20 acres level the holdings are probably more heterogeneous. Many of the smaller plots, no doubt, consist of accommodation land held by persons mainly employed in other avocations than farming, or of paddocks, &c., held in conjunction with residences and representing land occupied for pleasure and recreation rather than for farming as a business. The number of these holdings, i.e., from 1 to 20 acres, is very large, being nearly one-half of the total, although the area which they represent is only 6 per cent. of the whole. No doubt, however, many of them may fairly be described as economic units and may be

assumed to be small holdings which are mainly arable, and are devoted largely to vegetables, fruit, or some form of more or less intensive cultivation.

Adhering to the long-accepted definition of a small holding as being from 1 to 50 acres, the following are the numbers returned annually in recent years in England and Wales respectively:—

Years.	England.	Wales.	England and Wales.	Per cent. of Total Holdings.
1908	245,102	42,074	287,176	66.77
1909	245,856	42,155	288,011	66.85
1910	246,584	42,218	288,802	66.90
1911	250,166	42,322	292,488	67.19
1912	249,922	42,798	292,720	67.15
1913	249,773	42,673	292,446	67.12

As there was a loss in 1913 of 45,000 acres from the farming area of the country it is evident that a large number of individual holdings must have disappeared, and it is reasonable to assume, as small farms are commonly numerous near the centres of population, that the encroachment of the towns would reduce the number of small holdings very materially. Unless, therefore, there is a continual creation of new small holdings sufficient to counterbalance this loss, the numbers of such holdings must decline. It will be seen, however, that while up to 1912 the number of small holdings created over-balanced the number lost, in 1913 the number was insufficient to supply the deficiency caused by the withdrawal of land from cultivation or by the amalgamation of farms.

The last year prior to 1913 for which an analysis of the size of holdings in more than four groups is available was 1895, and it is of interest to compare the figures then obtained with those now presented. The grouping adopted was then rather different, as no division of the numbers above 100 and under 300 acres was made, although for farms above the higher limit two further divisions were adopted. The returns for the two years in corresponding groups stand as in the following table:—

Size of Holding.	1895.		1913.		Increase (+) or Decrease (—).	
	No.	Per cent. of Total.	No.	Per cent. of Total.	No.	Per cent. of Total.
Above 1 and not exceeding 5 acres	97,818	22.21	92,302	21.18	—5,516	—1.03
Above 5 and not exceeding 20 acres	126,714	28.77	122,117	28.03	—4,597	—0.74
Above 20 and not exceeding 50 acres	74,846	16.99	78,027	17.91	+3,181	+0.92
Above 50 and not exceeding 100 acres	56,791	12.89	59,287	13.61	+2,496	+0.72
Above 100 and not exceeding 300 acres	68,277	15.50	69,431	15.94	+1,154	+0.44
Above 300 acres	16,021	3.64	14,513	3.33	—1,508	—0.31
TOTAL	440,467	100.00	435,677	100.00	—4,790	—

The total number of separate occupations has decreased in 18 years by 4,790, the loss having been entirely among holdings not over 20 acres and holdings above 300 acres.

The reduction by 1,508 of the largest sized holdings represents an area of 895,753 acres, while the reduction of acreage in the two smallest groups is 64,662 acres. From 1895 to 1913 the total cultivated area declined by 553,665 acres, and it appears, therefore, that nearly eight-ninths of this reduction has been at the expense of the largest holdings, and that the medium-sized holdings have gained at least 340,000 acres from the largest, and probably more.

Importation of Vines and Potatoes into Malta.—Government Notice No. 21 of 1914, amends the regulations respecting the importation of plants, etc., into Malta.

The regulations provide that grapes must be accompanied by an antiphyloxeric certificate from the Board of Agriculture and Fisheries, and they will on arrival be subjected to examination.

Importation Regulations.

Potatoes must be accompanied by a statutory declaration by the shipper, naming the place of origin and stating that such potatoes were not grown on land infected with wart disease, and by a certificate from the Board of Agriculture and Fisheries stating that the locality in which the potatoes were grown is free from that disease.

Importation of Seeds into Norway.—The provisions of a law of 9th May, 1913, with regard to the marking and colouring of seeds imported into Norway were summarised in this *Journal* for July, 1913, p. 353. One of these provisions was to the effect that the Customs authorities may be empowered to treat certain seeds with a colouring solution before allowing importation. A decree of 14th October, 1913, provided that seeds of red clover, alsike clover and timothy were to be so treated, the colouring solution laid down by the Department of Agriculture being an eosine solution (8 grammes eosine in one litre of alcohol). According to a Royal decree of 13th March, 1914, and regulations of the Department of Agriculture of the same date, seeds of all species of spruce and pine—with the exception of species of "bread pine" (*Pinus cembra* and *P. sibirica*)—must also be so treated (*Nachrichten für Handel, &c.*, 11th April, 1914).

Cultivation and Use for Industrial Purposes of Potatoes in Germany (*Bull. of Agric. Intell.*, April, 1914).—A Society has recently been formed in Germany, with the approval of the principal societies interested, to encourage the cultivation of potatoes and their utilisation for industrial purposes. The Society will aim not so much at extending the area of land devoted to the crop as at increasing, by means of variety and manurial experiments, the yield obtained per unit of land. It proposes also to investigate the various methods which may be adopted for preserving the surplus product in a fresh or dried condition, and to co-ordinate the results obtained by individual workers in this connection. In order to obviate variations in price due to good or bad crops, the members will undertake, as circumstances demand, either to ensile or dry a portion of the crop.

Destruction of Field Voles in France.—The appearance of field voles has been reported from many of the French Departments, and it is

feared that unless energetic measures are taken to check their propagation there will this year be a repetition of the damage previously done by these rodents. The French Government have recognised the necessity for action, and a sum of £30,000 has been set aside to be utilised in subsidising local authorities, agricultural syndicates and associations in their efforts to destroy the pest. The State contribution will be made at the rate of 6d. per acre, but the particular method of treatment will be left to the local bodies concerned.

The Report of the Commission of Agriculture of the Chamber of Deputies, appointed to consider a private Bill dealing with small animals harmful to agriculture, examines in some detail the various methods of destroying the field vole, from simple mechanical devices to the use of a virus.

Where the invasion of voles is not general, fumigation of the runs with noxious gases may be resorted to. For this purpose sulphurous acid and carbon bi-sulphide have been found useful. In the first stages of an invasion poisons have been found effective. Among the poisons mentioned are arsenious acid, phosphorus paste, barium carbonate and nux vomica. The cost of treatment with arsenious acid is rather high, and several applications are necessary to ensure anything like complete destruction of the voles. The use of phosphorus paste is regarded as too dangerous for it to be recommended. In using barium carbonate it is suggested that the barium carbonate "bread" should be divided into pieces about the size of small nuts which may be soaked in creamy milk to make them more tempting, and one or two pieces placed in each burrow. Nux vomica has been found in experiments to be as effective as a virus, but is unfortunately fatal to many small birds.

The Report gives a synopsis of the history of the virus, describes the use of the different forms, and discusses the question whether they are dangerous to human beings. A virus is usually most effective when the population of voles is dense, and has in such cases been known to give a mortality of 90 to 95 per cent. on the first application. When the attack of rodents is not so severe it presents little superiority over poisons. The virulence, moreover, rapidly disappears, and when the voles fail to absorb sufficient to cause death they quickly become immune.

In conclusion the Report points out that isolated action is of little use, and emphasises the necessity for combined action over the whole of the district attacked.

"Profit per Acre" Competition in Canada.—During the summer of 1913 the Ontario Department of Agriculture organised an interesting competition on somewhat novel lines. The expenses of the contest were provided from the grant in aid of agricultural instruction, and the competition is considered to have represented a maximum of accomplishment for a minimum expenditure.

The competition was arranged in 26 districts and there were upwards of 200 entries. Entries were accepted only from young men who had attended the short courses in agriculture organised by the Department. One prize was given in each district for the competitor securing the largest net profit per acre; no restriction was made as to the crop to be grown, competitors being allowed to choose the crop which they considered would yield the highest return in their particular districts. Every effort was made to conduct the competition under ordinary farm conditions and to secure uniformity and accuracy. Each contestant was required to keep a record of his different items of

expenditure and the methods of cultivation adopted. Competitors were allowed to expend £1 1s. per acre for the rent of the land, 5d. an hour for labour, whether of man or horse, 2s. per load for manure, and the actual cost of the seed, fertiliser, spraying materials, etc., used. In calculating the returns a standard rate was fixed for each crop and was used throughout all the centres.

The prizes consisted of free travelling and maintenance for the Short Course in Live Stock and Seed Judging at the Ontario Agricultural College. In all, seven different crops were selected by the various competitors. Of the 26 prize-winners, 7 grew potatoes, 6 oats, 6 maize for silage, 2 maize for seed, 2 barley, 2 mangolds, and 1 grew turnips. The highest profit made after deducting the cost of seed, manure, etc., was £48 4s. from a crop of 427½ bushels of potatoes, while the lowest profit which gained a prize was 9s. 6d. from a crop of 57 bushels of oats. (*The Agric. Gazette of Canada, February, 1914*).

Russian Small Holdings.—A very good insight into the conditions which prevail on the peasant holdings in the black earth districts of Russia is given in a book* on the peasant question in Russia by Wieth-Knudsen. The black earth soil is remarkable for its richness in phosphates, potash and ammonia and contains from 3 to 16 per cent of humus. With sufficient rainfall abundant harvests can be obtained for many years in succession without the use of manures. Since very little organic manure is required the keeping of live stock does not occupy a very important place in the agricultural economy of these districts. Further, owing to the large natural increase in the population, the supply of agricultural labour is quite sufficient for requirements.

A holding of 25 acres is self-supporting, but in the case of one of 11 to 25 acres the peasant must have a subsidiary occupation. The majority of the peasants farm this latter class of holding, finding employment in the winter in the towns or in a home industry. The holders of less than 11 acres form the mass of permanent and migratory agricultural labourers, as the proceeds of their holdings are not nearly sufficient to support their families.

The needs of a Russian peasant's family are small, and the following statement shows the income and expenditure on an average farm in the government of Woronesh. The small amount of the actual monetary transactions is noteworthy.

Annual Income.	In Kind.	In Actual Money.	Total.	Annual Expenditure.	In Kind.	In Actual Money.	Total.
Agriculture ..	£ 22 18	£ 4 17	£ 27 15	Food ..	£ 14 1	£ 3 16	£ 17 17
Live Stock ..	6 3	6 1	12 4	Clothing ..	1 9	3 14	5 3
Horticulture & Poultry ..	0 2	0 10	0 12	House ..	1 8	2 0	3 8
Home Industry ..	0 4	11 16	12 0	Farm (Business Expenses) ..	11 12	10 0	21 12
Other income ..	5 5	5 11	10 16	Taxes ..	0 2	2 13	2 15
				Other expenditure ..	0 13	2 19	3 12
Total income ..	34 12	28 15	63 7	Total expenditure ..	29 5	25 2	54 7

* Bauernfrage und Agrarreform in Russland, K. U. Wieth-Knudsen, Munich, 1913.

The sum of £63 7s. is the gross income, as the expenditure on the farm, £21 12s., has not been deducted.

The following inventory of two peasant farms in the government of Kiev will convey a good idea of the economic conditions of a Russian peasant's family:—

	A Good Holding.		A Poor Holding.	
	£	s.	£	s.
Horses ..	(2)	9 9	(1)	3 3
Cows ..	(1)	3 3	(1)	3 3
Young animals ..	(2)	2 9	(1)	1 1
Sheep ..	(10)	3 3	(5)	1 7
Pigs ..	(4)	1 5	(2)	0 11
Fowls ..	(20)	0 10	(6)	0 3
House ..		12 13		5 5
Barn ..		9 9		3 14
Carthouse and shed ..		7 18		—
Cellar ..		1 1		1 1
Well ..		1 1		—
Granary ..		4 4		1 1
Agricultural machinery ..		10 11		3 3
Implements ..		4 4		2 2
		71 0		25 14

The *Bulletin of Agricultural and Commercial Statistics* for May, 1914, issued by the International Institute of Agriculture, gives the condition of winter cereals on May 1st as follows:

Notes on Crop Prospects Abroad. (100 being taken to represent the prospect of an average crop):—*Wheat*—Denmark, 106; Spain, 110; Scotland and Switzerland, 100; Rumania, 115; Canada, 103; Luxemburg, 85; Netherlands, 108; Tunis, 50. *Rye*—United States, 112; Japan, 101; Egypt, 94; Netherlands and United States, 106; Spain, 110; Luxemburg, 86; Denmark, 106; Rumania, 115; Switzerland, 100. *Barley*—Spain and Rumania, 110; Scotland and Switzerland, 100; Luxemburg, 85; Netherlands, 105; Japan, 106; Egypt, 92; Tunis, 50. *Oats*—Scotland and Switzerland, 100; Luxemburg, 80; Rumania, 110; Tunis, 60.

Russia in Europe (63 governments).—The final results of the cereal harvest in 1913 show the production of wheat to have amounted to 104,695,000 qr., or an increase of 34.3 per cent. as compared with 1912. Rye totalled 113,363,000 qr., a decrease of 3.9 per cent.; barley, 66,892,000 qr., an increase of 22.3 per cent.; oats, 113,362,000 qr., an increase of 13.6 per cent.; and maize, 8,490,000 qr., a decrease of 8.6 per cent.

Russia in Asia (25 governments).—The final figures of the harvest of 1913 give the production of wheat as 23,726,000 qr., an increase, as compared with 1912, of 6.8 per cent. Rye amounted to 4,590,000 qr., a decrease of 1.2 per cent.; barley, 5,115,000 qr., an increase of 5.6 per cent.; oats, 14,867,000 qr., an increase of 24.9 per cent.; and maize, 1,256,000 qr., a decrease of 25.8 per cent.

British India.—According to the final memorandum on the wheat crop of 1913-14, the production is estimated to have amounted to

39,119,000 qr., a decrease of 14.0 per cent. as compared with the production in 1912-13.

France.—The *Journal Officiel* of May 20th gives the following final official estimates of the production of the crops of 1913 (in quarters, and 1912 figures in brackets):—Wheat, 38,884,973 (40,736,369); mixed corn, 685,551 (728,839); rye, 5,990,500 (5,922,434); barley, 5,586,367 (5,945,294); oats, 37,692,569 (37,995,341); and buckwheat, 3,023,312 (2,711,610).

The areas under cereals on May 1st were officially estimated as follows (in acres, and areas on May 1st, 1913, in brackets): winter wheat, 15,428,954 (15,640,361); spring wheat, 609,571 (528,160); winter barley, 344,590 (373,884); spring barley, 1,463,450 (1,492,399); winter oats, 2,070,700 (2,060,227); spring oats, 7,758,468 (7,816,068); and rye, 2,911,167 (2,945,228). The condition of the crops on May 1st was as follows (80 = good, 60 = fairly good):—Winter wheat, 71; spring wheat and barley, 70; winter barley and oats, 72; spring oats, 69; and rye, 74. (*Journal Officiel*, May 14th.)

Germany.—The official report relating to the beginning of June gives the condition of the crops as follows (2 = good, 3 = average):—Winter wheat, 2.6; spring wheat, 2.5; winter rye, 2.7; spring rye, 2.5; spring barley, 2.4; oats, 2.5; and potatoes, 2.7.

Hungary.—The official report of May 25th states that the beneficial effects of the rains of the first half of May have, except in a few districts, been counterbalanced by subsequent drought. Wheat is suffering from rust almost everywhere. Rye is mostly thin, but promises better, on the whole, than wheat. Maize and especially potatoes have generally come up fairly well. According to the first estimate of the quality, wheat is mostly poor and medium, rye medium, and barley and oats mostly good and medium. The areas sown are estimated as follows (in acres):—Wheat, 8,404,000; barley, 2,780,000; oats, 2,624,000; and rye, 2,673,000. (*Dornbusch*, June 2nd.)

Italy.—The official report relating to the ten days, May 10th to 20th, stated that the condition of the crops in northern Italy continued to be very good generally, although some damage had been done by unfavourable weather in parts of Emilia. In central Italy, Campania and Basilicata the crops looked well. Rain was still wanted in parts of Apulia, in Calabria and in the islands. (*Broomhall's Corn Trade News*, June 1st.)

Canada.—A bulletin issued by the Census and Statistics Office at Ottawa states that on May 6th about 19 per cent. (132,000 acres) of the area sown with winter wheat in Ontario was reported as winter killed. In Alberta, the other large winter wheat province, the proportion was 15 per cent., representing 36,000 acres. The condition of the crop was 83 per cent. and was superior to that of any year since 1910. On the whole, spring seeding was well advanced. For the five provinces of Quebec, Ontario, Manitoba, Saskatchewan and Alberta the proportion of seeding reported as effected on May 6th was about 48 per cent. for wheat, 23 per cent. for oats, and 16 per cent. for barley.

United States.—H.M. Acting Consul at St. Louis reported on May 21st that damage estimated at 50 to 60 per cent. had been caused by Hessian fly in several important wheat growing counties of Missouri, and the Board of Agriculture for that state was advising re-sowing of

infested land with maize. In Kansas damage on some 500,000 acres out of 9,000,000 acres was reported.

The Department of Agriculture estimate the production of the cereals, from their condition on June 1st, as follows (in bushels and final figures for 1913 in brackets):—Winter wheat, 638,000,000 (523,561,000); spring wheat, 262,000,000 (239,819,000); oats, 1,216,000,000 (1,121,768,000); rye, 20,600,000 (41,381,000); and barley, 206,000,000 (178,189,000).

Argentina.—H.M. Chargé d'affaires at Buenos Aires in a report dated May 1st stated that heavy and persistent rains had done much damage to the maize crop which was then being harvested. No official estimate of the damage was available, but it was considered that 20 per cent. of the crop has been lost.

Fruit.—**Germany.**—H.M. Consul-General at Hamburg reported (May 20th) that cherry, pear and plum trees had a sound and abundant blossom and a very good crop might be anticipated. There was also an abundant supply of apple blossom, but, owing to the cold, wet weather, trees had not ceased blooming, and it was impossible then to say definitely how the crop would finally turn out. Early strawberries had suffered from frost, but from later kinds a good crop was expected. Gooseberries and currants promised abundant crops.

France.—H.M. Consul-General at Paris reports (May 29th) that the fruit crop in France is likely to be generally satisfactory as regards all kinds except prunes, which will probably yield rather less than last year; and that prices will therefore probably be rather lower than in 1913.

H.M. Vice-Consul at Caen reported on May 26th that the fruit crops in the Department of Calvados were good, and better than in preceding years.

H.M. Vice-Consul at Honfleur reports (June 6th) that in his district early cherries are plentiful and prospects are good for the later varieties. Good crops of table apples and early pears, heavy crops of cider apples, but only half a crop of plums and greengages, and very poor crops of late pears, are expected.

Holland.—His Majesty's Acting Consul-General at Rotterdam states that according to a report by the Dutch Department of Agriculture of May 20th complaints were being received from several districts that night frosts had done much harm to the fruit crops, which till then were mostly promising. In Limburg especially the damage was considerable, although less on the hills than in the valleys. Here and there drought was doing harm and rain was badly wanted, particularly in Zeeland. In this district much damage was being caused by insect pests. Elsewhere also pests were prevalent, but the vigorous measures adopted had materially lessened the evil. **Cherries.**—Prospects were moderate in the Upper and Lower Betuwe, rather bad in Limburg and the east of North Brabant, and good elsewhere. **Red and White Currants** were moderate in the Westland, the Bangert, and in Limburg; and good to very good in almost all other districts. **Black Currants** were moderate to good in most parts of the country. **Gooseberries** were good in the Upper Betuwe, the centre and west of North Brabant, Ysselmonde and the district around Dordrecht, bad in the Westland and the east of North Brabant, and very good in the island of Walcheren and other parts of the province of Zeeland. **Raspberries** were good in the centre and west of North Brabant, around Nymegen, in the province of Utrecht and in most parts of Limburg

and the Westland, but rather bad in the north of Limburg and the Krimpenerwaard.

Hops.—*Germany.*—Official reports give the condition of hops as between average and good in Wurtemberg on June 1st and as good in Bavaria at the end of May.

United States.—H.M. Consul at Portland, Oregon, states (May 16th) that there is said to be a moderate demand for the new crop of hops and for Oregon contracts, a few of which have been obtained at 7d. per lb. Although a number of hills are dead the new acreage is expected to make up more than the loss, and the outlook at present is favourable for a good crop, although nothing definite can yet be reported.

Live Stock in Argentina.—The number of cattle on 31st December, 1912, was 29,120,000, against 28,786,168 on the same date in 1911, the increase being equal to 1.2 per cent. Sheep totalled 83,546,000, against 80,401,486, an increase of 3.9 per cent. (*Bulletin of Agricultural and Commercial Statistics, May, 1914.*)

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on June 1st, state that wheat is very generally a good plant and promising, and appears to be the best of the three cereals. Barley and oats are less satisfactory, and the later sown corn especially is often a thin plant. Both, and especially oats, stand in need of rain. Only small differences are apparent in the acreage sown with spring crops as compared with last year, the area of both barley and oats being smaller by perhaps 1 per cent. Beans are probably the most satisfactory crop of the year, although it was still uncertain whether the sharp frosts at the end of May had affected them to any extent. Peas are generally looking very well, although weak in places.

Early potatoes have throughout the whole country, except in favoured situations, been cut by the sharp frosts at the end of May, and much damage has been done to them, while a serious consideration in their case is also that the date of lifting will be delayed. The main crop was hardly above ground, and appears practically everywhere to have escaped all damage. The area under potatoes is about the same as last year, but is rather greater in Lincolnshire.

Mangolds, where up, appear to be a fair plant generally, though often irregular, and nearly everywhere backward. Turnip-sowing has been more forward than usual in the north, where, indeed, it is often completed. In the midlands and south, however, much less had been done, owing to the dry weather, and it had in many districts not even been begun. Rain was much needed for all roots.

Hops were growing well in Kent until the cold spell checked them at the end of the month; in the western counties they were generally healthy, but had also been checked, and in some places damaged, by the frosts. Washing was becoming frequent in the western counties, but not much was being done in the south-east. An increase of about 3 per cent. in the area under hops is reported, mostly in Kent.

Fruit crops received a severe check from the widespread frosts at the end of May, and considerable damage was done to the trees and bushes.

In many cases it was, however, too early to see how much harm had been done. Less damage appears to have resulted in Kent, and in the extreme south-west; but elsewhere both strawberries and orchard fruit have suffered. As the effect of the sudden frosts, so near to the date of the reports, was still somewhat uncertain, prospective estimates of the yield must be very tentative. Strawberries appear about average, on the whole—though very different in different districts; raspberries a little over average, currants and gooseberries average. Apples and cherries are over average, particularly in the southern counties; pears about average, and plums rather below average.

The prospects for both kinds of hay are poor; the grass is in want of rain, and the cold nights have retarded growth. Some improvement might yet be effected by timely warm rains, but present indications are that both seeds hay and meadow hay will be quite 10 per cent. below average, the latter being, relatively, very slightly the better. Prospects, although below average, are best in the north and in Wales, and poorest in the eastern counties.

Live stock have generally done sufficiently well during the month, although pastures are now getting bare.

The supply of agricultural labour in England and Wales during May was, according to statements in the Board's Monthly Agricultural Report (June 1st, 1914), generally sufficient for requirements, with few exceptions. Where any changes of wages were reported they were rather higher than at this time last year.

The counties in which the supply was reported to be sufficient for requirements were Cumberland, Westmorland, Lincoln, Norfolk, Suffolk, Cambridge, Huntingdon, Bedford, Northampton, Warwick, Oxford, Berkshire, Worcester, Hereford, Gloucester, Dorset, Wiltshire, Hampshire, Essex and Middlesex. The following summaries relate to the supply of labour and to wages in other districts in England and Wales:—

Northumberland and Durham.—The supply was rather short in north Northumberland and north Durham, and the shortage is likely to be felt more when turnip hoeing starts. In these localities and in east Northumberland, east and south-east Durham, wages are now higher than last year by 1s. to 2s. per week for married men and £2 per half-year for unmarried men.

Lancashire and Cheshire.—The supply of labour varied considerably. It was short in north and south Lancashire, but elsewhere it was about sufficient. In north-east and east Cheshire labour was rather scarce, but it was adequate in other parts of the county.

Yorkshire.—More than one half of the reports stated that the supply of labour was sufficient and no change of wages had occurred lately, but two-fifths of the reports mentioned a scarcity of some class of labourers, the localities affected being in the west and centre of the East Riding, the northern districts of Yorkshire, and the south-east of the West Riding.

Shropshire and Stafford.—Labour was rather scarce in some parts and the shortage is likely to be more pronounced later on.

Derby, Nottingham, Leicester and Rutland.—The supply of labour was deficient in north-east Derby and north Notts, and cowmen were scarce in south Leicester. Elsewhere, however, the supply was about equal to the demand.

Buckingham.—Labour was deficient in this county.

Cornwall, Devon and Somerset.—In south-west and mid Cornwall, south and west Devon, and north and west Somerset the supply of labour was deficient, but was about equal to the demand elsewhere.

Surrey, Kent and Sussex.—The supply was sufficient during May, as a rule, but in a few localities some deficiency was reported.

Hertford.—The supply was deficient in parts of this county.

Wales.—There was some scarcity in a number of districts.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on June 1st, 1914, certain diseases of animals existed in the countries specified:—

Austria (on May 27th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 498 Höfe infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period April 16th—30th).

Anthrax, Blackleg, Foot-and-Mouth Disease (3 outbreaks in 2 communes).

Bulgaria (for the period May 14th—21st).

Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab, Swine Fever, Tuberculosis.

Denmark (month of April).

Anthrax, Glanders, Swine Erysipelas, Swine Fever.

France (for the period May 10th—16th).

Anthrax, Blackleg, Foot-and-Mouth Disease (17 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period May 1st—15th).

Foot-and-Mouth Disease (322 infected places in 173 parishes), Glanders and Farcy, Swine Fever.

Holland (month of April).

Anthrax, Foot-and-Mouth Disease (1 outbreak), Foot-rot, Glanders, Swine Erysipelas.

Hungary (on May 6th).

Anthrax, Dourine, Foot-and-Mouth Disease (total of 667 "cours" infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period May 11th—17th).

Anthrax, Blackleg, Foot-and-Mouth Disease (316 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Montenegro (for the period April 1st—15th).

Sheep-pox.

Norway (month of April).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period May 5th—13th).

Anthrax, Foot-and-Mouth Disease (24,169 animals), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (month of January).

Anthrax, Foot-and-Mouth Disease (35,737 animals in 481 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period April 11th—18th).

Glanders, Sheep-pox, Swine Fever.

Spain (month of March).

Anthrax, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of April).

Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (for the period May 18th—24th).

Anthrax, Blackleg, Foot-and-Mouth Disease (48 "étables" entailing 500 animals, of which 6 "étables" were declared infected during the period), Swine Fever.

The Weather in England during May.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	Inches.	Inches.		Hours.	Hours.
<i>Week ending May 9th:</i>							
England, N.E. ...	49.2	+2.4	0.76	+0.35	7	3.2	-2.7
England, E. ...	52.0	+3.6	0.69	+0.30	6	4.1	-2.1
Midland Counties ...	50.0	+1.7	0.73	+0.31	6	3.3	-2.3
England, S.E....	52.0	+2.4	0.63	+0.24	5	4.4	-1.8
England, N.W. ...	48.7	+0.7	1.36	+0.85	7	2.0	-3.7
England, S.W. ...	50.4	+1.4	1.31	+0.77	7	3.4	-2.9
English Channel ...	52.4	+1.7	0.68	+0.23	5	4.6	-3.0
<i>Week ending May 16th:</i>							
England, N.E. ...	49.0	+1.3	0.13	-0.29	1	5.6	-0.7
England, E. ...	49.3	-0.2	0.14	-0.25	3	5.1	-1.5
Midland Counties ...	49.9	+0.5	0.13	-0.28	2	5.0	-1.0
England, S.E....	50.8	0.0	0.15	-0.19	2	5.9	-0.8
England, N.W. ...	48.6	-0.5	0.14	-0.35	3	5.4	-1.0
England, S.W. ...	50.8	-0.9	0.23	-0.23	2	6.6	-0.2
English Channel ...	52.3	-0.7	0.07	-0.28	2	7.4	-0.8
<i>Week ending May 23rd.</i>							
England, N.E. ...	55.8	+6.9	0.67	+0.29	2	6.4	-0.1
England, E. ...	57.5	+6.6	0.29	-0.14	2	10.4	+3.8
Midland Counties ...	56.7	+5.9	0.35	-0.13	2	8.2	+2.1
England, S.E....	58.2	+5.9	0.37	-0.04	2	11.5	+4.7
England, N.W. ...	55.1	+4.6	0.37	-0.13	2	5.5	-1.1
England, S.W. ...	56.9	+5.2	0.19	-0.30	1	10.2	+3.3
English Channel ...	58.2	+5.2	0.32	-0.08	2	11.1	+3.0
<i>Week ending May 30th:</i>							
England, N.E. ...	47.4	-3.3	0.06	-0.34	2	5.8	-0.6
England, E. ...	48.6	-4.1	0.04	-0.40	1	8.1	+1.2
Midland Counties ...	48.4	-4.2	0.19	-0.33	2	4.8	-1.3
England, S.E....	50.0	-4.0	0.10	-0.34	2	6.6	-0.3
England, N.W. ...	48.9	-3.2	0.15	-0.37	2	6.3	-0.3
England, S.W. ...	50.0	-3.1	0.21	-0.29	3	5.9	-0.9
English Channel ...	53.0	-1.3	0.11	-0.38	2	7.6	-0.4

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in May and April, 1914.(Compiled from Reports received from the Board's Market
Reporters.)

Description.	MAY.		APRIL.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 0	8 9	9 2	8 11
Herefords	9 0	8 6	9 2	8 8
Shorthorns	8 11	8 2	9 0	8 4
Devons	8 11	8 3	9 0	8 3
Welsh Runts	—	8 5	9 2	8 8
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	10	9	10½	9½
Sheep :—				
Downs	9½	8½	10	9½
Longwools	8½	7½	9	8
Cheviots	10½	9½	11½	10½
Blackfaced	10½	9½	11½	10½
Welsh	10½	9½	10	9
Cross-breds	9½	8½	9½	9
	per stone.*	per stone.*	per stone.*	per stone.*
	s. d.	s. d.	s. d.	s. d.
Pigs :—				
Bacon Pigs	7 6	7 0	8 0	7 7
Porkers	8 1	7 7	8 7	8 1
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	22 13	18 17	23 4	19 8
„ —Calvers ...	21 10	18 0	22 1	18 9
Other Breeds—In Milk ...	19 17	17 11	21 13	17 10
„ —Calvers ...	—	14 17	—	15 17
Calves for Rearing	2 15	2 3	2 12	2 1
Store Cattle :—				
Shorthorns—Yearlings ...	12 3	10 9	12 6	10 12
„ —Two-year-olds... ..	16 10	14 9	16 15	14 18
„ —Three-year-olds ...	19 16	17 18	21 1	18 7
Herefords —Two-year-olds... ..	17 18	15 7	18 19	16 5
Devons— „ ...	17 4	15 13	17 8	15 5
Welsh Runts— „ ...	17 4	15 5	16 17	14 5
Store Sheep :—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	53 5	48 0	53 3	47 2
Store Pigs :—				
8 to 12 weeks old	27 6	21 5	28 4	22 0
12 to 16 weeks old	39 3	30 8	40 10	31 8

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in May, 1914.(Compiled from Reports received from the Board's Market
Reporters.)

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF :—						
English	1st	60 0	59 0	—	60 0	58 6
	2nd	55 0	56 6	—	57 0	56 0
Cow and Bull	1st	52 0	53 6	45 6	48 6	48 6
	2nd	47 0	49 6	40 0	43 6	43 6
Irish: Port Killed	1st	57 6	54 6	54 0	57 0	53 0
	2nd	52 6	53 6	48 0	52 0	49 0
Argentine Frozen— Hind Quarters	1st	43 6	43 6	43 0	42 0	43 0
Fore „	1st	35 6	35 0	35 0	34 0	35 0
Argentine Chilled— Hind Quarters	1st	53 0	53 0	50 6	55 0	51 6
Fore „	1st	36 6	36 0	35 6	35 6	35 6
Australian Frozen— Hind Quarters	1st	41 0	40 0	39 6	40 6	39 6
Fore „	1st	35 0	35 0	33 0	33 0	33 0
VEAL :—						
British	1st	78 0	74 6	85 6	78 6	81 6
	2nd	71 6	70 0	71 6	70 0	77 0
Foreign... ..	1st	70 0	72 6	—	81 6	—
MUTTON :—						
Scotch	1st	—	—	90 6	85 6	89 0
	2nd	—	—	85 0	77 6	84 6
English... ..	1st	78 0	76 0	79 6	80 0	78 6
	2nd	70 0	71 6	74 6	71 6	70 0
Irish: Port Killed	1st	—	—	82 6	—	74 6
	2nd	—	—	74 6	—	70 0
Argentine Frozen	1st	39 6	39 6	40 0	37 6	40 0
Australian „	1st	36 6	36 6	35 6	35 6	35 6
New Zealand „	1st	39 0	36 0	—	42 6	—
LAMB :—						
British	1st	99 0	107 6	98 0	104 0	102 6
	2nd	92 0	99 0	88 6	95 0	90 0
New Zealand	1st	60 6	60 0	56 6	60 0	56 6
Australian	1st	54 6	53 6	52 0	55 0	52 0
Argentine	1st	54 0	52 6	52 0	51 6	52 0
PORK :—						
British	1st	71 0	68 0	66 6	59 0	67 6
	2nd	64 6	64 0	60 6	53 6	62 0
Foreign... ..	1st	62 0	63 6	65 6	57 0	65 6

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 1912, 1913 and 1914.

Weeks ended (in 1914).	WHEAT.			BARLEY.			OATS.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Jan. 3...	s. d. 33 2	s. d. 30 5	s. d. 31 1	s. d. 33 3	s. d. 28 6	s. d. 26 2	s. d. 20 7	s. d. 19 10	s. d. 18 2
" 10...	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
" 17...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
" 24...	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
" 31...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb. 7...	34 0	31 0	31 0	33 2	28 10	26 7	21 4	20 1	18 9
" 14...	34 4	30 9	31 0	32 10	29 1	26 7	21 7	20 2	18 11
" 21...	34 6	30 11	31 0	32 8	28 8	26 7	21 9	20 7	18 11
" 28...	34 1	31 0	31 0	32 0	28 6	26 6	21 6	20 4	18 11
Mar. 7...	34 1	31 3	31 5	31 7	28 5	26 2	21 8	20 2	18 7
" 14...	34 0	31 1	31 6	31 2	27 11	26 0	21 8	20 2	18 7
" 21...	34 1	31 1	31 5	31 10	28 6	25 8	21 9	19 11	18 6
" 28...	34 4	31 3	31 4	30 3	27 6	25 7	21 8	19 7	18 8
Apl. 4...	34 10	31 4	31 6	30 9	27 0	25 6	21 11	19 2	18 5
" 11...	35 4	31 3	31 5	30 2	27 8	26 8	22 1	19 2	18 4
" 18...	36 7	31 6	31 7	29 11	26 11	25 4	22 4	18 10	18 4
" 25...	37 10	31 8	31 9	30 4	26 7	26 6	22 9	19 3	18 5
May 2...	38 1	32 2	31 9	30 2	25 11	26 0	23 1	19 6	18 5
" 9...	37 11	32 6	32 2	31 1	25 9	25 6	23 7	19 6	18 9
" 16...	37 8	32 10	32 7	31 2	25 4	26 3	23 7	19 9	18 11
" 23...	37 2	32 10	33 0	31 1	25 3	25 10	23 7	19 11	19 0
" 30...	36 10	31 7	33 9	30 0	26 1	26 1	23 9	20 1	19 4
June 6...	36 11	32 10	34 0	29 11	26 2	25 11	24 0	19 8	19 4
" 13...	37 0	32 8		30 8	24 7		23 10	20 2	
" 20...	37 5	32 8		30 8	23 10		24 0	19 8	
" 27...	37 10	32 8		30 2	24 3		23 11	19 1	
July 4...	38 2	33 1		31 7	25 2		23 11	21 0	
" 11...	38 3	33 4		30 2	25 10		24 1	19 4	
" 18...	38 10	33 6		30 9	24 9		24 8	20 5	
" 25...	38 9	33 10		30 9	24 1		23 4	20 8	
Aug. 1...	38 4	34 1		28 6	24 5		22 2	20 3	
" 8...	39 2	34 1		30 7	24 9		22 4	19 0	
" 15...	38 2	34 3		28 3	24 7		21 8	18 7	
" 22...	35 6	33 7		28 1	26 5		20 10	18 8	
" 29...	34 10	32 7		28 6	29 0		20 8	17 10	
Sept. 5...	35 1	31 11		29 9	30 11		21 8	17 8	
" 12...	33 5	31 9		29 0	31 5		20 5	18 0	
" 19...	32 7	31 7		29 6	30 9		19 10	17 11	
" 26...	31 7	31 6		29 9	30 1		19 5	17 9	
Oct. 3...	31 8	31 3		29 7	29 9		19 8	17 10	
" 10...	31 10	31 0		30 4	29 1		19 5	17 10	
" 17...	32 2	30 11		30 11	28 8		19 9	17 9	
" 24...	33 1	30 7		31 6	28 7		19 10	18 0	
" 31...	33 4	30 1		31 10	28 2		20 1	17 9	
Nov. 7...	33 1	30 0		31 11	28 1		19 11	17 9	
" 14...	32 10	30 1		31 2	27 8		19 9	17 11	
" 21...	32 1	30 4		30 11	27 5		19 11	18 1	
" 28...	31 9	30 9		30 8	27 0		19 8	18 4	
Dec. 5...	31 0	31 2		29 11	26 8		19 6	18 4	
" 12...	30 8	31 2		29 2	26 5		19 3	18 6	
" 19...	30 7	31 2		28 11	25 11		19 1	18 5	
" 26...	29 10	31 0		28 6	25 10		19 2	18 4	

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.

AVERAGE PRICES of **Wheat, Barley, and Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

	WHEAT.		BARLEY.		OATS.	
	1913.	1914.	1913.	1914.	1913.	1914.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France: April ...	48 9	45 10	30 1	28 5	24 0	22 4
May ...	49 8	46 9	30 1	28 8	24 0	22 9
Paris: April ...	50 10	45 4	30 6	29 0	23 0	23 6
May ...	51 1	49 6	30 2	29 0	23 0	23 6
Belgium: March ...	34 5	32 5	30 2	25 4	22 9	20 7
April ...	35 3	32 8	29 11	25 2	22 8	20 11
Berlin: March ...	43 1	41 7	—	—	22 11	21 3
April ...	44 3	41 6	—	—	—	—
Breslau: March ...	37 4	38 7	27 1*	27 5*	20 9	19 11
April ...	38 5	38 9	25 8†	24 5†	20 10	20 0
			26 8*	27 5*		
			25 3†	23 11†		

* Brewing.

† Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of May, 1913 and 1914.

	WHEAT.		BARLEY.		OATS.	
	1913.	1914.	1913.	1914.	1913.	1914.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	34 3	33 8	25 1	24 9	20 6	20 6
Norwich ...	33 5	32 2	24 9	24 8	18 9	18 3
Peterborough ...	31 2	32 6	24 4	25 11	17 10	19 1
Lincoln ...	31 6	32 11	26 2	25 6	20 3	19 3
Doncaster ...	31 5	32 5	25 9	24 2	20 3	18 9
Salisbury ...	32 2	32 1	25 8	23 9	20 2	18 9

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in May, 1914.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER:—	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
British... ..	per 12 lb. 14 6	per 12 lb. 13 6	per 12 lb. —	per 12 lb. —	per 12 lb. 13 3	per 12 lb. 12 3
Irish Creamery—Fresh	per cwt. 112 0	per cwt. 109 0	per cwt. 108 6	per cwt. 106 6	per cwt. 112 0	per cwt. 107 0
„ Factory	104 0	94 0	98 6	93 6	103 0	95 6
Danish... ..	—	—	117 0	113 6	114 0	112 0
French... ..	—	—	—	—	117 0	113 0
Russian	103 6	99 0	103 0	98 0	100 6	96 6
Australian	106 6	103 6	106 0	103 0	108 0	104 0
New Zealand	112 6	107 0	108 6	105 6	114 0	107 6
Argentine	105 6	102 0	105 0	102 0	107 6	103 6
CHEESE:—						
British—						
Cheddar	83 6	76 0	82 0	78 0	84 0	79 0
Cheshire	—	—	120 lb. 65 6	120 lb. 60 6	120 lb. 70 6	120 lb. 66 0
Canadian	69 6	66 0	per cwt. 70 0	per cwt. 65 0	per cwt. 70 0	per cwt. 67 0
BACON:—						
Irish (Green)	75 6	71 0	72 0	66 6	76 0	71 6
Canadian (Green sides)	67 6	65 6	65 0	62 6	67 0	64 6
HAMS:—						
York (Dried or Smoked)	117 0	113 0	—	—	115 0	109 6
Irish (Dried or Smoked)	—	—	—	—	116 0	110 0
American (Green) (long cut)	70 6	68 6	69 0	66 6	73 0	70 6
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British... ..	9 2	—	—	—	10 2	9 4
Irish	9 0	8 6	8 9	7 10	8 7	8 1
Danish... ..	—	—	—	—	10 1	8 6
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	97 6	86 0	—	—	98 6	88 6
Langworthy	90 0	83 6	75 0	70 0	98 6	88 6
Up-to-Date	78 6	64 0	48 6	45 0	88 0	78 6
HAY:—						
Clover	—	—	87 6	65 0	78 6	72 0
Meadow	—	—	—	—	70 0	64 0

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	MAY.		FIVE MONTHS ENDED MAY.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	77	48	392	282
Animals attacked	81	53	418	304
Foot-and-Mouth Disease:—				
Outbreaks	—	—	11	—
Animals attacked	—	—	74	—
Glanders (including Farcy):—				
Outbreaks	8	15	40	74
Animals attacked	9	26	86	219
Parasitic Mange:—				
Outbreaks	159	259	1,268	1,502
Animals attacked	257	484	2,280	3,082
Sheep-Scab:—				
Outbreaks	5	8	144	120
Swine Fever:—				
Outbreaks	605	301	1,770	991
Swine Slaughtered as diseased or exposed to infection ...	6,568	5,163	17,926	14,493
Tuberculosis:—				
Number of Premises notified...	542	555	2,438	*—
Number of bovine animals notified as for slaughter ...	575	622	2,590	*—

* The Tuberculosis Order came into operation on 1st May, 1913.

IRELAND.

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

DISEASE.	MAY.		FIVE MONTHS ENDED MAY.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	1	—	1	—
Animals attacked	1	—	1	—
Foot-and-Mouth Disease:—				
Outbreaks	7	—	74	—
Animals attacked	52	—	944	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	6	8	45	87
Sheep-Scab:—				
Outbreaks	25	43	336	288
Swine Fever:—				
Outbreaks	13	24	104	72
Swine Slaughtered as diseased or exposed to infection ...	122	142	513	436

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THE CRICKET BAT WILLOW

(Salix coerulea, Smith).

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THERE are many varieties of willow in cultivation in this country, but of these one tree is generally recognised as being most suitable for making first-class cricket bats. The tree, now popularly termed the "Cricket Bat Willow," is known botanically as *Salix coerulca*, and is most probably a first cross between the White Willow (*Salix alba*, L.) and the Crack Willow (*Salix fragilis*, L.).

The home of the Cricket Bat Willow is in the eastern counties of England, where it thrives vigorously. It is there almost exclusively that buyers seek their supply. There would seem, however, to be no cogent reason why the tree should not be successful in other parts of the country where the climate is equable, and soil conditions are suitable. It would probably not succeed in cold, wet regions, or in hot, dry places.

Identification.—The following description of the Cricket Bat Willow will help in distinguishing it readily from the numerous other varieties which bear so much resemblance to it, and are often confused with it.

The branches are ascending in habit, arising from the main stem at an angle less than a right angle, and the smaller branchlets are erect, giving the crown a conical form.

The bark is dark grey, and "close," that is with long, straight and narrow fissures. In the three illustrations the barks of White Willow, Cricket Bat Willow and Crack Willow are shown for comparison.

The young branches are sparsely covered with minute hairs. In winter the twigs become a rich reddish-brown in colour, which darkens after the following year.

The leaves are long and narrow, translucent, and covered with bluish-grey hairs on the under surface, giving an azure hue to the tree during summer.

One of the characteristics of the true *Salix coerulea*, S., is that the tree produces only pistillate or female inflorescences.

Soil Requirements.—The ideal soil for the Cricket Bat Willow is a rich, fertile alluvium, but it will grow successfully in most soils providing that there is sufficient moisture and free circulation. As a rule, the tree will not thrive in acid, peaty and water-logged soils, nor in heavy clay, light sand, gravel and chalk.

In unsuitable soil the tree becomes unhealthy, and therefore more liable to attacks by diseases and insect pests. The presence of these may consequently be regarded as an indication of the existence of unsuitable conditions. The most important pests are the fungus "*Physalospora gregaria*," the large Poplar Longicorn Beetle "*Saperda carcharias*," and the scale insect "*Chionaspis salicis*." The fungus attack causes cankerous spots on the young stem, eventually resulting in the peeling of the bark. This disease is particularly prevalent in peaty and acid soils.

In wet or marshy places, where there is a strong growth of coarse grass, the willow is more readily attacked by *Saperda carcharias*. The larvæ bore into the tree at the ground level, and then tunnel upwards to the top. Trees so attacked are rendered unhealthy, and are also liable to be broken by wind. Attacked timber, being riddled by the burrowings, is practically valueless.

The scale insect gradually saps the strength of the tree, and retards its growth.

Propagation.—The Willow can be propagated by means of sets or rooted cuttings. The former method, which is usually adopted, is far better, and much cheaper.

Experience has shown that the best size of set is about 20 ft. long with a diameter of 3 in., but smaller sets down to 10 ft. long and 2 in. diameter are often used. The best sets are obtained from young pollards, and should be of four or five years growth.

The sets should be chosen and marked in summer as it is easier to determine the quality and variety at that season. They should be cut in early spring, not winter, and treated by Mr. E. R. Pratt's* method in the following way:—

"They should be trimmed closely for four-fifths of their length, tied up in half scores and placed in a ditch or pond. Sets may be kept in water for a month, but it is not desirable to allow the rootlets to become more than half an inch in length."

* *Journ. Roy. Agri. Soc.*, LXVI. (1905), pp. 19-34.



FIG. 3.—Bark of Crack Willow
(*Salix fragilis*, L.)

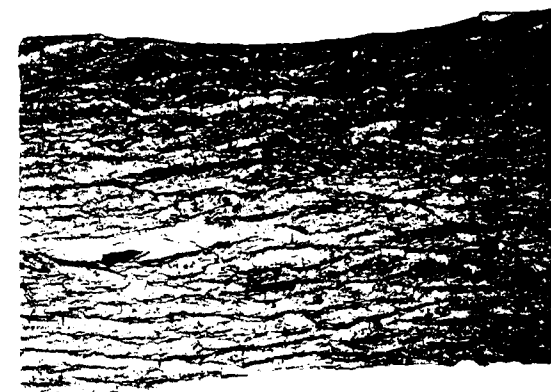


FIG. 2.—Bark of Cricket Bat Willow
(*Salix coerulea*, S.)



FIG. 1.—Bark of White Willow
(*Salix alba*, L.)

When young pollard growth is not available, straight and well-grown branches of young trees may be used.

The top branches of old trees are least suitable, since they are usually crooked and brittle, while they contain little sap and require much pruning. In the last-mentioned case the best method is to take cuttings about 12 in. long. After two or three years, when the cuttings have become established, each individual should be treated and all shoots removed excepting the best one on each, which should be left to develop. If more than one shoot is left on each stem, the tree produces two or more indifferent stems with poor crowns instead of one rapidly-grown main stem.

Cultivation.—Rapidity of growth and freedom from knots, in addition to straightness of stem, determine the quality of timber for bat making.

To obtain rapid growth it is essential that Bat Willows should have plenty of room, and be free from both overhead and lateral shade. The best results are secured by planting the trees at least 30 ft. apart in the open by the side of a running stream.

It should be especially noted that, in the case of the willow, close planting is harmful, as it hinders proper crown development and prevents that rapidity of growth which is essential for the production of first class timber.

The proper season for planting is the spring. In a free soil holes 2 or 3 ft. deep may be made by means of a stake. The sharpened end of the set is inserted, and the soil firmly pressed home. In stiffer soils, or where the subsoil is comparatively hard, a small hole of the same depth should be dug and loose earth stamped in around the set.

The main stem should be kept clean of branches up to a height of about 13 to 15 ft. In each year young shoots will appear on the stem, and these should be removed by rubbing off with the gloved hand. This should be done early in the season, and certainly before the young branches have become so strong that their removal would lead to injury of the bark. This treatment is necessary for the first three or four years after planting.

Trees planted in meadows will need protection from cattle. This can be ensured cheaply by placing three stakes 2 ft. from the set. These should be tied together with thorns, which keep the stakes in position, and in themselves afford protection. Rabbits must be rigorously excluded.

The Bat Willow becomes saleable when it has reached a diameter of about 15 in. at six feet up the stem. It is usually

most profitable to sell it at that size. The timber is generally sold standing; when felled it is cut into 28 to 30-in. lengths and subsequently cleft radially.

Financial.—During the past few years there has been an extraordinary demand for Cricket Bat Willow timber of all qualities, and at present the demand is just as great. First quality timber has realized remarkable prices. Professor Henry* gives many examples of very high prices, and quotes from Mr. John Barker, "A good set costs 1s. to 1s. 6d., and, if planted in a suitable soil, and does well, is worth from £5 to £8 in 15 years." He gives an instance in which eleven trees, 14 years old, averaging 55 to 60 ft. in height, and 14 to 15 in. in diameter at 5 ft., were sold by a Hertfordshire grower in January, 1912, for £81, of which the best tree containing 12 cubic feet of timber available for bats made as much as 13s. 4d. per cubic foot. On the same property in 1906 fifty-three trees averaging 13 in. in diameter with short boles giving only three bat lengths (about 8 ft. long) were sold for £190. These prices are, of course, somewhat exceptional, but the usual value of good quality timber is about 5s. to 7s. 6d. per cubic foot. Recently, however, even inferior timber has been known to sell at that price.

A RESIDENTIAL COURSE FOR THE TRAINING OF FARM LADS.

G. H. GARRAD, N.D.A.,

Agricultural Organiser for Kent.

KENT is already provided with a large and well-equipped agricultural college, at which, in addition to the ordinary courses of two, three and four years, short courses for farmers' sons are held periodically and the object of the experimental scheme described below was to cater for a class of agriculturist which has so far received very little recognition in the county, viz., the farm labourer and the very small farmer. The instruction of the farm labourer is only now beginning to be considered. It is true that his work is mainly manual, but it must be remembered that whatever may be the piece of work in hand there is always a correct and an incorrect way of doing it. A really first-class farmer will see that his young labourers, when they first come on to his farm, are instructed in the proper way of doing their work, but it more often happens that he

has not the time, or possibly the ability, to show them himself, and does not ensure that some capable person teaches them. The result is that they have to learn for themselves. A sharp lad will usually discover the correct way after more or less waste of time and expense to his master, whilst a less bright boy may never learn at all. The result is that the latter's work is badly and slowly done, he breaks his tools, and when he is put on to piece work he finds he is incapable of earning a living wage. Is it surprising that lads move off to the towns when their work has no interest for them and they cannot satisfy their masters? The writer has in mind a lad whose ordinary wage was 15s. a week and who was set to pull mangolds and remove the tops at 7s. 6d. per acre. He was unable to earn more than 1s. a day because he had no idea of the right way to remove the tops and had no one to show him. A boy should be taught the right way to set about the task allotted to him when he first takes up farm work and, furthermore, it is very desirable that his interest should be stimulated by having explained to him the reason why the work is done, and why one method of doing it is better than another.

It was with the idea of interesting labourers in their work and instructing them in manual labour that a month's course for farm lads was started in Kent in December, 1913. The Board of Agriculture and Fisheries were approached, and they offered liberal assistance on the understanding that no lads under the age of 16 were admitted.

The course was held at Toys Hill, a typical country village, four miles from Brasted and eight miles from Sevenoaks. The house occupied consists of two semi-detached cottages—the property of the London Medical Mission—now thrown into one and used in the summer months as a holiday home for children. The building was small and twenty-one was the utmost accommodation it could provide for. Upstairs were three bedrooms—one large one which, by using "two-decker" beds, could sleep thirteen boys and a man in charge, and two small rooms which would take four boys each. Downstairs were four rooms which were used as a dining room, a sitting-room, a washing room and a kitchen. Adjoining the house is a shed large enough to take three portable forges, and it made quite a satisfactory blacksmith's shop. Temporary latrines were put up in the garden and with the addition of the village hall, which made a splendid lecture room and carpenter's shop, the accommodation was complete. Beds and bed linen were hired with the house. Carpenters' benches, tools, etc.,

* *Trees of Great Britain and Ireland*, Elwes & Henry, Vol. VII., pp. 1763-68.

were borrowed from the Kent Education Committee, and other appliances were borrowed from the South Eastern Agricultural College, but as little extra equipment as possible was used, the object being to teach the boys to work with only such appliances as might reasonably be expected to be found on an ordinary farm. No land, other than the garden, was attached to the house, and for fields to drain, hedges to lay, and trees to prune, the school was entirely dependent on the goodwill of the neighbouring farmers. No trouble was experienced in this respect, as farmers were quite willing to have work done for them free of charge. Moreover, they watched very carefully the work that was going on, and it is satisfactory to be able to report that in every respect the work of the school met with their approval.

Some anxiety was felt at first as to what response would follow the appeal for students. A list of gentlemen who would be likely to be interested in the scheme was obtained from the Kent Education Committee and a circular letter signed by the chairman of the special sub-committee of the school was sent out describing the idea briefly and asking for the names of any lads who might be considered suitable and who would be willing and able to attend. The inclusive fee for the whole month's course was fixed at 30s., this being the estimated cost of feeding the lads, and it was suggested that villages which could supply a lad should be encouraged to start a local fund to enable the lad to pay the fee and other necessary expenses, as well as to continue any contribution to his home that the lad was in the habit of making. To be eligible for the course a lad had to be between the ages of 16 and 20 and actually at work on the land in the County of Kent.

As a result of this circular letter and a notice in the local papers more than forty applications were received for admission. Twenty-one of them were from farm labourers and twenty-one from the sons of working farmers. Accommodation could only be supplied for twenty lads so that it became necessary to make a selection from those who had applied. Particulars were collected of each lad, and any who could afford to go to an Agricultural College were at once rejected. A personal visit was then paid to each of the remainder and it was thus possible to select twenty smart lads who would be likely to benefit from the course. The successful candidates came from all parts of the county. Ten of them had their fees paid by their employers, nine were able to provide for themselves, and one was provided for by a local village committee.

The course of instruction included farm carpentry, forge and rough veterinary work, hedge laying, draining, thatching, the pruning and growing of fruit trees, the measurement of land and stacks, wood cutting, the sharpening of tools, and the construction and setting of farm implements. The amount of time devoted to each subject depended very largely on the weather, but fortunately, though very cold and wintry during the greater part of the month, the weather was dry so that a fair proportion of outdoor work could be done. The actual number of hours devoted to each subject is shown in the following summary :—

Subject.	Hours of Instruction.	
	Lecture Work.	Practical Work.
Lectures on "How Plants Feed and Grow"	21	—
Farm Carpentry	—	18½
Forge and Rough Veterinary Work	3½	14
Hedge Laying	—	14
Draining	—	8
Measurement of Land, Stacks, etc.	¾	7½
Chestnut Cleaving, Hurdle and Gate Making	—	8
Fruit Growing and Pruning	6½	3
Thatching	—	5
Cottage Gardening	3	4
Wood-cutting	—	2½
Lectures on Calf Rearing	3½	—
The Setting and Care of Farm Implements	—	1½
Killing, Plucking and Trussing of Chickens	—	1½
Sharpening of Tools	—	1
Knotting and Splicing of Ropes	—	4½
Ambulance Work	—	4½

An objection which was raised at once to the scheme when it was first mooted was that a month was not nearly long enough for the teaching of any of the above subjects. The objection is undoubtedly a just one, but a month was selected as the period for two reasons. In the first place the Committee were drawing for this experimental course on Wye College for their instructors and these instructors were only available during the vacation month of January. In the second place it was thought unreasonable to ask employers to spare their lads for a longer period than a month in the first instance. The time was, of course, too short for the lads to gain a thorough knowledge of the subjects dealt with, but at the same time it was considered that they would learn a great many things which

they would never have had the chance of learning if they had not attended the course.

On the last day before the breaking-up questions to be answered on paper relative to their ideas of the training were put to each lad. The replies were of a very practical and common-sense nature. The almost invariable answer to the question "Do you think a month is long enough?" was "No," but two lads very sensibly replied that they thought a month was long enough to give them a little insight into the work taught and that the rest could be learnt by practice. With this the writer is inclined to agree. It would be absurd to pretend to teach thoroughly in a month subjects each of which by common consent requires months or even years of practice to make perfect, but at the same time the main principles can be learnt in quite a short time. A lad can be shown how to do a piece of work, and he can learn how to do it without actually being able to do it at the outset. The ability comes from constant practice and that can follow any time after he has left the class. One lad stated that he did not think the time was long enough, but that he "had learnt ten times more in a month here than in a month at home."

Another criticism that was frequently met with before the course commenced was that too many subjects were on the syllabus, and that it would be very much better to concentrate on two or three and leave out the remainder. The reply is that every lad has by nature a preference for a certain kind of work. One lad is naturally an adept with an axe and consequently is fond of wood cutting; another lad takes a special interest in draining, another in pruning. A workman will always do very much better at a piece of work in which he takes a personal interest than at any other, and by taking such a variety of subjects as was taught at this course the lads were able to handle tools which in many cases they had never seen, still less handled before, and a latent ability was discovered which had never before even been suspected. In four or five cases the lads attending the course were waggoners' mates. They were boys who knew and thoroughly understood all about the harnessing and feeding of horses and something about ploughing, but they had no idea of any other work on the farm, and this was their first opportunity of handling a spade or a bill hook or an axe. In some cases lads found work which appealed to them very much more forcibly than that to which they had been accustomed. Such a discovery is a useful one, not only to the lad himself but also

to his employer, and the fact was noted in the certificates which were given to the lads at the end of the course.

When asked to note down on paper the subject which interested them most, six of the twenty lads comprising the class favoured a series of lectures which ran right through the whole month on "How plants feed and grow." This course of lectures had necessarily to be very elementary in character, but every opportunity was taken when describing the life history of plants and something of the chemistry of the soil, to explain the reason of things that are noted by everybody in every-day life, and why certain farm practices are good and others bad. "The reason why" was the key-note of these lectures, and it was gratifying to find that the lads took a real interest in learning about the common-place things around them. To open the eyes of the farm labourer to take an intelligent interest in Nature and in the observation of things to which his eyes were previously blind is a great step forward in giving a man an interest in his work-a-day life in the country.

Other subjects which were very popular were carpentry, forge work and hedge laying. The farm carpentry comprised the making of such useful things as cattle cribs, sheep troughs, hen coops, potato boxes, etc., and the articles when made found a ready sale amongst the neighbouring farmers. Only four of the twenty lads had had any previous lessons in carpentry, and the ignorance of some of the lads of the names and uses of many of the commonest tools was surprising. The forge work was of the simplest order, and consisted merely in learning how to put a point on to a rod of iron and the making of S hooks, staples, split links, and door fasteners. The hedge laying was practised on a very old and long-neglected hedge belonging to a neighbouring farmer. It was an excellent specimen to learn on, such a hedge as would baffle many a good hedge layer, and it needed much thought and common sense. Draining, chestnut cleaving and hurdle making, pruning, wood cutting, thatching, cottage gardening and the setting of farm implements all received a certain amount of attention, the thatching being practised on straw stacks following the visit of a threshing machine. Demonstrations were given in the killing, plucking and trussing of chickens, and amongst the lectures were included three public ones on cottage gardening and four—open to the farmers in the neighbourhood—on pig keeping, butter making, the feeding of dairy cows, and the improvement of grass land.

At first it was intended to run the lads in two classes of ten each, but the instructors soon found that for such subjects as

pruning the class was too large. It was therefore considered desirable to divide the lads up into three classes for practical work, all the classes combining for lectures. In this way fairly close individual attention was possible for all the students.

On three afternoons excursions were paid to neighbouring farms. A great deal can be learnt from such visits to well-managed farms. It is surprising to find how little a labourer knows about any farm other than the one he works on, and the sight of different types of buildings, implements, and systems of working cannot fail to do good. "You get different ideas which may be better than your own," as one lad expressed it.

The household arrangements were in the hands of the Vice-Principal, who lived actually with the boys. All the other instructors lived in a house close by. The lads slept in dormitories and were ruled very largely by their own monitors. The scheme was run in fact on the lines of a boys' camp and worked out very successfully. The moral effect on the lads of the month's residence must have been great, for many lessons were learnt without the lads being conscious of it. They were up every morning at a quarter to seven and it was insisted on that each lad should strip every morning to the waist to wash and that he should brush his teeth. A weekly bath in a tub was also compulsory. Each boy had to make his own bed, and daily inspection of beds, boots, clothing, etc., with the awarding of marks, encouraged habits of tidiness and neatness. The house work was all done by the orderlies on duty for the day and the only paid servants in the house were the cook and a boy of sixteen who assisted her. Smoking of cigarettes was altogether forbidden, and if any boy wished to smoke he was required to smoke a pipe. No beer was supplied for meals and all public houses were out of bounds. The ordinary day's time table was as follows:—

6.45 a.m.	..	Dress.
6.45 to 8	..	Morning run. Make beds and do the housework.
8	..	Prayers and breakfast.
9 to 9.45	..	Morning Lecture.—A series of morning lectures on "How plants feed and grow" ran through the whole course.
9.45 to 12.15	..	Practical Work.
12.30	..	Dinner.
1.30 to 2.15	..	Afternoon Lecture.
2.15 to 4.30	..	Practical Work.
5.30	..	Tea.
6.30 to 8	..	Indoor Work. Lecture, Demonstration, or Practical.
8.30	..	Supper.
9.30 to 10	..	Prayers and Bed.

Wednesdays and Saturdays were observed as half-holidays. For a course of only one month's duration one half-holiday a week should be sufficient. That at any rate was the opinion

of twelve of the twenty boys; in fact, if it was not for their keenness for football, probably all the boys would have been in favour of a full day's work on Wednesdays. There was no lack of desire on the part of the boys to learn as much as they could in the time at their disposal.

During the whole course there were twenty-two working days, excluding Sundays and days of arrival and departure, though as a matter of fact the lads were started on their work directly they arrived on the first day. The amount of work done was 39 hours lecture work, 96 hours practical work, and 9 hours visiting neighbouring farms, a total of 144 hours or an average of $6\frac{1}{2}$ hours work per day. This amount may not seem very much, but it must be remembered that the course was held when the days were at their shortest. Lecture work can of course occupy the winter evenings, but for lads who are unaccustomed to mental work and who are used to outdoor life it is inadvisable to give a great deal of this sort of instruction. One hour is quite as long as such lads can be expected to concentrate their attention on the lecturer, and as a rule the lectures that were given were of only three quarters of an hour's duration. Notes were always taken by the students, and visitors expressed surprise at the neatness and fullness of the notes and especially at the drawings made at these lectures.

The cost of such a scheme as this cannot be fairly judged from this experiment. In the first place Toys Hill, where the course was held, is high up on the top of a very steep hill, 650 feet above sea level, and three miles from any railway station, so that the cost of cartage was very heavy in proportion to the length of the course. Provisions were also expensive. In the second place most of the instructors were asked to spend a month of what was normally their Christmas vacation, and this involved some extra payment. The fitting up of the house, the forge and the carpenter's shop, and the dismantling again afterwards also have to be considered. The total net cost, however, amounted to less than £200, or under £10 per student. If a succession of courses had been possible the cost would have been very much reduced.

In the writer's opinion it would not be advisable to extend the length of each course much beyond a month, because success depends to such a large extent on the keenness of the students. The novelty of the work and the surroundings awakens interest directly the student arrives, and this interest can be maintained for a few weeks. But it will not last indefinitely, and it is preferable to send a lad away *before* his desire for learning is fully satisfied.

The lads who attended were unanimous in agreeing that they had learnt a very great deal during the month. The neighbouring farmers, who were most interested in the scheme and supplied all the work that was wanted, were loud in their praise of the work that had been done. One farmer who had supplied facilities to the students for thatching and draining on his own farm stated at the break-up dinner that "he had watched the work narrowly and attended the lectures. It was public money which was being spent but he bore witness to the great economy which had been exercised. . . . The quality of the work had been excellent. He had watched the lads thatching a straw stack and it had been well and quickly done. The drainage work had been excellent and so had the farm carpentry. The lads had been as keen as mustard and so had the instructors. That was the right spirit and he himself, though a farmer with many years' experience, had gained some useful knowledge from the lectures which he had attended." The reports from the employers of the lads after they had returned to their farms were equally favourable.

It is intended to repeat the experiment during next winter, and arrangements have already been made for the hire of the Trust School at Borden, near Sittingbourne, for the purpose. The course will commence on December 28th, 1914, and will continue for a month.

ON THE LOSS IN A STACK OF UNTHRESHED CORN.

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EVERY farmer knows that a stack of unthreshed corn is liable to be the abode of numbers of rats and mice, and when the corn is threshed out a considerable proportion of it is found to have gone to feed these uninvited guests. The losses naturally vary a good deal, even in different stacks on the same farm, but very few measurements seem to have been taken to ascertain what they actually represent.

During the season 1911-12 an opportunity presented itself at Rothamsted for securing some information on this point. Several acres of dredge corn, composed of a mixture of equal parts of oats and barley, were sown on Pastures Field, one of the new fields recently taken over. The bulk of the produce was threshed out a few weeks after harvest, but a stack repre-

senting the produce of $4\frac{1}{2}$ acres was left in the rick yard for a further $9\frac{1}{2}$ months, *i.e.*, until the following October, before threshing took place. The stack was well made and did not suffer visibly from the weather, but it soon became tenanted by mice, which multiplied considerably. When the threshing began it was evident that serious loss had taken place, and the results showed that the depredations had been considerably worse than was expected. The bulk threshed not long after harvest, *i.e.*, December 20th, 1912, yielded 27.7 bushels of head corn and 8.5 bushels of tail corn per acre. On the other hand, the $4\frac{1}{2}$ acres threshed on October 1st, 1913, yielded 59 bushels of head corn, and 13 bushels of tail corn, or 13 bushels head corn and 2.9 bushels tail corn per acre.

Thus during the $9\frac{1}{2}$ months in the stack more than one-half the grain had gone; reckoned in quantities per acre the loss in the stack had been 14.7 bushels per acre of head corn and 5.6 bushels per acre of tail corn. If the stack had been threshed with the others, and not kept it should have yielded $4\frac{1}{2} \times 27.7 = 124.6$ bushels of head corn, and $4\frac{1}{2} \times 8.5 = 38.2$ bushels of tail corn, instead of the actual yield of only 59 bushels of head corn and 13 bushels of tail corn.

Thus the loss amounted to 66 bushels of head corn and 25 bushels of tail corn. The head corn sold in December, 1912, at 23s. a quarter and the tail corn at 17s.: the gross financial loss was therefore £12: against this has to be set a slight rise in price of the remaining corn, which sold at 24s. a quarter in October, 1913, representing 7s. 6d. on the whole stack: the net financial loss was therefore over £11 10s. on a stack containing the produce of $4\frac{1}{2}$ acres, *i.e.*, more than £2 10s. per acre.

This result is subject to two errors which, however, work in opposite directions and tend to neutralise one another. The $4\frac{1}{2}$ acres included a strip along the road where the crop was not so large as in the rest of the field threshed earlier: this error tends to exaggerate the loss. On the other hand, the cost of threshing the stack was just as great as if it had its full quota of grain, so that the cost of threshing each bushel of grain was more than double in October, 1913, what it had been in December, 1912. This has not been taken into account in the above financial estimate. Thus one error tends to increase the loss and another to diminish it.

Another test made during the same period indicated a much smaller, but still considerable loss. Wheat had been sown on part (11 acres) of Harpenden Field, but the produce was not at once threshed on harvesting. Wheat from the adjoining

field—Little Hoos Field—was threshed not long after harvest. So far as could be judged at harvest time Harpenden Field gave at least as good a crop as the best of Little Hoos; there was, indeed, every reason to expect a better crop as the land had been fallowed during the hot, dry summer of 1911.

The crops on Little Hoos Field threshed not long after harvest, *i.e.*, December 12th, 1912, yielded 34 bushels of head corn, and 2 bushels of tail corn per acre. For Harpenden Field threshed on June 17th, 1913, the yield for 11 acres was 310 bushels of head corn and 91 bushels of tail corn per acre, or 27.2 bushels of head corn and 8.2 bushels of tail corn per acre.

Thus instead of turning out better than the Little Hoos field crop, as was expected, the crop actually turned out worse, and instead of the tail corn forming less than 6 per cent. of the total (as it did when threshing took place early) it formed more than 23 per cent.

Had the 11 acres been threshed in December, 1912, one might reasonably have expected on the Little Hoos Field basis at least 374 bushels of head corn and 22 bushels of tail corn.

This would mean a loss of 64 bushels of head corn, but this has reappeared as tail corn. The financial loss on the 64 bushels is the difference between the price of head and tail corn, which in December, 1912, was 6s., the head corn selling at 35s. and the tail corn at 29s.: on the whole stack this amounts to £2 8s. A worse loss was in store, however, for in June, 1913, the price of head corn went down and the wheat was sold at 33s. instead of 35s.: tail corn also fell. The loss thus caused was £5. Thus the total financial loss was £7 8s. on the stack representing the produce of 11 acres, *i.e.*, 13s. 5d. per acre, and this figure is on the low side because the crop was probably underestimated and no allowance has been made for the additional cost of threshing each bushel of head corn.

Thus of the two stacks left over, one from 4½ acres of dredge corn sustained a loss of about £11 10s., or £2 10s. per acre, and the other from 11 acres of wheat was held to sustain a loss of £7 8s. or 13s. 5d. per acre. The former may be overestimated and the latter is probably underestimated.

How far these results are typical could only be ascertained by further trial and by collecting data from large wheat growers. It is impossible to generalise on the subject, but one may safely affirm that the aggregate loss must be very considerable. Experience has shown several ways in which the loss may be increased or diminished. It is recognised that stacks left in

the open field are less liable to become infested with mice than those in the yard. Again, it is well known that owls, hawks, weasels and other animals prey on mice and rats, tending to keep them down and therefore to reduce the loss if they are encouraged. On the other hand a certain amount of drying is always liable to take place in the stack, thereby reducing the weight of the grain.

It is desirable to have more data as to this type of loss because the further practical question is raised: when ought we to thresh our corn? To some extent the question in many cases solves itself; money is needed and corn is saleable, so that the threshing is done as quickly as possible. Pressure of work, however, may cause some of the ricks to be left until a more convenient season, and then one must ascertain what is the cost of the postponement. This is obviously the difference between the loss in the stack and any rise in price that may set in. Looking over the prices from month to month over a period of years one can see little tendency for prices to rise after harvest until May, when a rise does set in till harvest time, when the price drops again; thus for the seven years, 1905-6 to 1911-12 inclusive, the average prices per month of wheat (according to the Board of Agriculture returns) were:—

September, 30s. 6d.; October, 30s. 5d.; November, 31s.; December, 31s. 2d.; January, 31s. 5d.; February, 31s. 5d.; March, 31s. 3d.; April, 32s. 2d.; May, 33s. 6d.; June, 33s. 8d.; July, 34s. 1d.; August, 34s. 1d.

Thus if a man held his wheat over from October till May the chances are that he would get a higher price for it, but while the gain is 10 per cent. the loss in the stack may be much greater, as has been seen above. Moreover, loss is certain to arise in every case, while the increase in price is only an average and may not occur in any particular year—in our case, indeed, the price actually fell. A further consideration is that corn ricks kept till June or July may furnish sufficient food and shelter for the mice to tide them over until the next lot of corn is almost ready for them. A successful corn grower told the writer that in his experience all threshing should be finished every year by April, and that nine times out of ten the corn threshed directly after harvest pays best all round. A farmer who for any reason defers the threshing of any of his stacks should not lose sight of the fact that the delay costs money.

POULTRY-KEEPING ON A SMALL HOLDING.*

J. H. SCOTT.

THE object of the year's work (1st April, 1913, to 31st March, 1914,) has been to obtain the greatest amount of profit from poultry-keeping on purely utility lines, in a manner that can be practised by any small holder able to devote about two hours a day to the work. The same piece of grassland, a trifle over half an acre in extent and divided into six pens, was in use for the third year in succession. The grass is kept in good condition by resting the pens for periods of a fortnight to a month when there are signs of their becoming bare.

The houses all have floors and are bedded with peat moss, which is changed three times a year for adult birds, but at frequent intervals in those houses which contain young chickens. No allowance has been made in the accounts for the value of this as manure.

One pen only was used to rear the chickens until they were old enough to leave the hens, at which age the chickens were passed on to a fresh pen until about ten weeks old, when the sexes were separated.

During the year it was decided to replace the whole of the stock by pullets which were raised entirely from one breeding pen belonging to the small holder.

The year opened badly for this object owing to the difficulty of obtaining broody hens in the early months. Another misfortune occurred in the loss of a great number of the earliest hatched chickens, through the depredations of a cat.

Hatching commenced on the 5th of February and terminated on the 24th June, hens being used. Each hen was given twelve eggs, and an average hatch of 9.4 chickens per sitting resulted, the total number of chickens hatched being 188. The number of losses amounted to 61. The net result was as follows :—

Number of chickens at beginning of the year ..	16
Chickens hatched	188
Cock chickens bought	204
.. .. .	15
Losses	219
.. .. .	61
Cockerels sold	83
Pullets retained for stock.. .. .	75

* For an account of a previous year's poultry keeping, see *Journal*, October, 1913, p. 604.



FIG. 1.—View of the Main Rearing Pen.



FIG. 2.—Part view showing the Centre of the Holding.

Feeding.—A considerable amount of time and labour was saved by reducing the quantity of soft food, the systematic use of this class of food during the winter being discontinued and only occasionally resorted to when the weather became severe. It was found that when the birds once commenced to lay, the egg yield was maintained on grain feeding, in which maize occupied a prominent place.

The various kinds of food used, together with the quantities and cost, were as follows :—

Class of Food.	No. of lb.	Cost.		
		£	s.	d.
Wheat	4,900	15	6	10
Maize	2,380	7	4	9
Meal	609	2	19	8
Barley	420	1	3	9
Sharps	336	1	5	0
Chick Seed	161		18	2
Bran	112		6	3
Meat Meal	84		15	8
Oyster Shell	224		9	0
Flint Grit	112		3	6
	9,338	£30	12	7

Sales.—All eggs were sold as “new laid,” and were disposed of either on the day of laying or on the day after; they were delivered clean and no badly-formed or very small eggs were included.

During the year 152 birds were sold, *i.e.*, 65 hens, 83 cockerels, 2 cocks and 2 pullets. These were marketed in the feather, being placed in crates which were taken by the local carrier to the purchaser in town, who paid the carriage.

The cockerels weighed when sold from 3½ lb. in the early part of the season, to 3¾ lb. later, no birds being fattened, though they were fed rather freely on whole maize; the first birds were sold on May 15th and the last on November 4th.

In order to avoid overcrowding half the hens were sold in June, and the remainder on October 20th, from which date until November 5th no eggs were laid.

The result of the year's trading shows a balance of £16 16s. 10d., from which must be deducted the items of rent, interest, and depreciation.

The total amount of capital employed does not exceed £30.

Record of the Number of Birds in Stock and Eggs laid for each month from April, 1913, to March, 1914.

1913.	Cockerels.	Pullets, 1912 hatched.	Chickens.	Sales.	No. of Eggs laid.
April a	2	67	16		
" b	—	—	30		
" a	2	67	46		
" c	1	2	—	3	1,144
May a	1	65	46		
" b	—	—	53		
" a	1	65	99		
" c	—	5*	6	10	1,064
June a	1	60	93		
" b	—	—	44		
" c	—	—	7‡		
" a	1	60	144		
" c	1*	29	—	30	446
July a	—	31	144		
" b	—	—	8‡		
" a	—	31	152		
" c	—	—	10	10	315
August .. a	—	31	142		
" c	—	1†	15	15	297
September .. a	—	30	127		
" c	—	3	15	18	251
October .. a	—	27	112		
" c	—	27	16	43	65
November .. a	—	—	96		
" c	—	—	21	21	45
" a	—	—	75‡		
December .. a	1	1913 Hatched.	—		
January .. b	—	75	—		154
" c	1	2	—		
" a	1	77	—		
" c	—	2	—	2	441
February .. a	1	75	—		
" c	—	1†	—		
" a	1	74	—		
" b	—	—	31		
" c	—	—	73		932
March .. a	1	74	104	Total Sales 152	Average. 521.6

* 1 killed by a dog.

† All pullets transferred to previous column.
a = Stock; b = Hatched; c = Sales.

‡ Died.

§ Purchased.

Table showing the Amount received from the Sale of Birds and Eggs during each Month of the year from April, 1913, to March, 1914.

Month.	Birds.	Eggs.	No. of Eggs sold per ls.
April	£ s. d. 4 3	£ s. d. 3 5 8	13—12
May	1 6 6	4 0 0	12—11
June	3 4 6	2 7 0	11—10
July	1 5 0	1 16 6	10—9
August	1 13 9	1 13 4	9
September ..	1 11 3	1 13 6	8—7
October	4 3 6	10 0	7
November ..	2 1 6	8 0	6
December ..	—	1 6 0	5—6
January	8 0	2 14 0	6—8
February ..	—	4 5 0	8—10
March	—	4 8 6	10—12
	£15 18 3	£28 7 6	

Trading Account.

	£ s. d.		£ s. d.	£ s. d.
Stock, 1st April, '13	8 9 10	Sales—		
Food	30 12 7	Eggs	28 7 6	
Birds	1 15 0	Birds	15 18 3	
Carriage ..	1 14 5	Sittings ..	14 8	
Sundries ..	18 7	Sacks	4 1	
Balance ..	16 16 10			45 4 6
		Compensation		7 0
		Stock, 31st March, 1914.		14 15 9
	£60 7 3			£60 7 3

Statement showing the Number of Cockerels sold, with the approximate Weight and Prices realised for each Month.

Month.	No. of Birds.	Weight.	Price obtained.
May	6	lb. 19½	£ s. d. 16 6
June	—	—	—
July	10	35	1 5 0
August	15	56½	1 13 9
September ..	15	56½	1 8 3
October	16	60	1 13 0
November ..	21	78½	2 1 6
	83	305½	£8 18 0

Average price per bird s. d.
" " lb. 2 1.73
" " 7

With two exceptions the stock was free from disease throughout the year.

The figures in the tables on pp. 306 and 307 show the facts relating to the year's work in tabular form.

PREVENTIVE INOCULATION FOR DISEASES OF STOCK.

THE following address by Sir Stewart Stockman, the Board's Chief Veterinary Officer, was delivered at Shrewsbury, on 6th June, 1914, at a meeting held under the auspices of the Shropshire Chamber of Agriculture.

Gentlemen,—When I was appointed to the post of Chief Veterinary Officer of the Board of Agriculture and Fisheries in 1905 I was invited by the National Veterinary Association to read a paper at their annual meeting on "Preventive Inoculation and Serum Methods." I propose as an introduction to the lecture which you have invited me to give to-day to reproduce the introductory remarks which were embodied in my paper in 1905, as I have not altered the views which I then ventured to enunciate. I think, moreover, there is a more general feeling to-day in favour of a more versatile policy in dealing with contagious diseases than there was nine years ago. Further, the Veterinary Department of the Board has undergone very considerable development within the last few years, and some methods which were then almost impracticable in the absence of facilities for dealing with disease by methods other than the purely administrative now seem possible. In a country like the United Kingdom, which lends itself so admirably to what is now known all over the world as the stamping-out method of dealing with contagious diseases of animals, it is not surprising that the more artistic and less radical methods have not greatly commended themselves to stock-owners. Nevertheless, I take it that the latter are anxious, as far as possible, to draw the fullest advantage from the more recent discoveries in the domain of prophylaxis in connection with veterinary medicine. The stamping-out method, with its promise of finality, must always appeal, and rightly so, to the practical mind, but, like most other things, it has its limitations.

A convenient and fair way to approach the subject of when we should resort to preventive inoculation would be, I think, to attempt first to define the circumstances under which a stamping-out policy is warrantable, for it seems to me at least

that the latter must always take precedence of the former under given circumstances, which sometimes obtain. I have heard it said by scientific men, mostly outside the veterinary profession, that the stamping-out method is crude and unscientific, but I venture in reply to that to say that the most scientific method of dealing with disease is that method which gives the best results. I would tabulate the circumstances under which a stamping-out policy is warrantable, as follows:—

- (1) If the etiology and pathology of the disease lead one to believe that it can be stamped out by slaughter.
- (2) If the commercial advantages to be derived from the expenditure incurred justify it.
- (3) If the infected centres can be located with reasonable accuracy, and, if after locating them and totalling up the probable cost, a country can afford it.
- (4) If the disease against which operations are to be conducted has only recently been introduced into the country; that is to say, it will almost always under such circumstances be worth while applying the stamping-out process.
- (5) If the disease constitutes a distinct danger to the health of men as well as to their animals.

It must not be forgotten, however, that in legislative veterinary medicine, although the teachings of science may clearly point to the advisability of stamping out disease, the difficulties of an administrative character which surround the undertaking must sometimes overrule everything. In the United Kingdom these difficulties are often a question of compensation, but in other countries, in some of which I have served as a State veterinary surgeon, sentiment and religious prejudices have to be considered. Sentiment and religious prejudice may at times seem ridiculous, but no administration can afford to despise them. Further, operations against a disease, which, looked at purely from the expert point of view, may promise success, might also from the point of view of the man who is making his living as a stock farmer upset his business to such an extent as to threaten him with ruin.

The aim and object of State veterinary medicine should be to devise methods whereby the stock industry can be carried on in spite of disease, and if that be granted I think you will agree that in many cases a policy in connection with the control and eradication of diseases of animals must be based on a compromise between good science and good administrative government. It does not necessarily follow that preventive inoculation should be directed against a disease simply because

the slaughtering-out policy is inapplicable, and the indications for the former measure might be completed by sketching in a general way the circumstances under which we may expect to derive advantage from it. I might begin by saying that the method of inoculation must be a practical and reliable one, and the materials in the form of a vaccine or serum must be prepared by competent workers. This may seem rather a platitude, but it is necessary to mention it, as vaccines and sera are sometimes advertised and pushed on a standard of honesty which is more commercial than scientific. It is not enough that a method will simply protect—it must do so for a period of time long enough to make its application a business proposition; but there is no doubt that those methods which give a passive immunity—that is, for a brief period—can often be utilised with advantage. I must also mention that the general application of some methods is contra-indicated, because they may help to keep up infection, and spread the disease further afield. Sometimes they render the animal more liable to contract other diseases, owing to the unhealthy condition which they may set up. Under certain circumstances, however, these methods can render great service. The methods used to confer immunity are as follows:—

- (a) By injecting a prepared serum.
- (b) By injecting, or administering, attenuated virus, which may be an artificial culture of a microbe or a body fluid from an infected animal.
- (c) By a combination of the first and second methods, but in this case the virus is not always attenuated.
- (d) Since writing the above another method has to be added, owing to the work which has recently been done in connection with epizootic abortion. If a pregnant animal be inoculated with the virus of abortion it is likely to abort, but a non-pregnant animal may be inoculated with an enormous dose of the virus without any bad result. Such an animal acquires a high degree of resistance to the disease, provided it is not allowed to become pregnant too soon after inoculation.

(At this stage Sir Stewart Stockman gave a detailed explanation of vaccines and sera, and the vaccination and serum treatment. He said that while the stamping-out method of dealing with diseases had its limitations, he must in fairness say that prevention by inoculation had its limitations also. Inoculation was not going to do everything, and he would be deceiving them if he led them to believe that inoculation was going to cure all their ills. It was sometimes said that veterinary medicines neglected the curative side, but this was not correct, and he

explained that oftentimes it would cost a farmer more to cure an animal of the disease from which it was suffering than it was worth.)

Proceeding, Sir Stewart Stockman said:

I cannot hope, of course, with the time at my disposal, to deal with every disease against which preventive inoculation may be used with more or less advantage. I propose to deal only with three diseases: Swine fever, swine erysipelas, and epizootic abortion.

Swine Fever.—This disease is caused by what is known as a filtrable virus. The disease may be disseminated by the excretions (urine and dung) of infected pigs, but as the result of experimental inquiries I do not think this is a factor of the first importance in the spread of swine fever, because without any cleansing or removal of manure I have repeatedly placed healthy pigs in pens where others have died of swine fever, and most of these pigs, though not all, have failed to contract the disease. I think the main factor in the dissemination of swine fever is the affected pig, and we know that if healthy pigs be put with diseased ones they almost never fail to contract the disease. In this connection I would also inform you that pigs which have passed through the acute stages of swine fever may remain unthrifty and infective to others for months, and, further, that pigs which have to all appearances recovered from the disease, and which appear to be in excellent condition, may in a small proportion of cases be capable of spreading infection for months. In support of this I have circumstantial evidence obtained in the field, and experimental evidence obtained at the Board's laboratory. Pigs become infected with swine fever mainly through swallowing infective material.

The incubative period, that is to say, the time which elapses before the symptoms appear after contact with infection, is about five days, but in mild attacks the signs may not be very evident for a longer period. The symptoms depend to some extent on the severity of the disease. In the mild outbreak few deaths occur, and nothing may be noticed except slight diarrhoea and unthriftiness; but if a thermometer is used the animals will be found to have a temperature higher than normal. There may also be a purple rash on the skin about the ears, belly, and thighs. In the more severe outbreaks the death rate may be appalling. The pigs shiver and bury themselves under the litter. If made to move, they often stagger about, and become hollow-flanked. The thirst is intense, and they can be seen and heard sucking up dirty liquid from the floors of the styes.

On cutting into the alimentary tract the internal glands are seen to have a strawberry-like appearance. The outer lining of the bowel shows small red hæmorrhages, and these may also be found on the surface and in the substance of the kidney. The inner lining of the stomach and bowel is usually congested in patches of varying size. Other parts show a more or less thick exudate of a greyish colour (it may be black from decomposition), and in chronic cases the bowel is much thickened and its surface corrugated. The most typical lesion, however, is the swine fever ulcer. These ulcers may sometimes be found on the skin as well as in the alimentary tract.

Preventive Inoculation.—This subject has occupied the Board since 1905, when experiments were begun with vaccination treatment as a possible means of dealing with swine fever. As an alternative to what are known as restrictions, the first trials are not very encouraging. The advice which the expert officers supplied to the Board on this subject was laid before the Swine Fever Committee in 1910, and was as follows:—

(a) The injection of anti-swine fever serum can be expected to give a pig a high degree of immunity for a period of about ten days, but infection on infected premises lasts for a much longer period than this. (b) If, during the action of the anti-swine fever serum a pig is exposed to natural infection (by contact with infected pigs or virus), it has a good chance of contracting the disease in only a mild form, followed by recovery, and, after recovery, of having a high degree of immunity. (c) By injecting at the same time anti-swine fever serum and a measured dose of virus, there is good chance of a pig contracting a comparatively mild attack of the disease, which ends in recovery, followed by a condition of prolonged immunity. (d) The injection of anti-swine fever serum to a pig already affected with the disease has little or no curative value. (e) Pigs which have recovered from an attack of swine fever, whether produced artificially by one of the processes of immunisation against the disease or by natural infection, frequently contract a fatal form of pneumonia or may remain stunted for a considerable period. (f) The duration of restrictions upon infected premises, where serum treatment has been adopted, cannot be shortened owing to this treatment. On the contrary, the premises might have to be kept in quarantine for a longer period than usual, owing to the employment of serum, which certainly interferes with the rapid progress of the disease. On the other hand, the use of serum may be expected to lessen the death-rate, and the consequent loss to

owners of infected premises. (g) It would be unwise to make use of vaccination (*i.e.*, injection of serum *plus* virus) on clean premises, as it would mean establishing fresh centres of disease, and because the death-rate consequent upon vaccination is often considerable. There is no doubt that the use of serum on premises infected with swine fever will reduce the death-rate from the disease, but to accomplish anything material the serum treatment must be applied almost immediately the disease appears. If there is delay in reporting, as very frequently happens, the death-rate may be enormous in spite of serum treatment, and having regard to the fact that anti-swine fever serum costs from 2s. to 2s. 6d. per dose, a pig owner may well grudge making use of it except under circumstances in which he feels he is likely to get value for the expenditure.

There are certain disadvantages connected with the use of serum. If serum alone is used it is advisable to mix up the diseased animals with the healthy in order that the temporary immunity given by the serum may be converted into a more permanent one, owing to the animals receiving infection while the effect of the serum is still active. This procedure, of course, is not without disadvantages. It is true that the death-rate is likely to be lessened, but, on the other hand, the pig owner may be left with a considerable number of weedy pigs, which it hardly pays to feed. I do not think for a moment that serum treatment in the case of swine fever will allow any relaxation of restrictions. It has its uses, however, and it is particularly likely to be of value to the pig feeder. For example, if a pig feeder is unfortunate enough to get swine fever on his premises his business is often stopped owing to the impossibility of allowing him to bring stores for feeding purposes on to his infected premises. Nor would it pay him to do so, if he is going to lose a large percentage of the newly-introduced animals from swine fever. By giving stores a dose of serum immediately before they are brought in, there need be very few losses from the disease provided the serumed pigs are mixed up with the others, so that they may acquire active immunity before the action of the serum passes off, that is to say, in the first ten days. Of course, it would be necessary to provide that no animals for a long period should go from such an establishment elsewhere than to a slaughter-house. The use of serum in this case is simply to allow a man to carry on his business of pig feeding in spite of the disease. As a State measure for controlling the disease, I am inclined to think that vaccination, that is to say, the injection of serum and virus at the same time,

gives more promise of being a general advantage. The present method of vaccination, however, is dangerous ; it is calculated to establish fresh centres of disease ; it sometimes makes the animals very ill ; it may leave them wrecks for weeks or months ; and it may cause a certain number of deaths. If, on the other hand, a safe and practicable method of vaccination can be elaborated, the objections would be generally overcome, and to this end research is being conducted by the Board. It is unnecessary, of course, for me to point out to you how advantageous it would be if we were in possession of a safe and practicable method whereby pig owners could render their animals proof against swine fever for a year or more. A certain amount of progress has been made in this direction, but I am afraid it is too early yet to give a final opinion.

Swine Erysipelas.—This disease is caused by the bacillus of swine erysipelas. The bacillus is widely distributed. It can pass a prolonged existence (as a saprophyte) outside the bodies of animals, and the infected or recovered animal is not by any means wholly responsible for the dissemination of infection. Further, the manifestations of the disease in many cases amount to no more than a passing indisposition. Nevertheless, the disease is responsible for a very considerable number of deaths if the total is reckoned, and it causes additional loss by putting fatting pigs back in condition. Swine erysipelas is not a scheduled disease, and is not required to be reported. I think it would be a mistake to add it to the list of scheduled diseases, as at present framed, because the ordinary administrative measures, if applied to it, would give rise to much inconvenience with practically no compensating gain, and restrictions on movement and quarantine of premises are not likely to reduce the number of outbreaks or the number of cases, having regard to the conditions under which the pig-keeping industry is carried on.

As already stated the virus is widely distributed, but as the disease is not required to be notified, it is not possible to arrive at an accurate estimate of its prevalence. In connection with swine fever, however, which is a notifiable disease, many of the more severe outbreaks of swine erysipelas are reported to the Board in the belief that they may be swine fever. All reports of this kind are carefully inquired into by the veterinary staff of the Board in the field, at the office, and at the laboratory, and I am able to give some idea of the importance and prevalence of the disease. But, inasmuch as these reports hardly ever relate to the milder outbreaks, in which the loss mainly

arises from interference with fattening operations, they may be taken to represent only a small proportion of the total, and, since the Board's connection with the premises ceases when it is established that the disease is not swine fever, it must be noted that deaths subsequent to the premises being freed are not recorded.

In all cases there is a rise of temperature accompanied by more or less shivering and loss of appetite. This is followed by a patchy red eruption on the skin, about the base of the ears, thighs, and body. In severe cases there is vomiting and great prostration; the pigs may stagger about; they breathe rapidly, and death may take place in about 48 hours.

In the mild form, which is known commonly as nettle-rash—the diamonds—the illness is nothing more than an indisposition, but the pigs may be unthrifty for a short time after the attack. Either form may be followed by somewhat serious results. The pigs may develop inflammatory troubles in their joints, and be very lame with rheumatism. They may develop inflammation of the inner lining of the heart, particularly around the valves, and die suddenly.

The lining of the stomach and intestines is congested in patches and its glands are red and swollen. The spleen may be slightly enlarged. On certain parts of the intestines there may be found patches of inflammatory exudate, but this is never so abundant as in swine fever, and the ulcers found in that disease are never present. When the heart is affected, a mass of exudate and new tissue form around the valves. The lymphatic glands are red and congested; small red spots (hæmorrhages) are found on the membranes.

Measures of isolation of the sick from the still healthy, and other sanitary measures, such as disinfection of the styes, should be taken, but it must be remembered that the majority of pig premises do not lend themselves to adequate disinfection. Even when an outbreak has begun, treatment with serum alone will greatly reduce the losses, and it is advisable to give each pig a dose of serum in the first instance under such circumstances. The serum will save most of those in the incubative stages of the disease. It will give the healthy pigs immunity for about ten days, and enable the fat ones to be marketed. If the disease appears annually on premises, as is frequently the case, great advantage can be derived from vaccination. In this case the pigs receive a measured dose of a pure culture of the bacillus, and at the same time a dose of serum. The object of this treatment is to give them all a very mild attack of the

disease, which is followed by active immunity. The immunity in this case lasts for about a year—*i.e.*, sufficiently long for commercial purposes in the case of fattening pigs. As this is to a large extent a seasonal disease, it follows that the animals should be immunised before the season of prevalence begins—not later than May. If new animals are brought on to infected premises, they should be vaccinated immediately before they arrive. This again will enable a man to carry on his business of feeding in spite of the disease.

Epizootic Abortion.—As you are aware, a great deal of work has been done by the Board in connection with this disease. In the first report of the Abortion Committee, which was published in 1909, it was shown that bovine abortion in this country was due to a special bacillus—the bacillus of abortion—which was first discovered in Denmark by Bang. The bacillus is a very small and somewhat oval rod, which is found in an exudate present in the uterus of affected animals. The bacillus in the exudate usually occurs in the form of clumps consisting of a large number of rods.

The work of the Committee showed that in the majority of cases infection took place through the alimentary tract, the bacilli being absorbed from the intestines into the circulation, and so reaching the pregnant uterus. The work of the Committee also showed: (a) That it would be possible to diagnose the disease by examining the blood of an animal before it aborts; (b) that it would be possible to immunise non-pregnant animals against the disease by injecting large quantities of the bacillus, which had been artificially grown. Since the publication of that report a great deal of work has been carried out with a view to making the methods of diagnosis and immunisation practicable undertakings. It may be said now, that it is practicable to test each animal in an infected herd, and pick out those which have the disease. The advantage of this is obvious, because, as you know, the virulent material in the case of abortion is not disseminated into the cowsheds, or on to the pastures, until the act of abortion is about to take place, and it is highly desirable to be able to isolate infected animals before they can abort and deposit infective material in the premises.

For the purpose of assessing the value of preventive inoculation in practice a large number of infected herds have been put under trial. The plan is as follows:—Heifers and non-pregnant cows on infected establishments are inoculated with a large dose of the living bacilli of abortion. They are

not put to the bull until two months after inoculation, so as to give the body time to eliminate the bacilli before pregnancy begins. A proportion of animals in herds are not inoculated; they are left as controls, so that a comparison can be drawn between the number of abortions which take place among the inoculated and that which occurs in the uninoculated. This is for trials only, to assess value. There has not been time yet to sum up all the results, but it would appear that, whereas abortions to the extent of 30 per cent. or more may occur in an infected herd, this loss can be kept down to 6 or 7 per cent. by employing preventive inoculation. It is possible, of course, that the method may be further improved. There is this difficulty, however, to be considered, namely, that some animals are not so immunisable as others. We know, of course, that even natural infection, which ought also to produce immunity, often fails to do so, since a small proportion of cows may abort three times in succession from natural infection. Never get rid of a cow that has aborted if you are a breeder. I think you will agree that epizootic abortion causes enormous loss to stock-owners, and, as you know, the advisability of dealing with the disease by the ordinary administrative order has many times been discussed. Having now to hand a method of picking out infected animals, it is probable that an administrative order of a drastic kind would considerably reduce the prevalence of the disease. On the other hand, I am bound to be quite frank with you in giving the results of our investigations in relation to prevalence, etc., so far as they have gone, which show that, given abortion in a herd, 30 per cent. of the animals are commonly affected, and even affected cows may carry to full time. Stock-owners, then, in considering whether abortion should be dealt with by ordinary administrative measures or not, have to ask themselves the question whether, having regard to the great prevalence of the disease, they are prepared to face the possibility of 30 per cent. of the animals on infected premises being under prolonged restrictions in relation to movement. A question of this kind I must, of course, leave to you as business men, and should you find it impracticable, the only other method is to adopt preventive inoculation. Should the final assessment of the results of the trials, which are now being carried on, justify it, I think you will find that the Board will be prepared to help you, as far as possible, by the distribution of a reliable vaccine. It is for you, however, as business men to make up your minds what course you think should be followed. I must confine myself to placing before you quite frankly the views of the epizootiological expert.

THE Board of Agriculture and Fisheries have for some time been in communication with a number of representatives of Fruit Buyers' Associations in order to

Packing of Apples. ascertain the views of the trade with regard to the packing of home-grown apples. The Board think it desirable that such information as they have been able to obtain should be brought to the notice of fruit growers.

Net Weight of Fruit in each Package to be Declared.—It appears that the point to which retail fruit dealers attach most importance is that every package should bear a tally or label with the net weight or count declared. The object of this requirement is to give the purchaser some security as to the amount of the goods he is purchasing. It is said to be impossible under existing conditions to estimate the amount with sufficient accuracy for the purposes of retail trade. The difficulty of complying strictly with this requirement is not under-estimated, but the views of the trade in the matter are so strong and so unanimous that it seems clear that it would be to the advantage of any grower who was in a position to do so to indicate, in the manner suggested, the net weight of packages of fruit sent to market.

Initials or Mark of Grower to appear on Packages.—Another point on which there appears to be little or no difference of opinion among buyers is that the initials of the grower or some distinguishing mark should appear on the package. The object in view is to facilitate the selection for purchase of apples consigned by growers who avoid the practice of "topping." It is alleged that much loss and inconvenience is occasioned to retail buyers of fruit by this practice. There is no doubt that unmarked packages of fruit are in many markets viewed by buyers with a good deal of suspicion, and that a grower who can affix to his produce a mark which will be taken by the retail dealers attending the market as a guarantee that the fruit is fairly packed, stands a much better chance than others of meeting with a ready sale. The practice of "topping" not only defrauds the buyer by leading him to pay a higher price for an article than it is worth, but puts him to great inconvenience because he finds himself with a short supply of apples of the class he requires to meet the demands of his particular circle of customers, and at the same time has left on his hands a certain quantity of inferior apples for which he has no use, although in the hands of some other retailer they might have been disposed of without difficulty.

Statement of Variety and Approximate Diameter.—There is also some evidence that preference would be given by purchasers to packages with labels stating, in addition to the net weight, the variety of the apples, and their approximate diameter.

The inquiries and correspondence related specifically to home-grown apples, but it is believed that the first two of the above requirements apply equally to all home-grown fruit.

THE Annual Report of the Education Branch of the Board of Agriculture and Fisheries has recently been issued dealing with the distribution of Grants for Agricultural Education and Research in the **Agricultural Education in 1913-14.*** These grants have been largely increased since the creation of the Development Fund, with the result that there has been a corresponding increase in the scope and extent of the work. Some 500 persons are now engaged in teaching agriculture or investigating agricultural questions in England and Wales. The total amount distributed in 1913-14 in the form of grants for agricultural education and research was £67,939. The figures for 1909-10 and 1911-12 were £12,900 and £28,690 respectively. The purposes to which grants were applied were:—(1.) Educational grants to Universities and Colleges. (2.) Grants for Advisory Work. (3.) Grants to Research Institutes and other Research Centres. (4.) Grants for Special Research and other Investigations. (5.) Research Scholarships (including expenses of selection). (6.) Grants for Farm Schools, Technical Classes, Local Lectures, &c. (7.) Capital grants-in-aid of the establishment of Farm Schools. (8.) Grants towards the expenses of Advisory Councils. (9.) Grants for Forestry Advice, Research and Experiments.

Co-ordination of Agricultural Education.—Reference has been made in previous reports to the steps the Board are taking with a view to the co-ordination of the work of Agricultural Education in England and Wales. The main object in view is to link together the different institutions and bodies engaged in providing agricultural instruction and technical advice, and in carrying on experimental and research work. The different branches of the work of these bodies react one on another, and co-operation between them is essential to prevent the waste inseparable from isolated effort. By the arrangements which are now being made it is hoped, on the one hand,

* Cd. 7450. Messrs. Wyman & Sons, Fetter Lane, E.C., Price 8½d.

that the results of research and experiment will be brought to the notice of agriculturists for whose benefit the work is intended, and that, on the other, the staffs engaged in the different branches of education may work in closer union than has hitherto been the case.

The country has been divided into eleven educational provinces (twelve provinces are proposed, but in one instance the necessary arrangements have not been made), each containing an Agricultural College and a group of counties closely associated with it. In each of the provinces is established an Advisory Council composed of representatives of the College, the Local Education Authorities, and the Board, and forming a connecting link between the various sections of the educational work of the province. In addition, an increase in the scientific staff has been or is being arranged for at the Central College in each province with a view to placing expert advice at the disposal both of the farmer and of the County Instructors, and also to assist in maintaining a connection with the Research Institutions.

While the preliminary work of organisation has made rapid progress in the course of the year, it is still incomplete. In the one instance already referred to co-operation between the educational authorities concerned has not been brought about; in another, where all directly interested in the local work are prepared to go forward on the lines suggested by the Board, the central College is still in process of erection and the staff, with the exception of the Principal, has not been elected. In other cases suitable men for the new scientific advisers' posts have not been found. In such cases the Board counsel delay. The demand for qualified men was foreseen and a number of carefully selected young men are now in training.

Agricultural Education provided by County Councils.—The issue of the Farm Institute Regulations in March, 1913, caused County Councils to devote much attention to a consideration of the steps to be taken to develop agricultural education in their districts, and in this they were greatly assisted by the Advisory Councils. An account of the activities of the County Councils during the year is given in the Report under the respective provinces, and from this it will be seen that schemes were approved during the year for the establishment of six new Farm Schools situated in Cheshire, Hampshire, Stafford, Warwick, Monmouth, and Carnarvon, two of these being in place of existing institutions. In addition, provision has been made for the extension of the Newton Rigg

Farm School in Cumberland, and for the rebuilding of the Midland Agricultural College partly with the aid of money drawn from the Farm Institute Grant. Schemes for the establishment of new Farm Schools are also under consideration in Durham, Northampton, Hereford and some other counties.

A preliminary step in the promotion of agricultural education to which the Board attach great importance is the appointment of an Organiser in each county, and it is satisfactory to note that during the year Organisers were appointed in 13 counties. This is a very marked advance, as in the previous year only seven counties employed special Officers of this type. Several additional appointments were also made after the end of the financial year. The experience of the past year has confirmed the Board in their previous views as to the desirability of appointing an Agricultural Organiser to take charge of the work of Agricultural Education in each county. Although owing to their recent appointment the work of the Agricultural Organisers has, in many cases, been mainly of a pioneer character, there is already much evidence of the increased support and assistance which this branch of education is receiving at the hands of local authorities on the advice of the Officers thus appointed.

During the year considerable attention was given to the question of providing Agricultural Education in Wales, and arrangements were made which will result in a marked development in the work during the year 1914-15. The Board conducted prolonged negotiations with the Development Commissioners with a view to obtaining a special grant for Agricultural Education in Wales. Although they were not successful in obtaining special treatment in the way proposed, the very substantial grants which can be earned under the Farm Institute Regulations enable Local Education Authorities to make a material extension in Agricultural Education without increasing to more than a small extent the net expenditure of the county on Higher Education generally.

Research and Advisory Centres.—During the year 1913-14 payments were made in respect of twelve Research Institutes and two other centres, amounting in the aggregate to £19,456, as compared with £6,434 in the preceding year. Work is now in progress in all the subjects for which the Development Commissioners recommended that Institutes should be founded,* excepting Plant Pathology, and for this subject a laboratory has been acquired and is being fitted up in the Royal Botanic

* *Journal of the Board of Agriculture*, October 1911, Vol. xviii, p. 546.

Gardens, Kew. A grant was made during the year to Leeds University to enable it to undertake research in Animal Nutrition in co-operation with Cambridge University, where research on that subject was already in progress. An experimental fruit station has been established at East Malling, in Kent, in connection with the Research Institute in Fruit Growing at the University of Bristol, and under the supervision of the South-Eastern Agricultural College, Wye.

In 1911 the Development Commissioners expressed their willingness to recommend an annual advance to the Board with a view to enable them to make grants for the purpose of extending the advisory and local investigation work of certain selected Colleges. Since then arrangements have been made for the appointment of a special advisory staff at nine centres, and further appointments will be made as opportunity offers. The payments made in the past financial year under this head amounted to £7,347. The account of the work carried on by means of the special advisory staff, which is given in the Report, shows the very considerable extent to which farmers were receiving assistance in regard to practical agricultural questions. In this respect, however, it is not exhaustive, as the agricultural staff employed by the County Councils also do a great deal of advisory work and are expected to supply information on questions relating to practical agriculture, horticulture, dairying, poultry-keeping, &c., the energies of the special advisory staff being in general devoted to the more difficult problems which require advanced scientific knowledge and investigation in a laboratory for their satisfactory solution.

THE *Journal of Heredity* (the organ of the American Genetic Association) publishes a translation of an article on "in-and-in" breeding by Professor Kraemer of Hohenheim. The subject is dealt with in a somewhat discursive manner, and makes no new contribution to knowledge. It

deserves mention, however, since it contains a useful summary of the literature on the subject. The question of how far the immemorial prejudice against inbreeding can be supported by scientific investigation has recently attracted increased attention on the Continent, and more especially in Germany, where systematic attempts are being made to improve the indigenous breeds of live stock by the application of recent discoveries in genetic science.

It is somewhat surprising to find that many prominent stock breeders on the Continent go so far as to maintain that inbreeding produces no injurious effects whatever. Professor Kraemer, however, on a review of the facts, takes the view that "*continued* inbreeding must always result in a weakened constitution, through its own influence." This was the view taken by Darwin, who wrote* : "The evidence immediately to be given convinces me that it is a great law of nature, that all organic beings profit from an occasional cross with individuals not closely related to them in blood; and that on the other hand, long continued close interbreeding is injurious."

It is probable that had Darwin been aware of the fact that many races of plants are normally self-fertilised (for example most of the cereals) he would have excluded the vegetable kingdom from this sweeping generalisation. Professor Kraemer goes on to instance the well-known case of the Bakewell short-horns. Inbreeding had no terrors for that pioneer, though there is evidence that he committed himself to a statement that his method could not be carried on for long with good results. Another case which has to be considered in this connection is that of the Chillingham cattle. These wild cattle were reared for centuries in a fenced park and, consequently, must soon have died out if inbreeding is an acutely pernicious influence. On the other hand, it appears that the fertility of these cattle tended to show a progressive decline.

Again, we are told that Bates practised close inbreeding for thirteen years, and that in the subsequent seventeen years he introduced "new" blood only three times. With regard to sheep, it is stated that the Browns inbred Leicesters for fifty years. On the other hand, there is a considerable body of evidence that the inbreeding of pigs rapidly produces a loss of fertility. The same applies to fowls and pigeons. Sebright's bantams degenerated when interbred, and an experiment which he made with owl pigeons nearly led to the extinction of the family.

In summing up the evidence collected by Darwin, Professor Kraemer very truly points out that in some cases the alleged evils of inbreeding are merely the result of pairing two individuals who both possess a hereditary taint, and that the results of such matings do not prove that inbreeding is in itself injurious. He might have added that it is conceivable that a tendency to sterility may equally well be regarded as

* *The Variation of Animals and Plants under Domestication.*

an hereditary taint and, moreover, one which is likely to be cumulative in its effect.

The matter has also been the subject of an extensive literature in France. There, too, conflicting views have been held. A prominent writer, Cornevin, seeks to draw a distinction between degrees of consanguinity as affecting the alleged evil influence. According to him collateral mating can be used more freely than that of individuals of the same "direct" line. Cornevin inbred Holland cattle for twelve years and Jerseys for seven years without evil results. On the other hand, he admits that the inbreeding of swine cannot be practised with safety, but in this case the evil to be feared is infertility.

To sum up, it would appear that *continued* inbreeding does in the end produce evil results, and from a practical point of view it is immaterial whether these are produced by the intensification of a defect common to the stock or by the operation of a law of nature. On the other hand, the main object of resorting to the practice is to fix a type, and there is abundant evidence to show that for this purpose inbreeding may safely be practised for a sufficiently long period to secure the end in view.

From the scientific standpoint it cannot be affirmed that the evidence is sufficient to establish a "law of nature" that inbreeding *by itself* is prejudicial. The facts, such as they are, can be adequately explained on the assumption that hereditary taints (including sterility), sometimes "dominant" sometimes "recessive," tend to be intensified, or brought to light, by consanguineous matings.

A COMPLETE comparison of the financial results of one year with another from the farmers' point of view is difficult. It is easy to show that a year was good, bad, or indifferent for certain kinds of commodities—that it was, for example, a good year for wheat, and a bad one for cattle or sheep, or that prices of dairy produce were low and prices of fruit or hops high, and so forth, but it is much less easy to make an estimate of the extent to which satisfactory prices or a good crop of certain commodities are set off by low prices or bad crops of others. For the purpose of a calculation

* From the Agricultural Statistics, Part III., 1913. [Cd. 7487.] Price 5d.

of this nature it would be necessary to know in each year the total amount realised by farmers for their aggregate output, excluding sales from one farmer to another. The information published in the Board's Report on the Agricultural Output (Cd. 6277), provided for the first time, for one year, materials approximately sufficient for such a calculation, but at present the data available are inadequate for an estimate of yearly fluctuations.

An attempt has, however, been made to obtain, for the past few years, an approximate measure of the extent to which the variations in price; from year to year, affect the receipts by farmers from the sale of their produce. For these price variations the Board's Return of Market Prices provides since 1904 fuller details of the annual fluctuations of value of agricultural commodities than have previously been available.

*Index Numbers of Prices of the Produce sold off Farms in
England and Wales.*

Average price, 1906-8=100.

Commodities.	1906-8	1909.	1910.	1911.	1912.	1913.
Cattle (25)	100	105	109	103	113	115
Milk (21)	100	100	100	106	109	106
Sheep (13)	100	81	90	87	100	106
Pigs (13)	100	105	119	100	109	126
Hay (11)	100	92	104	111	132	108
Wheat (8)	100	108	100	107	107	101
Barley (6)	100	104	95	119	118	112
Potatoes (6)	100	80	96	111	124	98
Poultry and Eggs (4)	100	106	104	102	107	109
Fruit (4)	100	71	112	108	103	119
Wool (3)	100	106	110	112	113	132
Butter (3)	100	100	101	105	106	105
Oats (2)	100	101	95	114	115	103
Hops (1)	100	185	127	252	146	220
Cheese (1)	100	96	95	105	110	101
Beans and Peas (1)	100	112	113	103	110	103
Vegetables (1)	100	121	103	134	125	111
General Index Number	100	99	104	106	112	112

The saleable products of the farms of England and Wales were classified in 17 groups, and each group was given a "weight" (shown in brackets in the table) in the calculation approximately in proportion to its relative importance in the total output. The year 1908, being that to which the calculations of agricultural output mainly related, naturally suggested itself as the most convenient "base" or standard, but the

objections to the adoption of prices for a single year became apparent when the calculations were made, and eventually it was decided to take the average of the three years 1906-8. This enabled a better level of prices to be obtained, especially for crops such as hops, hay, potatoes, &c., which vary greatly in value from year to year. The "weight" to be given to each commodity in calculating the index number was determined by the average value of the total sales off the farms in each of the three years at the prices then ruling. The calculation of the average price in each year was made mainly from the Board's weekly returns on the general principle of including the market quotations for that part of the year in which the particular commodities are mainly sold by farmers. The commodities having been thus arranged in an order of relative importance from the farmers' point of view, the index number for each subsequent year was calculated at the current prices, and the rise or fall in value shown for each, while the index number for the whole of the commodities gives a measure of the general change of the price level at which the year's agricultural output was realised.

It is to be noted that the "weight" attached to each group is based not on the total production, but on the proportion thereof which was estimated in the Agricultural Output Report as sold off the farms, excluding sales from one farmer to another. Thus of certain crops, such as hops and wool, the whole, and of others, such as wheat and potatoes, nearly the whole, is marketed, whereas in some cases, such as hay and oats, the proportion of the total crop sold is relatively small.

The variations in the value of particular commodities is in many cases considerable, but on the whole the last four years have shown a marked rise on the price-level of 1906-8, the years 1912 and 1913 being in the general result equal, although the producers of different classes of crops and live stock were diversely affected.

A DECREE of the Belgian Ministry of Agriculture, of 26th May, 1914, published in the *Moniteur Belge*, of 6th June, 1914, provides that, in view of the fact that dairies contribute to the spread of foot-and-mouth disease, the milk in dairies and creameries supplied by farms on which cattle are attacked with the disease, or are suspected of being attacked or exposed to infection, must immediately be heated

to a temperature of at least 80° C. When the whole milk is not so heated the cream and separated milk must be raised to that temperature. If the management of a dairy or creamery consents to accept milk from infected farms, such milk must only be admitted after the milk from farms free from the disease has been dealt with.

The vessels, etc., for transporting milk must be disinfected both internally and externally by placing them in boiling water, or in a boiling 3 per cent. solution of carbonate of soda. Vehicles must not be taken from an infected farm to a farm free from the disease.

On the report of a veterinary inspector the above measures as to pasteurisation and disinfection can be prescribed for dairies or creameries supplied by farms which are in danger of being infected by reason of the proximity of one or more centres of disease.

A complete list of the farms from which the supplies are drawn must be furnished by the manager of a dairy or creamery within 48 hours of an outbreak of foot-and-mouth disease being certified.

PART II. of the Annual Report of the proceedings of the Board under the Small Holdings and Allotments Act, 1908 [Cd. 7336], deals in part with the provision of allotments during 1913. In accordance with Section 59 of the Small Holdings and Allotments Act, 1908, the Board called for returns of the proceedings during the year 1913 of every Town Council, Urban District Council, and Parish Council in relation to allotments, and the opportunity was taken to obtain information of the total quantity of land that is held by the various Councils for allotments, and the number of tenants to whom it is let.

The total number of allotment authorities under the Act is approximately 8,300, and these authorities were required to send in their returns not later than 10th January, 1914. Up to 21st February returns were received from 7,950 of them. In the great majority of cases the returns show that no land is held for allotments, and that no applications were received. The number of returns which show that some action was taken in regard to allotments in 1913 is 1,932, 1,482 being from Parish Councils, 292 from Urban District Councils.

157 from Town Councils, and 1 from the London County Council.

On the 31st December, 1913, the total quantity of land let for the purpose of allotments by the various local authorities in England and Wales who sent in returns was 31,271 acres, of which 7,532 acres were the property of the Councils, and 23,739 acres were leased. This land is let to 118,240 individual tenants and 49 associations. The following statement shows the quantity of land let as allotments by the different classes of local authorities in England and Wales, and the number of tenants to whom it is let :—

STATEMENT OF THE AREA OF LAND LET AS ALLOTMENTS BY THE LOCAL AUTHORITIES IN ENGLAND AND WALES ON THE 31ST DECEMBER, 1913.

Local Authority.	Area of land let for allotments on 31st December, 1913.						Number of tenants holding allotments.
	Purchased.		Hired.		Total.		
	a.	r. p.	a.	r. p.	a.	r. p.	
London County Council.	85	0 3	45	1 20	130	1 23	1,310
Town Councils	2,887	0 8	2,622	2 39	5,509	3 7	37,653 and 35 associations.
Urban District Councils.	1,277	2 25	3,520	2 2	4,798	0 27	29,874 and 10 associations.
Parish Councils	3,282	1 2	17,550	1 22	20,832	2 24	49,403 and 4 associations.
Totals..	7,531	3 38	23,739	0 3	31,271	0 1	118,240 and 49 associations.

In rural parishes it is usually possible to obtain allotments direct from private landowners, and there is, therefore, no need in most cases for the intervention of the Local Allotment Authority, but in large towns this is less often the case, and it is satisfactory, therefore, to notice that out of the 76 County Boroughs in England and Wales allotments were provided by the Town Councils in 45.

During 1913 applications were received for allotments from 14,897 individuals and 6 associations, and the total quantity applied for was 3,744 acres. Allotment authorities are empowered by the Act to erect dwelling houses for occupation with any allotment of one acre or more, and 36 applications for houses were received during the year, but at present none have been actually erected.

The returns received show that 1,395 acres were acquired for allotments during the year 1913, as compared with 1,259 acres in 1912. The quantity purchased is 494 acres and the price paid £43,810; while the quantity leased is 901 acres, for which rents amounting to £2,063 are paid. 40 acres of the land purchased by allotment authorities were formerly held on lease by these authorities. The average price of the land purchased is £90 an acre, and the average rent of the land leased £2 5s. 9d. an acre. If the quantities purchased by the different classes of allotment authorities are considered separately, it appears that the average price paid by Parish Councils is £50 an acre, by Urban District Councils £100 an acre, and by Town Councils £110 15s. an acre. In the case of land leased, the average rent paid by Parish Councils is £1 14s. an acre, by Urban District Councils £3 an acre, and by Town Councils £3 8s. 6d. an acre.

The land acquired by local authorities during 1913 provided allotments for 4,231 individuals and 4 associations. In addition a large number of applicants were provided with allotments on land acquired before 1913, and it is expected that about 1,500 will be provided with allotments on land which was acquired in 1913 but had not been allotted at the end of 1913. The returns received show an unsatisfied demand from 9,329 individual applicants and 5 associations, and the quantity of land required to satisfy them is 3,034 acres. The unsatisfied demand is smaller than it has been at any time since the Small Holdings and Allotments Act came into operation.

FROM time to time the Board are notified of the loss of the parish copy of a tithe apportionment or tithe map originally deposited, as a rule, in the custody of the incumbent and churchwardens. The loss is frequently due to the fact that the document has been borrowed for the purpose of making a copy or an extract, and, not having been returned to its custodians, cannot now be traced. The matter is dealt with in the Annual Report of the Proceedings of the Board under the Tithe, &c., Acts in 1913 (Cd. 7333).

Where instances of such loss come under their notice the Board call attention to the obligation resting on the proper custodians of the document to recover it if possible, and failing this to replace it by a certified copy which will be made from

the originals in the Board's charge, on payment of the cost of making the copy.

The Board sometimes have occasion to call for the parish copy of a tithe apportionment or map, and it is not infrequently found to be seriously damaged and, in some cases, so much decayed as to be partly indecipherable. The Board undertake to restore, when practicable, such damaged documents or to replace them if their restoration is impossible, on payment of the necessary cost.

It appears evident that there has been considerable laxity in the local custody of these important documents, and it would be desirable that all who are interested in their preservation should see that they are in proper charge and that they are kept under suitable conditions.

During 1913 the Board were able by the sanction of the Treasury and with the assistance of the Ordnance Survey Department to complete the restoration of a number of the original tithe maps which are in their charge. A proportion of these, being especially those which have been most frequently inspected by the public, are naturally after some seventy years showing serious signs of wear. In the case of six parishes—Tottenham, Bexley, Merstham, Kingston-on-Thames, Bletchingley and Isleworth—entirely new maps have been prepared by a careful collating of the original with the diocesan and parish copies. The new maps, having been duly certified in accordance with the Tithe Acts, have also been reproduced by the Vandyke process and a limited number of copies thus reproduced are now available.

Under Section 15 of the Tithe Act, 1860, the Board are empowered on application to make a new tithe map and apportionment of a parish embodying the original and all subsequent apportionments. Such a map has been made for the parish of Portsea, and for all purposes of current reference is now open to inspection.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Assimilation of Soil Constituents by Oats (*Jour. of Agric., Victoria*, April, 1914).—Samples were obtained from a uniform oat crop at three different stages of development, viz., (1) just before flowering, (2) when the plants were well into ear and the lower leaves were turning yellow, and (3) when the crop was ripening. The samples were washed, dried, and divided into roots, straw and grain, and analysed for their content of the various soil constituents. The results in lb. per acre were as follows:—

Stage of Development.	In Grain.	In Straw.	In Roots.	In Grain.	In Straw.	In Roots.
	<i>Nitrogen.</i>				<i>Potash.</i>	
1	—	40.8	5.5	—	18.9	.5
2	4.2	29.6	5.7	.8	13.6	1.2
3	16.6	22.3	4.4	3.8	7.8	3.1
	<i>Lime.</i>				<i>Magnesia.</i>	
1	—	3.9	1.1	—	6.5	1.4
2	.3	5.7	1.5	.6	8.5	2.0
3	.8	4.6	2.0	2.2	7.0	1.4
	<i>Phosphoric Acid.</i>				<i>Silica.</i>	
1	—	7.6	.3	—	21.0	8.0
2	1.5	7.3	.5	1.3	25.0	13.0
3	5.0	3.2	1.0	13.0	34.0	21.9

Although the production of dry matter was greatest at the third stage of development (at ripening) the table shows that, in the case of each necessary food constituent, the maximum assimilation had been attained some time earlier, and that apparently the crop had finished with the soil as a source of plant food for some considerable time before it finished growing. Nitrogen and potash apparently cease to be absorbed by the crop about the time of full bloom, or between stages 1 and 2. Phosphoric acid, lime and magnesia continue to be absorbed somewhat later. Silica is absorbed as long as the plant is green.

The early cessation of nitrogen and potash absorption points to the need for an easily available supply of these food materials for the young oat plant. The later date to which phosphoric acid is absorbed favours the action of phosphatic manures for oats as compared with those supplying nitrogen, because their time of action is more prolonged.

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

These experiments showed further that little or none of the phosphoric acid absorbed is afterwards lost to the oat plant, but that some of the absorbed nitrogen and still more of the potash may be lost.

Dung-making Experiment (*Jour. Roy. Agric. Soc. Eng.*, 1913, Dr. J. A. Voelcker).—It is customary in some parts of the country to penalise, at the rate of 5s. per ton, the selling of hay off the farm, this representing the loss to the farm. On the other hand, if hay be consumed on the holding, the farmer is allowed 5s. per ton for cartage, and is supposed to get the consuming value of the hay from the increased bulk of the dung produced. It was accordingly considered desirable to ascertain by exact experiment how far the consumption of a certain amount of hay would increase the bulk of the manure produced when the latter was measured in accordance with the usual practice.

Four bullocks were placed in special feeding boxes at the Woburn farm from December 19th, 1912, to April 30th, 1913. They were divided into two lots of two each; both lots received the same quantities of a ration consisting of bean meal, crushed oats, roots, oat straw and chaff, and in addition one lot was fed hay, of which one ton was consumed in the period. The increase in the manure resulting from the hay feeding was found to be 55 cubic feet weighing 1 ton 9½ cwt. The moisture content of the manure made without hay was 75·82 per cent., that of the manure with hay 74·21 per cent.; the nitrogen content of the manure without hay was ·489 per cent., that of the manure with hay ·615 per cent. It was noticeable that, in the case of the manure made with hay, the straw was broken down very much more and the dung was distinctly better made.

Sterilisation of Soil (*Jour. d'Agric. Prat.*, April 23rd, 1914).—Experiments at the *Ecole nationale d'Agriculture de Rennes* in 1912 and 1913 have shown that yields of crops may be doubled in some cases by the addition of certain antiseptics to the soil.

In trials with white mustard in boxes in 1912 toluene, carbon disulphide, formaldehyde and tar gave appreciable increases in yield, while baryta, naphthol and creosote proved harmful. With barley in boxes various antiseptics proved beneficial in the following order: toluene, carbon disulphide, formol, chloroform and tar. Phenic acid proved beneficial in very small doses only.

Similar results were obtained from field experiments with mustard, except that copper sulphate which was harmful in the box experiments was beneficial in the field. Barley in the field was shown to be very susceptible to such antiseptics (with the exception of toluene) as are only beneficial in small doses.

In field trials in 1913 the effect of raising the doses of antiseptics to 50 cc. per sq. metre in the case of liquids and to 5 grammes per sq. metre in the case of solids was tested. These amounts proved harmful in the case of all antiseptics except sulphur and permanganate of potash. Toluene, carbon disulphide and formol were beneficial when applied in amount up to 10 cc. per sq. metre. Tar was effective in small amounts (1 cc. per sq. metre). The effect of sulphur was proportional to the amount used, while permanganate of potash was very effective even in the dose of 5 grammes per sq. metre.

Experiments with New Nitrogenous Manures (*Landw. Versuchs-Stationen*, Band 84, Heft. 1 and 2).—During the last six years a large number of experiments have been conducted at Harleshausen

Experiment Station to ascertain the value of some new nitrogenous manures, among them being calcium cyanamide, nitrate of lime, liquid manure, Schlösing nitrate, Burkheiser salts and Galalith. Schlösing nitrate differs from nitrate of lime in its content of free lime; Burkheiser salts are obtained as a by-product in the Burkheiser process for the purification of gas; and Galalith is a residue from the manufacture of casein into substitutes for horn, ivory, etc. As Galalith shares to some extent the hardness and elasticity of the finished product, it is at present distributed with some difficulty, and had to be powdered in these experiments.

The manures mentioned were compared with sulphate of ammonia and nitrate of soda, especially in regard to the time and manner of application.

Of the results obtained from the experiments the following may be noticed. The utilisation of the nitrogen of ammonium sulphate was equal to that of the nitrate of soda. The former produced the better effects if applied deeply or in the autumn, but the reverse was the case with shallow applications or in the spring. The nitrogen of ammonium sulphate was utilised to a greater extent on loamy than on sandy soils, except when applied as a top dressing to barley.

Nitrate of lime was rather less effective than nitrate of soda, and it produced better results on sandy than loamy soils. Schlösing nitrate was about equal to nitrate of soda for spring wheat and barley.

Compared with nitrate of soda, calcium cyanamide was the more effective for barley when the two manures were applied deeply in the autumn; but when applied in the autumn on the surface or in the spring either deeply or on the surface the nitrate had the advantage. The nitrogen in calcium cyanamide was better utilised on loamy than on sandy soils.

The nitrogen in the liquid manure was better utilised when the manure was mixed with the soil than when applied as a top dressing. Burkheiser salts were not so effective as sulphate of ammonia when applied to buckwheat and mustard, but in a further experiment with barley they produced rather better results than nitrate of soda. Galalith showed good results on a loamy soil, but on a sandy soil it was much less effective. The nitrogen in Galalith is not so largely utilised as that in the nitrates, and a considerable portion remains to feed the succeeding crop.

The percentage of nitrogen in the crops was found to be increased by the application of nitrogenous manures.

Crop Residues (*Deutsche Landw. Presse*, Feb. 18th, 1914).—The results of previous investigations into the value of the residue left by crops had been inconsistent, the chief difficulty being to estimate accurately the value of the roots. The conductors of a new experiment considered that the only satisfactory course was to take into account the whole of the root. Their numerous researches into root development and the changes in root growth had provided them with the necessary material for formulating a ratio between the weight of the part of the plant above the ground and the weight of the root at the time the crop had reached maturity. Having ascertained the weight of the plant above the ground in an air-dried condition it was easy to obtain the relative figures for the root portion by using the established ratio. The portion of the stem which would represent the stubble

was then weighed after being air-dried and the result added to that obtained for the roots. The conclusion drawn from the experiments was that the value of the residues, especially as regards nitrogen, is not so high as is generally supposed.

The amounts of residue left by the different crops, together with the nitrogen contents, were found to be as follows:—

—	Total residue in lb. per acre.	Nitrogen con- tents in lb. per acre.	Equal to Nitrate of Soda in lb. per acre.
Winter Rye	1,773	14.2	91
Winter Wheat	1,808	14.4	92
Oats	1,923	15.4	99
Barley	1,195	9.6	62
Beans	3,160	56.2	360
Red Clover—14 days after second cutting	1,795	41.0	263
Red Clover—after unhindered growth to middle of November of second year	5,756	157.8	1,011
Victoria Peas	918	15.5	99
Yellow Lupins	1,860	26.7	171
White Lupins	1,660	20.8	133

Effect of Manganese on Plant Growth (*Landw. Versuchs Stationen Bd. 83, Heft. 3 and 4*).—Previous pot culture experiments undertaken to test the effect of applications of manganese on oats and roots did not meet with results sufficiently definite to warrant any conclusions being drawn from them. The present experiments were therefore undertaken to obtain, if possible, more definite results and also to ascertain if any possibly harmful effects of manganese could be neutralised by an application at the same time of an easily soluble aluminium compound. The results of these experiments may be summarised as follows:—

1. Manganese salts produced a slight increase in the dry substance of the plant, chiefly as organic material;
2. The large quantities of manganese required to produce any considerable effect renders it highly doubtful whether its use as a manure is economically justifiable; and
3. It was not found that any harmful effect of manganese was removable by an application of aluminium salts.

Sulphur as Manure (*Landw. Versuchs-Stationen, Band 83, Heft. 5 and 6*).—The results of a number of experiments by other investigators had indicated that sulphur, by promoting nitrification, led to considerable increases in the yields of the different crops. The experiment under review failed to support this conclusion. Not only was there no increase in yield obtained after an application of sulphur, but there was no greater utilisation of the nitrogen in the soil. On the contrary, in both directions the plots receiving sulphur compared unfavourably with the control plots, but the difference was too small to justify any importance being attached to it. It was considered that the favourable results obtained from other experiments were due in some measure to insufficient provision against experimental error. The authors do not

deny that sulphur might be of considerable use in the treatment of fungoid diseases.

FIELD CROPS.

Experiments with Oats and Barley (*Jour. Roy. Agric. Soc., 1913, Dr. J. A. Voelcker*).—The four varieties of oats, Banner, Abundance, Sensation and Sparrowbill, were tested at Woburn in 1913. Banner was markedly the best, producing 10 bushels more corn and 2 cwt. more straw per acre than the next best kind—Abundance. Sparrowbill, a New Zealand variety, was later in ripening than the other varieties and much inferior to them in yield.

A barley experiment at Woburn in 1913 had reference to the rate of seeding, the quantities tried being 6, 8, 10 and 12 pecks per acre of "Chevalier." The highest result was obtained from the thickest seeding, though the difference between the yields from the highest and lowest rate of seeding was only 2½ bushels of corn per acre. The greatest amount of straw was obtained with the thinnest seeding. The highest value was given to the corn from the thickest seeding.

Grass Seed Mixtures (*North of Scotland Coll. of Agric., Bull. 18; W. M. Findlay, N.D.A.*).—This bulletin reviews the work carried out from 1907–13 by the North of Scotland College of Agriculture with regard to different grass seed mixtures.

Trials with perennial rye-grass were carried out for several seasons, on all classes of soil, and at both high and low elevations. No direct relation was found between the weight of hay produced and the quantity of perennial rye-grass sown in the mixture, a small quantity producing nearly as much of this grass in the hay as a large quantity. This was due to the greater stocking power and to the stalks being bigger. When a large quantity of perennial rye-grass was used, the pasture, during the second and third years, was neither abundant nor prolonged, and weeds were encouraged. It is stated that 10 to 14 lb. per acre of this grass in the mixture is sufficient to fulfil the requirements for one year's hay and two years' pasture. It might be advantageous to use more than this quantity (1) on soils where it is practically impossible to get red clover to grow, or (2) if an early and plentiful bite of grass is wanted for sheep either during the first winter or in the spring, or (3) where the tilth is bad.

With regard to the trials with Italian rye-grass it was found that neither a small nor large quantity in the mixture increased the hay crop. When the conditions suited it it competed too severely with red clovers; when the conditions did not suit it the quantity in the hay was very small. In all probability Italian rye-grass would be more useful where the field is pastured during the first year than where hay is made, as, when not allowed to go into ear, it lives longer and produces a large number of succulent leaf blades which seem to be preferred by animals to most of the other grasses; also, when eaten down it could not compete so severely with the other grasses in the mixture. Possibly the best use that Italian rye-grass can be put to, however, is to sow it either alone or as the predominant grass of a mixture for cutting green during the first summer. It can also be used as a catch crop after early potatoes.

The quantity of cocksfoot and timothy in both hay and pasture was increased by increasing the seeding (up to a certain point) and by reducing the quantity of perennial rye-grass. Cocksfoot, if sown in

small amount, especially along with a large quantity of perennial rye-grass is apt, particularly on good soils, to go readily into ear, and to form unsightly tufts, which are often neglected by stock; whereas, when larger quantities are sown, and also if the quantity of perennial rye-grass is comparatively small, the plants will form a larger proportion of leaf blades, and will be better eaten by stock.

From the results obtained with meadow fescue it is concluded that the reasons why this grass is so rarely seen in pastures in the north-east of Scotland, even though fairly large quantities of seed may have been used in the mixture, are that in the first year it is not able to compete with the quick-growing rye-grasses, nor in the second and third years with cocksfoot and timothy.

Tall oat-grass tended to increase the hay crop, but was not a success in the pasture.

Crested dogtail was present in small quantities in the first and second seasons, but increased considerably by the third. Cattle, however, did not relish the herbage on the plots where it was included.

Late flowering red clover produced more hay than any other kind, but tended to suppress the grasses.

On land where white clover did not grow naturally, wild white clover was much superior to ordinary white.

In trials carried out from 1909-1912 good results were obtained from Elliot's mixture, but many of the ingredients could with advantage have been omitted.

The following mixtures are recommended for the north-east of Scotland:—

	Medium Soils.	Light, Dry Soils.	Heavy Soils.	Peaty Soils.
Perennial Rye-grass ..	$\frac{1}{2}$ bushel.	$\frac{1}{2}$ bushel.	$\frac{1}{2}$ bushel.	10 lb.
Cocksfoot	6-7 lb.	8-12 lb.	7-8 lb.	5-6 "
Timothy	3-4 "	3 "	4-5 "	6-7 "
Late-flowering Red Clover ..	$1\frac{1}{2}$ "	2 "	1 "	2 "
Broad-leaved English Red Clover ..	2 "	2 "	2 "	—
Alsike Clover ..	1 "	—	1 "	1 "
Wild White Clover ..	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{1}{2}$ "	1 "
Kidney Vetch ..	—	1-2 "	—	—
Crested Dogtail ..	—	1 "	—	—
Rough-stalked Meadow Grass	—	—	1 "	1 "

Irish Flax Experiments, 1912 (*Jour. Dept. Agric. and Tech. Instr. for Ireland*, April, 1914).—*Manuring*.—The Department's experiments from 1901 to 1908 showed that good results are obtained from potassic manures, while phosphatic manures were a failure, as also was the application of agricultural salt. The results obtained in these years from the addition of a nitrogenous to a potassic manure were very irregular. From 1909 onwards, therefore, the effect of the addition of various quantities of sulphate of ammonia to muriate of potash has been tested, and opportunity has also been taken to experiment with steamed bone flour in place of the phosphatic manures which had previously proved failures.

Adverse results have been obtained from steamed bone flour in four successive years' (1909-12) experiments. As in the case of the other phosphatic manures tried this has been due to the encouragement of weeds to such an extent as seriously to impair the yield of the flax crop.

Muriate of potash, alone, in 1912 showed a small loss (an exceptional result), but there were substantial profits from adding sulphate of ammonia ($\frac{1}{4}$ and $\frac{1}{2}$ cwt. per acre) to the muriate of potash. Taking the four years 1909-12 the addition of sulphate of ammonia to muriate of potash has given an increased profit, generally speaking, in three years out of the four.

Liming.—Four plots, two at each of two farms, were limed early in 1911, and were cropped with oats. In 1912 the flax crop from these plots was compared with that from unlimed plots and the effect of 1 cwt. muriate of potash per acre was also tested both on limed and unlimed plots. The results of these preliminary trials indicate that liming the land one year in advance is of considerable benefit to the flax crop, and that muriate of potash forms a valuable supplemental dressing to lime.

Seed Trials.—Two kinds of Russian seed—viz., imported Pernau Crown, and Riga seed purchased in Ulster, and two kinds of Dutch seed, viz., imported Riga Child and a Dutch seed purchased in Ulster, were tested in 1912. Imported Dutch Riga Child gave the best results, while there was very little to choose between the other three varieties. A plot sown with Irish-saved seed was a partial failure owing to the defective germinating capacity of the seed. It is concluded from the results of this and previous experiments that the choice of the variety of flax seed to be sown should not be governed by the class of soil for which it is intended, but by the quality of the seed itself.

In another trial, two different brands of Pernau Crown seed gave, on the whole, better returns than seed from a stock carefully selected and grown on a farm in Russia for a number of years; and Dutch Riga Child gave results inferior to those from these first three varieties. Irish-saved seed from selected long stalks, and seed from an Irish-grown crop harvested at different stages of maturity, gave crops much below those from the imported Russian and Dutch seeds. The low monetary returns from Dutch Riga Child and the Irish seeds were probably largely due to the effect of the lodging of the crop of the former, and to the low germination of the seeds and the resulting poor brairds of the latter.

Growth of Maize as a Forage Crop (*Univ. Coll. of N. Wales, Bull. VI.*, 1913).—Seed was sown at the rate of 112 lb. per acre on $\frac{1}{4}$ acre plots at three centres in North Wales in 1913. At each centre considerable difficulty was experienced in preventing damage by birds, and at one centre the crop failed through the depredations of rats.

At the second centre the soil was a strong loam on a clay subsoil, the previous crop being wheat. The seed was sown with a turnip drill during the first week in June, in rows 26 in. apart. The land had received a heavy dressing of farmyard manure, together with 4 cwt. superphosphate and 4 cwt. kainit. In spite of the trouble from birds, a magnificent crop was obtained, some of the plants being over 6 ft. high. The horse-hoe was used three times and the hand-hoe once.

At the third centre the soil was a heavy loam and was manured with farmyard manure, the previous crop being oats. The maize was sown

with a corn drill. Germination was good, but dry weather and the prevalence of charlock checked subsequent growth. The crop, however, gave a good deal of useful fodder.

The experiments are taken to show that, under proper conditions, maize may prove a valuable crop in many districts in North Wales where a supply of succulent food is required in early autumn. The growth of the crop is limited by the fact that maize is easily affected by frost, but there was no damage from this cause during the experiment, although it is impossible to say that there is no danger of such damage in an average year.

Growth of Lucerne (*Univ. Coll. of N. Wales, Bull. VI., 1913*).—Since 1910 attempts to grow lucerne have been made at various centres throughout North Wales. Seed has been sown in various classes of soil, both with and without a covering corn crop; but, except in one or two cases, the lucerne has not been a success. In 1913 the effect on the crop of one ton of ground lime per acre, and of inoculation with soil from a field in which the crop had been grown successfully, was tested at several centres. In each case the lucerne was sown along with a corn crop, which was intended to be a light one; in some cases, however, too much seed was used and the lucerne suffered. At the time the report was published it was too soon to say whether the experiments in 1913 were more successful than previous trials.

Possible causes of the failure of the crop in the past have been the lack of nitrogen-fixing bacteria in the soil, and the wet climate of North Wales, this favouring the growth of weeds without correspondingly increasing the strength of the lucerne plant.

Varieties of Swedes (*Univ. of Leeds, Rept. No. 89*).—Twelve varieties of swedes were tested at the Manor Farm, Garforth, in 1913, on a medium loam soil, the previous crop being oats after wheat. The swedes were grown on the ridge and manured (per acre) with 10 tons dung in the row, 3 cwt. superphosphate and 1 cwt. steamed bone flour drilled with the seed, $\frac{1}{2}$ cwt. nitrate of soda sprinkled up the rows of young plants early in July, and $\frac{1}{2}$ cwt. nitrate of soda and 2 cwt. salt broadcast early in August. The swedes were drilled from May 14th to 17th at the rate of $3\frac{1}{2}$ lb. of seed to the acre.

The heaviest crops (viz., about 24 tons per acre,) were given by three bronzy-green topped varieties—Drummond's Improved, Garton's Model, and Kent and Drydon's Darlington. Then followed three purple-topped varieties—Webb's Masterpiece, Webb's New Buffalo and Sutton's Crimson King. Barnard's Golden Melon came next and was followed by Drummond's Extra Improved, Barnard's British Lion and Carter's Kangaroo.

The smallest crops (viz., about 19½ tons per acre,) were given by Driffields' Pioneer-Protector and Lund's Ajax, varieties which are claimed to resist finger-and-toe. There was no finger-and-toe on any of the plots at Garforth and trials were therefore carried out with these last two varieties and with the variety, British Lion, at another centre, on a loam soil subject to finger-and-toe. With the object of minimising loss from disease 15 cwt. ground lime per acre were applied a week before the swedes were sown. British Lion produced the best crop with the least finger-and-toe. Ajax and Pioneer-Protector did not justify their claim to be regarded as specially resistant to finger-and-toe. The failure of Pioneer-Protector as regards resistibility may have

been due to the unsatisfactory germinating capacity of the seed which resulted in the production of plants of low vitality.

The results of a variety trial carried out at a third centre on a stiff red loam soil agreed fairly closely with the Garforth results as regards the relative position of the different varieties, but Barnard's Golden Melon, Darlington and British Lion occupied higher positions, and Masterpiece a lower position than in the Garforth experiment. The varieties Pioneer-Protector and Ajax again gave the worst results.

Threshing Experiments (*Bulletin of Agric. Intell. and Plant Diseases, March, 1914*).—According to a writer in the *Maschinen Zeitung* there is less loss of grain when the sheaves are fed to the threshing machine sideways than when they are fed ears first. This conclusion was based on experiments with barley and a mixture of one-third barley and two-thirds oats. In both cases not only was the number of sheaves threshed greater when they were fed sideways, but the percentage of loss of grain was considerably less. With barley the loss was $\frac{1}{2}$ per cent. for sheaves fed sideways, and just under 2 per cent. when the sheaves were fed ears first. The corresponding percentages for the mixture of one-third barley and two-thirds oats were a little less than $\frac{1}{3}$ and $\frac{2}{3}$ per cent. respectively.

LIVE STOCK AND DAIRYING.

Manuring of Grass Land for Milk and Meat (*Harper Adams Agric. College, Report, 1913*).—In 1911 three plots of $3\frac{1}{2}$ acres each were fenced off in a poor field which had received no manure for some years, and had been grazed by stock. Each plot was drained and given a dressing of 15 cwt. ground limestone per acre. Plot I. then received $2\frac{1}{2}$ cwt. superphosphate per acre, and Plot II. $2\frac{1}{2}$ cwt. superphosphate and $\frac{1}{2}$ cwt. sulphate of potash per acre, while Plot III. received no manure. In February, 1912, the plots were again dressed with these manures, applied at the same rate, no limestone being given. Six cows and a number of bullocks had the run of the plots in 1912, and the financial returns from the milk and sale of the bullocks were given in this *Journal* for March, 1914.

In February, 1913, Plots I. and II. received the same dressing as previously, while Plot III. was left unmanured. On May 13th two cows were turned on to each plot, and on June 3rd two yearlings were put on Plots I. and II. in order to utilise the surplus herbage. On June 21st two more yearlings were put on Plots I. and II., and on July 1st two yearlings were put on Plot III. As the grass was consumed the yearlings were removed from the plots, and were put on again when increased growth of herbage took place. The milk cows on each plot received 2 lb. undecorticated cotton cake per head per day, but the other stock received no extra food. The experiment lasted for 20 weeks, and at the end it was found that the stock had been insufficient to consume all the herbage on the plots.

The yield of milk for the 20 weeks was, on Plot I., 851 gall.; Plot II., 885 gall.; and Plot III., 618 gall. The milk was valued at $5\frac{1}{2}$ d. per gall. during May, June and July, 6d. during August, and $6\frac{1}{2}$ d. during September. Plots I. and II. maintained four yearlings for 14 weeks and two yearlings for an additional three weeks and three days, while Plot III. maintained two yearlings for 13 weeks. Taking the average value of grazing such stock at 1s. 3d. per head per week, it will be seen that the amounts to be credited to each plot under this heading

are: Plots I. and II., £3 18s. 9d. each; Plot III., £1 12s. 6d. The total gain in weight made by the yearlings on Plot I. was 2 cwt. 2 qr. 17 lb., on Plot II. 3 cwt. 3 qr. 9 lb., and on Plot III. 2 qr. 14 lb. The results of the experiment may be summarised as follows:—

	Plot I.	Plot II.	Plot III.
	£ s. d.	£ s. d.	£ s. d.
Milk yield	20 6 7	21 4 3	14 13 8
Grazing (Yearlings)	3 18 9	3 18 9	1 12 6
Cost of manure	24 5 4	25 3 0	16 6 2
	1 5 6	2 5 2	—
Balance	22 19 10	22 17 10	16 6 2
Balance per acre	6 11 4	6 10 9	4 13 2

According to the above table the profit yielded by Plot I. was slightly more than that of Plot II., this being due to the higher cost of the manure applied to Plot II. If, however, account is taken of the fact that the yearlings on Plot II. gained about one-half as much again as those on Plot I. over an equal period, it will be found that Plot II. yielded the higher profit and repaid the increased expenditure on manure.

The Composition of Cheese made from Whole Milk (*Jour. Dept. of Agric. and Tech. Instr. for Ireland*, April, 1914).—Cheese, properly so-called, ought to be made from whole milk, and should contain as nearly as possible all the fat in the milk from which it was made. Investigations were undertaken to discover approximately what percentage of fat a whole milk cheese should contain, and to denote a limit below which this percentage should not fall.

Two classes of cheese were tested, Caerphilly and Cheddar. In each case a sample was taken of the whole milk from which the cheese was made, and this was immediately tested, as also was a sample of the corresponding "green" cheese; a second sample of the cheese was taken when "cured" and this was also tested.

In all 157 samples of milk, 168 of "green" cheese and 159 of "cured" cheese were tested, the milk and cheeses being obtained from various places in England and Ireland. The individual results are set out in the report, and show that in no case does the percentage of fat in the dry matter of the cheese fall below 47. In the Cheddar cheeses the highest and lowest percentages were 53.54 and 48.72 respectively in the "green," and 52.96 and 48.60 in the "cured," while for the Caerphilly cheeses the corresponding figures were 56.79 and 47.75 for the "green," and 57.15 and 47.11 for the "cured." The average percentage of fat in the dry matter of all the "green" cheese samples was 51.49 and of the "cured" 51.19, while that for all (327) samples was 51.33. It is recommended from these results that a percentage of 45 should be taken as the limit below which the fat in the dry matter of a genuine cheese should not fall.

Incidentally it was found that a gallon of milk gave respectively 1.3 lb. of "green" Caerphilly cheese, 1.239 lb. "cured" Caerphilly cheese, 1.056 lb. "green" Cheddar cheese and 1 lb. "cured" Cheddar cheese.

The Calcium and Phosphorus Supply of Farm Foods and their Relation to the Animal's Requirements (*Univ. of Wisconsin Agric. Expt. Sta., Research Bull. No. 30*).—Of the mineral substances needed by an animal, those of which the supply is most necessary are calcium and phosphorus. Grain is deficient in calcium but rich in phosphorus, so that when a growing animal is fed exclusively on grain the amount of calcium consumed will be dangerously low. Swine, when growing or breeding, if fed wholly on grain should receive an additional supply of calcium either as calcium carbonate, calcium phosphate or leguminous hay. Hays and straws vary widely in calcium content. Straws contain the least, while leguminous hays are very rich in calcium. Ruminants and horses consuming the usual hay and straw will ordinarily receive sufficient calcium for growth, especially when these foods have been grown on a soil rich in calcium. For continued and high milk production, with its extra drain of calcium, the supply of this substance may be dangerously low unless leguminous hays form a part of the ration or calcium is furnished in other forms. When grains form a liberal part of the ration the supply of phosphorus will be abundant under almost all conditions of animal life. From investigations carried out at the Wisconsin station the following conclusions were reached:—

The addition of calcium phosphate or calcium carbonate to grain rations in use in the Station increases the retention of both phosphorus and calcium by a growing pig, and results in the formation of a heavier "skeleton."

The relative efficiency of calcium carbonate and calcium phosphate in increasing the retention of phosphorus depends in a measure upon the amount of phosphorus present in the grain.

The addition of calcium carbonate to a grain ration increases the calcium and decreases the phosphorus in the urine.

The addition of calcium phosphate does not influence the amount of calcium and does not always influence the amount of phosphorus excreted in the urine.

Additional calcium supplied to growing swine increases the size of the shaft of the bone, but the length or rate of growth is not influenced.

High calcium rations, as compared with low calcium rations, have no effect whatever during a single gestation period on the size or calcium content of the "skeleton" of the foetus. The "skeleton" is not increased in any dimension by a wide variation in the amount of calcium fed to the mother.

Influence of Breed and Individuality on the Composition and Properties of Milk (*U.S. Dept. of Agric., Bureau of Animal Industry, Bull. 156*).—The data given in this bulletin show the influence of the breed and the individual upon the composition of the milk and upon the constants of the fat as shown by 11 cows, including three each of the Jersey, Holstein and Shorthorn breeds, and two of the Ayrshire breed. The cows were kept upon a uniform ration and the samples represent an entire lactation period for each. A compilation is also given which includes all complete analyses of the milk of pure bred animals for entire lactation periods published up to the present by American experiment stations.

The average percentage of total solids is highest with the Jersey and lowest with the Holstein. The fat content is 34.9 per cent. of the total solids with the Jersey breed and 28 per cent. with the Holsteins. The relation of the fat to the total solids is especially influenced by the

breed, and to some extent by the individual in the breed. The data corroborate the well-known facts regarding the variations in fat content due to breed.

The breed exerts a decided influence upon the protein content. A low average percentage of fat accompanies a low protein content, although the ratio is not constant. The milk of breeds such as the Jersey, yielding a high percentage of fat also contains a high percentage of protein; it also shows a higher ratio of fat to protein.

The proportion of the total protein present as casein does not seem to bear any special relation to the breed.

The ratio of casein to the fat varies uniformly with the breed. The variation between the Ayrshire, Shorthorn and Holstein is slight, but the Jersey has more fat in proportion to the casein.

The sugar content of milk does not show much variation either with the breed or with the individual.

The data show the well-known breed characteristics regarding the size of the fat globules, those in the Jersey being the largest, followed in order by the Shorthorn, Ayrshire and Holstein.

Breed is apparently a factor having some influence on the Reichert-Meissl number, the highest figure being found with the Jersey, while the Holsteins showed somewhat lower figures.

The influence of breed is shown on the iodine number. The Holsteins and Shorthorns have a noticeably higher number than the Jersey, with the Ayrshire coming between.

Little influence due to breed or individuality can be observed with the saponification number.

The melting point of the fat shows no variation that may be attributed to breed and but little in relation to individual animals.

With the exception of the size of the fat globules, the fat constants are far less influenced by the breed and the individuality of the animals than by the stage of the lactation period. The food of the animal is probably a greater factor than breed or individuality in influencing the nature of the fat.

PLANT DISEASES.

Celery Leaf-Spot (*Jour. Dept. Agric. and Tech. Instr. for Ireland*, April, 1914).—A description of this disease of celery, together with directions as to spraying, is given in the Board's Leaflet No. 238. It has been established definitely as a result of investigations by the Irish Department of Agriculture that the disease is transmissible through the use of affected seed, but it has also been found that if such seed be steeped, previous to sowing, for a period of three hours either in a diluted solution of formaldehyde (1 part 40 per cent. formalin in 600 parts water) or in hydrogen peroxide, the fungus causing the disease is killed, the seeds are not injured and they produce healthy seedlings.

It is stated that a recent investigation in England showed that 50 per cent. of the samples of celery seed examined bore the disease. The recognition of the disease on the seed is, however, not an easy matter for the non-expert, and when it is not proposed to treat the seed as indicated, a guarantee should be obtained when buying the seed that it is free from the disease.

Investigations on Potato Diseases (*Jour. Dept. Agric. and Tech. Instr. for Ireland*, April, 1914. G. H. Pethybridge, Ph.D., B.Sc.).—**Potato Blight**.—To discover the best time of spraying for this disease (*Phytophthora infestans*) spraying was started at three distinct times,

designated as "early," "normal" and "late." The first spraying for "early" was carried out on June 28th, for "normal" or July 10th, and for "late" on July 25th. The "early" and "normal" plots were sprayed three times at intervals of twenty-one days, while the "late" plots received no third spraying, as the plants were practically all dead when the time for it arrived. The diminution in yield due to delaying the first spraying until as late as July 25th was most marked. At this date the blight was evident on the potato tops to an extent sufficiently well marked to be noticeable at a casual glance. The "normal" spraying produced a heavier yield of healthy tubers than the "early" spraying, owing to the fact that the blight was spreading at a date subsequent to the third spraying in the case of the "early" sprayed plots, while the third spraying on the "normal" plots protected these potatoes at this time. In this and previous experiments it was found that the best results were obtained from plots sprayed just before the advent of unfavourable weather.

On the average, in 1913, both a higher total yield and a lower percentage of blighted tubers were obtained by using Burgundy and Bordeaux mixtures made up with a two per cent. solution of copper sulphate and the requisite quantities of lime or soda as against such mixtures made with only one per cent. of copper sulphate.

From the available experimental evidence it seems not unreasonable to conclude that upward spraying (so that both leaf surfaces are reached by the spray) is more profitable than downward spraying (so that only the upper leaf surface is reached).

As the result of numerous experiments Burgundy mixture has proved to be, on the whole, slightly more efficient than Bordeaux mixture. The great advantage of soda over lime is that the mixture made with it is much less likely, if properly prepared, to contain particles of grit which choke the spraying nozzles.

The efficacy of dry spraying or dusting with a prepared powder as a substitute for spraying with the ordinary Burgundy or Bordeaux mixtures has been tested. It is concluded from experiments made in 1913 that the use of dry powders does not result in as large a crop of healthy tubers as is obtained when spraying is done in the ordinary way.

To test the physiological action of spraying mixtures resistant varieties of potatoes were sprayed, these showing no disease during the season. From the average results it cannot be said that spraying had any decided influence either in increasing or diminishing the yield.

From laboratory investigations it would appear that although the fungus is capable of producing its resting spores when grown artificially in pure culture, it does not do so under natural conditions on any part of the potato plant, and, therefore, resting spores can be of no practical significance in securing the recurrence of the blight season after season.

Stalk or Sclerotium Disease.—All experiments in spraying the plants with various fungicides having resulted in failure to control this disease (*Sclerotinia sclerotium*), attention has been devoted chiefly to investigating the relation between the virulence of the attack and the date of planting, and it has been established that the later the potatoes are planted the smaller is the number of plants which are attacked. As regards yield, the maximum was obtained from potatoes planted in mid-April in 1913 as compared with mid-May in 1912.

Corky Scab.—Among the varieties of potatoes tested not one has been found to show any distinct or constant tendency to resist *Spongospora subterranea*. It would appear, from an experiment in which a mixture of sulphate of ammonia and lime was applied to the land, that such treatment is capable of producing a very considerable reduction in the yield of affected tubers, but not sufficiently great to warrant its being adopted on a practical scale.

Pink Rot and Will.—During 1913 both non-sexual and sexually formed spores of *P. erythroseptica* were found in plenty on plants in the field, being present on all the underground parts of the potato plant. Resting spores of the fungus reach the soil from rotting tubers, stalks, rhizomes and roots, and the soil is the source from which plants become infected. It has been established that the fungus which causes pink rot of the tuber causes a disease of the potato plant as a whole. The disease only assumes a serious aspect on land which has borne a crop of potatoes for several seasons in succession, so that, to avoid the disease, potatoes should be grown only on land in proper rotation. There is no satisfactory evidence to show that the disease can be transmitted by the "seed" potatoes.

FORESTRY.

Effect of Source of Seed upon the Growth of Douglas Fir (*Forestry Quarterly*, Vol. xi., No. 4).—The climatic conditions of central Europe make it necessary for European foresters to be careful in the selection of the seed of Douglas fir; seed from the Pacific Coast form, while possessing rapidity of growth, cannot withstand severe winter frosts; and seed from the Rocky Mountain form, while possessing hardiness, is very slow in growth. Endeavours have, therefore, been made for a number of years to find seed which combines the good qualities of the two kinds.

Tests were carried out in Livonia, Russia, by Count von Berg with seed obtained by the United States Forest Service from various localities in Montana, New Mexico, Utah, Idaho, Colorado, Washington and California in 1909 and 1910.

The seedlings raised from the 1909 seed were much weaker and smaller than those from the 1910 seed. In the 1909 seed, that from the forests at Montezuma (Colorado), Carson (New Mexico), Rio Grande (Colorado) and San Isabel (Colorado) made the best growth, the height of the seedlings in inches being respectively 10-19, 9-14, 15-20, and 9-17.

The 1910 seed included two samples of the Pacific Coast form. The growth of seedlings from these was faster than that from any of the other kinds, but one suffered severely from cold and the other was nearly destroyed by frost during the second winter. The stem and branches of this type are long, but slender and crooked, causing them to suffer greatly from snow. Seedlings raised from seed from Chelan on the eastern slopes of the Cascade Mountains in Washington grew nearly as high as the seedlings from Pacific Coast seed, but stood upright and scarcely suffered at all from frost. Should these seedlings prove resistant to frost in future the variety would seem to be the best suited to Livonia. Seedlings from seed from Colville are very similar to seedlings from Chelan and though perhaps less vigorous in growth appear to be more hardy. The seedlings from Montana and Idaho seed showed a rather uniform growth and formed a transition type to those from Colorado and New Mexico seed.

MISCELLANEOUS.

The Cross-Inoculation of the Root Tubercle Bacteria of Leguminosæ (*Proc. Roy. Soc. Victoria*, Vol. 25 (N.S.) Pt. II., 1912. A. J. Ewart and Norman Thompson).—There is a difference of opinion as to whether inoculation can be carried out on any one plant by the bacteria from the root tubercles of that plant only, or whether this can be done from any other plant of the same genus or from any cultivated legume. The point is of economic importance since the growth of a leguminous crop in certain new sandy or heath soils will receive an impetus if soil from a field in which the same crop has been recently grown is scattered over the field in order to introduce the root nodule bacteria into the new soil. The discovery of the extent to which cross inoculation of the root tubercle bacteria of leguminosæ is possible would determine how far the soil from any one crop of legumes could be used for another crop of legumes.

It was of special interest to determine whether the bacteria from the root nodules of leguminosæ native to Victoria were able directly to infect the leguminosæ not native. The broad bean, kidney bean, field pea, soy bean, lucerne, black medick, red clover and hairy vetch were grown in pots, and in the case of the seeds of each of these plants inoculation was attempted with the root nodule contents from five native leguminous plants. One pot in each case was left untreated, so that there were 48 pots altogether. Although the experiment was repeated the results were entirely negative, no nodules being found on the roots of the inoculated plants (pots and soil were sterilised).

The failure of the experiment is ascribed to the fact that the specialised nature of the bacterial contents of the root nodules of native legumes prevented the inoculation of plants presenting dissimilar biological and nutritive conditions.

All nodule organisms are apparently forms of *Bacillus radicola*, but the bacteria best adapted for inoculating are those from the same host plant. In the case of plants so far removed from each other systematically or in physiological condition as in this experiment, the bacteria would need a long period of adaptation in which they might gradually merge into a more generalised condition.

When, however, bacteria from one plant are grown on nutrient gelatine media, they appear rapidly to develop more generalised infective powers. Thus, although peas and beans grown in water cultures and inoculated with bacteria taken directly from acacia tubercles failed to develop any root-tubercles, it was found possible readily to infect peas and to a less extent broad beans, grown both in water cultures and in sterilised soil, with bacteria from acacia tubercles isolated and cultivated on nutrient gelatine.

Effect of Size, &c., of Experimental Plot on Yield (*Mitt. der Deut. Landw. Gesell.*, 23rd May, 1914; Dr. Schneidewind).—A series of experiments, which will be continued over several years, was commenced in 1913 at Lauchstädt, to test the effect of the size of the experimental plot and the way in which it is laid out on the yield.

The plots were chosen on a very uniform field and were of three different sizes, viz., 9, 100 and 200 square metres (10.764, 119.6 and 239.2 square yards). In the case of the 9 square metres plots, 30 were laid out for treatment, each plot touching the next, while 20 were laid out with an unplanted border of about 31½ inches between each

The question of liability would, it is stated, not interfere with the relations between the credit societies and the joint stock banks, as it is the practice (in Ireland) for the bank to make advances on overdraft on the joint and several guarantee of some of the more substantial members in a society, and it would probably continue to require this security, whatever type of liability were adopted.

A brief outline is given of how an average "thrift and credit" society on a limited liability basis might be founded. "If, say, the sum of £1,200 would supply the normal credit requirements for reproductive purposes of the medium and small cultivators and other borrowers residing in the area covered by the operations of the society, the resources of the society might be constituted as follows: Assuming the membership of the society to be eighty, and that the nominal share capital is £500 (one hundred £5 shares being issued), each member would have at least one share, the balance of twenty shares being taken up by the better-off members. It is suggested that only 5s. per share be paid up, the outstanding capital remaining as a security for the solvency of the society.

"It should be noted that this reserve liability can be called upon only in the extreme case of the society's assets failing to meet its liabilities, and only to the extent found necessary to cover any such deficit in the assets.

"The paid-up capital would amount to £25. Taking the normal deposits of the society at £900, a bank overdraft of £275 would complete the required lending capital of £1,200. If $3\frac{1}{2}$ per cent. be paid on deposits, 4 per cent. on the overdraft, and if $6\frac{1}{4}$ per cent. be charged to borrowers—the capital being turned over once in the year—the society would pay out £41 in interest, and earn £75, thus making a profit for the year of £34."

The Committee recommend that in a limited liability society the members should take up shares in proportion, as far as possible, to their means. The amount borrowed from the society by any members should not be allowed to exceed £5 for each share held by him; this plan would offer a strong inducement to many members to increase their shareholding.

No matter what the number of shares held in a society, each member should, it is stated, possess only one vote, so as to avoid giving undue voting influence to the better-off members.

It is recommended that the total obligations incurred by a limited liability society to outside creditors should be strictly confined in amount, so as to bear a due relation to the total nominal liability of the members, allowance being made for possible failures to realise the security in the case of individual members.

Deposits in Credit Societies.—A most important cause of the insufficiency of agricultural credit has been the lack of deposits in credit societies. The failure of Irish credit societies to attract deposits compared with the signal success of Continental credit societies, is ascribed to (1) the competition of the Post Office Savings Banks, which offer Government security combined with secrecy; (2) the widespread reluctance of persons with savings to allow the fact to become known to their neighbours; (3) the distrust, in many instances, of the business aptitude of the society; and (4) the fact that funds could hitherto be

obtained in Ireland more cheaply and with less trouble from State Departments or joint stock banks than depositors.

One of the most important recommendations made by the Committee in the course of their Report is that a system of credit societies should be established under an Agricultural Credit Section of the Department of Agriculture (assisted by an Advisory Committee), with efficient methods of audit, inspection and supervision, combined with full local responsibility for the proper management of the societies, and there is little doubt that under such a scheme the confidence of depositors would be increasingly gained.

The Committee state that the rate of interest offered on deposits is not so influential a factor as security in attracting deposits. The interest should not in their opinion exceed $3\frac{1}{2}$ per cent., which would be higher than that offered by the Post Office Savings Banks, while not so high as that paid to the joint stock banks for advances on overdraft.

Trading Powers and Credit Societies.—During the last few years some attention has been directed to the question of the desirability or otherwise of conferring upon agricultural credit societies in Great Britain and Ireland the trading powers which, to a considerable extent, are possessed by similar societies on the Continent, more especially in Germany. The matter is fully discussed in the Report, and the conclusion is reached that generally the supply of agricultural requirements and the sale of agricultural produce are matters best dealt with by a society separate from the credit society. The principal grounds on which the conclusion is based are that the qualifications required for satisfactorily filling the position of secretary to a trading society are in many respects different from those required in the secretary of a credit society. A trading society, too, can, as a rule, more profitably operate in a larger area than that covered by a credit society. There would undoubtedly be considerable difficulty in keeping the banking and trading accounts and funds of a single society separate; in addition there would be the temptation to a secretary to devote himself to that portion of the work which proved the more profitable financially.

Loans made by Credit Societies.—The practice of agricultural credit societies of renewing loans is greatly deprecated by the Committee. To guard against this, they suggest that an interval of a month might, with advantage, be insisted on between the repayment of a loan and the making of a fresh loan to the same borrower. The main safeguard, however, against renewals should be the insistence upon the punctual repayment of loans.

The necessity for great secrecy on the part of the committee of an agricultural credit society in respect of loans is strongly emphasized.

As regards the term of the loan the Committee think the arrangement at present in force in Ireland, viz., repayment within a year, unless the loan be made repayable by regular instalments of equal amount, satisfactory, except that in the latter event a maximum of three years should be imposed. As regards the amount of the loan no change is recommended in the present maximum of £50.

The question of adequate security for a loan is of the utmost importance, and the Committee think that, save in exceptional cases, it should be insisted that the borrower furnish two approved sureties. Mortgage security, it is stated, is unsuited in several respects for the financial arrangements of a credit society and may lead to injurious

results. (This recommendation seems to have been made as a result of the recent disastrous failures of credit societies in Hesse, due partly to these small societies tying up their funds in mortgage security and unwise speculation in real property.)

The adoption of the current account or overdraft system in the making of advances by credit societies in Ireland to members is not recommended. In the Committee's opinion the safest course is that each loan should be of definite amount, for a definite period, and for a definite purpose to be approved of in each case by the Committee of the society.

Wherever possible, it is thought that payment of loans should be made to borrowers by cheque upon the joint stock bank where the society has its current account.

The recommendation as to the rate of interest on loans is that this should be normally $6\frac{1}{4}$ per cent. per annum ($= 1\frac{1}{4}$ d. per £1 per month), this rate to be reconsidered by the society when the reserve fund reaches £300 or one-fourth of the deposits.

The Inadvisability of Advances to Credit Societies from State Funds.—A more than usually interesting section of the Report under notice is devoted to a consideration of the advisability of aiding credit societies by advances from State funds.

The experience of other countries in this connection is taken to prove that while much can be accomplished by a well-organised administration of State financial aid to co-operative credit, there are many drawbacks attached to any system which tends to an undue dependence upon State funds too easily obtained as a source of capital, and leads to a consequent weakening of the spirit of self-help.

In Ireland a comparatively large amount in State loans has been advanced directly to credit societies, the Department of Agriculture having lent over £18,500 for the purpose and the Congested Districts Board £7,000. In the year 1907, almost £19,000 of the funds of the societies consisted of State money, as compared with £17,000 in deposits. The position in 1911 was much more satisfactory, and it is recommended that the advances at present outstanding should be gradually withdrawn and the societies urged to secure as far as possible local deposits in lieu of the State loans thus withdrawn, and to arrange for bank overdrafts where such do not now exist.

The Inspection and Audit of Credit Societies.—If there was one aspect of the co-operative credit movement which impressed itself more than any other upon the attention of the Committee it was the paramount importance of an effective and regular system of inspection and audit of the societies. Without this, all efforts to establish the movement on a sound and lasting basis are, it is believed, foredoomed to failure. "The greater the original expectations created by the formation of numbers of rural societies, the greater will be the disappointment due to their inevitable collapse if they are not subjected periodically to the supervision and inspection—stringent but sympathetic—of some outside and independent authority."

The remarkable success of the Co-operative Credit movement in Germany and other countries has been largely due to the exceedingly effective methods of audit and supervision adopted, the State assuming considerable responsibility in these countries for seeing that effective audit arrangements are in force.

The Committee therefore recommend the abolition of the option given to a credit society under the Friendly Societies Acts of choosing two persons to act as auditors, and that it should be definitely provided that only the services of public auditors should be employed. They recommend further that all annual audits should take place at the office of the society, when the auditor would be in a position to receive any necessary explanations from the secretary and the committee, while these latter in turn would benefit by any advice the auditor might think it desirable to give. The State itself, it is stated, should not directly carry out the audit, but should defray, in whole or in part, the cost of an annual audit by public auditors. This assistance should be given only in the case of those smaller societies whose profits do not admit of their defraying such expenditure from their own funds. Such audit should, to avoid expense and loss of time, be carried out, when feasible, by auditors for specified areas.

The proposed Agricultural Credit Section of the Irish Department of Agriculture would be responsible for the periodical inspection of all affiliated credit and loan fund societies and for suitable arrangements for audit by public auditors.

The Committee propose to associate the county committees of agriculture in Ireland with the organisation of rural credit in their sphere of operation, and also to make use of the itinerant instructors in agriculture (or, where not feasible, special instructors) for establishing credit societies.

Up to about three years ago the application of co-operative principles to the marketing of eggs in Canada was comparatively unknown.

During the past year or so, however, the Co-operative Marketing movement has been largely developed, and of Eggs in Canada. "egg circles" are now familiar institutions in many of the provinces, particularly in Ontario, Quebec and Prince Edward Island.

In Ontario Province there are at present some twenty circles. Nine of the circles are in Ontario county and these exported during the thirteen months, December 1st, 1912, to December 31st, 1913, eggs to the value of over £7,300. The advantage of co-operation is well shown by the fact that the average price of eggs paid to the circles was $\frac{1}{4}$ d. per dozen more than that paid to poultry-keepers by the local stores.

In Prince Edward Island co-operative marketing of eggs is the most important form of agricultural co-operation in the Province. The rapidity with which the movement has developed is striking. Although the first egg circle was not formed until March 20th, 1913, there were nineteen circles in active operation on March 20th, 1914. These circles have a membership of 1,220 and they have so far disposed of over 175,000 dozen eggs. Fifty-two more circles are in process of formation and most of these are only awaiting the necessary outfit to commence work. Many of the circles have been formed in isolated districts and it has been found desirable to promote a central association to organise the work throughout the Province. This Association is known as the Prince Edward Island Co-operative Egg and Poultry Association, and the Act of incorporation describes as one of its principal objects to engage "in such commercial enterprises as may be deemed advisable to facilitate the more profitable production and disposal of the produce

of individual circles." The Association is further to encourage the production and marketing of eggs and poultry as well as the purchasing, breeding and distribution of improved strains of high producing stock.

The Act also provides that the members are to be grouped into separate egg circles, each of which is given a number. The individual members in each circle are also to be designated by a number. The stamp used by the Association is to consist of a double lined circle with the letters "P.E.I." printed at the top and in the centre two numbers, the lower one to be the number of the circle and the upper one that of the individual in the circle. The Association may lend stamps to the members, but the latter must return them if they fail to use them in accordance with the regulations.

The local circles are semi-independent and can amend their own constitution and by-laws, subject to the approval of the central Association. They may be represented at each meeting of the Association by two delegates. The board of directors of the central Association may employ a business manager, who himself must not be a director, and who is to have charge of the collection and sale of the eggs and apportion the returns among the members. Every egg not intended for home use must be delivered to the Association duly stamped.

The superintendence of the work in the different provinces is undertaken by the Poultry Division of the Live Stock Branch of the Dominion Department of Agriculture, who co-operate with the Provincial Departments in designing the requisite legislative measures and generally do what they can to assist in making the movement a success.

The Division are at present engaged in planning a uniform system of stamping to take the place of the large number of different methods at present in use.

Although the Canadian egg circles have only been recently formed the beneficial effects of co-operation are already well in evidence. The price of eggs has been raised, the general standard of quality has improved and greater attention is paid to proper breeding and feeding (*The Agricultural Gazette of Canada*, May, 1914).

OFFICIAL NOTICES AND CIRCULARS.

SINCE the Tuberculosis Order of 1913 came into operation the Board of Agriculture and Fisheries have from time to time received representations as to its working, particularly as

Tuberculosis Order of 1914.

to (a) the difficulty in making valuations on the two bases and the inequitable compensation that often resulted therefrom, and (b) the advisability of all bovines obviously tuberculous being brought within the scope of the Order. To meet these points the Board have issued a new Tuberculosis Order, which came into operation on the 1st inst. The main alterations in the provisions of the earlier Order are as follows:—

"Emaciation due to tuberculosis" is throughout the Order substituted for "tuberculosis with emaciation."

Notification is required of any bovine suffering from a chronic cough and showing definite clinical signs of tuberculosis.

Owing to the difficulty experienced in making the two valuations previously required, it has been decided that only one valuation has now to be made, and that has to be the market value of the animal.

The scale of compensation has not been altered; but the amount payable will be different, as it is now based on the market value.

The Board have been authorised by the Treasury to refund to Local Authorities *three-fourths of the gross compensation* paid by them for animals slaughtered, in place of *one-half of the net compensation* as heretofore authorised. For this purpose surplus proceeds of salvage of carcasses, though payable to the owner, will not be treated as compensation.

The chief provisions of the new Order are given below.

Notice of Disease.—2.—(1) Every person having in his possession or under his charge—

- (i.) any cow which is, or appears to be, suffering from tuberculosis of the udder, indurated udder or other chronic disease of the udder; or
- (ii.) any bovine animal which is, or appears to be, suffering from tuberculous emaciation; or
- (iii.) any bovine animal which is suffering from a chronic cough and showing definite clinical signs of tuberculosis

shall without avoidable delay give information of the fact to a constable of the police force for the area wherein the animal is, or to an Inspector of the Local Authority.

Notification of Disease by Veterinary Surgeons.—3.—(1.) A veterinary surgeon or veterinary practitioner who in his private practice is employed to examine any bovine animal, and is of opinion that the animal is suffering from tuberculosis of the udder or tuberculous emaciation, or suffering from a chronic cough and showing definite clinical signs of tuberculosis, shall with all practicable speed give notice of the existence or suspected existence of such disease to an Inspector of the Local Authority.

(2.) A veterinary surgeon or veterinary practitioner who under and in accordance with this Article gives notice of the existence or suspected existence of disease to an Inspector of the Local Authority shall be entitled to receive from the Local Authority a fee of two shillings and sixpence for each notification.

(3.) Where two or more animals are examined by a veterinary surgeon or veterinary practitioner on the same premises and at the same time and are found to be diseased, one fee only shall be payable to him under this Article in respect of the notification of the existence or suspected existence of disease in such animals.

Examination of Animals, &c.—4.—(1.) The Local Authority shall in every case where, by reason of information received under the preceding Articles or otherwise, there is reasonable ground for supposing that on any premises in their District there is a cow which is suffering from chronic disease of the udder or giving tuberculous milk, or a bovine animal which is suffering from tuberculous emaciation or suffering from a chronic cough and showing definite clinical signs of tuberculosis, direct a Veterinary Inspector with all practicable speed to examine the diseased or suspected animal and any other bovine animals on such premises which the Veterinary Inspector considers it is desirable to examine to ascertain whether any cow on the premises is suffering from tuberculosis of the udder or giving tuberculous milk, or whether any bovine animal thereon is suffering from tuberculous emaciation or suffering from a chronic cough and showing definite clinical signs of

tuberculosis, and the Inspector may, with the previous consent in writing of the owner of the animal or of his agent, but not otherwise, apply the tuberculin test to any cow which the Inspector suspects of suffering from tuberculosis of the udder, or of giving tuberculous milk, or to any bovine animal which the Inspector suspects of suffering from tuberculous emaciation.

(2.) The Veterinary Inspector may at all reasonable hours enter on any part of the premises and examine any bovine animal thereon, and the Veterinary Inspector may require any cow on the premises to be milked in his presence, and may take samples of the milk, and the milk from any particular teat shall if he so require be kept separate, and separate samples thereof shall be furnished.

(3.) The Inspector may also take samples of the fæces or urine of any bovine animal on the premises, or of any abnormal discharge from any bovine animal thereon.

(4.) The occupier of the premises and the persons in his employment shall render such reasonable assistance to the Inspector as may be required for all or any of the purposes of this article, and any person refusing such assistance shall be deemed guilty of an offence against the Act of 1894.

(5.) The Veterinary Inspector shall as soon as possible send to the Local Authority a report showing the result of his examination and investigation. The Local Authority, if not themselves the Sanitary Authority, shall cause a copy of the report to be sent to that Authority if the report shows that any animal is suffering from tuberculosis of the udder or tuberculous emaciation, or giving tuberculous milk, or suffering from a chronic cough and showing definite clinical signs of tuberculosis.

(6.) If the report of the Inspector as to any animal does not show that it is suffering from tuberculosis of the udder or tuberculous emaciation, or giving tuberculous milk, or suffering from a chronic cough and showing definite clinical signs of tuberculosis, notice in writing shall forthwith be given by the Local Authority or an Inspector of the Local Authority, to the owner or person in charge thereof that the provisions of this Order relating to precautions to be adopted with respect to milk and detention and isolation of suspected animals have ceased to apply to the animal. A notice to the like effect may be given at any time by an Inspector or other officer of the Board acting under their directions.

Slaughter of Diseased Animals.—5.—(1.) Where the report of the Inspector under the preceding Article shows that there is an animal which is suffering from tuberculosis of the udder or tuberculous emaciation, or giving tuberculous milk, or suffering from a chronic cough and showing definite clinical signs of tuberculosis, the Local Authority shall with all practicable speed cause notice in writing (in the form set forth in the Schedule hereto* or to the like effect) to be given to the owner or person in charge of the animal and also to the Board, and cause the animal to be slaughtered; provided that if, before the slaughter is carried out, the owner of the animal, or any person on his behalf, gives notice in writing to the Local Authority, or to their Inspector or other officer directed to carry out such slaughter, that the owner objects to the animal being slaughtered under the provisions of this Order, it shall not be lawful for the Local Authority to cause the animal to be slaughtered without the special authority of the Board first obtained.

* Not here printed.

(2.) If the value of an animal proposed to be slaughtered, as agreed or certified under this Order, exceeds thirty pounds, the Local Authority shall not proceed with its slaughter unless so directed by the Board.

Valuation for Compensation.—6.—The market value of an animal shall before slaughter be determined for the purposes of this Order by agreement between the Local Authority and the owner of the animal, or if they shall fail so to agree, by a valuer appointed by the Local Authority and the owner or on the application of the Local Authority appointed by the Board, but in either case paid by the Local Authority, and such valuer shall give to the Local Authority and to the owner a certificate in writing of the said value.

Post-mortem Examination of Slaughtered Animals.—7.—(1.) In the case of every animal slaughtered by a Local Authority under this Order, the Local Authority shall cause the carcass, at the time of the slaughter or as soon as practicable thereafter to be examined by a Veterinary Inspector of the Local Authority, or (if so required by the owner or person in charge of the animal before it is slaughtered) by some other veterinary surgeon, who, failing agreement between the Local Authority and such owner or person, shall be nominated by the Board but paid by the Local Authority.

(2.) The Veterinary Inspector or other veterinary surgeon shall at the conclusion of his examination give to the Local Authority and to the owner or person in charge of the animal a certificate of the result of the examination in the Form set forth in the Schedule hereto* or to the like effect.

Compensation.—8.—(1.) If the Local Authority fail to carry out the examination required by the preceding Article, or if the certificate of such examination does not show that the animal was suffering from tuberculosis, the Local Authority shall, by way of compensation, pay to the owner thereof a sum equal to the market value of the animal, and a further sum of twenty shillings.

(2.) If the certificate of the examination shows that the animal was suffering from tuberculosis (not being advanced tuberculosis), the Local Authority shall, by way of compensation, pay to the owner a sum equal to three-fourths of the market value of the animal, or the sum of thirty shillings, whichever sum is the greater, after deducting from such sum one-half of their reasonable costs of any valuation of the animal by a valuer appointed by the Board, and of any examination of its carcass by a veterinary surgeon other than the Veterinary Inspector.

(3.) If the certificate of the examination shows that the animal was suffering from advanced tuberculosis, the Local Authority shall by the way of compensation, pay to the owner a sum equal to one-fourth of the market value of the animal, or the sum of thirty shillings, whichever sum is the greater, after deducting from such sum one-half of their costs of valuation and examination as in the preceding case.

(4.) For the purposes of this Order an animal slaughtered under this Order shall be deemed to have been suffering from advanced tuberculosis

(a) when there is miliary tuberculosis of both lungs;
(b) when tuberculous lesions are present on the pleura and peritoneum;

* Not here printed.

(c) when tuberculous lesions are present in the muscular system, or in the lymphatic glands, embedded in or between the muscles.

(5.) If in any case the sum received by the Local Authority on sale of a carcass of an animal slaughtered under this Order exceeds the amount paid for compensation to the owner of the animal, the Local Authority shall pay that excess to the owner, after deducting reasonable expenses.

Precautions to be adopted with respect to Milk, &c.—9.—(1.) The milk produced by any cow which is, or appears to be, suffering from chronic disease of the udder or tuberculous emaciation or is suffering from a chronic cough and showing definite clinical signs of tuberculosis, shall not be mixed with other milk until the cow has been examined by a Veterinary Inspector in accordance with the provisions of this Order, and until either three clear days after the examination have expired or the owner or person in charge thereof has been notified that this Article has ceased to apply to the cow; and all milk affected by this Article shall forthwith be boiled or otherwise sterilised, and any utensil in which such milk is placed before being so treated shall be thoroughly cleansed with boiling water before any other milk is placed therein. These provisions shall also apply to the milk of a cow in relation to which a notice of intended slaughter has been served from the date of the service of the notice until the slaughter of the animal.

(2.) A Local Authority, or a Veterinary Inspector on their behalf, may by written notice apply the provisions of this Article to the milk produced by any cow specified in the notice which is suspected of giving tuberculous milk and is examined under this Order, and such provisions shall apply accordingly.

Detention and Isolation of Suspected Animals.—10.—(1.) Every person having in his possession or under his charge any cow which is, or appears to be, suffering from chronic disease of the udder, or any bovine animal which is, or appears to be, suffering from tuberculous emaciation, or is suffering from a chronic cough and showing definite clinical signs of tuberculosis, shall keep the animal isolated as far as practicable from other bovine animals, and also keep the animal in his possession or under his charge, until the animal has been examined by a Veterinary Inspector in accordance with the provisions of this Order and the owner or person in charge thereof has been notified that this Article has ceased to apply to the animal.

(2.) A Local Authority, or a Veterinary Inspector on their behalf, may by written notice apply this Article to any bovine animal specified in the notice examined under this Order, and such Article shall apply accordingly.

Suspected Animals in Markets, Fairs, and Sales.—11.—(1.) In the case of

- (i.) any cow which is, or is suspected by a Veterinary Inspector to be, suffering from tuberculosis of the udder; or
- (ii.) any bovine animal which is, or is suspected by a Veterinary Inspector to be, suffering from tuberculous emaciation, or which in his opinion is suffering from a chronic cough and showing definite clinical signs of tuberculosis,

and which is exposed in a market, fairground, or saleyard, the Veterinary Inspector may, by notice served on the owner or person in charge of the animal, require it to be removed from the market, fairground, or saleyard to the premises from which it was brought thereto, or at the

option of the owner or person in charge to a slaughterhouse or other suitable premises specified in the notice, and thereupon the animal shall forthwith be removed by the owner or person in charge to those premises for the purpose of examination under the foregoing provisions of this Order or slaughter in the slaughterhouse.

(2.) Where the premises to which the animal is required under this Article to be moved are not in the same District as the market, fair-ground, or saleyard, the Inspector serving the notice shall forthwith send a copy of the notice to the Local Authority of the District in which the first-mentioned premises are situate.

Cleansing and Disinfection.—12. The occupier of any premises on which there has been a cow suffering from tuberculosis of the udder or giving tuberculous milk, or a bovine animal suffering from tuberculous emaciation, or suffering from a chronic cough and showing definite clinical signs of tuberculosis, shall if so required in writing by an Inspector of the Local Authority cleanse and disinfect at his own expense, and to the satisfaction of the Inspector, that part of any shed or other erection in which the animal has recently been placed or kept.

Reports to the Board.—13. Every Local Authority and their Inspectors and officers shall send and give to the Board such reports, returns, and information as to their proceedings under this Order as the Board require.

Extension of certain Sections of Diseases of Animals Act, 1894.—14. Tuberculosis shall be a disease for the purposes of the following sections of the Act of 1894 (namely):

Sections nineteen and twenty (*Slaughter in Disease and Compensation Generally*);

Section forty-three (*Police*);

Section forty-four (*General Administrative Provisions*);

and also for the purposes of all other sections of the said Act containing provisions relative to or consequent on the provisions of those sections and this Order, including such sections as relate to offences and legal proceedings.

Information to be given as to certain Animals or Animals in contact therewith.—15. Article 36 of the Animals (Transit and General) Order of 1912 (*Information to be given as to Diseased or Suspected Animals or Animals in contact therewith*) shall apply to

- (i.) any cow which is, or is suspected of, suffering from tuberculosis of the udder or giving tuberculous milk; and
- (ii.) any bovine animal which is, or is suspected of, suffering from tuberculous emaciation, or which is suffering from a chronic cough and showing definite clinical signs of tuberculosis.

Offences.—16. Every person who—

- (i.) fails to give the notice required by Article 2 or Article 3 of this Order; or
- (ii.) fails to comply with any provision of this Order relating to precautions to be adopted with respect to milk or relating to detention and isolation of animals; or
- (iii.) fails to comply with any notice directing removal of an animal from a market, fair-ground or saleyard; or
- (iv.) fails to cleanse or disinfect any erection which under this Order he is required to cleanse or disinfect,

shall, according to and in respect of his own acts and defaults, be deemed guilty of an offence against the Act of 1894.

The Order extends to England, Scotland and Wales, and came into operation on July 1st, 1914. The provisions of the Order are to be executed and enforced, except where otherwise provided, by the Local Authority.

The Tuberculosis Order of 1913 is revoked; but notices under that Order will have effect as notices under this Order, and in the case of an animal slaughtered before the commencement of this Order the compensation will be ascertained under the revoked Order.

THE Board of Agriculture and Fisheries propose to award the following Scholarships tenable for three years from October 1st next:—

Scholarships in Agricultural and Veterinary Science. Three Agricultural Science Scholarships of the value of £150 per annum open to students who have graduated with honours in Science at a British University. Candidates will be required to produce evidence of high proficiency in one of the sciences, chemistry, botany, zoology or physiology, and to give an undertaking that they will study one of these sciences in its applications to agriculture at institutions approved by the Board.

Two Veterinary Research Scholarships of the value of £150 per annum open to students who have obtained the diploma of the Royal College of Veterinary Surgeons. Scholars will be required to prosecute research in Veterinary Science in institutions approved by the Board.

Three Veterinary Scholarships of the value of £100 per annum open to students who have graduated with honours in science at a British University, and tenable for three years at a Veterinary College in the United Kingdom.

Applications for any of the foregoing scholarships must be made not later than July 17th on a form to be obtained on application from the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

No outbreak of foot-and-mouth-disease has been confirmed in any part of the United Kingdom since that in County Cork, Ireland, on June 2nd, referred to in the article in the *June Journal*. As mentioned in that article, the last case in Great Britain itself was confirmed on March 20th.

Foot-and-Mouth Disease. An Order was made by the Board on July 2nd, operating two days later, allowing cattle, sheep, goats, or swine brought from any port in Ireland—except from Cork, from which shipments are still prohibited—to be landed at any landing place in Great Britain under the normal Regulations, *i.e.*, subject to the examination of the animals in the landing place and to their detention for 10 hours therein. The movement of Irish animals into many districts in Great Britain is still, however, prohibited by Regulations made by the Local Authorities of the districts.

MISCELLANEOUS NOTES.

In the Board's Annual Report for the year 1913 on Sea Fisheries (Part I.) [Cd. 7449, price 1s. 1d.] attention is directed to the use of fish meal for feeding stock and poultry, and an account is given of a few of the experiments which have been carried out to test the comparative values of fish meal and other foods.

Fish Meal as a Feeding Stuff.

The development of the manufacture of fish meals progresses steadily, although the fish meal industry has at present to contend with a certain amount of prejudice—not, it would appear, wholly unfounded—against the feeding of fish products to stock and poultry, on the ground that this form of food imparts an unpleasant flavour to meat and milk, and in the case of poultry may have ill effects upon the birds themselves. On the other hand, the experiments referred to suggest that the judicious use of fish meal may produce highly satisfactory results if suitable meals are selected and careful attention is paid to the question of the proportion of fish meal relatively to other foods which should be administered. It would appear that the fish meals at present on the market vary greatly in quality, and it may be desirable that experiments should be conducted with a view to establishing a standard for this form of food. This is a question which might well engage the attention of those interested in the production and sale of fish meals.

It is only comparatively recently that waste fish in the form of fish meal has come into use for feeding purposes, although it has often been used in an unprepared state for feeding pigs. As a result of experiments which have been made in Germany and elsewhere it is stated that some 3 lb. per head per day of fish meal may be given with satisfactory results to fattening bullocks, and that in the case of dairy cows the use of fish meal will lead to increased production of milk without the risk of imparting an undesirable flavour to the milk, provided that no more than 2 lb. per head per day are given.

In the winters of 1911-12 and 1912-13 experiments were carried out at the Seale Hayne Agricultural College to test the value of fish meal as a food for pigs. The experiments have already been summarised in this *Journal* (June, 1913, p. 241), but they may be briefly referred to again. They seem to show that the addition of fish meal to other foods, in the proportion of some 16 to 22 per cent., will lead to a marked increase in the weight of the pigs so fed as compared with those fed on a diet containing no such meal. The pigs used for the experiment were fed on foods arranged in four series, the first consisting of maize and gram or Indian peas; the second consisting of these two foods with an admixture of fish meal; the third consisting of maize with wheat, oats and barley with an admixture of fish meal; and the fourth of the same foods with the omission of the fish meal.

So far as the experiments go it appears that the substitution of fish meal for a certain proportion of the food gives increased profits, amounting to 3s. 7½d., or 42 per cent., per pig in the case of series 2, and of 12s. 3d., or 94 per cent., per pig in the case of series 3, in spite of the higher actual cost of feeding. It is said that no complaint was made regarding the flavour of the pigs which were the subject of the experiments.

The following table shows the main details and results of the experiments:—

Period.	Series.	No. of Pigs.	Carcass Weight.		Food.		
			At Start.*	Increase.	Maize.	Fish Meal.	Other.
Jan. 11 to May 6, 1912.	1	4	lb.	lb.	lb.	lb.	lb.
	2	4	320	357	1,383	0	691†
Sept. 20, 1912, to Jan. 14, 1913	3	8	320	440	1,073	461	540†
		8	490	1,117	4,582	728	560‡
			520	848	5,198	0	672‡

Series.	Value of Food used.	Value of Pigs.		Profit.	
		At Start.	At End.	Total.	Per Pig.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	6 17 5	8 8 0	16 18 6	1 13 1	0 8 1½
2	8 4 6	8 8 0	19 0 0	2 7 0	0 11 9
3	19 14 6	13 10 0	43 7 3	10 2 9	1 5 4
4	17 6 8	13 16 11	36 8 5	5 4 10	0 13 1

Satisfactory results are understood to have been produced also from the feeding of fish meal to sheep and to poultry—both laying hens and fattening stock. It appears, however, to be necessary to exercise great caution in feeding poultry on fish meal, which should be given to them only in moderate quantities, attention being paid to the proportion of fish meal to other foods.

Undoubtedly great caution needs to be used in feeding fish meal to farm stock, for there is reason to suppose that an excessive diet of fish meal may create a disagreeable flavour in such meat as pork and possibly in other products, but the experiments seem to show that a judicious use of such meal may be productive of results which are wholly satisfactory.

In this connection the following quotation from the *Fishing Gazette* (New York, April 11th, 1914) is of interest:—

"Fish guano as a supplementary food for cattle, hogs and fowls is coming into more general use in Germany. The first tests in this article were made by H. Weiske as far back as 1873-74, when it was found that this class of feed increased the appetite and consequently the weight of the animal. Opinions of investigators seem to differ as to the influence of such feed on the taste of milk and butter. In *Die Futtermittel des Handels*, published by the Association of Agricultural Experimental Stations, it is stated that lard obtained from

* Carcass weight = 70 per cent. live weight.

† = gram or Indian peas.

‡ = home grown odd corn of wheat, oats and barley.

hogs fed with fish meal is absolutely free from odour of fish and that no fishy taste is noticeable.

"The general practice in feeding cattle, &c., with fish meal in Germany is to commence by giving the animal a small quantity in order to accustom it to the sharp odour and then increase the quantities to the following: Pigs are given 100 to 500 grammes (3.527 to 17.637 oz.) of fish meal per day, mixed with other materials, during the fattening season. Cattle receive 1 kilo. (2.2046 lb.) of fish meal for every 500 kilos. of their weight; sheep, 200 to 300 grammes per 100 kilos. of their weight. Fish meal is mixed with hay, chopped straw, turnips, groats of oats, and other fodder usually given to animals. Fish meal cakes manufactured from herrings, as marketed by the Aktien-Gesellschaft Delfin, a Swedish concern, contained 15 to 25 per cent. of wheat, bran or groats of oats and 75 to 85 per cent. of chopped herrings."

An account of some recent investigations by a German agricultural experiment station appeared in this *Journal* for April, 1914, p. 61.

DURING the year 1913 records were kept of cases of swine erysipelas which came to the notice of the veterinary officers of the Board in connection with inquiries into reported cases of swine fever, and for the first time it is possible to supply some definite information in relation to the prevalence of the former disease.

The records of these cases are given in the Report of the Chief Veterinary Officer of the Board for 1913 [Cd. 7423, price 2½d.], the counties and the months in which the cases occurred being shown.

It is to be noted that the figures of the total number of cases so obtained for the year 1913, viz., 1,795, refer only to outbreaks which were believed or suspected to be swine fever, and do not represent the total number of outbreaks, for many cases of a milder form are recognised by stockowners as something different from swine fever, and are not reported.

There is, however, positive evidence that the disease exists in at least 59 administrative counties in Great Britain, and it is interesting to observe that it exists as far north as the Orkneys, and as far south as Cornwall; in Cardigan on the west, and in Norfolk on the east.

The disease is prevalent in the eastern counties* of England from Essex to Yorkshire. This may be accounted for partly by the fact that these are great pig-keeping counties, and possibly because the bacillus has found a favourable soil in these counties for its existence outside the bodies of swine.

In examining the monthly incidence of this disease in Great Britain, it is interesting to note the steady rise in the number of cases in the summer months. This is probably due to the increase in the number of bacilli in the soil during the warmer months. The cases in the earlier and later parts of the year are due partly to the number of swine which died of verrucose endocarditis, a chronic form of the disease, which often follows an acute attack in the summer months, and leads to sudden death some months after apparent recovery.

The susceptibility of the different classes of swine is brought out in the following table:—

Class of Pig.	Total Number in Infected Herds.	Number Affected.*	Percentage Affected of the Total.
Boars	130	11	8.4
Sows	1,527	205	13.4
Unweaned Pigs	3,083	52	1.6
Fattening Pigs	7,944	1,574	19.8
Store Pigs	7,188	840	11.6
Total	19,872	2,682	13.4

That the percentage of fattening pigs attacked is considerably higher than that of any other class is in conformity with past experience and with the view generally held. The above table, however, also shows that the disease is not confined to fattening pigs, as is frequently stated. The percentage of stores attacked is high, while it is interesting to note that in all 52 unweaned pigs were affected.

In the following table the herds are classified according to the number of deaths known to have occurred in each herd (the cases diagnosed clinically by local veterinary inspectors are excluded—see footnote):—

Number of Infected Herds.	Average Number of Swine in each Herd.	Herds classified according to the Number of Deaths known to have occurred.												Outbreaks Diagnosed Clinically. No Deaths.
		One Death.	Two Deaths.	Three Deaths.	Four Deaths.	Five Deaths.	Six Deaths.	Seven Deaths.	Eight Deaths.	Nine Deaths.	Fourteen Deaths.	Seventeen Deaths.		
1,795	11.07	1,245	177	64	29	9	8	5	3	1	1	1		252

It will be seen that out of the total of 1,795 infected herds, only one pig per herd died of the disease, or was proved when slaughtered to be suffering from the disease, in 1,245 herds. This is partly accounted for by the smallness of the herds in this country, the average number of swine in each infected herd being 11.07. The death-rate, however, is high for the herds in which only one pig died, for many of these herds consisted of only one or two pigs, belonging to small owners.

Further, it is unsafe to argue from the fact that only one pig was known to die in each of 1,245 herds out of a total of 1,795 herds that the disease is unimportant in this respect to stockowners, as there are years in which the disease has assumed disastrous proportions in certain districts, as it did in the Chatteris District in 1905, when some hundreds of fat pigs perished of the disease. Stockowners should therefore treat outbreaks of the disease seriously, and seek professional

* This does not represent the full number of affected animals in infected herds, as no record is available of what occurred after the opinion was arrived at that swine fever did not exist in cases diagnosed clinically by local veterinary inspectors.

advice to devise the best means of preventing the disease spreading to their healthy stock, and the farm becoming permanently infected by the bacillus.

An account of the symptoms of swine erysipelas, together with methods of prevention and remedies, are given in the Board's Leaflet, No. 227, which may be obtained free of charge on application.

THE Tenth International Veterinary Congress will be held at the Central Hall, Westminster, London, S.W., from August 3rd to 8th, 1914. The official address of the organising committee is 10, Red Lion Square, London, W.C. The official programme recently issued by the committee gives the constitution of the honorary, organising,

executive and ladies' committees and also the permanent committee of the International Veterinary Congresses, together with a list of the subjects to be dealt with this year by the Congress and the bye-laws. The proceedings on each day from August 4th to August 7th consist of general meetings on each morning and sectional meetings on each afternoon. The subjects to be dealt with at the general meetings are foot-and-mouth disease; tuberculosis; epizootic abortion; public control of the production, distribution and sale of milk in the interests of the public health; and disinfection of waggons. The sectional meetings will deal with (1) veterinary science in relation to public health; (2) pathology and bacteriology—(a) Johne's disease, (b) bovine piroplasmiasis (European), (c) ultra-visible viruses, (d) distemper (etiology and vaccination); (3) epizootiology—(a) anthrax, (b) swine fever, (c) glanders, (d) sarcoptic mange of the horse; (4) veterinary medicine and surgery—(a) anaesthesia, (b) laminitis, (c) surgical treatment of roaring, (d) the use of drugs in the treatment of disease caused by nematode worms; (5) tropical diseases; and (6) zootechny.

The programme gives a list of the excursions arranged for delegates and members after the close of the Congress. Excursions will also be made during the sessions of the Congress.

Applications for membership should be addressed to the Hon. Secretary, Sir Stewart Stockman, 10, Red Lion Square, London, W.C. The amount of the subscription is:—Ordinary members, £1; extraordinary members, 10s.; ladies, 5s.

Importation of Cattle, etc., into Canada.—The Board of Agriculture and Fisheries have been officially informed that the importation of cattle, other ruminants, and swine into the Dominion of Canada is now permitted from Great Britain, provided that the importer obtains the necessary authority from the Department of Agriculture at Ottawa and observes certain conditions as regards the fodder used on the voyage.

Information regarding the official certificates which must accompany livestock exported from this country to Canada may be obtained from the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

Importation of Potatoes into Bermuda.—The importation of potatoes into Bermuda from Great Britain and Ireland was prohibited as from January 15th, 1914, by Regulations of April 22nd, 1914, made under the Potato Importation Act of 1914.

Importation of Gooseberry Plants into Norway.—A Royal Mandate of February 12th, 1914, prohibited the importation into Norway from abroad of gooseberry plants and parts, including fresh gooseberries, but empowered the Norwegian Department of Agriculture to grant exemption from the prohibition.

According to a circular of the Norwegian Department of Finance and Customs of April 30th, 1914, such exemption may be granted on condition that the application is accompanied by a certificate from a publicly appointed horticulturist in the country in question, to the effect that the nursery from which the plants are supplied either is free from mildew ("stikkelsbaerdraeberen") or has satisfactorily disinfected the plants before despatch.

The carriage of gooseberry plants, etc., in Norway, is at present, prohibited to the "Amts" of Finnmarken, Tromsø, Nordland, North Trondhjem, South Trondhjem, Romsdal and North Bergenhus, from all other parts of the country, unless special permission for such carriage be granted by the Department of Agriculture. As the prohibition of the carriage of gooseberry plants, etc., from the southern and some of the western parts of the country to the northern and the other western parts was issued by reason of the supposition that mildew does not occur in the above-mentioned northern and western "Amts," the Department of Agriculture state that applications for permission to import gooseberry plants from abroad to these "Amts" will likewise not be granted.

Importation of Animals into the United States.—The Board of Agriculture and Fisheries have been officially informed that the United States Government have resumed the issue of permits, for shipment on and after the 20th June, for the importation into the United States of cattle, sheep, and other ruminants, and swine from Great Britain.

The issue of such permits was suspended by the United States Government in consequence of the recent outbreaks of foot-and-mouth disease in this country.

All permits issued are subject to the approval of Dr. W. H. Wray, of "Maryland," Beaconsfield, Bucks, the representative of the United States Department of Agriculture in Great Britain. Only hay, fodder, or litter forwarded from the United States, or such material originating from the farms from which the animals are shipped, or of known origin in Great Britain and approved by Dr. Wray, will be allowed by the United States Government to accompany the animals, and the animals will not be permitted to be shipped on the same vessel with horses originating from the Continent of Europe. Horses from Great Britain can, however, be shipped on the same vessel as cattle, sheep, or other ruminants or swine from this country, subject to the origin of the fodder accompanying such horses being approved by Dr. Wray.

Losses of Live Stock from Disease in the United States.—The Bureau of Statistics of the United States Department of Agriculture has published estimates of the losses of live stock from diseases and exposure during the year 1913. (*United States Department of Agriculture, Farmers' Bulletin No. 590.*)

The losses of swine from disease in 1913 are estimated at 119 to every 1,000 pigs in the United States, these exceeding the heavy losses

in 1912 of 110 per 1,000, and the average yearly loss in the preceding 10 years of 54.9 per 1,000. Probably more than 90 per cent. of the loss in 1913 was due, it is stated, to swine fever. Reckoned in numbers, the loss of pigs in 1913 was 7,005,000 head, of a value of £15,200,000. On the basis that the average weight of a pig in the United States is 150 lb., the total live weight of these pigs would exceed 1,000,000,000 lb. from which about 800,000,000 lb. of dressed meat and lard would have been obtained. This amount would have been sufficient to furnish every family of the United States (average 4½ persons) with about 40 lb. If there had been no such loss, the increasing scarcity of meat in the United States would, it is stated, probably have been largely prevented.

The losses of cattle in 1913 are estimated at 19.8 per 1,000 from disease and 10.9 per 1,000 from exposure. The total losses per 1,000 from both disease and exposure, if applied to the estimated number and value of cattle, would indicate a loss of about 1,737,000 head, of a value of £14,294,000.

The losses of sheep in 1913 are estimated at about 21.7 per 1,000 from disease and at 21.0 per 1,000 from exposure, and these losses, if applied to the estimated number and value of sheep would indicate a loss of about 2,124,000 head, of a value of £1,788,000.

In the case of both cattle and sheep the losses in 1913 were below the normal.

Putting together the figures given above it will be seen that more than 10 per cent. of the total possible meat production of the United States is lost through disease, and that the yearly value of the meat food animals lost from disease and exposure approximates to £31,000,000.

Foreign and Colonial Legislation relating to Sales on Commission.—There are no special legislative enactments dealing expressly with the protection of growers consigning their produce to market for sale on commission. Provisions on the subject, however, appear in certain foreign and colonial laws dealing with such subjects as produce exchanges and markets, trade in agricultural products and contracts with commission agents. The laws in question are given below, with an indication of their principal provisions so far as these can be summarised. They are arranged under the following heads:—(1) Trade in agricultural produce; (2) Contracts with commission agents; and (3) Produce exchanges and markets.

(1) *Trade in Agricultural Produce.*—In two countries, Canada and Tunis, some attempt has been made to deal with the problem in legislation on trade in agricultural produce.

In Canada, an "Act respecting Grain," of April 1st, 1912 (*The Canada Gazette*, Supplement, April 27th, Ch. 32) enforces the licensing of grain commission merchants in the Western Inspection Division of Canada, and compels them to give a bond, with sufficient surety, to the effect that they will faithfully account and report to all growers consigning grain to them to be sold on commission, and pay them the proceeds of the sale, less commission and necessary and actual disbursements. Whenever a grain commission merchant sells all or a portion of any consignment he must, within 24 hours of such sale, make a report to the consignor, and forward to him a true statement of such sale, signed, and in a form prescribed by the Act, and to which vouchers for all charges and expenses must be attached. This statement must show (1) the part of the consignment sold; (2) the price received; (3) the date of sale; (4) the name of purchaser; (5) the

grade; (6) the amount of advance; (7) the terms and delivery of sale. If the consignor receives no remittance or report of the sale, or is dissatisfied with the report of sale, he may lodge a complaint with the authorities, and the production and inspection of the commission merchant's books, records and other memoranda of the sale can be officially ordered.

In *Tunis*, a "Décret portant interdiction du racolage des denrées alimentaires," of January 30th, 1913 (*Journal Officiel Tunisien*, N. 10, February 1st, 1913,) prohibits in public or open places outside the officially recognised markets, all irregular dealing in poultry, pigeons, tame rabbits, game, eggs, butter, fruit, vegetables, fish, cereals, animals, etc. This does not apply to the purchase of food for personal consumption, to sales by growers of their own produce on their own property, to sales by merchants and shop-keepers in their storehouses and shops, and, in towns, to hawkers licensed by the municipality.

(2) *Contracts with Commission Agents.*—In *Canada* (Ontario), an "Act respecting Contracts in relation to Goods in the Possession of Agents and Others," of March 19th, 1910 (*Statutes of Ontario*, 1910, Chapter 66, 10 Edw. VII) regulates (for the province of Ontario) contracts in respect of goods in the possession of commercial agents or other persons. The aim of this law, however, is rather to protect the rights of third parties than to protect the owners of the goods.

In *Russia*, a "Law of April 21st, relating to Contracts with Commission Agents" (May 4th, 1910, fasc. 69, No. 688) makes provisions which afford protection to a grower forwarding produce to a commission agent to be sold on commission. Under this law the commission agent is bound to carry out his commissions in the most advantageous manner for the consignor. The commission agent who has sold produce below the price indicated by the consignor must indemnify the latter to the extent of the difference, unless he is able to prove that it has not been possible to sell the goods at the price fixed, that the sale at the actual price obtained avoided greater losses, and that he had no time to ask for fresh instructions from the consignor.

The law deals with such questions as perishable, damaged, non-insured and lost goods, contains the important provision that goods in the hands of an agent, whether sent by the consignor or bought on his account, are considered to be the property of the consignor, even in the case of the bankruptcy of either, and states that the commission agent must duly inform the consignor of the sale effected on his behalf and furnish proper accounts. Accounts are held to be accepted by the consignor if he has raised no objection within three months of receipt.

Finally, it regulates the action to be taken in the case of death or legal incapacity of the consignor or of the commission agent.

(3) *Produce Exchanges and Markets.*—There are provisions in laws regulating produce exchanges and markets, which bear (to a small extent) on this subject in the case of Germany, Austria, Egypt, France and Rumania.

In *Germany*, a Law of May 8th, 1908, respecting Produce and other Exchanges, modifying the law of June 22nd, 1896 (*Reichsgesetzblatt*, 1908, p. 183) provides that before any class of goods or produce can be quoted at a produce exchange, the representatives of those interested in this particular commodity must be consulted. It prohibits dealings in "futures" in cereals or milling products, fixes penalties for so doing, and makes provision to prevent as far as possible any such dealings.

In *Austria*, a Law of January 4th, 1903, modifying and completing the law of April 1st, 1875, relating to the organisation of produce and other exchanges, regulates the working of agricultural produce exchanges and prohibits dealing in "futures" as regards grain and milling products.

In *Egypt*, Law No. 24, of November 8th, 1909, contains provisions respecting commercial exchanges and the regulations to be observed by brokers. It authorises, under certain conditions, dealings in "futures" and the settlement of accounts by the payment of "differences."

In *France*, Laws of July 13th, 1911, and February 27th, 1912, and Decree of June 21st, 1913, regulate the way in which brokers and commission agents are to carry on their business. The method of keeping records of purchases and sales is laid down and requires the public notification of the regulations in force in produce exchanges and markets as to ordinary transactions and dealings in "futures."

In *Rumania*, a Law of 11th June, 1913, and a Decree of 29th July, 1913, contain provisions regulating exchanges and corn and other markets and stipulate that chambers of commerce must, when required by the Government Department concerned, organise markets for cereals, goods and cattle in their districts. The markets are placed under the control of the chambers of commerce and industry, but their working is in the hands of a commission composed of three or more business men. In rural districts local agriculturists may also be appointed on the commission.

One of the chief duties of this commission is to exercise control over the commission agents carrying on business in the market, and for this purpose it has disciplinary power over those who infringe the market regulations.

THE *Bulletin of Agricultural and Commercial Statistics* for June, 1914, issued by the International Institute of Agriculture, gives the condition of cereals on June 1st, as follows

(100 being taken to represent the prospect of an average crop):—*Wheat*—Denmark, 105; Scotland, Ireland, Rumania, and Switzerland, 100; Luxemburg, 83; Netherlands, 99; Sweden, winter, 115, spring 105; Canada, winter 98, spring 100; United States, winter 115, spring 102; Japan, 105; Egypt, 95; Tunis, 40. *Rye*—Denmark, 103; Ireland, Rumania, and Canada, 100; Luxemburg, 85; Netherlands, 94; Sweden, 108; Switzerland, 95; United States, 104. *Barley*—Denmark, Scotland, Rumania, and Canada, 100; Ireland, 95; Luxemburg, 94; Netherlands, 90; Sweden, 108; Switzerland, 99; United States, 106; Japan, 110; Egypt, 99; Tunis, 40. *Oats*—Denmark and Scotland, 100; Ireland, 95; Luxemburg, 88; Netherlands, 98; Rumania, 110; Sweden, 103; Switzerland, 99; Canada, 99; United States, 101; Tunis, 50.

Forecasts of Production.—Estimates of the production of the 1913-14 crop in certain countries are given as follows:—*Wheat*—Belgium, 1,746,000 qr., a decrease of 5.4 per cent. as compared with 1912-13; Spain, 15,035,000 qr., an increase of 7.0 per cent.; Italy, winter wheat, 22,499,000 qr., a decrease of 16.0 per cent.; Russia in Europe (63 governments), winter wheat, 37,120,000 qr., an increase of 0.5 per cent.; India, 39,119,000 qr., a decrease of 14.0 per cent.; Japan, 2,980,000 qr., a decrease of 5.4 per cent. *Rye*—Belgium, 2,518,000 qr., a decrease of 3.9 per cent.; Spain, 3,384,000 qr., an increase of 3.9 per cent.; Italy,

620,000 qr., a decrease of 4.9 per cent.; Russia in Europe, winter rye, 108,766,000 qr., a decrease of 3.3 per cent. *Barley*—Belgium, 489,000 qr., a decrease of 3.3 per cent.; Spain, 8,841,000 qr., an increase of 7.2 per cent.; Italy, 1,102,000 qr., a decrease of 15.0 per cent.; Russia in Europe, winter barley, 1,071,000 qr., an increase of 14.2 per cent.; Japan, 12,328,000 qr., a decrease of 5.8 per cent. *Oats*—Belgium, 5,100,000 qr., an increase of 3.7 per cent.; Spain, 3,135,000 qr., an increase of 20.7 per cent.; Italy, 3,532,000 qr., a decrease of 20.8 per cent.

New Zealand.—Provisional figures for the cereal harvest in 1913-14 give the production of wheat as 675,000 qr., an increase of 4.3 per cent. as compared with 1912-13. The production of oats is estimated at 1,874,000 qr., a decrease of 23.7 per cent.

United States.—The Department of Agriculture estimate the yield of the cereals, from their condition on July 1st, as follows (in bushels and final 1913 figures in brackets):—Winter wheat, 655,000,000 (523,561,000); spring wheat, 275,000,000 (239,819,000); maize, 2,868,000,000 (2,446,988,000); oats, 1,201,000,000 (1,121,768,000); and barley, 211,000,000 (178,189,000). The condition of rye was 92.9 compared with 88.6 last year. The proportion of last years' wheat crop still on hand was 4.2 per cent. (*Dornbusch*, July 8th).

Canada.—A Bulletin, dated June 12th, issued by the Census and Statistics Office at Ottawa, states that the estimated area under wheat is 11,203,800 acres, or 188,800 acres more than in 1913, 10,230,500 acres (an increase of 185,500 acres) being spring sown; under oats, 10,811,000 acres (an increase of 377,000 acres); and under barley, 1,604,000 acres (a decrease of 9,000 acres). In Ontario and Quebec the condition of the grain crops is generally satisfactory, and in the West prospects are generally reported as favourable, though rain is wanted, especially in Manitoba and southern Alberta.

France.—The area under maize on June 1st was officially estimated at 1,140,942 acres, compared with 1,019,369 acres at the same date in 1913; under potatoes, 3,842,653 acres, compared with 3,678,991 acres; under sugar beet, 598,572 acres, compared with 571,657 acres; and under hops, 7,321 acres, compared with 7,054 acres. The condition of the crops was as follows (60 = fairly good, 80 = good):—Maize 69, potatoes 73, sugar beet 67, apples and pears for cider and perry (31,369 acres) 70 and hops 67. (*Journal Officiel*, June 16th.)

Hungary.—The official report of the 22nd June estimates the yield of wheat at 16,683,000 qr. compared with 18,913,000 qr. the final estimate of 1913, and that of rye at 5,947,000 qr. compared with 6,095,000 qr. Barley was good in 22 counties, average or average to good in 35 and below average or poor in 6 while oats were good in 16, average or average to good in 45 and below average in 2. In the chief maize growing districts the sowings were mostly vigorous and developing well. Potatoes were vigorous and healthy.

Fruit and Potatoes.—*Germany.*—H.M. Consul-General at Frankfurt-on-Maine, in a report, dated July 6th, gave the following information relating to the fruit crops of Germany, based upon information collected by the German Fruit Growers' Association at Eisenach.

Frosts in May caused damage in many districts more especially in Hesse, the valley of the Saale, lower Bavaria and Franconia, and in Silesia and Westphalia where, in places, very much damage had been done. Drought also had had an adverse effect in some provinces. On the whole apples were average to good but poor crops were expected in Rhineland and the Thuringian States. Pears were somewhat better than usual but less satisfactory than apples. Greengages and mirabelle

plums were mostly good, but average to good in Rhineland and Wurtemberg. Zwetschen plums were almost a failure in Thuringia, poor in the Province and Kingdom of Saxony, and had suffered severely from frosts and pests in lower Bavaria. In the Rhenish Palatinate, the Bavarian Palatinate, and the Bühl and Volkach districts, however, good crops were anticipated. Cherries varied considerably in the different provinces, but on the whole were about average. In the Province of Saxony and in the Palatinate and Hesse-Nassau the crop was good, but in lower Bavaria it had been badly damaged by frosts and pests and in many cases destroyed. Small fruit was good on the whole.

Holland.—H.M. Acting Consul-General at Rotterdam, in a report relating to the condition of crops on June 1st, stated that fruit did not promise to be abundant in Holland this year. Blossom was plentiful, but frosts, drought and, in some instances, pests had occasioned much damage. *Apples* were good in most districts of Guelderland, in Walcheren and in Zealand, moderate in the Upper Betuwe, the provinces of Limburg and Groningen and in the Westland, and fairly good in the south of Utrecht, around Nymegen and in North Brabant. *Pears* were moderate in the south and north of Limburg, South Beveland, in the Upper Betuwe and several other districts, and fairly good or very good elsewhere. *Plums* were fairly good in the Westland district, rather bad in the south of Limburg and mostly satisfactory elsewhere. *Grapes.*—In the Westland grapes under glass were good but those grown in the open were bad. Both crops were generally good elsewhere. *Early Potatoes* were fairly good in the Westland, the Upper Betuwe, in Limburg, Utrecht, Overijssel and in Guelderland (north of the Rhine), moderate in North Brabant, and good or very good elsewhere. *Beans* on the whole were good to very good. *Peas* were good almost everywhere.

France.—H.M. Consul-General at Paris in a report, dated June 18th, stated that the prospects for all kinds of plums and apricots were good, and a heavy crop might have been expected had it not been for the heavy rains of the last fortnight causing much fruit to fall. Prospects for apples and pears were fairly good.

H.M. Consul at Bordeaux in a report, dated June 19th, stated that the crop of Imperial plums or Prunes d'Ente in the Departments of Lot-et-Garonne, Lot, and Dordogne was expected to yield from 20,000 to 25,000 tons, according to the weather which might prevail up to the middle of August, when plums are gathered in. The yield last year was estimated at 5,500 to 6,000 tons.

United States.—H.M. Consul at Portland, Oregon, reported (June 16th) that the estimates of the probable apple crop, which were made early in the season, appeared to have been very much too large. Newtown blossomed heavily, but a large quantity of the young fruit had dropped from the trees. Spitzenbergs did not bloom so profusely, but they had set better than the Newtowns. Arkansas Blacks had also dropped from the trees to a great extent, and Winesaps were beginning to do the same. A great many apples were showing slight discoloration on the stem, which would probably mean further heavy falls, and it would be nearly the time of the apples going to market before an accurate estimate could be made. These conditions were

the results of an early spring followed by cold, wind and rain, which did not prevent the fruit setting, but caused it to fall afterwards.

The Department of Agriculture give the condition of apples on June 1st as 110.8 per cent. of the 10 years' average and that of pears as 104.7 per cent.

Hops.—*Germany*.—H.M. Acting Consul at Mannheim stated (June 28th) that in spite of the continual cold weather hops were thriving well and were of normal growth, so that the outlook was very satisfactory in his district.

United States.—H.M. Consul-General at San Francisco stated (June 3rd) that the area under hops in the Pacific States was about the same as last year, but that the yield would undoubtedly be considerably less.

Live Stock in France.—The *Journal Officiel* of June 6th gives the numbers of farm animals on December 31st, 1913, as follows (corresponding numbers in 1912 in brackets):—Horses under 3 years, 672,530 (684,550); total horses, 3,230,700 (3,222,140); mules, 192,570 (196,410); asses, 360,390 (358,660); rams over 1 year, 295,410 (297,570); ewes over 1 year, 9,334,840 (9,517,400); sheep over 1 year, 2,589,000 (2,652,640); lambs under 1 year, 3,993,780 (4,000,098); total sheep, 16,213,030 (16,467,700); bulls, 284,490 (283,670); oxen, 1,845,620 (1,844,790); cows, 7,807,560 (7,745,750); other cattle, one year and above, 2,855,780 (2,842,710); other cattle under 1 year, 2,013,930 (1,988,980); total cattle, 14,807,380 (14,705,900); boars, 38,550 (37,610); sows, 906,960 (894,380); fat pigs over 6 months, 2,808,230 (2,765,910); pigs under 6 months, 3,294,010 (3,205,850); total pigs, 7,047,750 (6,903,750); and goats, 1,453,230 (1,408,520).

THE Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on the 1st July state that June was

Agricultural Conditions in England and Wales on July 1st.

warm and dry, except for some heavy thunder rains which fell in different parts of the country. These rains were much needed, but were insufficient in the southern half of England, though in the counties north of the Wash and the Mersey the month was generally favourable for the crops. Heavy hailstorms in certain districts caused some damage to crops, but this was local and not general in character. The wheat crop is healthy and was coming into ear well at the end of June. The yield for the country as a whole is expected to be slightly above the average; crops in the extreme south are rather poor, but in the north-eastern counties they are very satisfactory. Both barley and oats have suffered from lack of sufficient moisture, especially where sown late, and they are short in the straw, especially oats. The yield of barley is expected to be above average in the north-east, but for the country as a whole the yield is expected to be somewhat under average. Oats have suffered to a still greater extent and are unsatisfactory in all but the northern counties, while in the south-east prospects are extremely poor. The outlook for beans is quite satisfactory in nearly all parts of England and Wales, though spring beans have not done well in some places; attacks of aphids are not often mentioned, and the general yield seems likely to be slightly above the average. Peas are

healthy and promising in the north-east, but in other counties the outlook for the crop is not so good, and over the whole country the yield will probably be somewhat deficient.

Potatoes are reported healthy and fairly promising. The yield of the early sorts has suffered from the May frosts, though many crops recovered partially in June. The main crop was generally in need of rain at the end of the month. While the outlook in Lincolnshire promises heavier crops than usual, the yield indicated for the country as a whole is rather less than the average.

The root crops have naturally suffered from want of sufficient rain, especially in the east and south-east. In some localities sowing of turnips and swedes had not been completed by the end of June, in other cases a good deal of resowing was needed owing to turnip fly. On the whole, a fairly good plant had been obtained in the northern counties and Lincolnshire, but elsewhere the crop was often thin and backward. Mangolds are also backward, as a rule, and frequently irregular in plant, and consequently only a poor yield is indicated at present. All roots were badly in need of rain.

In the southern half of the country haymaking made good progress in June; a good proportion of seeds' hay and some amount of meadow hay was carted in good condition, while in the south-east the work was nearly finished. In the northern counties haymaking had just commenced. Seeds' hay is in some localities proving lighter and in others heavier than anticipated last month, but the estimate for the whole country is slightly lower, being 12 per cent. below average. For the meadow crop the estimates show a more substantial reduction, and the yield, which last month promised to be relatively slightly better than that of seeds' hay, is now put at 15 per cent. below average.

The dry weather has caused pastures to become rather bare in all parts of the country, and rain was needed; in some instances live stock have been affected adversely, but, as a rule, all classes have done well in June.

The warm June weather has benefited the hops, and the bine has generally grown well, though it is now in need of rain. Aphis attacks have been general and, consequently, washing has been necessary, but the attacks have not been so severe as usual. In the south-eastern counties the crop may possibly be above the average, on present prospects, but in the western counties a yield slightly less than usual is anticipated. For the crop, as a whole, an average result is indicated.

Estimates of the fruit crops are reduced for all kinds except gooseberries and cherries, as the effects of the May frosts have been seen more clearly. Strawberries have been about an average crop on the whole. Raspberries and currants are now considered rather smaller crops than usual, but estimates for gooseberries are better and the crop is rather larger than usual. Apples and pears vary much in different districts, but on the whole are rather under average. Plums are quite average in Kent, though not so satisfactory for the country as a whole. Cherries are showing large crops in Kent, and fairly large in the country generally.

Summarising the returns, and expressing an average crop by 100, the condition of the crops on the 1st July indicated probable yields the condition of the crops on the 1st July indicated probable yields which may be denoted by the following percentages:—Wheat, 101, barley, 97; oats, 94; beans, 101; peas, 98; potatoes, 97; mangolds, 94; seeds' hay, 88; meadow hay, 85; hops, 100.

THE supply of agricultural labour in England and Wales during June was, according to statements in the Board's Monthly Agricultural Report (July 1st, 1914,) usually sufficient for requirements in the southern half of England, such shortage as was felt being local and not general. In the south-west of England, in Wales, and in the northern counties, however, a scarcity of men was more common. The labour conditions in the various counties were as follows:—

Northumberland, Durham, Cumberland, and Westmorland.—The supply of ordinary labour was about sufficient in Northumberland and Durham, but men for turnip hoeing were difficult to get in most parts of Durham. It was stated in east Durham that Irishmen who have usually been paid 13s. per acre for hoeing are this season receiving up to 17s. In Cumberland a great scarcity of labourers was reported. In the north-east young men of 18 to 22 years and servant girls were very scarce; in the south-west hardly any temporary labour was obtainable for the hay harvest and turnip hoeing. In south Westmorland men were fairly plentiful, but wages had kept high.

Lancashire and Cheshire.—In north Lancashire local labour was scarce and dear at the Whitsuntide hirings, but there was a plentiful supply of temporary Irish labour. Further south reports varied, five reporters stating that the supply was sufficient and six stating that it was deficient in their districts.

Yorkshire.—In the West Riding the supply of labour was fairly sufficient, except locally, but in the North Riding a scarcity of men for turnip hoeing was frequently reported, and in some districts of the East Riding men were scarce.

Shropshire and Stafford.—Labour was short in a number of districts, particularly for temporary work.

Derby, Nottingham, Leicester and Rutland.—Except in north-east and east Derby, south Leicester, and Rutland the supply of labour was deficient either as regards temporary or permanent men, but more frequently the latter.

Lincoln and Norfolk.—The supply was generally sufficient, though some local shortage was sometimes mentioned.

Suffolk, Cambridge and Huntingdon.—The supply of labour was sufficient for requirements. In north Cambridge the number of pickers available for fruit picking was in excess of the demand.

Bedford, Northampton and Warwick.—The supply of temporary labour was insufficient in one or two districts, and in other parts there were strikes of regular labourers. Wages were higher than last year in some cases.

Buckingham, Oxford and Berkshire.—Labour was fairly plentiful in all districts.

Worcester, Gloucester and Hereford.—The supply was generally sufficient, although temporary help was occasionally scarce, more especially in north-west Gloucester.

Cornwall, Devon and Somerset.—In several districts the supply of labour was equal to the demand, but more than half the reporters stated that there was a deficiency in their districts, especially in the case of temporary hands for haymaking and turnip hoeing.

Dorset, Wiltshire and Hampshire.—The supply was sufficient or plentiful throughout the division, but less labour was required than usual owing to the dry weather.

Surrey, Kent and Sussex.—As a rule the supply of both permanent and temporary labour was sufficient. In east-central Sussex, however, both classes were reported to be scarce, and in north-west Surrey, north-east Kent, and east Sussex temporary hands, mainly for fruit and pea picking, were difficult to obtain.

Essex, Hertford and Middlesex.—Except in north-west Essex, where many men were on strike, the supply of labour was sufficient for requirements in Essex and Middlesex. There was some shortage, however, in Hertford, wages having increased by 1s. to 2s. per week, as compared with last year, in north Hertford.

Wales.—Labour was short in a number of districts. Some increases of wages as compared with last year were reported

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on July 1st, 1914, certain diseases of animals existed in the countries specified:—

Austria (on June 17th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 906 Höfe infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period May 16th—31st).

Anthrax, Blackleg, Foot-and-Mouth Disease (6 outbreaks in 2 communes), Rabies.

Bulgaria (for the period June 14th—21st).

Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Denmark (month of May).

Anthrax, Glanders, Swine Erysipelas, Swine Fever.

France (for the period June 14th—20th).

Anthrax, Blackleg, Foot-and-Mouth Disease (16 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period June 1st—15th).

Foot-and-Mouth Disease (913 infected places in 318 parishes), Glanders and Farcy, Swine Fever.

Holland (month of May).

Anthrax, Foot-rot, Glanders, Swine Erysipelas.

Hungary (on June 3rd).

Anthrax, Dourine, Foot-and-Mouth Disease (total of 1,823 "cours" infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period June 15th—21st).

Anthrax, Blackleg, Foot-and-Mouth Disease (231 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period May 1st—15th).

Glanders and Farcy, Sheep-pox.

Norway (month of May).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period June 14th—21st).

Anthrax, Dourine, Foot-and-Mouth Disease (34,851 animals), Glanders and Farcy, Rabies, Sheep-pox, Sheep Scab, Swine Erysipelas, Swine Fever.

Russia (month of February).

Anthrax, Foot-and-Mouth Disease (18,635 animals in 409 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period May 9th—16th).

Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Spain (month of April).

Anthrax, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of May).

Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (for the period June 22nd—28th).

Anthrax, Blackleg, Foot-and-Mouth Disease (30 "étables" entailing 372 animals, of which 17 "étables" were declared infected during the period). Swine Fever.

The Weather in England during June.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
<i>Week ending June 6th:</i>	°F.	°F.	Inches.	Inches.		Hours.	Hours.
England, N.E. ...	52.5	+0.1	0.05	-0.38	2	4.7	-1.6
England, E. ...	53.4	-1.1	0.19	-0.27	3	5.7	-1.3
Midland Counties ...	54.2	-0.2	0.09	-0.41	2	4.2	-2.0
England, S.E. ...	54.7	-0.9	0.24	-0.22	2	6.3	-0.7
England, N.W. ...	52.5	-1.2	0.16	-0.34	2	4.7	-2.1
England, S.W. ...	55.0	+0.3	0.17	-0.31	2	5.6	-1.3
English Channel ...	56.3	+0.7	0.06	-0.44	1	7.8	-0.2
<i>Week ending June 13th:</i>							
England, N.E. ...	52.4	-1.1	1.73	+1.29	4	6.5	+0.3
England, E. ...	54.8	-0.6	1.10	+0.57	4	6.8	0.0
Midland Counties ...	54.1	-1.4	1.67	+1.19	4	6.0	-0.2
England, S.E. ...	55.9	-0.6	0.49	-0.01	3	7.9	+1.0
England, N.W. ...	54.1	-0.7	0.82	+0.35	4	5.8	-1.1
England, S.W. ...	54.8	-1.0	1.29	+0.79	5	5.4	-1.5
English Channel ...	54.8	-1.8	0.65	+0.21	4	5.2	-2.8
<i>Week ending June 20th:</i>							
England, N.E. ...	57.9	+3.5	0.50	+0.09	2	9.8	+3.6
England, E. ...	59.5	+3.4	0.29	-0.24	2	9.3	+2.8
Midland Counties ...	61.1	+4.9	0.16	-0.30	1	9.7	+3.7
England, S.E. ...	60.2	+3.0	0.26	-0.21	2	8.8	+2.1
England, N.W. ...	60.9	+5.2	0.35	-0.12	1	10.8	+4.1
England, S.W. ...	60.3	+3.8	0.36	-0.18	2	8.5	+1.6
English Channel ...	58.6	+1.2	0.31	-0.10	2	6.2	-1.9
<i>Week ending June 27th:</i>							
England, N.E. ...	57.7	+1.7	0.40	-0.02	2	7.8	+1.6
England, E. ...	58.9	+1.1	0.24	-0.19	2	8.9	+2.1
Midland Counties ...	58.2	+0.6	0.24	-0.24	2	8.7	+2.6
England, S.E. ...	59.1	+0.6	0.26	-0.14	2	10.1	+3.1
England, N.W. ...	56.0	-1.0	0.39	-0.19	3	7.2	+0.9
England, S.W. ...	56.8	-0.8	0.23	-0.31	2	7.7	+0.9
English Channel ...	58.2	-0.3	0.31	-0.10	3	7.9	-0.3

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in June and May, 1914.

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

Description.	JUNE.		MAY.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots ...	9 2	8 10	9 0	8 9
Herefords ...	9 4	8 7	9 0	8 6
Shorthorns ...	9 0	8 2	8 11	8 2
Devons ...	9 0	8 1	8 11	8 3
Welsh Runts ...	—	8 2	—	8 5
	per lb.*	per lb.*	per lb.*	per lb.*
Veal Calves ...	d. 9½	d. 8½	d. 10	d. 9
Sheep:—				
Downs ...	9½	8½	9½	8½
Longwools ...	8½	7½	8½	7½
Cheviots ...	10½	9½	10½	9½
Blackfaced ...	10	9½	10½	9½
Welsh ...	9½	8½	10½	9½
Cross-breds ...	9½	8½	9½	8½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs ...	7 3	6 10	7 6	7 0
Porkers ...	7 9	7 4	8 1	7 7
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	22 18	18 16	22 13	18 17
„ —Calvers ...	21 8	17 15	21 10	18 0
Other Breeds—In Milk ...	20 12	17 2	19 17	17 11
„ —Calvers ...	—	15 10	—	14 17
Calves for Rearing ...	2 17	2 4	2 15	2 3
Store Cattle:—				
Shorthorns—Yearlings ...	11 17	9 17	12 3	10 9
„ —Two-year-olds... ..	15 12	13 17	16 10	14 9
„ —Three-year-olds... ..	18 19	16 18	19 16	17 18
Herefords —Two-year-olds... ..	16 14	15 2	17 18	15 7
Devons— „	16 6	14 19	17 4	15 13
Welsh Runts— „	16 8	15 4	17 4	15 5
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	43 10	40 10	53 5	48 0
Store Pigs:—				
8 to 12 weeks old ...	26 1	20 6	27 6	21 5
12 to 16 weeks old ...	38 0	29 11	39 3	30 8

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS IN
ENGLAND in June, 1914.

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

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
BEEF:—		s. d.	s. d.	s. d.	s. d.	s. d.
English	1st	62 6	60 0	—	62 0	59 0
	2nd	57 6	57 0	—	59 6	56 0
Cow and Bull	1st	53 0	56 0	49 0	49 6	51 6
	2nd	47 0	51 6	44 6	45 0	46 6
Irish: Port Killed	1st	60 0	57 6	57 0	60 0	57 0
	2nd	55 6	56 6	53 6	57 0	53 0
Argentine Frozen—						
Hind Quarters	1st	44 6	44 6	44 6	42 6	44 6
Fore "	1st	35 6	35 0	35 0	33 0	35 0
Argentine Chilled—						
Hind Quarters	1st	52 0	51 6	50 0	52 0	50 0
Fore "	1st	35 6	35 0	32 0	33 6	33 0
Australian Frozen—						
Hind Quarters	1st	42 0	41 6	43 0	41 6	43 0
Fore "	1st	35 6	35 0	32 6	33 0	32 6
VEAL:—						
British	1st	74 6	74 0	81 6	76 0	79 6
	2nd	70 0	69 6	69 0	67 6	74 6
Foreign... ..	1st	—	70 0	—	79 6	—
MUTTON:—						
Scotch	1st	—	—	88 6	84 6	85 6
	2nd	—	—	84 0	77 6	81 0
English... ..	1st	76 6	78 0	79 6	77 0	77 6
	2nd	71 0	74 0	74 6	70 0	73 0
Irish: Port Killed	1st	—	—	76 6	—	73 6
	2nd	—	—	68 0	—	69 0
Argentine Frozen	1st	39 6	40 6	42 0	37 6	42 0
Australian "	1st	37 6	36 6	39 0	36 0	39 0
New Zealand "	1st	39 0	37 6	—	43 0	—
LAMB:—						
British	1st	87 6	98 0	87 0	90 6	88 6
	2nd	83 6	90 0	78 0	81 6	81 6
New Zealand	1st	60 6	60 0	57 0	60 6	57 0
Australian	1st	57 0	55 0	54 0	55 6	54 0
Argentine	1st	55 6	55 6	53 6	52 6	53 6
PORK:—						
British	1st	69 0	68 0	62 6	60 6	60 6
	2nd	64 6	65 6	56 0	55 0	56 0
Foreign... ..	1st	65 6	60 6	—	57 6	—

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 1912, 1913 and 1914.

Weeks ended (in 1914).	WHEAT.			BARLEY.			OATS.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Jan. 3 ...	s. d. 33 2	s. d. 30 5	s. d. 31 1	s. d. 33 3	s. d. 28 6	s. d. 26 2	s. d. 20 7	s. d. 19 10	s. d. 18 2
" 10 ...	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
" 17 ...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
" 24 ...	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
" 31 ...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb. 7 ...	34 0	31 0	31 0	33 2	28 10	26 7	21 4	20 1	18 9
" 14 ...	34 4	30 9	31 0	32 10	29 1	26 7	21 7	20 2	18 11
" 21 ...	34 6	30 11	31 0	32 8	28 8	26 7	21 9	20 7	18 11
" 28 ...	34 1	31 0	31 0	32 0	28 6	26 6	21 6	20 4	18 9
Mar. 7 ...	34 1	31 3	31 5	31 7	28 5	26 2	21 8	20 2	18 7
" 14 ...	34 0	31 1	31 6	31 2	27 11	26 0	21 9	19 11	18 6
" 21 ...	34 1	31 1	31 5	31 10	28 6	25 8	21 8	19 7	18 8
" 28 ...	34 4	31 3	31 4	30 3	27 6	25 7	21 8	19 7	18 5
Apr. 4 ...	34 10	31 4	31 6	30 9	27 0	25 6	21 11	19 2	18 4
" 11 ...	35 4	31 3	31 5	30 2	27 8	26 8	22 1	19 2	18 4
" 18 ...	36 7	31 6	31 7	29 11	26 11	25 4	22 4	19 3	18 5
" 25 ...	37 10	31 8	31 9	30 4	26 7	26 6	22 9	19 6	18 5
May 2 ...	38 1	32 2	31 9	30 2	25 11	25 6	23 7	19 6	18 9
" 9 ...	37 11	32 6	32 2	31 1	25 9	25 6	23 7	19 9	18 11
" 16 ...	37 8	32 10	32 7	31 2	25 4	26 3	23 7	19 11	19 0
" 23 ...	37 2	32 10	33 0	31 1	25 3	25 10	23 9	20 1	19 4
" 30 ...	36 10	32 7	33 9	30 0	26 1	26 1	24 0	19 8	19 4
June 6 ...	36 11	32 10	34 0	29 11	26 2	25 11	24 10	20 2	19 8
" 13 ...	37 0	32 8	34 1	30 8	24 7	24 11	24 0	19 8	19 0
" 20 ...	37 5	32 8	34 1	30 8	23 10	25 10	23 11	19 1	20 0
" 27 ...	37 10	32 8	34 3	30 2	24 3	25 4	23 11	21 0	19 9
July 4 ...	38 2	33 1	34 4	31 7	25 2	24 6	24 1	19 4	—
" 11 ...	38 3	33 4	—	30 2	25 10	—	24 8	20 5	—
" 18 ...	38 10	33 6	—	30 9	24 9	—	23 4	20 8	—
" 25 ...	38 9	33 10	—	30 9	24 1	—	22 2	20 3	—
Aug. 1 ...	38 4	34 1	—	28 6	24 5	—	22 4	19 0	—
" 8 ...	39 2	34 1	—	30 7	24 9	—	21 8	18 7	—
" 15 ...	38 2	34 3	—	28 3	24 7	—	20 10	18 8	—
" 22 ...	35 6	33 7	—	28 1	26 5	—	20 8	17 10	—
" 29 ...	34 10	32 7	—	28 6	29 0	—	21 8	17 8	—
Sept. 5 ...	35 1	31 11	—	29 9	30 11	—	20 5	18 0	—
" 12 ...	33 5	31 9	—	29 0	31 5	—	19 10	17 11	—
" 19 ...	32 7	31 7	—	29 6	30 9	—	19 5	17 9	—
" 26 ...	31 7	31 6	—	29 9	30 1	—	19 8	17 10	—
Oct. 3 ...	31 8	31 3	—	29 7	29 9	—	19 5	17 10	—
" 10 ...	31 10	31 0	—	30 4	29 1	—	19 9	17 9	—
" 17 ...	32 2	30 11	—	30 11	28 8	—	19 10	18 0	—
" 24 ...	33 1	30 7	—	31 6	28 7	—	20 1	17 9	—
" 31 ...	33 4	30 1	—	31 10	28 1	—	19 11	17 9	—
Nov. 7 ...	33 1	30 0	—	31 11	28 1	—	19 9	17 11	—
" 14 ...	32 10	30 1	—	31 2	27 8	—	19 11	18 1	—
" 21 ...	32 1	30 4	—	30 11	27 5	—	19 8	18 4	—
" 28 ...	31 9	30 9	—	30 8	27 0	—	19 6	18 4	—
Dec. 5 ...	31 0	31 2	—	29 11	26 8	—	19 3	18 6	—
" 12 ...	30 8	31 2	—	29 2	26 5	—	19 1	18 5	—
" 19 ...	30 7	31 2	—	28 11	25 11	—	19 2	18 4	—
" 26 ...	29 10	31 0	—	28 6	25 10	—	—	—	—

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.

AVERAGE PRICES of **Wheat, Barley, and Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and Breslau.

		WHEAT.		BARLEY.		OATS.	
		1913.	1914.	1913.	1914.	1913.	1914.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
France:	May	49 8	46 9	30 1	28 8	24 0	22 9
	June	48 10	47 6	29 11	28 10	23 9	23 1
Paris:	May	51 1	49 6	30 2	29 0	23 0	23 6
	June	49 11	48 0	30 8	28 8	23 5	24 3
Belgium:	April	35 3	32 8	29 11	25 2	22 9	20 7
	May	36 1	34 6	29 8	25 1	23 2	21 8
Berlin:	April	44 3	41 6	—	—	22 11	21 3
	May	44 8	44 4	—	—	22 11	22 11
Breslau:	April	38 5	38 9	26 8*	27 5*	20 10	20 0
	May	39 2	42 3	25 3†	23 11†	21 0	21 8

* Brewing.

† Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of June, 1913 and 1914.

		WHEAT.		BARLEY.		OATS.	
		1913.	1914.	1913.	1914.	1913.	1914.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London...	...	34 3	35 5	27 3	24 10	21 1	20 2
Norwich	...	33 8	34 1	24 2	24 9	17 9	18 11
Peterborough	...	31 3	33 5	23 6	22 2	17 8	19 1
Lincoln	...	32 0	34 5	—	23 3	19 11	20 4
Doncaster	...	31 4	34 0	—	28 2	19 9	19 8
Salisbury	...	32 3	33 2	24 1	22 4	20 6	19 8

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS IN ENGLAND in June, 1914.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British...	14 0	13 0	—	—	13 0	12 0
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
" Factory ...	111 0	107 0	108 0	105 0	110 6	106 6
Danish...	102 6	94 6	98 0	93 0	103 6	95 6
French...	—	—	118 0	114 0	116 6	114 0
Russian...	103 0	98 0	103 0	99 0	102 0	98 0
Australian...	107 0	103 0	106 0	103 0	108 0	104 0
New Zealand...	114 0	108 0	111 0	108 0	114 6	109 0
Argentine...	106 0	103 0	—	—	104 0	100 0
CHEESE:—						
British—						
Cheddar ...	83 0	77 0	82 0	78 0	69 6	63 6
Cheshire ...	—	—	120 lb.	120 lb.	120 lb.	120 lb.
Canadian ...	69 6	65 6	65 0	62 0	71 0	66 0
BACON:—						
Irish (Green) ...	75 6	71 6	74 0	67 0	77 0	73 0
Canadian (Green sides)	66 0	64 6	63 6	60 0	65 6	62 6
HAMS:—						
York (Dried or Smoked) ...	116 0	111 0	—	—	114 6	108 0
Irish (Dried or Smoked)	—	—	—	—	114 6	108 0
American (Green) (long cut) ...	73 6	70 0	73 0	70 0	75 6	71 6
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British...	9 9	—	—	—	10 7	9 9
Irish...	9 8	9 4	9 7	8 9	9 6	9 0
Danish...	—	—	9 8	9 0	10 7	9 3
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII. ...	91 0	78 6	—	—	95 0	85 0
Langworthy ...	—	—	75 0	70 0	95 0	85 0
Up-to-Date ...	76 0	61 6	61 6	56 6	87 6	80 0
HAY:—						
Clover ...	—	—	87 6	65 0	81 0	73 6
Meadow ...	—	—	—	—	71 0	64 6

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked
or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	JUNE.		SIX MONTHS ENDED JUNE.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	49	35	441	317
Animals attacked	53	38	471	342
Foot-and-Mouth Disease:—				
Outbreaks	—	—	11	—
Animals attacked	—	—	74	—
Glanders (including Farcy):—				
Outbreaks	11	14	51	88
Animals attacked	51	24	137	243
Parasitic Mange:—				
Outbreaks	123	157	1,391	1,659
Animals attacked	208	300	2,488	3,382
Sheep-Scab:—				
Outbreaks	3	1	147	121
Swine Fever:—				
Outbreaks	418	239	2,188	1,230
Swine Slaughtered as diseased or exposed to infection ...	4,645	2,544	22,571	17,037
Tuberculosis:—				
Number of Premises notified...	530	613	2,973	*—
Number of bovine animals notified as for slaughter ...	575	679	3,170	*—

* The Tuberculosis Order came into operation on 1st May, 1913.

IRELAND.

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

DISEASE.	JUNE.		SIX MONTHS ENDED JUNE.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Foot-and-Mouth Disease:—				
Outbreaks	1	—	75	—
Animals attacked	9	—	953	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	4	5	49	92
Sheep-Scab:—				
Outbreaks	11	31	347	319
Swine Fever:—				
Outbreaks	12	13	116	85
Swine Slaughtered as diseased or exposed to infection ...	129	73	642	509

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THE WORK OF THE ROTHAMSTED
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E. J. RUSSELL, D.Sc.

Director of the Station.

EVER since the Rothamsted Experimental Station started in 1843 its main business has been to work out the problems of crop production, and in doing so it has adapted itself to the agricultural conditions of the day so that its work should be of immediate value to those occupied in farming. In the old days, when corn growing was the central feature of British agriculture, the Rothamsted work could be applied direct on the farm, but the greater diversity and the closer specialisation of modern farming have altered matters, so that the Station now finds that its most useful sphere of action is to fit in with the scheme of the Board of Agriculture and Fisheries, and to devote itself to investigations for the purpose of obtaining knowledge that instructors can teach and county experts can use in their business of advising farmers.

The secrets of Nature are not lightly discovered, and can only be won by ordered and systematic investigations. Each of the Research Institutes that have been set up has to specialise, and to Rothamsted has been allotted the study of soil fertility and plant nutrition, for which its tradition and its equipment peculiarly fit it.

At one time it was taught that the fertility of the soil depended chiefly on the amount of plant food present, and that an increased fertility could be obtained simply by increasing the supply of plant food—in other words, by adding the necessary manures. Advice given on these lines so often turned out to be wrong that fuller investigations were made, and it was then discovered that soil fertility does not depend on one but on at least six factors: (1) the amount of plant food in the soil,

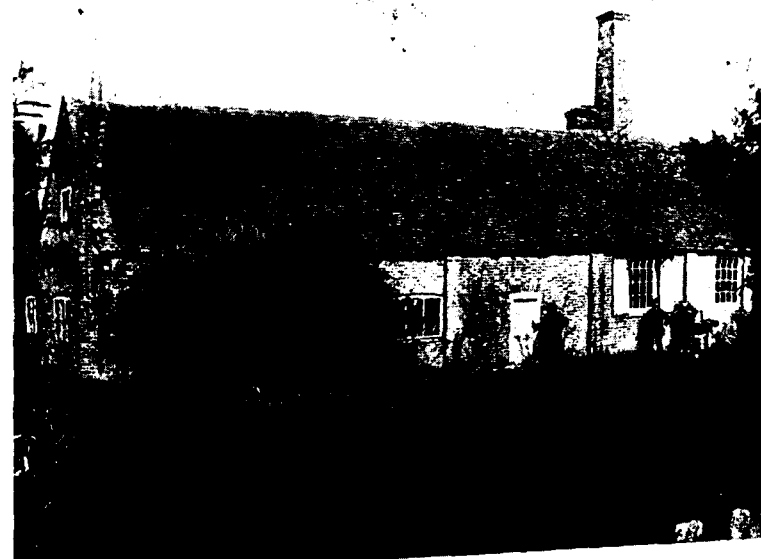
(2) the amount of water present, (3) the air supply, (4) the temperature, (5) sufficient space for root development, and (6) absence of injurious agents.

For the present, attention is concentrated on the first and last of these. Two methods have been adopted for studying the plant food in the soil: in one the crop is analysed to find what it has taken from the soil, and in the other the soil is studied to see what it can give up to the plant. It is necessary to utilise both methods, since we have to be certain (or as certain as we can be) that our results are correct, and the closer the check the better. Visitors to the Rothamsted laboratories will remember the imposing array of bottles round the walls; these contain samples of crops grown under known conditions and put up for analysis to see what they took from the soil.

Before the second method—the study of the soil—had been adopted very long it became obvious that the soil was much more complex than was originally supposed, and this complexity was impressed on the investigators by a very important discovery. It was found that the manures added to the soil are (with a few exceptions) not the food of plants, but have first to undergo a manufacturing process. Obviously, the value of the manure to the crop must be determined not only by the nature of the manure but by the efficiency of the manufacturing process. The practical man had long recognised that the soil came into the question somehow, for he spoke of certain soils as “grateful,” and it is now realised that these are the soils on which the manufacturing process proceeds more easily and completely, and where, therefore, the full value of the manure can be obtained.

This manufacturing process is under investigation at Rothamsted. It is brought about by living organisms so small that they can only be seen by a powerful microscope, and so numerous that all attempts to count them have failed; we only know that the population of the British Islands is small in comparison with the number in a single ounce of soil.

In at least two of its economic aspects the manufacturing process in the soil is curiously like that in an industrial factory; the soil organisms are not all equally useful, and the process is accompanied by waste. The manager of a soil, unlike his confrère in the factory, can adopt a very short way of dealing with useless or undesirable inhabitants: he can simply kill them and so give freer scope to the useful ones. Methods for doing this by partial sterilisation have been worked out at Rothamsted and described in earlier papers in this *Journal*



Rothamsted Experimental Station.—First Laboratory. 1843-1855.



Rothamsted Experimental Station.—Lawes Testimonial Laboratory, 1855-1914.



Rothamsted Experimental Station.—Proposed New Laboratory, 1914.

They are now being used in glasshouse practice and may eventually become cheap enough for employment on the farm. Partial sterilisation is, however, only a crude method of dealing with the soil population and lacks that discrimination which is essential for successful control. The separate groups of organisms are therefore being studied in greater detail, to discover more clearly what they do in the soil.

The control of the waste is equally important; its significance is not always realised. On several of the Rothamsted plots the value of the material loss by waste exceeds £2 per acre per annum, whilst in high farming the loss may be even greater, though in ordinary farming it is no doubt less. The first step is to discover where and how the waste occurs, and then to devise means of getting over it. The loss arises in two ways: (1) some of the nitrogen compounds of the manure or the soil do not produce their full proportion of nitrate, but instead yield gaseous nitrogen which is of no use to the plant and simply escapes into the atmosphere; and (2) by the washing out of nitrates, which, if not taken by the plant, are speedily washed down in the drainage water. The mechanism of these losses is being studied, in order to find a way of obviating them.

Very similar processes go on in a manure heap, serious losses taking place which amounted in some of our experiments to over 30 per cent. in four months, a loss equal to £9 on a 100-ton heap of manure. The manure heap is therefore being carefully studied along with the soil.

The New Farm.—Up till recently the Rothamsted Experimental Station held only five fields, and as these were fully occupied with the classical experiments no land was available for new work. In 1911, however, an additional 230 acres were taken on a long lease and were gradually got into order; they are farmed largely without stock, manures being purchased and everything sold off, this method having certain advantages when experiments are to be undertaken. There being no buildings available, some were erected—stables, stalls for six bullocks, a covered manure yard, and the usual chaffing room, granary, store for artificial fertilisers, etc. In addition, a large Dutch barn has been built, with stout wooden posts set in concrete and affording 8,550 cubic yards capacity, at a cost of only £127.

Much of this land is farmed in the ordinary way, but from time to time additional areas are brought into experiment; this is done in a definite systematic manner to test some method

or principle devised in the laboratory ; there are no haphazard trials. The usual course is that the laboratory investigations clear up some point in soil fertility or in plant nutrition, and suggest some way in which the growth of the plant might be increased. The method is carefully tested by pot experiments carried out under carefully controlled conditions in the pot culture house, and the laboratory experiments are revised in the light of the results obtained. Thus the *principle* of the method is established. It does not follow, however, that the method will work in the field : the weather, the subsoil, the difficulties of manipulation and other causes may all operate against it and reduce or nullify its effects. Field experiments are therefore made, first on a small scale, and then if need be on a larger one.

Broadly speaking, there are two ways in which soil fertility investigations may be applied to agriculture : they may lead to increases in crop or they may enable the farmer to obtain the same crop at lower cost. There are limits set by the climate to the possibilities of increasing the crop : but there is no limit to the farmer's desire to lower the cost of production.

Another guiding principle is that so far as possible old methods are utilised and developed instead of seeking to bring out quite new ones. The old methods have many advantages : they are effective or they would not have survived, they can be worked on the farm, and they are capable of improvement.

In laying out new experiments at Rothamsted it is unnecessary to conduct simple manurial trials. The old plot experiments admirably demonstrate the properties of the artificial manures and their effects on the crop and the soil : our newer experiments, therefore, start out from the basis thus acquired.

One of them is directed to the study of problems revealed by the periodical surveys of the plots, one of which is now in progress. The manures applied in certain cases contain 80 to 200 lb. of nitrogen, but we only recover some 50 or 60 lb. in the crop and the remainder is lost. How can we recover more and thus secure a better return for our outlay ? Part of the loss cannot yet be explained, and is under investigation in the laboratory, but part is due to the failure of the plant to take up all the food given to it. A proper balancing of the manure enables the difficulty to be got over to some extent ; in the two instances shown in the table on the next page the same amount of nitrogen is given in each case, but in one case the manure is well balanced while in the other it is not.



Rothamsted Experimental Station.—Broadbalk Wheat Plots, 1913.



Rothamsted Experimental Station.—Hoos Barley Plots, 1913.



Rothamsted Experimental Station.—Glass House and Cage for Pot Cultures.

Laboratory experiments were made to see if any stimulant could be administered to the crop to get it to utilise the food

	Broadbalk Wheat.		Amount of Nitrate running away in drainage water, per million.	Barnfield Mangolds.	
	Grain, bushels per acre.	Straw, cwt. per acre.		Roots, tons per acre.	Nitrogen recovered, lb. per acre.
Badly balanced manure ..	16.0	14.8	17.8	24.7	134
Well balanced manure ..	26.7	30.8	8.5	29.3	172

materials better, but they have not yet proved very successful. The crops are not abnormally large and the varieties used are capable of better growth; something is clearly standing in the way.

Inspection of the soil at once shows that it is too heavy to give the best results; the soil type therefore is one limiting factor.

Now this difficulty is an old one and has long since been met by an old device. Chalk lies below the surface of the land in Hertfordshire and the old practice was to dig down for it and apply it to the land at the rate of 80 or 100 tons per acre. The treatment was effective, but it is nowadays out of the question for financial reasons, and no other has taken its place, nor have we any other to suggest. Seeing, therefore, that we must have recourse to chalking and liming, a series of laboratory and field experiments was undertaken to see just what the lime and the chalk do in the soil and how much—or rather how little—is needed to effect improvement. These showed that lime and chalk are both absorbed up to a certain point, beyond which any excess lies free in the soil. Excess of chalk was found to do no harm, and probably no good, but an important difference was revealed between lime and chalk which had not before been observed. The excess of lime (after the soil is saturated) acts as a partial sterilising agent, killing a number of soil organisms and depressing fertility for a time, but afterwards changing into carbonate and becoming innocuous; at this stage the soil fertility increases considerably. Chalk shows no such effect. This difference is being studied more fully in pots with a view to possible application in the field. While the laboratory investigations were in progress a field experiment was started. The land was divided into three parts, one receiving, at a cost of £3 6s. 8d. per acre, a dressing of 20 tons of small chalk obtained in the excavation of a sewage filter bed;

one was chalked on the old Hertfordshire method by the men who make a speciality of this kind of work, approximately 50 tons being given at a cost of £3 7s. 10d. per acre; and the third was left untreated. This was done during the winter of 1912-13. The effect of the chalk on the physical texture of the soil was manifested in a few months. Cultivation became and has remained easier: the ploughman found his work facilitated, and a good tilth was readily obtained, one harrowing less being needed than on the untreated land. The cost and the yields in the barley experiment were as follows (per acre):—

Chalking Experiments.

	Total Cost of Chalking per acre.	Crop returns, 1913, Barley.		
		Yield.		Value above unchalked land.
	£ s. d.	Grain, bushels.	Straw, cwt.	£ s. d.
Lump chalk, Hertfordshire method—approximately 50 tons per acre..	3 7 10	68.2	26.5	2 1 0
No chalk	—	59.4	24.0	—

The data for the other crops are not yet available; it is already clear, however, that the operation is likely to be profitable, for in the first season nearly two-thirds of the outlay was recovered.

Cultivation Experiments.—Another method by which the soil conditions may be improved for the plant is to increase the depth of soil over which the roots may range. There are some very old Rothamsted experiments on the subject. In 1849 the Rev. S. Smith, of Lois Weedon, Northamptonshire, attempted to prove that trenching could profitably be undertaken for wheat cultivation. Trenched plots were therefore laid out for wheat in Hoos Field, the method being to bring up the subsoil and bury the top soil. No increase in crop was observed, however. More recently (1909) the experiment was repeated with fruit trees, the trenching being done on the modern method in which the subsoil is kept below and the top soil kept on top. No evidence could be obtained that trenching had any effect either on the growth of the trees, or on the soil moisture or nitrates. Now trenching is not a farm operation, but it is closely related to subsoiling which is usually considered valuable, and in order to clear up the problem some plots have been laid out to test the effect of subsoiling: this year potatoes are being grown on them. Mr. F. J. Gurney kindly gave us the implement, which worked very well, breaking up the subsoil with a minimum expenditure of labour.

It is proposed to extend the cultivation experiments, for probably less is known about the cultivation processes than about any other branch of soil treatment. Before designing any proper set of experiments, however, it is necessary to know what cultivation does. A series of laboratory experiments is already in hand to study the air, water and temperature relationships of the soil, which are known to be affected by cultivation, and it is hoped to get some information about that remarkably intricate subject, the texture of the soil. When these are more advanced it will become possible to evolve some scheme of tillage experiments to examine things such as the difference between a "fresh" and a "stale" furrow, which are known to be of practical importance, but which have not received the attention they deserve from experimenters, and indeed cannot until they have been more systematically studied.

The Green Manuring Experiment.—Throughout the Rothamsted experiments a number of observations have shown the marked effect of ploughing-in a green crop as a preparation for a succeeding crop. Every four years the residues of a clover crop after carting the hay are ploughed-in, on half of the Agdell Field, and the effect on the succeeding crops in the rotation is recorded. In Hoos Field some leguminous crop has periodically been ploughed-in and a number of grain crops have then been grown.

The following typical yields (per acre) show that the effect of these residues is lasting:—

	Oats, 1912.		Barley, 1913.	
	Grain, bushels.	Straw, cwt.	Grain, bushels.	Straw, cwt.
Clover residues ploughed-in, 1911, Plots 7, 8, 9, 10	41	23	39.3	18.5
No manure, Plots 3 and 4	17	14	34	17.3

Further experimental work has been undertaken on Little Hoos and Broadbalk Fields. During last season a four-year-old lucerne ley was broken up, fallowed during the hot weather and sown with wheat in October. The land had received no manure for some years, but the wheat crop now looks at least as heavy as that on an adjoining plot receiving 14 tons of farmyard manure every year. These observations form the basis from which we start.

The growing scarcity of stable manure renders it imperative that some method should be worked out whereby the farmer

can get all the benefit of stable manure in some other way, and green manuring affords an obvious means of doing this. Experiments in the laboratory and pot culture house, however, showed that the growing plant has a complex effect on the soil and on other crops, and that one could not without further trial advocate unrestricted green manuring. For example, it was found that the growing plant apparently depressed the nitrate-making process in the soil, and that some interval was needed between two crops in order that the stock of soil nitrate might accumulate.

Another action is indicated as the result of Pickering's work: one growing crop has an injurious effect on another growing crop apparently through exerting some deleterious influence on the soil. It appears, therefore, that there is another side to the question, and that a growing crop not only takes out certain plant foods (which are automatically returned when the crop is ploughed-in, or can be added as artificial fertilisers), but it may also have other effects. This is while it is actually growing: the residues ploughed-in seem to be wholly beneficial—at any rate no ill-effect has yet been detected in the field, although one (a destruction of nitrate in certain circumstances) has been indicated in the laboratory. So far as our present knowledge goes the best results are only attained when a period of fallow comes after the green manure crop.

A difficulty at once arises. While the land is lying fallow it is subject to loss of nitrates by leaching; indeed, one of the great merits of green manuring is that it puts a crop on the land in autumn when the stock of nitrates is high and the crop takes up the nitrates and holds them safely from the winter rain. A simple way round the difficulty is to have the necessary fallow only during dry weather, and experiments made in the dry summers of 1911 and 1913 show that this is entirely successful, excellent results being obtained when a green crop was ploughed-in, and the land exposed for a few weeks to hot summer weather. Indeed, higher crops were obtained than on other heavily fertilised plots.

It is to clear up these and similar problems that a definite green manuring experiment has been begun. A field is divided into four parts, one of which is farmed with artificials only, one with farmyard manure and artificials, and two with artificials and green manure but no farmyard manure. One of the two last carries leguminous crops and the other non-leguminous crops for the green manure. An eight-year rotation has been drawn up so as to keep the green-manured land as closely cropped as possible, and to reduce to a minimum all losses by leaching; whether other losses will also be reduced has yet to

be determined. The eight-year run should show how far green manuring can be regularly practised under farming conditions, and whether periodical fallows will be necessary.

Mixed Crops.—The harmful effect of some growing crops on others observed by Mr. Pickering gives an added interest to the study of weeds. Hitherto it has been supposed that weeds are mainly harmful through depriving the plant of water, food, and root space, but Mr. Pickering's observations indicate that there is something more. Pot experiments have therefore been started and careful field observations taken to ascertain the importance of these effects in practice. We must know the real case against weeds before we can decide how much it is worth spending in order to eliminate them.

It does not always appear that one crop injures another. It is not uncommon for farmers to grow a mixture of oats and barley as dredge corn, and it is commonly stated that the yields are larger than when the two are grown separately. An experiment with the mixture was therefore made at Rothamsted during 1912 and 1913, and it was found to yield *exactly the same* as the mean of the two cereals grown separately. The yields per acre were as shown in the following table:—

	1912.		1913.	
	Grain, bushels.	Straw, cwt.	Grain, bushels.	Straw, cwt.
Oats alone	17.3	26.4	19.7	12.2
Barley alone	36.2	26.8	32.4	18.4
Average of both	26.8	26.6	26.0	15.3
Mixture of oats and barley	27.7	26.3	26.2	15.2

If there was an ill effect at any period it must have been counterbalanced later, and in the end there was neither the decrease of crop expected from some of the pot observations, nor the increase claimed by the growers.

In another case it appears that one crop actually benefits another growing with it. The sowing of a leguminous crop with a corn crop seems to lead to an increase of crop. This is well seen on the Agdell Field, where clover is seeded in with the barley on one half the plots, but not on the other half; the yields are as shown in the table on p. 394.

As this experiment has gone on so long it is difficult to say whether the effect is due to the ploughed-in clover residues from the previous shift or to the young plants in with the crop, but there is evidence in favour of the latter view.

Thus we have the three cases: (1) Mr. Pickering's observations certainly indicate that one growing plant has a directly

	Grain, bushels per acre.				Straw, cwt. per acre.			
	1905.	1909.	1913.	Average of 9 courses	1905.	1909.	1913.	Average of 9 courses
Barley seeded with clover, Plot 2 C. .	31.4	33.4	32.5	34.1	20.1	23.8	15.0	20.6
Barley sown alone, Plot 1 C. .	23.1	26.8	22.0	29.2	13.5	18.7	9.0	16.8

harmful effect on another; (2) the dredge corn experiments indicate that no such effect is finally produced; and (3) the Agdell rotation experiment indicates an actual beneficial effect when one of the crops is a leguminous crop. It is very necessary to clear up these apparent discrepancies, and a series of experiments is in hand for the purpose.

The Quality of the Crops.—Hitherto we have discussed only the quantity of crop obtained; in practice, however, it is necessary to have regard also to quality. Observations are therefore made in the field, and reports are obtained from experts to give information as to the effect of the various methods of treatment on the quality and character of the produce raised on the various plots. There is, however, a considerable element of uncertainty in all these empirical methods, and chemical and botanical work is therefore in progress to devise methods for examining crops and instituting exact comparisons between one and another. The work is slow and difficult, but it has to be done, for without a knowledge of the structure and composition of the crop the expert cannot satisfactorily advise the farmer as to its feeding value or its value for industrial purposes. Naturally, this side of the work appeals more to the expert than to the grower.

Publication of the Results.—As all the Rothamsted work is intended for the development of agriculture it is essential that the results should be widely known. This is effected (1) by means of an annual report sent free on application to any person directly interested in agriculture, and (2) by throwing the plots open to inspection by farmers' clubs, agricultural societies, etc., arrangements for which can be made on application to the Secretary of the Station.

THE CONTROL OF AIR CURRENTS IN POULTRY HOUSES AND BROODERS.

MAJOR PERCY HOPE FALKNER, R.A.M.C.

A REPORT on the poultry houses used in this country would expose some strange homes where the domestic hen is expected not only to maintain her health but to yield a profit to her thoughtless owner. Insanitary conditions due to filth, and to absence of ventilation and sunlight are very prevalent.

Poultry house construction is a subject with which breeders of poultry cannot be too familiar. It is therefore intended to discuss here one group of principles bearing upon that right and proper ventilation absolutely necessary in every plan whether intended for the making of a new house or the adjustment of outbuildings for poultry. In the past, poultry keepers gave but little thought to these matters; if up-to-date, they had a vague notion that ventilation was necessary, and therefore provided minute holes and apertures somewhere near the roof for the admission of air, or openings "at a convenient height," through opposite walls of the house, thereby creating a cross-draught fatal to success.

Now we have reached what is known as the open-fronted poultry house, which consists of a suitable compartment or room tightly closed on all sides except the *open* front. This supplies the fowls with fresh pure air both by day and night—an arrangement similar to the open cubicles or sleeping quarters commonly used for the treatment of consumptive patients.

The "old timer" tried to provide warmth for his poultry by unnatural methods, confining them at nightfall in an impure atmosphere, with the result that tuberculosis in one form or another robbed his own and other people's hen roosts.

Animal heat is the outcome of a perfectly natural process, viz., the digestion by the birds of suitable and well prepared foods. If the health of the birds is normal, the sugars, starches, and fats contained in their food are readily assimilated and transformed into heat and energy. This is not the kind of heat provided by a close and impure atmosphere.

The open-fronted poultry house is sufficient for every requirement and has come to stay. Its aim and object is the provision of absolutely open air conditions without their disadvantages. Driving sleet, rain or snow cannot benefit any animal; but apart from these, the still and always fresh air of a modern henflat is not far removed from nature.

Fowls housed upon the sanatorium plan lay more and better eggs than those badly housed; the chickens thrive and "make good" because they are the produce of healthy parents; the "open air" hen lives longer, is much less susceptible to disease if properly tended, and is altogether more lucrative. The provision of a suitable atmosphere, free from draughts, and with as much sunshine as possible, at once lays a foundation for successful operations on the poultry farm.

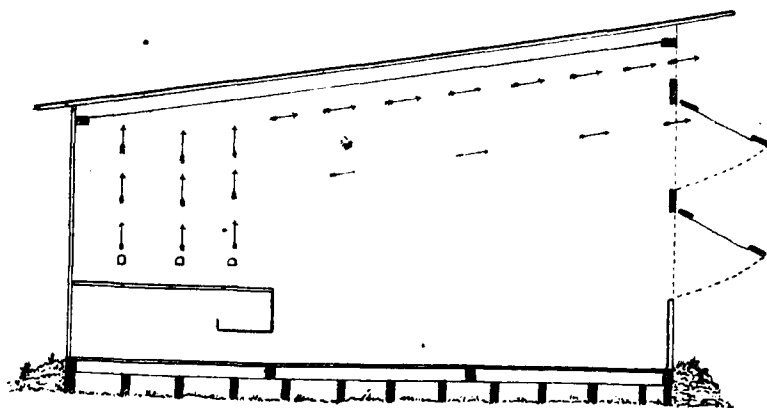


FIG. 1.—Section of a British Intensive Poultry House.

Diffusion of Air.

Fig. 1 represents the section of a British intensive house. When the flock retires to roost large volumes of warm, damp air are expired by each unit. This heated atmosphere, being lighter than cold air, at once passes gently upwards until it meets the sloping roof. The tendency is still upwards and outwards, as shown by the arrows, and it is obvious why the incline of the roof has an important bearing on ventilation.

When the air surrounding the flock rises, fresh cool air passes slowly inwards to take its place. This new supply comes, of course, from the front of the house, through the lower rather than the upper half of its open front, but as there is no need to arrange specially for its transfer to the roosts the important point to consider is the outward passage of impurities. It will be pointed out later how this process is completed without draught, but reference must first be made to another type of open-fronted house.

The Tolman Fresh Air House is shown in Fig. 2. The posterior side of the roof, located over the roosting quarters, is short, and takes an abrupt ascent to meet the upper end of the long anterior section which, in turn, slopes gradually towards the low, wire covered, open front. This house is the

invention of an American whose name it bears; and so far as the writer is aware was the first successful unit of the modern type of poultry house. Tolman's design is still popular in the United States, where two advantages are claimed for it: (1) a rigid frame capable of bearing deep masses of snow that automatically slide off in due course; and (2) a contrivance whereby the animal heat given off from the flock is retained without any lack of ventilation.

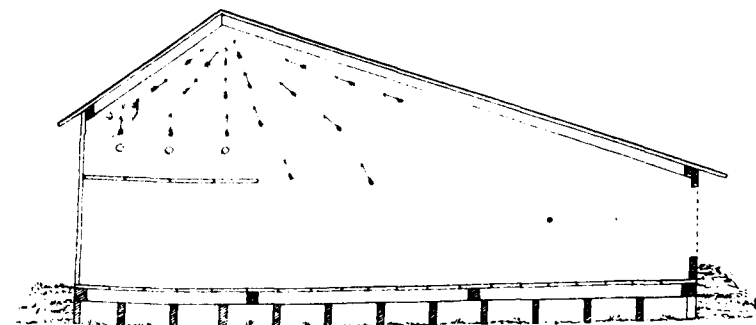


FIG. 2.—Section of the Tolman Fresh Air Poultry House.

Heated air takes an upward course as suggested by the arrows; but owing to the conformity of the roof it remains there, more or less, with all its impurities, and is inhaled again and again by the flock. In order to prevent the cold draught from "striking" the hens at night the roosts are located above the level of the open front—an unnecessary precaution scarcely based upon sound principles of hygiene.

Fig. 3 outlines the section of an improved type open-fronted Tolman house. The design is that of Dr. P. T. Woods, an American authority. Arrows show the direction in which

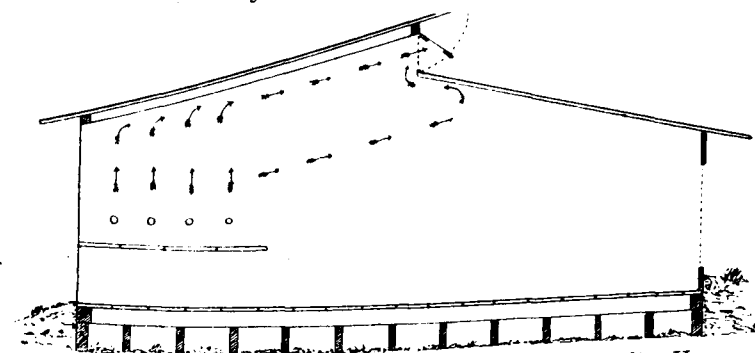


FIG. 3.—Section of Improved Open-fronted Tolman Poultry House.

the heated and unwholesome effluents slowly pass outwards. Contrary to the "blind" apex of the Tolman design,

Woods dropped the front section of his roof for a narrow adjustable window to extend from one gable end to the other, as illustrated in the section. This fitting not only allows direct sunlight to pass over and purify the roosting apartment—an extra light very necessary for the birds when scratching in the litter—but effectually clears away the impure atmosphere referred to in Tolman's plan. An explanation is given below of the reasons why the narrow cloth-panelled window cannot create draughts in the sleeping quarters.

Muslin-covered Fronts.—When the open air idea became fashionable many operators advocated the provision of muslin curtains and muslin-covered windows in lieu of uncovered wire netting. They claimed that this material excluded driving rain and at the same time admitted ample supplies of fresh air to replace the heated gases, which, they believed, also passed freely through the fabric—through wet cloth.

In the first place the term "muslin" as applied to poultry houses is not literally interpreted. The writer has seen it, quite recently too, represented by burlap sacking, and by a material, saturated with a heavy oil dressing, more like the sailcloth of a Thames barge. Having made some careful experiments in this direction the writer knows that even unbleached and untreated calico, comparatively light and open ordinary material, will prevent the passage of a strong air current, changing it into a slow diffusion: nothing more than a sluggish blending of the outer and inner atmospheres, strictly confined to a slight depth behind the cloth, and utterly useless as a means of admitting the thousands of cubic feet of fresh air essential to birds in the sleeping quarters. The cloth becomes air-proof during wet weather when ventilation is most necessary.

To realize this, it is merely necessary to sleep in a bedroom during calm sultry weather with open windows and closely drawn blinds. No matter of what material the blinds are made, open net or glazed cloth, obstruction to the entrance of air from without is at once apparent by comparing the atmosphere of the room when the blinds are raised with the atmosphere when they are lowered.

Cloth-covered window frames are often necessary to protect the litter from driving rain. They also admit light (glass is unsuitable for the purpose in view); but it must be borne in mind that their adjustment according to the state of the weather is an important part of every operator's routine. They should never be considered an efficient means of ventilation if closed: in this respect they are a delusion. In a sheltered location or

during settled summer weather the house is really far better without them.

The "Air Cushion."

What may be termed an "air cushion" is a partially confined section of the atmosphere which permits of diffusion but no circulating air currents. An example may be found in the very ordinary type of wooden fence represented in Fig. 4.

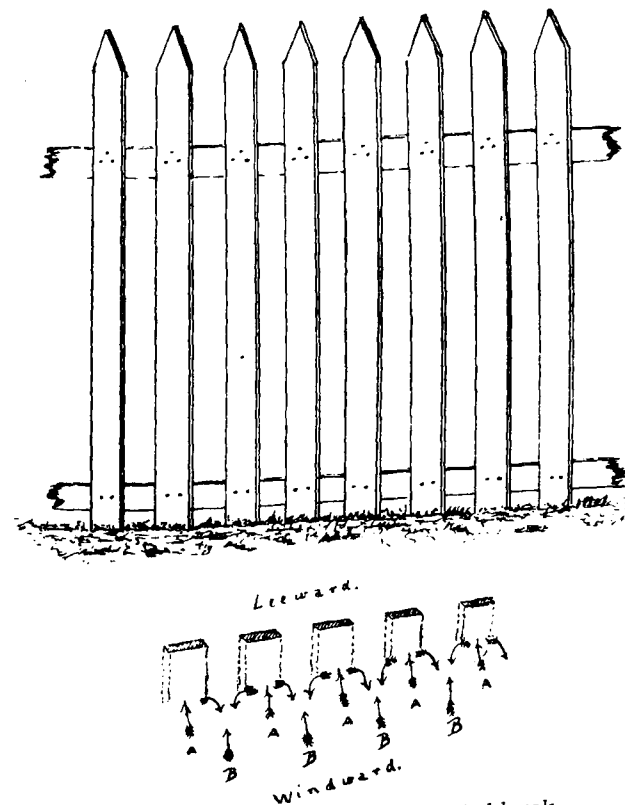


FIG. 4.—Wooden Fence acting as Wind-break.

Suppose there is a strong wind blowing. At first sight one might presume that it would pass between the bars with comparative ease. On the contrary, the structure "breaks" the wind to a considerable extent; in fact, there is a comparatively still atmosphere behind the bars, however strong a breeze may blow against their front surfaces. The section of five bars illustrates how this condition is brought about. Currents marked A turn inwards and backwards to a point facing each interspace, where they meet to form the "cushion" or buffer, to control, and effectually prevent, the currents

marked B from passing through the spaces, thereby creating a lee side. It may be noted here that this type of hurdle would afford useful shelter for stock ranging over windswept ground, or for a poultry run located in an exposed position. A fence so made will not entirely resist high wind pressure like one completely covered with boards or iron sheeting, and is therefore less liable to injury.

As to Fig. 5, a strong wind blowing against the front of this house takes the course shown by the arrows. The inside double-headed shafts represent a perfect "air cushion," which

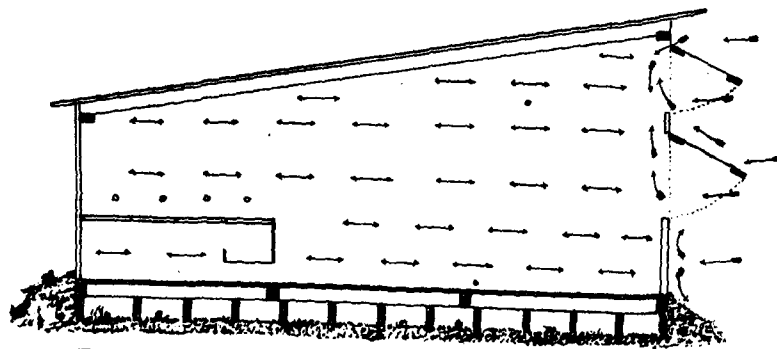


FIG. 5.—Section of Poultry House, illustrating the Air-Cushion.

turns back the wind, however strong it may blow; and every poultry house should be carefully constructed with a view to the creation and maintenance of such a condition. The Woods type shown in Fig. 3 is perfect in this respect, for although it has a skilfully placed window behind the open front there is no draught as regards the sleeping quarters. If the important principle outlined is violated one must expect an unsatisfactory condition as regards freedom from draughts.

A brief reference may be made to the fireless brooder and its "air cushion"—whereby an environment free from circulating air currents is available for the chicks.

Fig. 6 is a fireless hover with its front wall partially removed to show an insufficient and improperly placed padded quilt. Chickens so covered-in cause an upward current by heating the atmosphere in their immediate vicinity: the air passes rapidly upwards between the frame and hover wall, also through the exposed calico which the frame supports, and unsatisfactory conditions result. To establish the "air cushion," the covering should be completed as shown in Fig. 7 (sheets of newspaper in addition to the quilt are often most useful for the purpose). The chickens will now generate and maintain sufficient warmth

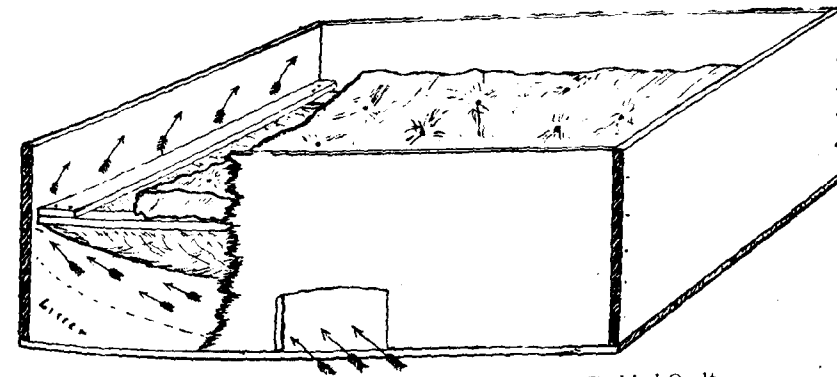


FIG. 6.—Fireless Hover, showing inefficient Padded Quilt.

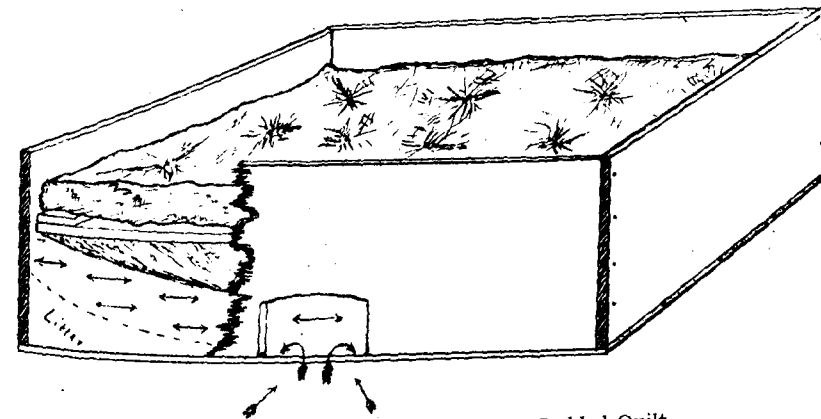


FIG. 7.—Fireless Hover, with efficient Padded Quilt.

if the environment of the plant is, at the time, suited to the fireless method. The right kind of ventilation takes place by slow diffusion upwards, through and around the quilt, and also by way of the entrance to the hover, but it must be remembered that circulating air within this appliance is fatal to success and the greatest hardship that can be imposed upon the chickens.

THE FOOD OF THE COMMON MOLE.

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THE following record constitutes the results of an investigation into the nature of the food of the Common Mole (*Talpa Europea*). The work, which was carried out in the Zoological Department of the University College of North Wales, was suggested by Professor R. G. White, and the incidental expenses

were defrayed from the Advisory Grant made by the Board of Agriculture and Fisheries to the Agricultural Department.

The investigation—though extending over a part of the year only (December 5th, 1913, to February 5th, 1914,) and therefore lacking something of completeness on this account—nevertheless serves to emphasise the economic importance of the animal.

In a recent paper, Scheffer* discusses the habits and food of the Kansas Mole (*Scalops aquaticus*) and concludes that this mole is to be regarded as a valuable asset to the agriculturist, not only in warring against certain insect pests (notably "white grubs"), but also in the aeration of the soil—its work in this direction more than atoning for the slaughter of the earthworms on which it largely feeds. Scheffer further exculpates this mole from any damage to roots and underground vegetation:—"The amount of vegetable matter found in stomach examinations is usually no more than might have been taken in incidental to the ingestion of other food."

This last conclusion was found to be fully applicable to the British mole.

The method employed was that usually adopted in such investigations, viz., the examination and identification of the stomach contents of a sufficient number of moles. The alternative method of feeding captives was not attempted, while field observations are of course precluded by the subterranean habits of the animal.

The moles were derived from two localities, those numbered 1 to 50 in the tables being taken in the neighbourhood of the College Farm, Aber, Carnarvonshire, while those numbered 51 to 100 were trapped near Bodorgan, Anglesey.

The accurate identification and counting of all the various items in the stomachs was often difficult, but, as far as possible, the figures given represent the highest number of corresponding parts of any particular animal form found in a stomach. Any stomachs which did not contain a sufficient volume of ingested matter in a form which could be identified were rejected.

The tables are for the most part self-explanatory, but a few points may be noted. It is evident from the columns that the menu of the mole is a long one. At the same time it is clear that earthworms and, in the moles examined, leather jackets are to be looked upon as the staple articles of diet, these appearing in 92 per cent. and 87 per cent. of the stomachs respectively. Centipedes came next in 50 per cent. and wireworms in 41 per cent. of the stomachs.

* Bulletin No. 168. Kansas Experimental Station, 1910.

Of all the items leather jackets and wireworms are, from an economic point of view, the most interesting. The number of these pests consumed by the voracious mole is certainly enormous. The time a grub or other form may remain in the animal's stomach in a recognisable condition was not determined, but there is every reason to believe that digestion must be an exceedingly rapid process. Scheffer found that a Kansas mole (*Scalops aquaticus*) supplied with food to its taste will consume more than its own weight in a day.

From the lists given, the average number of leather jackets per stomach is to the nearest integer five (5.4). As a low estimate it may be assumed that four times this number, i.e., 20, are consumed on the average per day. That is to say, in the course of six months a single mole would account for 3,650 leather jackets—no inconsiderable number.

A testimony to the insatiable appetite of the animal is found in the fact that one mole had succeeded in cramming no fewer than 38 rather large worms into its capacious stomach.

Though the mole shows so little discrimination in the choice of its food, nothing edible seems too small or too insignificant to be diligently sought and consumed. Small worms, cocoons, minute grubs, ants and tiny beetles all figure in the lists. In some stomachs hordes of tiny grubs barely .5 cm. long were present. Parasitic nematodes were found in 20 stomachs, sometimes in large numbers.

Though there is no doubt that the vegetable contents of the stomach of the mole are only accidentally ingested along with animal food—worms in particular—there were found indications that on occasion the mole may use its small sharp teeth with effect in severing obstructions to its progress through the soil. In one mole there were found several sections of a fern rhizome which might almost have been cut with a razor. A large ball of grass was found in another mole.

In conclusion, one suggestion may perhaps be made. It would seem that if it were desired to form some idea of the soil pests of any particular piece of land no better criterion could be obtained than an examination of the stomach contents of moles taken upon that land.

Table Showing Food of the Common Mole.

No.	Date.	Sex.	Worms.	Worm (Lucy).	Leather Jackets.	Small Grubs.	Wireworms.	Centipedes.	Caterpillars.	Ickles.	Ickle Larv.	Nematodes.	Remarks.
1	Dec. 5	♂	1		5	147	2					0	
2	"	♂	1		0	35	2					0	
3	"	♂	1		0	35	2					119	
4	"	♂	1		0	28	2					11	Vegetable matter containing a few pine needles.
5	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
6	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
7	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
8	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
9	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
10	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
11	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
12	Dec. 6	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
13	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
14	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
15	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
16	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
17	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
18	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
19	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
20	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
21	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
22	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
23	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
24	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.
25	"	♂	1		0	35	2					1	Vegetable matter mostly pine needles.

No.	Date.	Sex.	Worms.	Worm (Lucy).	Leather Jackets.	Small Grubs.	Wireworms.	Centipedes.	Caterpillars.	Ickles.	Ickle Larv.	Nematodes.	Remarks.
26	Dec. 11	♂	1		0	35	2					1	Low plant stems.
27	"	♂	1		0	35	2					1	Low plant stems.
28	"	♂	1		0	35	2					1	Low plant stems.
29	"	♂	1		0	35	2					1	Low plant stems.
30	"	♂	1		0	35	2					1	Low plant stems.
31	"	♂	1		0	35	2					1	Low plant stems.
32	"	♂	1		0	35	2					1	Low plant stems.
33	"	♂	1		0	35	2					1	Low plant stems.
34	Dec. 11	♂	1		0	35	2					1	Low plant stems.
35	"	♂	1		0	35	2					1	Low plant stems.
36	"	♂	1		0	35	2					1	Low plant stems.
37	"	♂	1		0	35	2					1	Low plant stems.
38	"	♂	1		0	35	2					1	Low plant stems.
39	"	♂	1		0	35	2					1	Low plant stems.
40	"	♂	1		0	35	2					1	Low plant stems.
41	"	♂	1		0	35	2					1	Low plant stems.
42	"	♂	1		0	35	2					1	Low plant stems.
43	"	♂	1		0	35	2					1	Low plant stems.
44	"	♂	1		0	35	2					1	Low plant stems.
45	"	♂	1		0	35	2					1	Low plant stems.
46	"	♂	1		0	35	2					1	Low plant stems.
47	"	♂	1		0	35	2					1	Low plant stems.
48	"	♂	1		0	35	2					1	Low plant stems.
49	"	♂	1		0	35	2					1	Low plant stems.
50	"	♂	1		0	35	2					1	Low plant stems.

♂ = male, ♀ = female.

Table Showing Food of the Common Mole—continued.

No.	Date.	Sex.	Worms.	Worm Locutions.	Leather Jackets.	Small Grubs.	Wireworms.	Caterpillars.	Caterpillar Larvae.	Beeches.	Beech Larvae.	Nematodes.
50	Dec. 10.	m.	1	-	+	1	1	-	-	-	-	-
51	"	"	1	1	+	1	1	-	-	-	-	-
52	"	f.	1	1	+	1	1	-	-	-	-	-
53	"	f.	1	1	+	1	1	-	-	-	-	-
54	"	f.	1	1	+	1	1	-	-	-	-	-
55	"	f.	1	1	+	1	1	-	-	-	-	-
56	"	f.	1	1	+	1	1	-	-	-	-	-
57	"	f.	1	1	+	1	1	-	-	-	-	-
58	"	f.	1	1	+	1	1	-	-	-	-	-
59	"	f.	1	1	+	1	1	-	-	-	-	-
60	"	f.	1	1	+	1	1	-	-	-	-	-
61	"	f.	1	1	+	1	1	-	-	-	-	-
62	"	f.	1	1	+	1	1	-	-	-	-	-
63	"	f.	1	1	+	1	1	-	-	-	-	-
64	"	f.	1	1	+	1	1	-	-	-	-	-
65	"	f.	1	1	+	1	1	-	-	-	-	-
66	"	f.	1	1	+	1	1	-	-	-	-	-
67	"	f.	1	1	+	1	1	-	-	-	-	-
68	"	f.	1	1	+	1	1	-	-	-	-	-
69	"	f.	1	1	+	1	1	-	-	-	-	-
70	"	f.	1	1	+	1	1	-	-	-	-	-
71	"	f.	1	1	+	1	1	-	-	-	-	-
72	"	f.	1	1	+	1	1	-	-	-	-	-
73	"	f.	1	1	+	1	1	-	-	-	-	-
74	"	f.	1	1	+	1	1	-	-	-	-	-
75	"	f.	1	1	+	1	1	-	-	-	-	-
76	"	f.	1	1	+	1	1	-	-	-	-	-
77	"	f.	1	1	+	1	1	-	-	-	-	-
78	"	f.	1	1	+	1	1	-	-	-	-	-
79	"	f.	1	1	+	1	1	-	-	-	-	-
80	"	f.	1	1	+	1	1	-	-	-	-	-
81	"	f.	1	1	+	1	1	-	-	-	-	-
82	"	f.	1	1	+	1	1	-	-	-	-	-
83	"	f.	1	1	+	1	1	-	-	-	-	-
84	"	f.	1	1	+	1	1	-	-	-	-	-
85	"	f.	1	1	+	1	1	-	-	-	-	-
86	"	f.	1	1	+	1	1	-	-	-	-	-
87	"	f.	1	1	+	1	1	-	-	-	-	-
88	"	f.	1	1	+	1	1	-	-	-	-	-
89	"	f.	1	1	+	1	1	-	-	-	-	-
90	"	f.	1	1	+	1	1	-	-	-	-	-
91	"	f.	1	1	+	1	1	-	-	-	-	-
92	"	f.	1	1	+	1	1	-	-	-	-	-
93	"	f.	1	1	+	1	1	-	-	-	-	-
94	"	f.	1	1	+	1	1	-	-	-	-	-
95	"	f.	1	1	+	1	1	-	-	-	-	-
96	"	f.	1	1	+	1	1	-	-	-	-	-
97	"	f.	1	1	+	1	1	-	-	-	-	-
98	"	f.	1	1	+	1	1	-	-	-	-	-
99	"	f.	1	1	+	1	1	-	-	-	-	-
100	"	f.	1	1	+	1	1	-	-	-	-	-

[illegible]

THE AGRICULTURAL POPULATION OF ENGLAND AND WALES.

THE decennial enquiries which have been held since 1801 into the numbers and occupations of the people have distinguished, in one form or another, the proportion of the population chiefly engaged in agriculture. In the earliest Census the number of persons so occupied was returned, but in the three succeeding enquiries, the number of families, not individuals, was ascertained. The defects of this classification, however, became evident, and in 1831 it was supplemented by a table showing separately the owners of land and farm labourers over 20 years of age. In 1841 the method of taking the Census by persons instead of by families was reverted to, and in 1851 the important innovation of grouping the occupations in Classes was introduced, and the broad definition under which persons following agricultural occupations were grouped is given in the Census Report for 1861 as (a) persons possessing or working the land and engaged in growing grains, fruits, grasses, animals and other products, and (b) persons engaged about animals. Since that date many modifications have been made, though it may be said that the general characteristics of the groups have on the whole been preserved.

Numerous changes in classification were introduced in 1901 by the Registrar-General at the suggestion of the Board of Agriculture, and these, although effecting a considerable improvement in the returns, impaired the value of the figures to some extent for purposes of comparison. The classification adopted in 1901 was, however, retained in 1911*, so that the returns for these two years are comparable to some extent.

With a view to securing greater accuracy in the returns the Board issued memoranda to agriculturists both in 1901 and 1911. That in 1911 stated that "in view of the importance at the present time of questions relating to the number and distribution of the agricultural population, the Board trust that all persons concerned will on this occasion render their best assistance to ensure that the particulars entered on the Census Schedules by farmers and farm labourers are precise and specific and capable of accurate arrangement in the groups to which they respectively belong."

It must be understood, in discussing the results of the Census of 1911, that the figures represent persons who derive

* The memorandum by the Registrar-General as to the Agricultural Classification in the Census of 1911 was given in this *Journal* for March, 1911, p. 1027.

their living mainly from the pursuit of agriculture, and that they afford only a partial indication of the extent to which the land gives employment to the people, as they do not show in how many instances agriculture forms a secondary occupation.

The Extent of the Increase in the Agricultural Population.— Bearing the above explanations in mind, the number of persons, aged 10 years and upwards, classified as engaged in agriculture in 1911 (on farms, woods and gardens) was 1,235,237, of whom 1,140,515 were males and 94,722 females; in 1901 the numbers so classified were 1,128,604 persons (1,071,040 males and 57,564 females).

It may be stated at once that the increase of 37,158 in the number of females is probably due almost entirely to the more complete return in 1911, owing to the revised instructions and examples on the schedule, of farmers' and graziers' daughters and other female relatives assisting in the work of the farm; under this heading the numbers rose from 18,618 to 56,856.

Even ignoring the increase in the female agricultural population, however, the total population engaged in agriculture will be seen to have increased considerably during the last decade, as a result of 69,475 more males being returned in 1911 as engaged in agriculture as compared with 1901.

In view of the widespread impression as to the depopulation of rural districts in recent years, or at all events, as to the decline in the number of workers on farms, and having regard to the fact that each Census since 1851 had shown a decline, this increase of 69,475 in the number of males is so remarkable as to raise the question whether it is not fictitious and attributable to some change in classification or difference in method of return rather than to an actual increase of agricultural employment. Some part of it is undoubtedly due to improvement in the returns enabling many of the labourers, who, in default of information at previous Censuses as to the nature of their work, had necessarily to be classed as "General Labourers" to be assigned to their proper heading as "Agricultural Labourers." In the rural districts between 1901 and 1911, however, the total reduction in the numbers of general labourers was only 18,079, and the extent of the transfer of "General" to "agricultural" labourers between 1901 and 1911 must have been much less than this total. A further possibility of error exists in the difficulty, which has always been found, in regard to the classification of domestic gardeners as distinct from other gardeners, and in the separation of

carters and wagoners on farms from those ordinarily working on roads, but an examination of the rules for coding and of the figures under the respective headings has failed to reveal any change which would have the effect of increasing the numbers classified under agriculture.

To make the numbers of the total agricultural population for 1901 and 1911 comparable with those for previous Censuses back to 1851 they must be modified by the inclusion of "domestic gardeners," and by the exclusion of farmers' sons and other male relatives under 15 years and of female relatives of all ages who were returned as assisting in the work of the farm, since the procedure adopted included more of these persons at some Censuses than at others.

The numbers (so corrected) of males and females at each Census, 1851-1911, and the proportion per cent. of these numbers to the total population aged 10 years and upwards of England and Wales, are given below:—

Year.	Males engaged in Agriculture.	Percentage of total males aged 10 years and upwards.	Females engaged in Agriculture.	Percentage of total females aged 10 years and upwards.
1851*	1,544,087	23.5	168,652	2.4
1861*	1,539,965	21.2	115,213	1.5
1871*	1,371,304	16.8	85,667	1.0
1881	1,288,173	13.8	64,216	0.6
1891	1,233,936	11.6	51,045	0.4
1901	1,153,185	9.5	38,982	0.3
1911	1,253,859	9.2	37,969	0.3

Grouping the figures in this way and so avoiding any risk of error through possible changes in the method of return of gardeners and of farmers' relatives, the males increased from 1,153,185 in 1901 to 1,253,859 in 1911, or by 8.7 per cent.; in each previous intercensal period there had been a decline, amounting in 1891-1901 to 6.5 per cent., in 1881-1891 to 4.2 per cent., in 1871-1881 to 6.1 per cent., and in 1861-1871 to no less than 11.0 per cent. Thus the rate of decrease from the period 1861-1871 onwards shows a constant tendency to diminution, interrupted only at the period 1891-1901 (when an appreciable proportion of the decrease shown may well be attributable to absence from this country of an abnormal number of agricultural workers owing to the South African War).

The females included in the above table declined from 38,982 in 1901 to 37,969 in 1911, or by 2.6 per cent., compared

* The figures for 1851, 1861, and 1871 include the "Retired."

with a decrease of 23.6 per cent. in 1891-1901; the figures are, however, open to the suspicion of possible overlapping between "farm servants" and "domestic servants on farms."

Confining comparison with previous Censuses to male and female farmers and graziers and male farm workers (excluding farmers' relatives under 15 years of age), we have the following figures:—

Census year.	Farmers, Graziers.		Farm Workers.	Total.	Increase or decrease per cent.
	Males.	Females.	Males.		
1851*	226,515	22,916	1,232,576	1,482,007	—
1861*	226,957	22,778	1,206,280	1,456,015	— 1.8
1871*	225,569	24,338	1,014,428	1,264,335	— 13.2
1881	203,329	20,614	924,871	1,148,814	— 9.1
1891	201,918	21,692	841,884	1,065,494	— 7.3
1901	202,751	21,548	715,138	939,437	— 11.8
1911	208,761	20,027	757,552	986,340	+ 5.0

These figures show an increase in the number of persons returned as farmers and graziers from 224,299 in 1901 to 228,788 in 1911, or 2.0 per cent., and in the number of male farm workers from 715,138 to 757,552, or 5.9 per cent., the increase on the whole group being 5.0 per cent. If the extent of the transfer between 1901 and 1911 from "general" to "agricultural" labourers (referred to above, see p. 409) be put at as high as 10,000 out of the total reduction of 18,000 in the numbers of "general labourers" in rural districts, and if it is assumed that the number of agricultural labourers withdrawn in 1901 owing to the War amounted to as much as 40,000, there would be but a very slight decrease in farm workers (about 1 per cent.) compared with those recorded in the four previous intercensal periods. In the case of agriculturists as a whole, it may be seen, that, even on the above assumptions, *there has been an actual as well as an apparent increase during the past intercensal period.*

This increase in the agricultural population between the last two Censuses has been achieved despite the fact that between 1901 and 1911 about 268,500 acres were withdrawn from the farmed area altogether in England and Wales, and that about 819,000 acres were withdrawn from arable cultivation.

The Proportion of the Agricultural to the Total Population.—Although there has been this increase in the agricultural

* The figures for 1851, 1861, and 1871 include the "Retired."

population, agriculture as an industry has not been able to absorb its share of the natural increase in the population. This is brought out by a comparison between the agricultural population and the total population over a number of years. In England and Wales the proportion shown in the comparative table above (p. 410) as borne by males engaged in agriculture to the total male population aged 10 years and upwards was 138 per 1,000 in 1881, 116 per 1,000 in 1891, 95 per 1,000 in 1901, and 92 per 1,000 in 1911.

The figures of population have, in the above table, been made as comparable as possible, but according to the classification adopted in the Censuses of 1901 and 1911, the proportion of the male agricultural population to the total male population aged 10 years and upwards in England and Wales dropped from 88 per 1,000 in 1901 to 83 in 1911. There were eleven counties (Cambridge, Gloucester, Hereford, Huntingdon, Salop, Anglesey, Cardigan, Carnarvon, Merioneth, Montgomery and Radnor) in which the proportion increased, though in each of these counties the rate of growth of the total population was below that for the country as a whole. The eight counties (Cambridge, Hereford, Huntingdon, Rutland, Anglesey, Cardigan, Montgomery and Radnor), which in 1901 had upwards of 30 per cent. of their males over 10 years of age engaged in agriculture, all showed increased proportions in 1911 with the exception of Rutland.

Sub-division of Occupations (Male).—The nature of the employment of the male agricultural population aged 10 years and upwards in England and Wales is shown for 1901 and 1911 in the following table:—

Occupation.	Males.	
	1901.	1911.
Farmers, graziers	202,751	208,761
Farm workers (employees)—		
Farm relatives assisting	89,165	97,689
Farm bailiffs, foremen	22,623	22,141
Shepherds	25,354	20,838
Agricultural labourers in charge of cattle	81,302	69,094
" " " horses	154,377	128,122
" " " not otherwise distinguished	348,072	425,063
Woodmen	12,034	12,301
Nurserymen, seedsmen, florists		28,736
Market gardeners	123,125	35,818
Other gardeners (not domestic)		75,549
Agricultural machine proprietors and attendants	6,480	7,286
Others	5,757	9,117
Total	1,071,040	1,140,515
Domestic gardeners	87,900	118,739

Farmers and Graziers.—The number of males returned as farmers or graziers in 1911 was 208,761 or 6,010 more than in 1901—a somewhat large figure—and 6,843 more than in 1891. (On the other hand the number of female farmers and graziers decreased between 1901 and 1911 by 1,521.) The figures for 1901 and 1911 include fruit, hop and potato growers, and poultry farmers, who were formerly classed under other headings, so that exact comparison with the returns previous to 1901 is not possible, but it is probably correct to say that there has been no decrease in the last fifty years in the number of farmers and graziers.

With regard to the distribution over the country of the increase in the number of farmers, the only arable county in which the farmers and graziers (male and female) decreased was Lincolnshire, and there the decline was but slight, amounting to 0.8 per cent. The decrease was fairly general in the grazing area comprised in the northern, north-western and north Welsh counties, but outside this group there was only one grazing county—Monmouthshire—in which a decline in the numbers was recorded; the greatest decrease was in the West Riding of Yorkshire, where it amounted to 5.7 per cent. Increases of over 10 per cent. in the number of farmers occurred in three arable counties (Huntingdonshire, Essex and Hampshire), and—excluding London and Middlesex—in three grazing counties (Surrey, Sussex and Oxfordshire).

Farm Workers.—It has been the general impression in recent years that the number of workers on the farms has been constantly on the decline. In a Report on *Migration from Rural Districts*, recently issued by the Board, the reasons adduced in support of this view were that the levelling up of the general intelligence and education of farmers has led them to greater resourcefulness in the economy of labour and greater willingness to use labour-saving machinery and appliances. It might also be expected that the better education of the farm labourer would have made him individually more competent, but it may be doubted whether this factor counts for much in the forces tending towards the reduction in the number of labourers employed. In fact, complaints are general that labourers skilled in their craft are less numerous than formerly. Against these forces making for decreased employment in agriculture must be set the fact that there has been a great increase in recent years in intensive cultivation, fruit-growing, vegetable-growing, flower-growing and the like;

and it is clear that in this direction—apart from the multiplication of holdings cultivated by the occupier and his family—possibilities of employing more labour on the land at present lie. The general consensus of opinion was that the supply of labour is deficient, and the conclusions come to in the Report referred to were that “when all deductions are made, it is evident that, at the present time, considerably more men could find employment on the land than are now available. There certainly appears to be a fairly general deficiency of skilled farm hands.” Owing to the natural increase in the population and to the fact that agriculture is not an expanding industry “the general movement of population from the rural districts is in some degree inevitable. It is not easy to estimate how far the movement is in excess of, or less than, the normal increase of population. The impression given is that it has been much accelerated in the last year or two, but there is reason to doubt this.”

Turning now to the Census returns, it is found that the total number of *male* farm workers, comprising relatives assisting in the work of the farm, farm bailiffs and foremen, shepherds and agricultural labourers increased from 720,893 in 1901 to 762,947 in 1911. For the reasons stated above (see p. 411) from this increase of approximately 42,000 two deductions probably have to be made amounting at an outside estimate to about 50,000*; so that while it is safe to say that there has not been a decrease of more than 1 per cent. in the number of farm workers, it is probably more correct that these have either not decreased at all or have even increased slightly.

Analysing the returns for farm workers, the number of male “relatives” increased from 89,165 to 97,689; the effect of the multiplication of the smaller sized holdings is apparent in this increase. The number of male shepherds decreased from 25,354 to 20,838, which is rather surprising in view of the fact that, according to the Board’s returns the number of sheep increased in the period from 18,976,000 to 19,331,000. Similarly the number of male agricultural labourers in charge of cattle decreased from 81,302 to 69,094, while the number of cattle increased from 5,535,000 to 5,914,000. It is, of course, probable that a certain number returned as shepherds or cattle men in 1901 were classified as “not otherwise distinguished” in 1911.

* Of this total 40,000 is allowed for agricultural labourers absent in South Africa in 1901. In a paper read before the Royal Statistical Society in June, 1907, by Lord Eversley, the number of such men was estimated at 20,000.

In addition to the expansion in the live stock industry of the country the development of fruit farming and market gardening has contributed, in some counties, to the apparent arrest of the decline in the number of persons classified as farm workers; as far as possible labourers in orchards and market gardeners are excluded from the heading “Agricultural Labourer, Farm Servant,” but the returns do not always permit of the distinction being made.

The two counties in which the numbers of male farm workers showed the greatest increase were Huntingdonshire (14.5 per cent.) and Cambridgeshire (14.9 per cent.). In connection with this increase it may be noted that the farmers, male and female, increased by 11.1 and 9.9 per cent. respectively in these counties, and that there was an increase in Huntingdonshire of 5,645 acres (8 per cent.) in the area under corn crops, of 384 acres (4 per cent.) under potatoes, of 66 acres (8 per cent.) under orchards, and of 229 acres (50 per cent.) under small fruit; in Cambridgeshire also there were increases under each heading, amounting to 15,079 acres (7 per cent.) under corn crops, 4,764 acres (19 per cent.) under potatoes, 2,907 acres (90 per cent.) under orchards, and 3,350 acres (90 per cent.) under small fruit.

There were altogether twenty-five counties in which the recorded rate of increase for male farm workers was above the average for England and Wales, and in nearly every case the increase of workers is associated with an increase either in some branch of tillage or in dairying. In the other counties where farm workers have, on the average, increased less, the increase of tillage and dairying has been less marked.

It is interesting to compare the numbers of male farm workers enumerated at successive ages in 1911 with those returned as 10 years younger in 1901. Such a comparison gives the following result and suggests that a good many of the younger men leave farm work, and that some probably return to it later in life, as on leaving the Army:—

1901.		1911.		Percentage in 1911 to corresponding number in 1901.
Age.	Number.	Age.	Number.	
15—25	233,215	25—35	148,081	63.5
25—35	130,757	35—45	111,843	85.5
35—45	106,476	45—55	97,071	91.2
45—55	83,979	55—65	67,991	81.0

Market Gardeners, etc.—The heading under which one would certainly look for an increase is that of "market gardeners." Unfortunately the figures for these are not available for 1901; a comparison can, however, be made between the numbers of (male) nurserymen, seedsmen, florists, market and other (but not domestic) gardeners in the two Censuses. These numbers were, in 1901, 123,125 and in 1911, 140,103 or an increase of some 17,000. It is practically certain that this is an understatement of the increase in view of the fact that the Census records an apparent increase in domestic gardeners of some 31,000, some proportion of which was certainly due to a more definite return in 1911. Taking the total number of males working in gardens, whether in market gardens, nursery gardens, or in domestic service, the increase appears to have been from 211,025 to 258,842. The counties having the largest numbers in 1911 classified under the heading "nurserymen, seedsmen, and florists" (from which are excluded as far as possible, florists who are only shopkeepers or shop assistants), were Middlesex (3,750), Hertfordshire (2,186), Surrey (2,147), Sussex (2,135), Kent (1,994) and Essex (1,692); the counties with the largest numbers classified as "Market Gardeners (including Labourers)," were Worcestershire (3,550), Hampshire (2,122), Middlesex (2,062), Yorkshire W. R. (1,900), Sussex (1,828), Lancashire (1,799), Gloucestershire (1,744), Bedfordshire (1,715), Kent (1,591), Norfolk (1,562), and Cheshire (1,455). These figures are, however, incomplete owing to the number of persons included under the heading "Other Gardeners (not Domestic)" who would have been classified under one of the two former headings had the returns been more definite. They also fail to represent the total numbers engaged in the cultivation of fruit, vegetables and flowers, both on account of the impossibility of separating completely such persons from those engaged in ordinary farm work, and on account of the casual labourers (fruit pickers, pea pickers, etc.), who would mostly be returned according to the occupations they were following at the date of the Census.

Woodmen.—The number of woodmen rose from 12,034 in 1901 to 12,301 in 1911, or by only 2.2 per cent., having increased from 9,448 or by 27.4 per cent. in the previous ten years. The area of woods and plantations was 1,788,816 acres in 1891 and it increased by 58,535 acres during the succeeding four years; in the next ten years only 52,483 acres were added, giving a total of 1,899,834 acres in 1905; and by 1908, the last year for which the figures are available, the area had increased to 1,907,053 acres.

Agricultural Machine Proprietors and Attendants (male and female) increased from 6,545 to 7,346 or by 12.2 per cent. as compared with 40 per cent. in the previous intercensal period. The figures do not represent the actual rate at which the use of machinery has increased, since many farmers use their own machines; they do, however, give some indication of the extent to which labour has been supplemented by the use of hired machinery and attendants. In the arable counties the numbers of agricultural machine proprietors and attendants rose from 3,558 to 4,103, or by 15.3 per cent., and in the grazing counties from 2,987 to 3,243 or by 8.6 per cent.; among the latter, Lancashire, which was the only county in England and Wales in which the number of farm workers actually declined, showed the greatest relative increase among agricultural machine proprietors and attendants, whose numbers rose from 79 in 1901 to 167 in 1911.

The Employment of Women and Children in Agriculture.—The increase in the number of women engaged in agriculture from 57,564 in 1901 to 94,722 in 1911 has been explained above as due almost entirely to the more complete return in 1911 of farmers' and graziers' daughters and other female relatives assisting in the work of the farm, the numbers under this heading increasing from 18,618 to 56,856.

It will be seen from the table on page 410 that while the decline in the male agricultural population has been arrested the diminution in the female agricultural population probably still continues. The proportion per cent. of females aged 10 years and upwards engaged in agriculture (excluding farmers' female relatives) will be seen to be only 0.3 per cent.

Omitting the female relatives, the directions in which women are chiefly engaged are as farmers or graziers—20,027 (21,548 in 1901); agricultural labourers in charge of cattle (probably largely milkers)—4,934 (3,797 in 1901); as agricultural labourers not distinguished as in charge of cattle or horses—8,280 (8,149 in 1901); and as nurserymen, seedsmen, florists and market and other (but not domestic) gardeners—4,202 (5,104 in 1901).

As regards the employment of children on farms, the total number of males of 10 years of age or over, and under 15 returned as farmers and graziers, was 46 in 1891, 6 in 1901 and 11 in 1911. The extent of the employment of children as "farm workers" is brought out in the following table showing the numbers of such male farm workers of the ages of 10–13, 13 and 14 in the three years 1891, 1901 and 1911:—

Age.	1891.		1901.		1911.	
	No.	Per cent. of total.	No.	Per cent. of total.	No.	Per cent. of total.
10 and under 13	65,785	78	3,174	4	544	I
13			15,283	22	8,614	11
14			25,861	36	23,276	31

Thus the employment of boys under 15 as farm workers (the most important group) may be said to have rapidly diminished in the last twenty years. Part of the decrease from 18,457 in 1901 to 9,158 in 1911 of boys under 14 was due to the smaller number returned as farmers' relatives, these declining from 2,147 to 1,267. At 14 there was also a decrease from 25,861 to 23,276, but this occurred in spite of an increase from 3,608 to 4,128 in the number of farmers' relatives. The numbers returned in 1911 at ages 10 and under 13 were quite inconsiderable, 544 in all; at age 13 the number was 8,614 and at age 14, where the principle influx takes place, it rose to 23,276.

DISEASES OF PEAS.

In the case of peas the possibility of an outbreak of disease due to hibernating mycelium is impossible, as peas are annuals. There is also no evidence to show that the spores of either of the diseases discussed below are conveyed with the seed. Hence it follows that every infection must originate from some outside source. Freedom from disease must therefore mainly depend on preventive measures, the most important of which is promptness in destroying, preferably by burning, all diseased material, which carries the spores, which are the only possible means of starting an infection the following season.

POWDERY MILDEW (*Erysiphe polygoni*, D. C.)

During a comparatively dry, bright season, the leaves of peas often show sickly yellowish-green blotches, which gradually increase in size until the whole of the foliage changes to a yellow colour and soon wilts and dries, but the leaflets as a rule do not fall. If the under-surface of a leaf, just commencing to show yellow patches, is carefully examined, the

discoloured patches will be seen to be covered with a delicate whitish mildew, which gradually spreads over the entire surface, or even over both surfaces of the leaf. Under favourable weather conditions a row of peas presents the appearance of having been whitewashed—leaves, stems and pods being equally covered with the mildew. In such cases the plants soon die outright, and in every instance the injury caused to the foliage affects the crop, the injury being in proportion to the amount of mildew present. When examined under a microscope, the mildew is seen to consist of myriads of conidia, or reproductive bodies, which are produced in chains, but soon become free from each other and form a dense white mass on the surface of the leaf, suggesting the idea that it had been sprinkled with flour. These conidia or summer-spores, which are capable of germination at the moment of maturity, are scattered by wind, rain, insects, etc., and spread the disease. Later in the season when the infected plants are dying, a second form of fruit, known as winter-fruit, is produced from the same mycelium that gave origin to the summer-fruit. The winter-fruit first appears in the form of minute yellow balls which eventually become dark brown or blackish, and are often present in myriads on the dead leaves. These spherical winter-fruits enclose spores or reproductive bodies. They remain unchanged until the following spring, when they decay and the spores are liberated. These spores infect young pea plants and give origin to mycelium which first produces the crop of summer-spores.

In addition to cultivated peas, *Erysiphe polygoni* attacks various kinds of vetches, both cultivated and wild, and also several of our commonest weeds belonging to widely separated families of plants.

Preventive Measures.—Spraying is practically ineffective unless commenced sufficiently early—it should be commenced before the disease appears, more especially if the weather is dry and hot.

Liver of sulphur, used at a strength of 1 oz. in 4 gallons of water, is preferable to Bordeaux mixture for this disease. There is no suspicion of the disease being carried in the seed, and hence the infection each year must be derived from some outside source, due to neglect in not burning diseased pea straw, or in permitting the growth of weeds capable of harbouring the parasite.

The above remarks only apply to garden peas, as spraying is impracticable in the case of field peas.

PEA MILDEW (*Peronospora viciae*, De Bary).

This mildew is liable to be confounded, by the casual observer, with the Powdery Mildew described above, but the two are quite distinct, belonging to totally different groups of fungi. Further, the best methods of treatment are very different in the two cases. The leaves first become covered with a delicate white mould, which soon changes to a pale pinkish-grey colour, and may pass unnoticed until its presence is indicated by the wilting and yellowing of the leaves. The powdery appearance of the mould, so characteristic of Powdery Mildew, is entirely absent, and, inspected with a good pocket-lens, the mildew is seen to consist of myriads of upright stems, which bear numerous branches at the tip, the tip of each branchlet bearing a single conidium or summer-spore. It is these summer-spores, dispersed by various agents, that spread the disease during the growing season. The winter-spores are produced on the mycelium in the tissues of the dead leaves, and cannot be seen from the surface. These winter-spores, as usual, remain in a resting or unchanged condition until the following spring, when they germinate and infect peas and allied plants.

In addition to cultivated peas, the parasite under consideration attacks both wild and cultivated vetches, and many other wild plants belonging to the pea family.

Preventive and Remedial Measures.—The only possible means of a first infection in the spring is from the presence of winter-spores, and hence the necessity for destroying all diseased material—burning is the only certain method of accomplishing this object, as the winter-spores pass through the intestinal canal of an animal without injury. Spring infection is often due to fragments of diseased leaves falling to the ground, where they decay and liberate the winter-spores, which remain on the ground until the following spring. Rotation of crops would in this instance be desirable.

When the disease is present, spraying with half-strength Bordeaux mixture should be resorted to. Liver of sulphur is much less satisfactory in its action on the mildews proper.

PEA RUST (*Uromyces fabae*, De Bary).

During certain years, more especially when the weather is hot and dry, peas are liable to be attacked by rust, and if conditions are favourable for the rapid spread of the fungus much damage to the crop follows. There are three forms of fruit in the life-cycle of the fungus, and all are produced in



DISEASES OF PEAS.
(For description see text).

succession on the same plant. First appears the aecidium or "cluster-cup" stage, followed by the uredo- or summer-spore condition, which forms numerous small, brown, powdery patches on the leaves, stipules and stem. This condition reproduces itself throughout the growing period of the host-plant, and is responsible for the spread of the disease. When the plant is fading the uredo condition ceases to appear, and is followed, on the same parts of the plant, by the teleuto-spore or winter-spore stage, which appears in the form of small, nearly circular blackish patches on the leaves and stipules, but the patches are often more or less elongated and streak-like on the stem. The spores of the last-named form of fungus fruit are the only ones capable of infecting plants in the following season, hence every care should be exercised in securing their destruction.

In addition to peas, *U. fabæ*, as its name denotes, also attacks broad beans, on which its occurrence is much more general and destructive than in the case of peas. It also attacks various vetches and other plants belonging to the pea family.

Preventive Measures.—Spraying is practically of no avail against rusts. The most certain means against a recurrence of the disease is to burn infected pea straw; if this is not done the winter-spores will be in some way returned to the land in a condition capable of infecting future crops.

BLACK ROOT-ROT (*Thielavia basicola*, Zopf.).

One stage in the life-cycle of this fungus was found by Berkeley more than half a century ago, parasitic on the roots of seedling peas, and was at that time considered very destructive. Since that period up to about fifteen years ago the fungus remained practically unobserved, whereas at the present day it ranks amongst the most destructive of parasites, attacking more especially seedling plants. In this country peas and asters suffer most, but it has been recorded as attacking cultivated orchids, and many different kinds of annuals. Weeds of various kinds are also attacked—in fact, the parasite appears to exercise no discrimination, the only requirement being a seedling. Much of the puzzling disease of sweet peas known as "streak" is also caused by *Thielavia*.*

* According to Manns and Taubenhaus (*Gardener's Chronicle*, April 5, 1913), the disease known as streak on sweet peas is caused by an attack of the *Bacillus lathyri* (Manns et Taub.). The disease also attacks clover, and it is suggested that control measures will be along lines to prevent infected soil being splashed on to the stems by rain, or carried by other means, unless a successful spray can be found. On small areas a mulching of straw several inches thick along either side of the row may prevent distribution.

On the Continent, and more especially in the United States, seedling tobacco suffers severely from this parasite.

The fungus has a somewhat complicated life-history. The earliest conidial or summer-stage presents the appearance of a delicate snow-white mildew, surrounding the stems of seedlings at the ground level. The mycelium producing this form gradually encroaches on the tissues of the root and lower part of the stem, changes to a dark colour, and produces chains of very dark-coloured chlamydospores or resting-spores, which only germinate after a period of rest. Finally, when the attacked plant is killed by the parasite, a third form of fruit, containing winter-spores, develops on the dead root and stem. Both this form of fruit and the chlamydospores remain in the soil and infect seedlings the following season, and as practically any kind of seedling serves as a host-plant, the yearly production of spores continues, and when land once becomes infected the eradication of the parasite becomes a difficult task.

Seedling peas attacked by the fungus are generally about six inches high when they show by a yellowing and shrivelling of the leaves that something is wrong; finally they droop and fall to the ground as in "damping off." If the injury is caused by *Thielavia*, the root and lower portion of the stem will present a blackened appearance, due to the presence of the chlamydospore stage of the fungus.

Preventive Measures.—In the great majority of cases this disease is due to infected land. This infection may be brought about by various means. When a diseased crop is grown the roots of dead seedlings remain in the soil, and are capable of attacking the seedlings of almost any kind of plant, whether cultivated or wild. Further, in the absence of living plants the fungus can pass through the entire course of its development as a saprophyte, obtaining its food from humus. The infection of a new area has frequently been traced to manure, on which the fungus reproduces itself at a rapid rate. In the United States sterilisation of seed-beds by means of steam is favoured, but this method is not practised to any extent in this country. Formalin (= 40 per cent. formaldehyde) is a most effective fungicide for sterilising soil. The seed-beds should be thoroughly soaked with a solution of formalin in water in the proportion of one pint of formalin to twelve gallons of water. One gallon of the mixture should be used for each square foot of soil. After the watering is completed the soil should be covered for two or three days

with coarse sacking to keep in the fumes. The watering should be done after the seed-beds have been prepared for sowing, and a week or ten days should intervene between the watering and the sowing of seed, to allow for the complete escape of the formalin fumes and for the drying of the soil.

PEA SPOT (*Ascochyta pisi*, Lib.).

This fungus attacks the leaves and pods of peas. On the pods there first appear pale yellowish spots, which gradually increase in size and often encroach on each other. After a time the spots become dry, present a shrunken appearance, and are surrounded by a dark border, and the central sunken portion becomes studded with the minute black perithecia of the summer-spore stage of the fungus. When the pods are attacked while young, they often become more or less contorted, and seed is not formed. Infected leaves soon shrivel and die.

Scarlet runners and various wild vetches are also attacked.

It has recently been stated that a fungus called *Mycosphaerella pinodes*, Stone, is the winter-fruit condition of the *Ascochyta*.

Treatment.—Spraying with Bordeaux mixture will hold the parasite in check, if carried out when the earliest symptoms of the presence of the disease are observed.

DESCRIPTION OF THE FIGURES.

- (1) Portion of a pea stem showing the conidial condition of Powdery Mildew—*Erysiphe polygoni*, D. C. Natural size.
- (2) A portion of the first conidial form of fruit of Black Root-rot—*Thielavia basicola*, Zopf. Mag. 400.
- (3) A portion of the second or chlamydospore form of fruit of *Thielavia*. When the chains of chlamydospores are mature they break up into their component cells. Mag. 400.
- (4) Free cells of chlamydospores. Mag. 400.
- (5) Winter-fruit or perithecium of *Thielavia*. Mag. 150.
- (6) Ascus containing eight spores from winter-fruit or perithecium of *Thielavia*. Mag. 300.
- (7) Single spore of same. Mag. 600.
- (8) Leaf of pea showing numerous pustules of the uredo- or summer-spore stage of Pea Rust—*Uromyces fabæ*, De Bary. Nat. size.
- (9) Uredospores of *Uromyces*. Mag. 400.
- (10) Teleutospores or winter-spores of *Uromyces*. Mag. 400.
- (11) Pea pods attacked by pea spot (*Ascochyta pisi*, Lib.).

FURTHER NOTES ON NARCISSUS FLIES.

J. C. F. FRYER.

(Entomologist to the Board.)

In the article* on Narcissus Flies published in the *Journal* for May, 1914, p. 136, it was found impossible to deal in detail with certain phases of the life-history of these insects, partly because further field observations were required and also because a leaflet can only include the more essential facts, stated dogmatically, without any general discussion on undecided problems. That the subject of Narcissus Flies in general is attracting attention may be gathered from a recent correspondence in the *Gardener's Chronicle*, and it may therefore be well to place on record a few further observations which have recently been made, without waiting for a future revision of the Leaflet already published.

The following observations for the most part concern the habits of *Merodon equestris* and *Eumerus strigatus* when egg-laying, and were made during the first week in June.

As regards *Merodon*, several accounts have already been published of the habits of this fly when egg-laying, and the following observations in the main agree with those made by other investigators. The fly was found to be exceedingly abundant in certain localities and it was possible to observe a number of females in the act of oviposition. The regular mode of procedure appears to be as follows. The fly first spends some time in moving from one part of the Narcissus bed to another, settling repeatedly on the foliage or on the ground, thoroughly exploring its surroundings. Finally it crawls to the centre of a plant where not infrequently is a hole $\frac{1}{4}$ -inch or more in diameter passing from the surface of the soil down to the bulb. This hole was originally filled by the leaves and stem of the Narcissus, but when the foliage dies down and shrivels an open shaft is left. On finding such a hole, the fly backs down it, until its head may be below the surface of the soil. An egg is then laid, usually, it appears, on the earth forming the side of the hole, less frequently on the leaves near the neck of the bulb. If the hole is blocked by earth or by the leaves of the Narcissus, the egg may be placed on the earth at the edge of the hole, in any crack in the soil, or, as happened on several

* Written for a Leaflet, and since issued as Leaflet No. 286.

occasions, under lumps of earth lying near. No eggs were found on the foliage above ground. The egg, which is about $\frac{1}{16}$ inch in length, is oval, white in colour and rather conspicuous; it is usually fixed to the earth or leaf, but the attachment is weak and it easily becomes dislodged. The number of eggs a female may lay round one plant was not discovered. One female appeared to deposit four, of which two were below ground near the bulb, one on the edge of the hole and another under a neighbouring lump of earth. On several occasions two eggs were found after the female had flown away, less frequently three or one. It was, of course, difficult to make sure that all the eggs round one plant had been laid by one female, but it appeared to be so in the case of the four eggs mentioned above. The length of time taken for the eggs to hatch is still uncertain; some of those found hatched in four days.

Turning next to *Eumerus strigatus*, considerable difficulty was found in observing females in the act of egg-laying. The flies are small, dark in colour and very active; they frequently settle on the ground, crawling about at the base of the foliage, passing under lumps of earth and sometimes entering cracks in the soil. It was therefore difficult to follow one insect for any length of time. Finally, however, a fly was seen to back down a hole over a bulb as was observed in the case of *Merodon*, though it seemed to penetrate more deeply into the earth. After five minutes the fly was disturbed, inadvertently, and the hole from which it flew was carefully examined. About 40 eggs were found together in a mass some two inches below the surface of the ground on the side of the hole. They were lightly attached to the soil, but separated and fell on to the neck of the bulb as soon as they were touched. In colour and shape they resembled those of *Merodon* but were exceedingly minute (in length rather more than $\frac{1}{64}$ inch) and only just visible to the naked eye. Since a bulb attacked by *Eumerus* always contains a number of larvæ it was expected that many eggs must be laid together by one fly, and this naturally facilitated the search. No other flies were actually seen when egg-laying, but eggs were noted on some bulbs left exposed on the surface of the soil.

If the above observations represent the usual habits of *Merodon* and *Eumerus* when egg-laying, it is evident that the hole left over the bulb as the foliage dies is a distinct danger to the plant. It enables the flies to lay their eggs in such a position that the larvæ on hatching can at once start burrowing into the bulb without running much risk in reaching their food

plant. When the eggs are laid on the surface of the ground the young larvæ must burrow down three inches or more before finding a bulb, and during this process they are open to the attacks of predaceous insects or may succumb to unfavourable conditions, as for instance to drought, to which they may be susceptible. In the case of the field where the observations were made it was found an easy matter to block completely the holes over the bulbs by merely raking the surface, and when the soil admits of this treatment it may prove well worth the trouble involved.

A final paragraph may be devoted to the question as to whether *Eumerus* will attack sound bulbs. The view has been expressed that *Eumerus* is only a scavenger and therefore injures only bulbs which are attacked by some other disease. Many hundreds of bulbs attacked by *Eumerus* were examined last year and in many cases there was no evidence of the presence of other disease. Frequently bulbs were noted with a number of *Eumerus* larvæ under the scales at one side or in the neck, the remainder of the bulb being perfectly sound. When the interior of the bulb has been completely destroyed it is naturally impossible to assert definitely that no other disease has been present. On the Continent *Eumerus strigatus* has occasionally been recorded as a serious pest to onions, but no mention is made of its merely following some other attack, as for instance that of the onion fly (*Phorbia cepetorum*), which could hardly have failed to pass unrecognised. In this country onions have, so far as is known, remained immune, and it is hoped that if an attack by *Eumerus* on this plant is noted it will be duly recorded. On the whole it seems that there is little evidence to justify the assumption that *Eumerus strigatus* is a harmless scavenger, and until this is definitely proved it is wiser to treat it as a pest.

WHILE considerable improvement has taken place in the seed trade in Wales in recent years, it is evident from an enquiry* made by Mr. Stapledon for the

The Condition of the Seed Trade in Mid-Wales. Agricultural Department of the University College of Wales, Aberystwyth, that the

condition of the trade in the College area is still capable of improvement. As the state of affairs revealed by this enquiry is probably characteristic of some other districts in England and Wales an account may be given of the results obtained.

* Report on the Condition of the Seed Trade in the Aberystwyth College Area, Aberystwyth, 1914, price 1s.

While a number of farmers purchase high grade seed from firms of recognised standing, quite half the grassland of the district under discussion is sown with seed purchased locally, much of this being of inferior quality. The enquiry of the Aberystwyth College referred solely to this locally purchased seed, and in all 353 samples were analysed.

Clovers.—The average results obtained in the case of clovers were as follows :—

Species.	No. of Samples.	Impuri- ties.	Old Seed.	Germin- ating Capacity.	Quality.
		Per cent.	Per cent.	Per cent.	Per cent.
Red Clover and Cow- grass	70	3.0	9.2	87.3	85.4
Alsike Clover	29	2.8	11.5	74.0	72.0
White or Dutch Clover	22	5.6	13.6	71.8	67.9
Trefoil	18	1.5	5.5	81.0	79.0

It is clear that a large amount of very poor seed of all the clovers is on the market as the result of the practice of mixing varying amounts of old and small seed with some proportion of higher grade seed. Much of the old seed was sometimes found to have an almost negligible germinating capacity. The largest amounts of very small seed were usually found to accompany the inclusion of varying amounts of foreign weed seeds. Further, samples devoid of foreign weed seeds (and therefore presumably of British origin) had, on the average, a better germinating capacity, and, except where large amounts of ribgrass or sheep's sorrel were present, also a higher purity than those samples which contained undoubted foreign impurities.

As regards clovers in mixtures, these were often found to be of particularly poor quality. Fairly high grade red clover was often found mixed with deplorable samples of white and of alsike clover. Large amounts of very small trefoil were used as an adulterant, especially in white and alsike clovers.

That the samples of clovers analysed were in some cases simply the screenings from higher grade samples was presumably shown by the presence of large amounts of rye-grass (caryopses) in red clover, and of large amounts of weed seeds, especially ribgrass and sheep's sorrel. It is considered that poor samples of red clover are probably adulterated with ribgrass, which would seem to be an accepted and recognised ingredient in samples of "mixed clover" in the district.

Dodder was found to be a frequent impurity, and many clover samples were attacked by weevils and mites.

The prices were given in some cases, and many of the poorest samples were evidently sold at excessively high prices—e.g., two samples of alsike purchased at 11d. per lb. were, on the basis of the germinable seed they contained, respectively worth 2½d. and 4d. per lb.; a sample of white clover purchased at 1s. per lb. was worth only 6d.; a sample of red clover costing 11d. was worth only 4.1d.; and a sample of cowgrass sold at 1s. 2d. was worth only 10d. per lb.

Grasses.—The following were the average results obtained in the case of grasses :—

Species.	No. of Samples.	Impurities.	Germinating Capacity.	Quality.
		Per cent.	Per cent.	Per cent.
Perennial Rye-grass	49	3.3	86.0	83.7
Italian Rye-grass*	34	2.1	79.0	78.6
Timothy ..	22	Practically pure.	95.0	95.0
Cocksfoot ..	23	1.0	70.0	69.3
Sheep's Fescue ..	9	2.4	48.2	46.6
Meadow Fescue ..	11	1.2	80.0	79.0
Tall Fescue ..	5	3.0	54.0	52.4
Tall Oat-grass ..	3	2.0	70.0	68.6

Thus, very poor samples of all the grasses except timothy are put on the market. Inferior samples were generally found to be of poor weight, and in particular many samples of cocksfoot, tall fescue and sheep's fescue consisted only of seeds of light weight. With the rye-grasses the practice of mixing seeds of several grades would seem to be quite usual; and with all grass seeds it would seem possible that the mixing of seeds of different ages is commonly practised, although this fact is not so easily detected with grass as with clover seeds.

The cocksfoot, meadow fescue and sheep's fescue sold in mixed grass seeds were usually of a very poor quality, and worse than the averages of those sold in pure samples.

Adulteration of grass seeds was not so prevalent as with clover seeds. Perennial rye-grass was, however, present in large quantities in samples of Italian rye-grass, and sometimes also in cocksfoot. Soft brome and Yorkshire fog were abundant in grasses, but were probably natural impurities.

As with clovers a great many of the inferior samples of grasses were sold at prices above their true value.

* Included 32.8 per cent. perennial rye-grass.

Impurities.—With regard to impurities, the amount (25 per cent.) of foreign species of weed seeds was large. The chief cases in which large amounts of a few species of weeds were met with in samples were the following :—

Ribgrass (*Plantago lanceolata*) up to 20 per cent. in red clover and 25 per cent. in mixtures.

Sheep's Sorrel (*Rumex Acetosella*), up to 15 per cent. in white clover.

Self-heal (*Prunella vulgaris*), up to 3 per cent. in clovers.

Mayweed (*Anthemis arvensis*), up to 2 per cent. in clovers.

Fat Hen (*Chenopodium album*), up to 2 per cent. in clovers.

Soft Brome-grass (*Bromus mollis et secalinus*), up to 12 per cent. in perennial rye-grass and 20 per cent. in mixtures.

Yorkshire Fog (*Holcus lanatus*), up to 5 per cent. in perennial rye-grass and 7 per cent. in mixtures.

Hair-grass (*Aira flexuosa*), up to 5 per cent. in mixtures.

A further point in connection with impurities may be referred to, although of purely local importance, and that is the extent to which the samples examined contained weeds which flourish in the district in which the samples are sown.

Of the weeds which are very abundant or frequent in the pastures and meadows of Mid-Wales, the seeds of the following were found to be abundant or frequent in the samples tested :—Yorkshire fog, ribgrass, cat's ear, self-heal, creeping buttercup, mouse-ear chickweed, sheep's sorrel, ox-eye daisy, wild carrot, docks, creeping thistle, and soft brome.

The conclusions come to by Mr. Stapledon are that in purchasing cheap seed from a non-reputable firm the farmer may be completely deceived and pay from 8d. to 10d. a lb. for an article worth from 3d. to 5d.

Secondly, the farmer who purchases at a low price makes no allowance for a correspondingly low germinating capacity in the amount of seed he sows per acre. He probably procures seed of an average quality of about 85 per cent., or very considerably less, and drills according to the usual practice in his neighbourhood, which means that his sowing of germinable seed to the acre is far too small to produce a satisfactory plant. The case is even worse when he contracts with a vendor to supply seed for long leys at so much per acre. In the first place the price is usually ridiculously low, often about 12s. 6d. per acre. The seed supplied is necessarily of the cheaper and non-permanent plants and is proportionately poor in these. The net result is a quite inadequate sowing per acre of non-lasting perennial rye-grass, and red clover, and a mere sprinkling of

the more permanent cocksfoot, timothy, alsike, and Dutch clovers, if they are included at all.

The results due to inherent defects in the seeds themselves are, moreover, very striking. It has been shown that samples germinating about 75 per cent. and less are usually mixed samples. It need only be added that really old seed and very small seed do not produce healthy or vigorous seedlings and cannot be expected to succeed on the exposed situations and thin soils so common in the district. To this cause failures of alsike and Dutch clover are held to be due, failures which have reacted adversely on the popularity of two valuable plants. Further, cheap samples of clovers are usually of mixed stock—they consist, perhaps, partly of British, and partly of Chilian, North American, or European seed. A farmer would not expect an even crop of potatoes if he used alternate "sets" from Ireland, Scotland and the Fens—nor can he look for a good even clover "plant" from a hopelessly mixed stock. It is furthermore a fact that Chilian red clover, however well it may germinate, is quite unsuited to exposed and trying situations.

Finally, Mr. Stapledon suggests that farmers should realise that it is impossible to put down land to grass for six years with rye-grass and clovers only, at something under a sovereign an acre. The sowing must be reinforced with plants of a more permanent character; but the benefit will not be apparent until farmers take steps to employ the right varieties for their particular needs, and, above all, take some trouble to purchase reliable seed of those varieties.

THE recently formed Forestry Branches of the Board and the Office of Woods have prepared a Joint Report [Cd. 7488, price 10½d.] which will be continued as an

Forestry Report, annual series. In the first Report the 1912-1913. opportunity has been taken of giving, besides a review of the work of the

Branches, a brief survey of the attitude of the State towards forestry from the late mediæval period to the present day, and an outline of the history and present position of the woods and forests in possession of the Crown, together with descriptions of the Woodman's School and the Wood Distillation Works in the Forest of Dean. An account is given also of the timber trade of the United Kingdom from the 18th century onwards. A map showing the extent of woodlands and uncultivated land in England and Wales accompanies the Report.

The total area of woodlands in England and Wales is approximately 1,884,000 acres, about 64,000 acres (or 3.4 per cent.) being owned by the Crown. It is difficult to estimate the annual production of timber arising from this area, but it is suggested in the Report that the annual production for *Great Britain* may be put (as a liberal estimate) at 20,000,000 cubic feet, and it is pointed out that this is approximately equivalent to one twenty-fourth of the volume of the principal kinds of unmanufactured timber imported into the United Kingdom. The average total value of timber (manufactured and unmanufactured) imported annually into the United Kingdom during the decade 1903-1912 was nearly £32,000,000, which probably represents more than the total value of all the woodlands in England and Wales. These figures indicate the extent to which the country is dependent upon external supplies. The close connection between consumption of timber and industrial progress is illustrated by the fact that the imports of the principal kinds of unmanufactured timber per head of population have risen from 0.09 load in 1861 to 0.17 load in 1891 and 0.21 load in 1911.

A question of importance not only in regard to forestry but to industry in general is the price of timber. Since about 1880, when modern means of transport were more thoroughly developed, there has been a steady all-round rise in the price of timber, and when existing prices are considered in relation to sources of supply, it will be found that there is every probability of this rise continuing. Whether the value of timber will ever rise to so-called "famine" price it is, of course, impossible to predict; but as definite surveys are made one by one into the extent of virgin forests in various parts of the world, the results disclose that the reserves are by no means so large as had been anticipated.

One of the considerations in favour of a policy of afforestation is the necessity of providing adequate supplies of those timbers which are essential to the industrial prosperity of the United Kingdom. The great bulk of timber imports is derived from coniferous timber—the type of timber for the growth of which the waste land of the country is best adapted. Moreover very large areas of "waste" land would produce better results, financially, from the growth of timber than from the present methods of partial utilisation; and there is the further consideration that the experience afforded by the Crown estate at Inverliever has shown that the amount of employment is greatly increased on beginning afforestation operations on land hitherto used for grazing. But not only might waste land be

with advantage planted; existing woodlands are at present producing very much less than their maximum yield, and their improvement would have the same effect as afforestation.

At this stage in the development of forestry in this country it is essential to lay a firm foundation on which a sound system of procedure can be developed. Such a foundation can only be obtained by the collection of accurate knowledge as to the production of timber under varying conditions, by experiments designed to solve doubtful questions, by actual participation by the State in afforestation operations, and finally by the training of such foresters as may be necessary to meet the special needs of the situation. It is clear that the existing Crown Woods form a ready nucleus on which to begin; and it is proposed to utilise them as far as possible for such purpose.

As regards the improvement of privately-owned woodlands, the only possible means of advance at present, so far as the State is concerned, lies in placing before the owner information which will show that it is worth while to manage woods well, in providing educational facilities for the owner, the agent, and the woodman, and finally in supplying the best possible technical advice.

As regards afforestation of uncultivated land, the outstanding feature of the problem is the absence of accurate information as to the actual afforestable area and of the productive capacity of the land. To meet these difficulties the Board propose to take two steps—in the first instance to collect accurate information by means of organised enquiries or surveys, and secondly, to secure land for commercial planting in typical districts where there is a large area of uncultivated land, and where a *prima facie* case for afforestation has been established. By this means all the information necessary to decide on the desirability of carrying out a systematic scheme of afforestation should be obtained.

To the end of the period covered by the Report, substantial steps had been taken in pursuance of the policy indicated above. For the purpose of forestry education, grants of £250 each were made in respect of the year 1912-1913 to the forestry schools at Oxford, Cambridge, Bangor and Newcastle; the grant of £1,200 which was made to the Royal Agricultural College, Cirencester, covers both agriculture and forestry. The whole cost, approximately £490, of the Woodman's School in the Forest of Dean is borne by the land revenues of the Crown. Exclusive of Indian forest probationers and similar students at Oxford and Cambridge, there were undergoing instruction 35 academically-trained students, 60 part-time forestry students, and 33

woodmen. Provision was also made for research at the five centres for forestry instruction named above, a grant of £1,200 per annum from the Development Fund being allotted for this purpose. Owing to lack of staff it was not possible to proceed with the field work in connection with the minor forestry experiments for which the Board receive a grant of £1,000 per annum from the Development Fund, although progress had been made with the preliminary arrangements. The scheme for the provision of technical advice, of which particulars were given in this *Journal* for January, 1913, page 850, was put into operation during 1912-1913, and promises to be successful. Progress has been made with the survey of afforestable land; a flying survey of 333,000 acres in Wales was carried out, and, in addition, the catchment areas in Wales belonging to the Birmingham and Liverpool Corporations' Waterworks were surveyed. The planting up of water-catchment areas is a special phase of the afforestation question and the Board desire to render such assistance as lies in their power to local authorities who may own such areas.

Note.—Advantage may be taken of this note to indicate a correction which should be made in the statement of paper imports at p. 71 of the Report, where the quantities have been erroneously stated to be in "tons" instead of "cwt."

THE Board think it may serve a useful purpose to publish a short account of the constitution and objects of the Agricultural Education Association. The Association was formed at the suggestion of Mr. A. E. Brooke-Hunt, late Superintending Inspector to the Board, and first Chairman of the Association, which was

constituted on October 11th, 1894. Originally it consisted of the Heads of Agricultural Departments in English and Welsh Colleges; but in 1901 its constitution was considerably enlarged, and it now consists of members of any organisation or institution connected with agricultural education or research who at the time of their election are engaged in teaching or research, or who are members of the permanent staffs of public bodies, such as the Board of Agriculture and Fisheries and the Board of Education, which may from time to time be approved by the Council of the Association.

The Chairman of the Association is Professor W. Somerville, D.Sc., School of Rural Economy, Oxford; and the Hon. Secretary is Principal P. Hedworth Foulkes, B.Sc., Harper Adams Agricultural College, Newport, Salop.

Object.—The object of the Association, as defined by the rules, is the development of agricultural education and research by mutual assistance and advice among the members. The Association endeavours to attain that object by frequent intercourse and discussion, and thus to promote co-operation and uniformity of action among the institutions concerned as regards educational questions, field experiments, research, publication of results, and other matters where agreement is desirable, without interfering with the individuality or local needs of each institution. It is also always ready to assist and advise public bodies dealing with matters relating to agricultural education.

Council.—The affairs of the Association are managed by a Council, which consists of the Chairman and Honorary Secretary of the Association, the Chairman and the Secretary of the three Standing Committees, and an elected representative of each of these Committees. The latter are elected for a period of three years, whilst all other members of the Council are *ex officio*.

Standing Committees.—There are three Standing Committees for Agriculture, Biology, and Chemistry respectively, and these Committees hold their own meetings, in addition to the ordinary meetings of the Association, and discuss various problems met with from time to time.

In addition, temporary Committees are elected as occasion arises to deal with special work undertaken by the Association.

Membership.—At present the Association consists of members of the teaching staff of practically every Agricultural Department and Agricultural College in Great Britain, together with others connected with public bodies in Ireland and the Colonies officially interested in agricultural education.

When constituted, the Association had 8 members. At the present time the membership is 142, representing 64 departments and institutions.

The following is a list of the Departments, Colleges, and Local Bodies, one or more of the members of which are now members of the Association :—

Board of Agriculture and Fisheries ; Board of Education ; Development Commission ; Department of Agriculture and Technical Instruction for Ireland ; Board of Agriculture for Scotland ; Rothamsted Experimental Station ; the Universities of Aberdeen, Bristol, Cambridge, Edinburgh, Leeds, and Oxford ; the University College of Wales, Aberystwyth ; the University College of North Wales, Bangor ; Armstrong College, Newcastle-upon-Tyne ; University College, Reading ; South-Eastern Agricultural College, Wye, Kent ; Midland Agricultural College, Kingston, Derby ; Agricultural College, Aspatria ; Royal Agricultural College, Cirencester ; Harper Adams Agricultural College, Newport, Salop ; College of Agriculture and Horticulture, Holmes

Chapel, Cheshire ; Seale-Hayne Agricultural College, Newton Abbot, Devon ; Agricultural and Horticultural College, Uckfield, Sussex ; Edinburgh and East of Scotland College of Agriculture, Edinburgh ; North of Scotland College of Agriculture, Aberdeen ; West of Scotland Agricultural College, Glasgow ; National Fruit and Cider Institute, Long Ashton, Bristol ; Dauntsey Agricultural School, West Lavington, Devizes ; Hampshire Farm School, Basing ; Cumberland and Westmorland Farm School, Newton Rigg, Penrith ; East Anglian Institute of Agriculture, Chelmsford ; Madryn Castle Farm School, Pwllheli, North Wales ; Monmouthshire Agricultural Institution, Usk, Mon. ; Harris Institute, Preston ; the County Councils of Bedfordshire, Devonshire, Essex, Herefordshire, Lancashire, Lincolnshire, Monmouthshire, Montgomeryshire, Nottinghamshire, Pembrokeshire, Shropshire, Somersetshire, Staffordshire, Suffolk, and Warwickshire ; Royal Agricultural Society of England ; Royal Horticultural Society ; Institute for Research in Agricultural Economics, Oxford ; Union of South Africa Department of Agriculture, Pretoria ; Government College of Agriculture, South Australia ; Government College of Agriculture, Cape Colony ; Macdonald College, Quebec ; Department of Agriculture, Grey University College, Bloemfontein ; and the Departments of Agriculture at Nairobi (British E. Africa), Kampala (Uganda), Zanzibar, and Jehot (Assam).

The Association may thus claim to be a body of experts in agricultural education.

Work.—The Association holds a summer and a winter meeting in each year. The summer meeting takes the form of a conference, and is usually held in conjunction with the British Association.

Summer meetings have been held respectively at the following centres :—

South-Eastern Agricultural College, Wye, Kent ;
Armstrong College, Newcastle-on-Tyne ;
Cambridge University ;
Rothamsted Experimental Station, Harpenden ;
Woburn Experiment Station, Beds. ;
West of Scotland Agricultural College, Glasgow ;
Midland Agricultural and Dairy College, Kingston, Derby ;
Bristol University ; and
St. John's College, Oxford.

At these and other meetings of the Association every opportunity is afforded the members of enquiring into the system of management of the college or station visited, and papers relating more particularly to recent research in agricultural science are read and discussed.

The Association has carried out an extensive scheme of crop rotation trials, the results of which have been published by the Board of Agriculture and Fisheries, and it has formulated and printed recommendations on such subjects as the following :—

Chemical and Mechanical Analyses of Soils on a Uniform Basis ;
Field Experiments on the Manuring of Crops on a Uniform Basis ;
Joint Experiments on the Summer and Winter Feeding of Dairy Cows ;

Joint Experiments to test Seed Mixtures for Permanent Grass;
 Joint Experiments to test the Efficacy of Inoculating Material on Beans and Clover;
 Joint Experiments with Varieties of Roots and Cereals;
 Joint Experiments on the Watering of Milk through the Cow;
 Regulations to be adopted in Seed Testing;
 Scheme for Recording Plant Diseases;
 Scheme for Spraying Experiments; and
 Scheme for Testing the Citric Solubility of various grades of Basic Slag.

The Association has on several occasions been consulted by the Board of Agriculture and Fisheries and has assisted the Board of Education in revising the agricultural syllabus of that Department. Further, it has several times been in communication with the Joint Education Board of the Royal Agricultural Society and the Highland and Agricultural Society as to the method of carrying out the examinations for the national diplomas in agriculture and dairying.

It was mainly at the instigation of the Association that the Royal Agricultural Society instituted the agricultural education exhibitions at their annual show, and the Association uses its best endeavours to make these annual exhibitions successful and interesting to the agricultural community. In this exhibition it yearly provides, at its own expense, a stand for the distribution of the agricultural literature published by the institutions it represents, and several thousand reports are distributed free of charge each year to enquirers at the Royal Agricultural Society's show.

Members of the Association gave evidence before the recent Rural Education Conference, and collected information from its members to lay before meetings of the Conference, on which it was officially represented. The Association is also represented on the recently formed Agricultural Education Conference.

The Association has under consideration a pension scheme for agricultural teachers, which it is hoped will shortly mature.

Members of the Association are supplied with the *Journal of Agricultural Science* at a reduced cost on making application to the Honorary Secretary. The Association provides, free of charge to members, copies of abstracts from papers read at their own Conferences or at the Agricultural Section of the British Association, and in this way very useful information has been circulated among the governing bodies of the various institutes connected with the Association and the agricultural education committees of the various County Councils.

Application for membership should be made on the form pro-

vided, which can be had on application to the Honorary Secretary. Members are elected at the yearly or half-yearly meetings of the Association on being proposed and seconded by two members of the Association. The subscription is 10s. per annum.

CONSIDERATION has been given by the Board from time to time, partly as a result of the continued unsatisfactory progress of swine fever, to methods of dealing with this disease other than by slaughter.*

Artificial Immunisation of Swine against Swine Fever.†

The Board have been fully aware, in this connection, of the potential value of artificial immunisation, but they recognised that the method possessed serious defects which it would be necessary to remove, if possible, by further investigation before they could be used in practice.

The difficulties in the way of generally making use of methods of artificial immunisation were emphasized in information supplied to the Swine Fever Committee in 1910, which was based on special experiments carried out at the Board's laboratory, and on the consideration of a very large number of field observations carried out in the United States, where the methods were first elaborated and put under trial, and where the amount of serum which has been used is enormously in excess of that used in all the other countries added together.

The advice laid before the Committee in 1910 was given in this *Journal* for July, 1914, p. 312.

During 1913 representations in favour of adopting artificial immunisation were made to the Board by associations interested in the meat trade. These representations were based mainly on what was alleged to have been the result of introducing such methods into practice in Holland. The President of the Board decided to send representatives—one of the Board's Superintending Inspectors and two of the Board's Veterinary Inspectors—to Holland and Hungary to collect information regarding the progress of artificial immunisation against swine fever in these countries.

While the reports submitted by these officers are full of carefully collected and interesting information, they cannot be said to have revealed any means of materially lessening the

* See the Annual Reports of the Chief Veterinary Office for 1903, 1906, 1907 and 1909. Very full information on this subject was furnished to the Swine Fever Committee in 1910 by the Board's Chief Veterinary Officer and by Sir John McFadyean.

† See also the article on Preventive Inoculation for Diseases of Live Stock, *Journal*, July, 1914, p. 308.

difficulties referred to above. These reports were laid before the Committee who subsequently published an Interim Report, which was summarised in this *Journal* for March, 1914, p. 1098.

The Swine Fever Committee, after considering the evidence on the subject of artificial immunisation, which had been laid before them at various periods by witnesses, advised the Board in December, 1913, that it would assist the completion of their labours, if the Board would extend the observations from the laboratory to the field of practice in connection with their present operations in relation to swine fever. In accordance with this advice, the Board decided to conduct field observations which had previously been considered, on the following lines, subject to the consent of owners of infected premises which appeared suitable:—

(1.) On a series of selected premises all visibly affected pigs are to be slaughtered with a view to removing gross infection. All apparently healthy pigs are to receive a suitable dose of serum, according to weight. A second visit is to be made to the premises eight days after the serum has been administered, and any visibly affected pigs at the time of the second visit are to be slaughtered. A second injection of serum is to be given after the second visit, if thought desirable.

The object of this kind of observation is to test in practice the value of serum in cutting short the disease or lessening the death-rate in the absence of sources of heavy infection.

(2.) On a series of selected premises all pigs, whether visibly affected or not, are to receive a suitable dose of serum according to weight. No pigs are to be slaughtered.

The object of this observation is to test in practice the value of the serum followed by exposure to gross natural infection, and to control the results in (1).

(3.) On a series of selected premises all pigs are to receive a suitable dose of serum according to weight, and those remaining apparently healthy after a week are to be removed to other closely adjoining premises in the same occupation, the sick being left on the original premises.

The object of this observation is to test the practicability of removing healthy pigs from infected premises to others without risk of carrying infection.

(4.) Healthy pigs on clean premises which closely adjoin infected premises are to receive serum and virus.

The object of this observation is to determine the practicability of using the method of vaccination for the production of active immunity and the risk of loss amongst the vaccinated pigs.

Veterinary officers have been specially detailed to carry out on suitable premises and to superintend such of these observations as owners will agree to, including *post-mortem* examinations on all pigs which may die during the period of the trial, but, of course, the number of observations and the character of the same will depend on the consent of owners, many of whom, the Committee were informed, would welcome the use of serum.

SPENT hops from breweries are largely used as a manure by market gardeners for a variety of crops. They are either made into compost or dug into the soil direct. The average content of spent hops in manurial substances, compared with well-rotted farmyard dung, may be given as follows:—

	Spent Hops.	Well-rotted Dung.*
Nitrogen ..	0.60 per cent.	0.606 per cent.
Phosphoric Acid ..	0.27 "	0.595 "
Potash ..	0.10 "	0.491 "

These figures indicate that, as compared with farmyard manure, spent hops are relatively very poor in potash, although, in other respects, the two manures are not dissimilar in composition. Spent hops possess a considerable capacity for absorbing moisture. As regards soil, they have proved to be an excellent manure on light and medium soils, and there is little danger of their making the land sour provided the soil does not become unduly depleted of lime.

In quantity they may be safely applied up to 15 tons per acre, but it is advisable to use in conjunction with them such artificial manures as sulphate of potash and basic slag or bone meal.

In particular, spent hops would seem to make an excellent top dressing or mulch for fruit trees, and are largely used by nurserymen for mulching rhododendrons, azaleas, etc., and such plants lift with a splendid root system when thus mulched. Gooseberries have been greatly benefited by dressings of spent hops.

An article in *Les Résidus Industriels* (Paris, n. d.) recommends the use of spent hops as a mulch for strawberries, and for application to meadows after cutting the first crop for hay. It maintains that by so doing the second crop will be much more abundant.

As regards price, spent hops may be obtained from breweries in some cases at 1s. per load, exclusive of the cost of cartage.

* Voelcker (from McConnell's *Agricultural Notebook*).

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

The Relation of Certain Plants to the Formation of Nitrates in Soils (*Cornell Univ. Agric. Expt. Sta., Memoir No. 1; T. L. Lyon and J. A. Bizzell*).—Experiments have shown that crops differ from one another in respect of the occurrence of nitrates in the soil on which they grow, and that for any one soil the nitrate content is largely dependent on the crop grown. Field experiments have, therefore, been conducted with a number of crops over a period of six years, and determinations made as to the effect of each crop on the nitrate content of the soil.

The nitrate content of soil under timothy, maize, potatoes, oats, millet and soy beans was found to be different for each crop on the same soil, and there was a characteristic relationship between the nitrate content of the soil and the crop at different stages of growth. During the most active growing period of maize, nitrates were frequently higher under the maize than in cultivated soil bearing no crop. This may be accounted for on the assumption that nitrate formation is stimulated by some processes connected with the active growth and absorbing functions of some higher plants, particularly of maize. There are, moreover, indications that the maize plant obtains a large part of its nitrogen in some form other than as nitrates.

Under both maize and oats the nitrate content was higher during the period when the crop was absorbing most soil nitrogen than in the later stages of growth. Nitrates under these crops and under millet failed to increase late in the season, when nitrogen absorption had practically ceased, although uncropped soil showed a very large increase in nitrates at that time. It is possible that some plants exert a depressive influence on nitrate formation during their later period of growth.

Soil under lucerne was found to nitrify more rapidly than soil under timothy, both in the case of soil on which the crops had been grown continuously and in that from which they had been removed and the soil fallowed for two seasons. The result was the same when the soil was treated with dried blood, and it is suggested that the character of the organic matter left in the soil by the plants determines to some extent the rate of nitrate formation in the soil.

A further test with other crops tended to prove their influence on the nitrate content of the soil in the year following that of their growth. Maize was the only crop following which the nitrates in the previously planted soil were higher than in the previously bare soil. Potato soil was the next highest in nitrates while oat soil contained least nitrates.

Timothy maintained a lower nitrate content in the soil than did any other crop. Mixed grasses also caused a very low nitrate content, and a strongly repressive influence of these plants on nitrate formation is indicated, which may be a cause of the injurious effect of grass in orchards on soil in which the supply of available nitrogen is deficient.

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Apart from the influence of cultivation, the cause of the great differences in the nitrates under the crops mentioned may be found in the inherent differences between various crops in their stimulating or inhibiting influence on the production of nitrates, as well as in their relative rates, amounts and forms of nitrogen absorption. If the effect of certain plants on nitrate formation in the following year should be of general application, the influence of a crop on nitrification may be an important factor in crop rotation.

Effect of Sodium and Potassium Manuring on Composition and Yield of Plants (*Rhode Island Agric. Expt. Sta., Bull. 153*).—This experiment was commenced in 1894 to determine the effect on plant growth of different relative amounts of sodium and potassium when applied as chlorides and carbonates. Forty-eight plots were taken of $\frac{1}{16}$ th acre each, and the effects of the treatment on a number of root crops were noted.

The soil was kept supplied with liberal amounts of nitrogen and phosphorus. Two different amounts of lime were used, but in all cases the soil appeared to be somewhat acid. During the earlier years of the test the average annual applications constituting full allowances of sodium and potassium were (per acre):—

Sodium chloride 250 lb.

Sodium carbonate 220 lb.

Potassium chloride 420 lb.

Potassium carbonate 330 lb.

From 1907 to 1910 the full applications of sodium and potassium were reduced to about one-third of the above amounts.

Determinations made during the earlier years of the experiment showed that an increase in the sodium manures increased the percentage of phosphorus, but not that of nitrogen, in the crops. The percentage of sodium was increased, but that of potassium was decreased in most cases.

In the case of onions, the results in 1908 showed that the addition of the full allowance of sodium to the full allowance of potassium affected uniformly neither the size of the crop nor the percentage of total and reducing sugars. With the full amount of sodium the reduction in the amount of potassium to one-half and one-quarter the amount resulted in successive decreases in the crop, but the percentage of sugar was not changed in all cases.

The yields of mangolds, from 1907 to 1910, showed, as a rule, that even with the full ration of sodium, the quarter ration of potassium and in many cases the half ration were not sufficient for maximum growth. A reduction from the full to the quarter ration of sodium, when given with the quarter ration of potassium, usually depressed the yield.

A twenty-five per cent. increase in the yield of beet-roots was not an unusual result of adding sodium manures, so that, though there was in most cases a reduction in the percentage of total and reducing sugar in the crop, the actual amount produced was increased.

Although the substitution of sodium for potassium materially decreased the growth of potatoes, the percentage of starch, hydrolyzed by acid, was not changed. The percentage of nitrogen, however, was increased and the ash decreased by the substitution. The increase in nitrogen was shown to be due to the omission of potassium rather than to the addition of sodium. The increase in nitrogen was quite general in other root crops.

Comparison of Rich and Poor Dung (*Yorks. Council for Agric. Educ., Guide to Expts. at Manor Farm, Garforth, 1913*).—Comparison was made of the effect of dung from fattening bullocks that received a liberal amount of concentrated food, and of dung from similar bullocks that received only a moderate amount of concentrated food. An analysis of the dung gave the following percentages of constituents:—

	Rich Dung.	Poor Dung.
	Per cent.	Per cent.
Moisture	78.89	81.31
Nitrogen, Total	0.63	0.44
as Ammonia	0.19	0.08
Phosphoric Acid	0.34	0.25
Potash	0.57	0.49

The value of the rich dung was estimated at 10s. 10½d. per ton, and of the poor dung at 8s. per ton.

Plots of ½th acre in size were taken, and in November, 1909, dung at the rate of 8 tons per acre was applied. The crops of hay obtained since the treatment are as follows:—

	Average Crop per Acre.	
	Rich Dung Plots.	Poor Dung Plots.
	Cwt. qr.	Cwt. qr.
1910	46 1	43 3
1911	35 1	33 1
1912	27 2	26 3

Green Manuring (*New Zealand Journ. of Agric., 20th May, 1914*).—With a view to ascertaining the relative values of certain crops for the purpose of green manuring this test was carried out on a sandy loam soil. The plots were seeded on the 23rd December, and the resulting crops were ploughed under on the 2nd April. Each plot received a dressing of 2 cwt. basic slag and 28 lb. sulphate of potash. A crop of rye-grass and red clover was then grown on all the plots with the results shown in the table below:—

Green Manure Crop.	Seeding per Acre.	Cost per Acre.	Approx. Weight ploughed under.	Yield of Green Rye-grass and Red Clover per Acre.
		£ s. d.	Tons.	Tons.
White Mustard	20 lb.	7 6	12	10.38
Scotch Vetches	2 bus.	1 0 0	6	9.33
Rye-corn	2 bus.	10 0	10	8.62
Bare Fallow	—	—	—	7.66

White mustard showed a considerable superiority over the other crops tested. Its chief advantages are (1) rapidity of growth, as it can be ploughed under from 6 to 8 weeks from seeding; (2) rapidity of

decomposition in a light soil; and (3) cheapness of seed. It is recommended that ground limestone or lime be applied to the soil in conjunction with green manuring. Emphasis is laid on the fact that these results are obtained from only one year's work, and should not be taken as conclusive.

FIELD CROPS.

Growth of Sugar Beet (*Jour. Dept. of Agric. and Tech. Instr. for Ireland, April, 1914*).—These experiments in 1913 were in continuation of those in 1912. The object was to test the comparative merits of cultivation (1) on the flat in rows 18 in. apart; (2) on drills 27 in. wide—the crop being treated much the same as are mangolds; (3) on drills 27 in. wide—the crop being moulded up after hoeing, etc. The experiments were carried out at 12 centres on plots 1/10th acre in size. In 1913, at 6 centres 1 cwt. sulphate of ammonia, 3 cwt. superphosphate, and 15 tons farmyard manure per acre were applied, while at the other 6 centres 1½ cwt. sulphate of ammonia and 4½ cwt. superphosphate were given per acre without farmyard manure. Kainit was applied at the rate of 6 cwt. per acre at all the centres. The variety of sugar beet tested was Klein-Wanzleben Original "Z," and the seed was generally sown at the rate of about 25 lb. per acre. The plants were singled out to 9 in. apart on all plots.

Trial was made in 1913, as in 1912, of a top dressing of nitrate of soda at the rate of 1½ cwt. per acre in two applications after the plants were singled on each plot. The average yields for the two years are shown in the following table:—

Plots.	Average yield of Roots per Acre.		Ratio of Factory Weight to Gross Weight.	Average Sugar Content of Roots.	Average Co-efficient of Purity (Apparent).
	Gross Weight.	Factory Weight.			
	Tons. cwt.	Tons. cwt.	Per cent.	Per cent.	
Ordinary Drills:—					
(a) Without Nit. Soda	13 16	9 8	68.1	16.5	89.45
(b) With	15 1	10 3	67.4	16.1	89.24
Moulded up Drills:—					
(a) Without Nit. Soda	14 2	10 3	72.0	16.3	89.42
(b) With	15 11	11 4	72.0	16.2	89.55
On the Flat:—					
(a) Without Nit. Soda	14 14	10 17	73.8	17.0	89.60
(b) With	16 10	12 1	73.0	16.5	89.28

From this table it will be seen that the flat plots produced slightly higher yields and sugar content, but it is stated that this increase would not compensate for the extra cost of labour on the flat plots, and the method of moulding up ordinary drills appears to be that best adapted to Irish conditions.

It would appear from the results obtained from the application of nitrate of soda that its use in Ireland for sugar beet, manured as were these plots, would not prove remunerative.

From 1911 to 1913 in some cases plots of mangolds were grown alongside the sugar beet, the average yield of the mangolds being about double that of the factory weight of the best plots of beet.

Varieties of Barley and Oats (*Herts C.C., Agric. Sub-Committee, Rept. on Field Expts., 1913*).—*Barley*.—Five varieties were tested in 1913, in

continuation of previous trials of 1911 and 1912. The trial was conducted at four centres on the following descriptions of soil: (1) a medium loam overlying chalk; (2) chalky boulder clay; (3) a glacial gravel, light and hungry, suffering much in a season with less rainfall than 1913; (4) a mixed medium soil, with no natural chalk. All the plots were sown at the rate of 3 bushels per acre.

For the three years in succession the average yield of the four standard varieties has been in the same order, viz.: (1) Archer, (2) Plumage, (3) Chevalier, (4) Maltster. The new barley, Plumage-Archer—not included in 1911—was second in 1912, but first in 1913.

The 1913 season was favourable and there was not much lodging, but Plumage-Archer, Maltster and Plumage were the best in this respect, Chevalier was slightly lodged and Archer was the worst. This result agrees with that of 1912.

Oats.—Five varieties of oats were tested at the same four centres as the barley trials. Sowing was at the rate of 4 bushels per acre. The order of yield for each of the three years is as follows:—

In 1911 (average of 3 centres): Victory, Beseler's Prolific, Abundance.

In 1912 (4 centres): Golden Rain, Abundance, Victory, Beseler's Prolific.

In 1913 (4 centres): Leader, Golden Rain, Abundance, Victory, Beseler's Prolific.

Leader, which was only tested in 1913, is a new variety produced by crossing the progeny of Waverley and Abundance with the naked oat of China. It is stated that it often bears five grains in the spikelet, but in the present trial no spikelets were found containing five grains, though a good many contained four. The yield was very high at each centre. At one centre where the weight of straw was ascertained the varieties yielded in the following order:—Leader, Beseler's Prolific, Golden Rain, Victory and Abundance. At all the centres Abundance and Golden Rain ripened earliest, Leader and Victory were intermediate, while Beseler's Prolific was the latest.

Manuring of Turnips (*N. of Scotland Coll. of Agric., Report on Expts. in 1912*).—Seven plots were chosen at each of four centres with the object of testing the relative values of different forms of phosphate when applied with dung to turnips. Each plot, with the exception of the control, received $\frac{1}{2}$ cwt. sulphate of ammonia and $\frac{1}{2}$ cwt. potash salts per acre. The further manures, together with the cost and average yield per acre were, as follows:—

Plot.	Manuring per Acre.	Cost of Manures per Acre.	Average Yield per Acre.
		s. d.	Tons. cwt.
1	No manure	—	8 14
2	$3\frac{1}{2}$ cwt. superphosphate	19 9	23 8
3	3 cwt. slag	17 7	20 9
4	$1\frac{1}{2}$ cwt. ground mineral phosphate	14 8	19 0
5	$1\frac{1}{2}$ cwt. steam bone flour	18 10	20 13
6	$2\frac{1}{2}$ cwt. bone meal	24 9	20 6
7	3 cwt. dissolved bones	28 1	20 10

A further test was carried out in order to compare various combinations of soluble and insoluble phosphates. Four plots were taken at

each centre; each received $\frac{1}{2}$ cwt. sulphate of ammonia and $\frac{1}{2}$ cwt. potash salts per acre, while in addition the following mixtures of phosphatic manures were given, the cost and average yield per acre being also shown:—

Plot.	Manuring per Acre.	Cost of Manures per Acre.	Average Yield per Acre.
		s. d.	Tons. cwt.
1	$1\frac{1}{2}$ cwt. super + 2 cwt. basic slag ..	18 4	22 8
2	" " + $1\frac{1}{2}$ cwt. ground mineral phos. ..	16 5	20 10
3	" " + $1\frac{1}{2}$ cwt. steam bone flour ..	19 2	20 18
4	" " + $1\frac{1}{2}$ cwt. bone meal ..	23 1	19 0

In another experiment designed to show the effect of omitting various ingredients in a turnip manure, the following results were obtained:—

Plot.	Manuring per Acre.	Yield per Acre.
		Tons. cwt.
1	Sulph. amm. + super., but no potash ..	21 3
2	" " + potash, but no phosphate ..	24 7
3	Super. + potash, but no sulph. amm. ..	24 15
4	Sulph. amm. + super. + twice potash given to Plot 2 ..	30 0
5	" " + potash + ground Algerian phosphate ..	26 0
6	" " + slag + potash salts ..	26 0

As a general rule it has been found that phosphates are most essential for roots, but in this trial only 21 tons 3 cwt. of turnips were obtained when the potash salts were omitted, while 30 tons resulted when potash was given in a double quantity.

Nitrogenous Manuring of Wheat (*Jersey Committee of Tech. Instr. and Agric., Report, 1913*).—Burgoyne's Fife was used for this experiment, and was drilled in on December 23rd, 1912, at the rate of 145 lb. per acre. The manures were applied as a top dressing on April 25th, 1913. The rates of application of the manures and the yields of grain and straw were as follows:—

Plot.	Manuring per Acre.	Yield of Grain per Acre.	Yield of Straw per Acre.
		lb. Cwt. qr.	Cwt. qr.
1	Superphosphate (35% sol.) .. 241 Phosphate Powder .. 241 Sulphate of Potash .. 60	19 3 $\frac{1}{2}$	63 0 $\frac{1}{2}$
2	Same as Plot 1 + Nitrate of Lime .. 241	26 3 $\frac{1}{2}$	80 2
3	Same as Plot 1 + Nitrate of Soda .. 198	22 0	82 0 $\frac{1}{2}$
4	Same as Plot 1 + Nitrolim .. 172	25 0 $\frac{1}{2}$	68 1 $\frac{1}{2}$
5	Same as Plot 1 + Sulphate of Ammonia .. 153	23 1 $\frac{1}{2}$	75 1 $\frac{1}{2}$

Growth of Linseed (*Univ. Coll. of N. Wales, Bull. VI., 1913*).—Experiments were carried out at seven centres in 1913, and the yield of seed from $\frac{1}{2}$ acre ranged from 70 lb. to 262 lb., and of straw from about 4 cwt. to 8 cwt. 76 lb.—the highest yields both of straw and seed being obtained at the same centre. The crops in many cases were not so satisfactory as in previous years, owing, apparently, to the fact that they were sown late, and that, owing to the wet spring, the ground was not in very good condition for the satisfactory germination of the seed.

One of the most serious drawbacks to the crop is the difficulty experienced in threshing. For satisfactory results the drum of the threshing machine must be carefully adjusted, and the crop put through the machine at least twice.

Further tests were undertaken to compare the three varieties, Russian, Morocco and Calcutta seed. The Russian seed gave distinctly the best results, both as regards weight of seed and straw. The Morocco linseed was characterised by very big seed and grew well, but the crop was very thin. The Calcutta linseed was almost a failure; the plants did not attain a height of more than a few inches, and could only be harvested with great difficulty.

LIVE STOCK, DAIRYING, AND FEEDING STUFFS.

Cost of Raising a Dairy Cow (*U.S. Dept. of Agric. Bull. No. 49*).—An experiment was started in 1908 on a Wisconsin farm with the view of ascertaining the average cost of raising dairy cows until they are two years old. The heifers raised on the farm, 75 in all, were Jerseys, and care was taken to record the consumption of food and to make complete daily records of all hours of labour expended and other items. The experiment terminated in 1913, and the conclusions reached as the result of five years' work are as follows:—

The average net cost of a dairy cow 1 year old is £8 4s. 8d., which consists of its initial value, £1 9s. 4d.; food, £5 2s. 10d.; labour, 18s. 6d.; other costs, £1 6s. 6d.; total, £8 17s. 2d., the allowance for manure being 12s. 6d.

The average net cost of a dairy cow 2 years old is £12 15s. 11d., consisting of its initial value, £1 9s. 4d.; food, £8 10s. 2d.; labour, £1 12s. 6d.; other costs, £2 17s. 3d.; total, £14 9s. 3d., the deduction for the value of the manure being £1 13s. 4d.

The most important item of cost is the food, which in this experiment was 65.5 per cent. of the total net cost of the cow. Labour formed 12.5 per cent., and all other costs 22 per cent.

One-half of the food cost in the first year and one-third for the full two years is for whole and skim milk.

The cost of feeding the calf for the first four weeks is nearly double that for any other four-week period, owing to the calf being dependent almost entirely upon whole milk.

The labour required is about 40 hours during the first year and 23 hours the second year. The total cost of man and horse labour for two years is £1 12s. 6d. The manure produced during two years is worth £1 13s. 4d.; consequently, the cost of labour is offset by the value of the manure.

The item "other costs" includes interest, charge for the use of buildings and equipment, expense for bedding, miscellaneous expenses, share of general farm expenses, and a charge to cover losses by death and discarding.

This investigation of the cost of rearing a dairy cow would seem to indicate that a heifer entering the dairy herd at 2 years of age should be worth at least £12 15s. to cover the cost only, and it would appear that a farmer in the Wisconsin district cannot afford to raise a heifer calf that will not sell for more than £12 15s. at 2 years of age.

Clover Hay and Clover Silage for Dairy Cows (*Montana Agric. College Expt. Sta., Bull. 94*).—Trials were carried out as to the respective merits of clover hay and clover silage as food for dairy cows.

It was found that second crop clover made into silage during September and October after being frozen kept well until May and June the following year, but became dark in colour, strong smelling and was not relished by cows after the weather became warm. Cattle had a keen appetite for the silage during the winter months.

The daily production of milk on clover hay was found to be 22.8 lb., and of fat 0.93 lb., while on clover silage the daily production of milk was 24.08 lb., and of fat 0.97 lb.

On a ration of clover hay the cost of producing 100 lb. of milk was 3s. 0.95d., and of 1 lb. of fat, 8.95d., while on clover silage the cost of 100 lb. of milk was 3s. 0.7d., and of 1 lb. of fat, 8.9d. In milk production 2.33 lb. of clover silage was required to equal 1 lb. of good clover hay.

The value of clover silage, according to these experiments, ranges from 9s. 10d. to 11s. 6d. per ton with an average of 10s. 7½d.

Use of Oat Meal for Fattening Pigs (*Fühling's Landw. Zeitung, July 1st*).—An experiment has recently been carried out in connection with the agricultural experiment station at Harleshausen to compare the value of oat milling offals and barley meal for fattening pigs. The oat feeding meal used was composed chiefly of the outer seed coat of the kernels and layers immediately below, mixed with a certain amount of meal particles of various grades, and the analysis showed it to contain 8.18 per cent. of water, 17.98 per cent. protein, 9.14 per cent. fat, 59.35 per cent. carbohydrates, 2.02 per cent. crude fibre, and 3.33 per cent. ash. For the purpose of the experiment the barley meal and oat feeding meal were fed in each case in conjunction with potatoes, roots, bran, a patent maize food sesame cake, and fish meal. The total increase in weight of the pigs during the fattening period was slightly in favour of the barley meal, but the oat feeding meal was found to be considerably more economical. To produce 100 lb. increase in live weight the average expenditure in the case of oat feeding meal was 29s. 6d., while in the case of barley meal it amounted to 36s. 6d. It is concluded that good quality oat feeding meal may be advantageously used for pig fattening.

Feeding Experiments with Rice Gluten Meal (*Deutsche Landw. Tierzucht, May 22nd, 1914, summarised in Bull. Agric. Intell., July, 1914*).—A concentrated food for dairy cows under the name of rice gluten meal has been placed on the German market. It consists of a mixture of rice gluten (obtained as a by-product in the manufacture of rice starch) and rice meal (an offal from rice milling). Analysis shows that it contains 92.3 per cent. dry matter, 36.94 per cent. crude protein, 31.25 per cent. albuminoids, 11.86 per cent. fat, 36.87 per cent. carbohydrates, 1.32 per cent. cellulose, and 5.31 per cent. ash. An experiment has recently been carried out comparing the food with earth nut cake and bran. The experiment lasted 75 days. For the first part

the cows received 6½ lb. rice gluten meal each and during the second part 11 lb. each. per day. A record was kept of the quantity and quality of the milk produced as well as of the increase or decrease in weight.

The results of the experiment showed that the food was equal to a mixture of earth nut cake, dried beet slices and wheat bran. Its use is recommended for feeding dairy cows if it can be obtained at a satisfactory price.

HORTICULTURE.

Influence of Grass upon Growth of Orchard Trees (*Agric. and Hort. Research Sta., Long Ashton, Ann. Rept., 1913; B. T. P. Barker.*)—For some years experiments have been carried on in a young cider orchard to test the effect of the removal of grass round each tree, in some cases for a radius of 4 ft. 6 in. and in others of 3 ft., while in the remainder the grass was allowed to grow to the base of the tree. In 1910 a limited number of the areas of 4 ft. 6 in. radius were extended to 6 ft. The trees were cultivated for two years after planting before the experiments were commenced, and the results are not, therefore, possibly so definite as might have been the case had the influence of the grass been brought into play earlier. The following table shows the average size of the trees at the start of the experiment (the girth at 5 ft. 6 in. above ground being taken as 100), and in the following years:—

Treatment of Tree.	Average Girth.				
	1906	1909	1910	1911	1913
Cultivated area 6 ft. radius	100	—	—	273	324
„ 4 ft. 6 in. radius	100	199	242	277	326
„ 3 ft. radius	100	180	219	255	303
Grass	100	166	196	232	284

The gain by the trees in the cultivated areas was chiefly effected in the first three or four years after planting, and became less each year afterwards. By 1911 it was concluded that the limit of the beneficial effect of cultivation had been reached, and accordingly the grass was allowed to grow up to the tree in all cases. The most recent measurements show that in several cases there is a tendency for the trees in the grassed area to gain slightly on those originally cultivated; it is suggested that the latter on being grassed over are more susceptible to the injurious effect of grass, for the time being at any rate.

More conclusive results were obtained in the case of an orchard planted in 1908, near Gloucester. Five varieties of apples were tested, some being cultivated to a radius of 2 ft. immediately after planting and others being left grassed over. The girths of the stems were measured in 1913 at 4 ft. from the ground. The increase in girth was very considerable for each variety, and whereas the trees grassed over had an average circumference of from 3½ in. to 4½ in., according to the variety, those cultivated ranged from 5 in. to 6½ in.

The difference between cultivated and uncultivated trees was much greater in this experiment than in the case of the Long Ashton trial, and this is ascribed to the fact that in the latter case all the trees were cultivated for two years prior to the commencement of the test.

Varieties of Strawberries (*Yorks Council for Agric. Educ. and Leeds Univ., Guide to Expts., 1913.*)—Tests were made with different varieties of strawberries during the three years ending 1910. As the soil was of a sandy character, nearly 100 tons of heavy clay were dug in per acre, and dung at the rate of 30 tons per acre, and lime at the rate of three tons per acre were applied. The land had received an annual dressing since 1902 of about 11 cwt. of phosphatic manures, per acre, half being applied in early spring and half in early summer. The highest yield was obtained from Laxton's Fillbasket, while Laxton's Perpetual and President were nearly as prolific, the fourth and fifth places being taken by Bedford Champion and Scarlet Queen respectively.

WEEDS AND PLANT PESTS.

Use of Kainit in Destroying Weeds (*Landw. Jahrbücher, Heft. 4, Band xlv.*)—While it has been recognised for some years that kainit may prove effective in destroying weeds the results obtained hitherto have been considered too variable to warrant this manure being used to any extent for this purpose in place of the usual vitriol sprays. Lack of success in the past has been mainly due to an imperfect acquaintance with the conditions which should prevail at the time of application and the present investigations were undertaken by the Royal Agricultural Academy of Bonn-Poppelsdorf, at the Institute for Soil Investigation and Plant Growth, to ascertain what these conditions should be and also to determine if the use of kainit for destroying weeds could be economically justified. Of the results obtained from the investigations, the following may be noted:—

1. Kainit is quite effective in destroying weeds provided the conditions at the time of application are favourable.
2. Not less than 1,050 to 1,250 lb. per acre should be applied and up to 1,800 lb. per acre may be used with advantage according to the stage of development of the weed.
3. Complete success can only be expected if the kainit is distributed when the plants are wet with dew or rain and the remainder of the day is free from rain. In cloudy, dull weather, although the kainit is quite effective, some time elapses before the weeds are destroyed.
4. Kainit is most effective when the ground is frozen, but applications at this time are not recommended as the seed corn is also harmed.
5. Fine grinding and a uniform distribution of the kainit enhance its useful effects.
6. Kainit is much more effective if it is applied when the weeds are in the earlier stages of growth.
7. Kainit does not kill all weeds. It is most effective when used against charlock, wild radish, bindweed, speedwell, chickweed, nettle, groundsel and cornflower; less effective against persicaria or redshank and spurrey; and only slightly effective against spreading orache, sow thistle and fumitory.
8. Top dressings of kainit on heavy soils may cause undue consolidation of the surface soil, but this may be counteracted by applying a sufficient quantity of lime.
9. As the potash in the kainit is utilised either by the crop to which it is applied or remains available for succeeding crops, there is no wastage from a manurial standpoint.
10. Generally speaking no ill effect is produced on the cereal crop itself. When the heavier applications are made the crops may some-

times suffer at first but soon recover. Pulse crops appear to be most liable to damage.

11. As the potash is utilised by the crops the cost of applying the kainit for weed destruction is comparatively trifling, the only additional cost being that entailed by the extra fineness of grinding.

NOTES ON AGRICULTURAL CO-OPERATION.

THE following note on the Table Rabbit Movement in England has been communicated to the Board by Mr. P. E. Wilson.

The Table Rabbit Movement in England.

A brief description of what has been done in the direction of breeding table rabbits during the past three years, will be of interest, more particularly perhaps to small holders.*

In the Autumn of 1911, a meeting of breeders who were deeply interested in the production of table rabbits, was held at the London Dairy Show, and a club was established under the title of the English Table Rabbit Club. The main object of this Club was educational, and printed leaflets, setting forth its aims and objects, were very soon widely circulated. The Club was managed by a committee, and the subscription was fixed at the very moderate sum of 2s. 6d. per annum, it being deemed highly important to enable the small holder and cottager to join the ranks.

Space forbids a very detailed account of the Club's activities, but it may be said that the Club achieved no small amount of success in its self-imposed task of educational work. It must be borne in mind that prejudice and ignorance of the subject were widespread and progress was very slow. Since the Club was founded, however, things have altered for the better.

The English Table Rabbit Club had many different objects in view, but it had one very important object, and that was to bring together utility rabbit breeders in every part of the country. It is believed, though it is not definitely asserted, that no attempt had previously been made to band utility breeders together, and the merits of this step were made very evident on the publication of printed lists of members, this resulting in business being done between breeders who had been quite ignorant of each other's existence. For example, a breeder in the south was enabled to send produce to a member in the north, while a member in North Wales purchased stock from another in the Home Counties.

This collection of names and addresses formed the nucleus of a table rabbit society and introduced the principle of co-operation.

The Club also instituted a system of free stud bucks for the purpose of improving the stock of its members, and infusing fresh blood into established strains. This step was taken in order to encourage the use of the right breeds, and by a system of coupons members had the opportunity of sending their does for service to the right stamp of bucks, which were placed at different centres in the country.

An important step in connection with the parent club, was the establishment of local branches. The first of these was formed at Southend-on-Sea (Essex), and in rapid succession there followed similar

* See also the Board's Leaflet No. 265 (*Utility Rabbit Breeding for Small Holders*), which incorporates the main points of an article by Mr. P. E. Wilson, published in this *Journal* for March, 1911, p. 982.

branches at Watton (Herts.), Blackburn (Lancs.) and Bradford (Yorks.). Each branch had its own committee and local honorary secretary. The chief advantage of these local groups of utility rabbit breeders lay in the fact that more could be done by way of co-operative effort, since the committees could personally assist their members. The success of these local branches is well merited, and is due in the main to the indefatigable energy and enthusiasm of their promoters.

During this period articles on the subject were appearing in different periodicals, and there can be no question that to-day we hear more about table rabbits, from a greater number of contributors, than would have been deemed possible a year or two ago.

At the annual general meeting of the English Table Rabbit Club, held in the autumn of 1913, a very important step was taken, as it was then decided that the Club should be converted into a trading society. This step was not taken without very serious consideration and discussion, but it was unanimously agreed that the step was a wise one, and that the Club, as a trading society, would have more scope and power in aiding the movement.

The English Table Rabbit Club, therefore, no longer exists, as such, but is by no means buried or forgotten; on the other hand, it is distinctly stated in the prospectus of the new society:—

"The English Table Rabbit Club was formed in 1911 to encourage the breeding of table rabbits in England, and has till now confined its attention solely to propaganda and educational work, which has met with a considerable amount of success. The Club now ceases to have a separate existence, and is incorporated in this Association.

"The British Table Rabbit Association, Limited, is formed to follow up the work and early efforts of the English Table Rabbit Club, on a more businesslike footing, and for actual trading."

The British Table Rabbit Association, Ltd., is registered pursuant to the Industrial and Provident Societies Act, 1893, and is also affiliated to the Agricultural Organisation Society. It has of course many objects, which are set forth fully under Rule 4; but the principal business will be the breeding and sale of table rabbits (both carcasses and breeding stock), and the sale of skins. The buying and distribution of foodstuffs and hutches and other accessories is also included.

The Association is based on the co-operative principle. Shares in the Association are of the value of £1, of which only 2s. 6d. is payable on application. This arrangement brings membership within reach of the small owner. There is little doubt that if a larger sum was immediately required on each share, a large number of men would be prevented from becoming members. Though no definite time can be fixed, it is the intention of the committee that the balance be paid in calls of 2s. 6d. per annum, or a sum equivalent to the subscription fixed for the English Table Rabbit Club, which the Association has superseded.

The liability of members is strictly limited to the amount of their shares. No member may hold more than 200 shares, and the shares are transferable.

The Association will deal with both members and non-members, but there are distinct advantages in membership. It is stated that:—

"The profits of this Association are, under Rule 11, to be dealt with as follows:—

The payment of five per cent. interest on the paid-up share capital shall be the first charge on the net profits arising from the general

business of the Society, and the balance of the net profits shall be allocated as follows:—

- (1.) At least one-half to the reserve fund, until the said fund equals the share capital.
- (2.) Not less than five per cent. to the workers employed by the Society at the time the division takes place, as a bonus proportionate to the wages earned by them respectively during the period to which the division relates.
- (3.) The remainder of the net profits shall be divided amongst the members as the committee may in their discretion approve, some consideration being taken of the quantity of rabbit flesh supplied by each member for the Society to deal with.

Arrangements have already been made to assist breeders by receiving rabbit carcasses and dressing and marketing these in London. The Association is also prepared to purchase rabbit skins from both members and the general public at current prices. Though breeders often have difficulty in obtaining even a penny or two for their skins, it is believed that by bulking and grading, considerable profits can be earned by the Association in trading in skins; such profits will of course benefit members.

The Association also supplies good, healthy breeding rabbits, and in this way it is hoped that the number of breeders of table rabbits may be augmented, and also that the stock of existing breeders may be improved. This provision of really sound animals is urgently required, as misrepresentation and unsatisfactory business methods have done harm in the past and have caused considerable loss and disappointment to beginners, who in their inexperience have been saddled with utterly worthless stock.

In future, breeding stock will be procurable from agents of the Association in different parts of the country, and this will mean a saving in the cost of carriage to members, who will be likely to apply to the address nearest to them.

The committee is at all times prepared to give expert advice and assistance to breeders and others, and rules for consignments, special labels for the despatch of dead rabbits, and a variety of information can be obtained on application to the Secretary of the Association.

As the Association was only registered on the 28th November last, no details can yet be furnished in regard to actual trading, but for a young society the work is well in hand, and the outlook is promising.

The work and trade of the Association will grow with the movement, and it may be mentioned that a new departure has already been made in the offer by the Association of seeds specially suitable for the production of rabbit food, and sold in small quantities, to meet the needs of the cottager and allotment holder. If the movement is to grow steadily, education of the public and the producer must go hand in hand with improved organisation for the disposal of produce. No cost of propaganda or educational work will be borne by the funds of the Association, but will be carried on where possible by means of voluntary subscriptions.

It is noteworthy that provision is now made for table rabbits classes at many different shows throughout the country. The London Dairy Show provides two classes for rabbits, and the Association has lately given most careful attention to the subject, and to the provision of a proper standard for judging which has been adopted by the British Dairy Farmers' Association. In this connection, it may be added that a most successful show was held at Southend last autumn, in connection with the local fanciers' show, under the auspices of the Southend-on-Sea

and District Branch of the English Table Rabbit Club, and classes were provided for rabbits, dressed in "Ostend" fashion, and in their skins. Classes were also provided for rabbit skins, and articles made from rabbit skins. There is little doubt that, apart from the question of rabbits as meat, there is much to be done in improving the sale of skins, and this matter is receiving the careful attention of the committee.

In conclusion, it may not be out of place to mention the fact that for the years 1911-1912-1913, foreign rabbit meat has been imported into this country to the extent of 1,482,169 cwt., representing a value of no less than £2,111,144 sterling. If any further proof of the need for the British Table Rabbit Association, Ltd., was required, it is found in these figures, which indicate that the production of the table rabbit is a matter of national importance.

The address of the registered office of the Association is Stoneleigh Farm, Newport, Salop.

OFFICIAL NOTICES AND CIRCULARS.

The Board of Agriculture and Fisheries stated a few days ago that there was in this country sufficient wheat to supply the whole population for about four months.

Supply of Wheat in the United Kingdom. They have now obtained more complete information including returns of the stocks of wheat and flour held by about 160 of the principal millers in Great Britain.

On the basis of the figures now available it may be said with confidence that there is actually in the United Kingdom at the present time, including the home crop now being harvested, five months' supply of bread stuffs.

This is additional to the wheat and flour on passage and due to arrive shortly.

The Board of Agriculture and Fisheries have made special enquiries by their own officers into the supply of meat now in cold storage in the principal centres in

Supply of Meat. England and Wales.

As regards chilled and frozen meat, the existing stocks are sufficient to meet the ordinary needs at the normal rate of consumption for about six weeks, while there are three to four weeks' supply on passage and due to arrive shortly.

As regards home supplies, which represent 60 per cent. of the total consumption, the Board have ascertained from the recently collected agricultural returns that there is a substantial increase in the numbers of live stock as compared with last year.

The Board of Trade Central Office for Labour Exchanges is making special arrangements for the supply of the farm hands, etc., required in connection with the harvesting season.

Labour Exchanges and Harvest. All farmers and other employers who are desirous of engaging this class of labour should communicate their wants to the manager of the nearest Labour Exchange, the address of which can be obtained from the local Post Office.

It should be remembered that no fees are charged, either to employers or employees.

The Board of Agriculture and Fisheries have received a number of complaints from farmers representing that all their working stock of horses has been requisitioned for military purposes, and that they are unable to harvest their crops, or are seriously impeded in doing so.

Supply of Farm Horses: Co-operation among Farmers. His Majesty's Government have clearly stated in Parliament that it is their desire that such interference with harvest operations should be avoided: but where it has unfortunately happened that necessary working stock has been withdrawn, the Board of Agriculture and Fisheries would urge that neighbouring farmers, landowners and land-agents should interest themselves in remedying the misfortune by some measure of co-operation, and that those in a position to do so should arrange to assist or to procure assistance for those whose stock has been removed to supply the needs of the nation.

The Board of Agriculture and Fisheries appeal to horticulturists, both owners of private gardens and market growers, to preserve for distribution to allotment holders and cottagers their surplus stocks of seedling vegetables suitable for autumn planting in the district. These seedling plants, usually destroyed after the growers' own requirements have been satisfied, might under present conditions prove most useful. It is suggested that the owners of private gardens should distribute their surplus plants locally either direct or through relief committees.

In districts in which allotments are numerous, the owners of large gardens might be able, at little inconvenience or expense,

to sow during this month cabbages suitable for planting out in October, and so provide plants for those who themselves have no facilities for raising seedlings. Timely assistance in supplying plants would largely increase the comfort of cottagers in the coming year. Market growers who may have larger stocks of surplus seedlings than could be utilised locally are invited to communicate with the Board, who will endeavour to arrange for their distribution.

There is a second direction in which horticulturists, both professional and amateur, might give timely assistance. The Board themselves and the horticultural Press will publish hints on the selection and cultivation of vegetable crops, and instruction will be provided by the teaching staffs of Colleges and County Councils, but it will be recognised that printed instructions have very limited uses in the circumstances under consideration, and that it is impossible to convey adequate practical instruction to all who are likely to need help, through the comparatively small number of horticulturists engaged as instructors by education authorities. Much might be accomplished, however, if the gardeners employed in private establishments and skilled amateur horticulturists would volunteer to give practical hints on the cultivation of vegetables to the relatively inexperienced people who will endeavour to eke out their resources in the coming year by resorting to the cultivation of the allotments provided for them by agencies formed to combat the hardships caused by unemployment.

Although there are large stocks of food in the country it is the duty of every occupier of land to avoid waste, and by forethought and consideration of the needs of others to alleviate the hardships that a rise in the price of foodstuffs will entail.

The Development Commissioners desire to suggest to landowners in England and Wales that they should at once forward to the Agricultural College for their Province particulars of any waste land which they are willing to place at the disposal of suitable authorities for improvement by such means as reclamation or afforestation. The particulars of the land should include situation, approximate area, elevation, character of the soil, and the terms on which the land can be obtained by an authority willing to improve it.

THE following arrangements have been made by the Board of Agriculture and Fisheries for the issue of certificates required by certain Colonial and Foreign Governments to accompany plants, &c., imported from England and Wales:—

**Plant Export
Certificates.**

1. *Certificates for Plants exported to the U.S.A.*—The American Government now require that all "nursery stock" (an expression which for this purpose includes orchids) shipped from this country to the United States shall be accompanied by a certificate from a duly authorised officer of the Board that the plants have been examined and found to be free from injurious plant diseases and insect pests. Nursery stock shipped between May 31st and October 1st must be examined at the time of packing, but the stock shipped during the remainder of the year must be examined on or after October 1st, after which no further examination is necessary till June 1st following.

Growers who desire to export to the United States should advise the Board as early as possible in the year, so that arrangements may be made for a preliminary inspection of their premises during the summer months. A final examination will be made as early as possible in October, and if the nursery is free from injurious diseases and pests the Board will be prepared to issue any certificates required up to the end of the following May on payment of the fee indicated below.

Fee.—The usual charge will be £2 2s. od. in respect of each nursery. A larger sum will be charged in certain cases, and the Board will be prepared to consider applications for a reduced fee when two or more nurseries in the same occupation can conveniently be examined in conjunction.

Stock shipped between May 31st and October 1st will be examined under the conditions explained in Section 3 of this Memorandum.

2. *Phylloxera Certificates.*—These certificates cannot be issued by the Board unless the premises where the plants were grown have been examined by one of their Inspectors. The necessary examination will be made and an unlimited number of certificates issued on payment of a fee of £2 2s. od. A separate fee is not charged, however, if the nursery has been inspected in accordance with the arrangement outlined in Section 1.

3. *Certificates for Plants to be sent by Parcel Post and for consignments under 112 lb. in weight.*—When a certificate is required that the plants or bulbs in a consignment have been examined and declared to be healthy or to be free from specified pests, the exporter should make application to the Board a few days before the consignment is to be dispatched. As regards plants or bulbs to be sent abroad through the Parcel Post, the following procedure must be followed:—The plants must be sent to the office of the Board in a box which can easily be opened and the plants must be packed in such a way that they can be taken out and thoroughly examined and then repacked by the Inspector. The box must be labelled "Plants (or bulbs) for export." A prepaid adhesive label addressed to the consignee must be enclosed, together with the Customs declaration required by the Postal Regulations. After examination the parcel will be posted and a receipt of posting obtained and sent to the consignor. If it be desired that the parcel shall be insured the requisite sum must be forwarded.

No fee is charged for the examination of consignments packed in one box and weighing under 11 lb.

NOTE.—As several countries now refuse to admit plants by Parcel Post, growers should consult the information given in the Post Office Guide as to the regulations of the country of destination before sending plants for examination.

Consignments of plants weighing under 1 cwt. will also be examined at the Board's office. The fees charged for the issue of certificates in such cases are as follows:—

	s.	d.
Packages not exceeding 56 lb. in weight	2	6
" between 56 lb. and 1 cwt. in weight	5	0

Consignments exceeding 1 cwt. cannot be examined at the Board's office, and the fees in such cases will be at a special rate. If, however, it is necessary for an Inspector to travel more than 20 miles to the place of examination the fee will be £2 2s. od.

The fee must be paid before the certificate can be issued.

Every care is taken to ensure that plants examined at the Board's offices are properly repacked and promptly dispatched, but it must be distinctly understood that the Board cannot accept any liability in respect of any consignment examined or certificate issued by them.

4. *Potato Certificates.*—Applications for the Board's certificate as to the freedom of a district from Wart Disease of Potatoes must in all cases be accompanied by a declaration by the actual grower of the potatoes, giving the name of the farm, the parish and county in which it is situated, and stating that Wart Disease has not been known to exist on the premises. The application and declaration must reach the Board at least three days before the consignment is to be shipped. No charge is made for these certificates.

Particulars of the special arrangements made for the issue of certificates to accompany potatoes shipped to Australia and Argentina will be forwarded on application.

The Board will be glad to furnish information as to the regulations in force in any particular colony or country.

THE Potatoes (Corky Scab) Order of the Board of Agriculture and Fisheries, which applies to England and Wales, and will come into operation on September 1st, 1914, makes the following (among other) provisions:—

In this Order "Disease" means the disease affecting potatoes which is known as *Spongospora scabies* (Masse), or *Spongospora subterranea* (Johnson), or *Spongospora solani* (Brunchorst), or Corky Scab, or Powdery Scab; and "diseased" means visibly affected with disease.

Notification of Disease.—The occupier of any premises on which disease exists, or appears to exist, shall forthwith notify the fact by post or otherwise to the Board, or to an Inspector or other officer of the Board or of the Local Authority authorised to receive such notification, and where practicable a specimen showing the disease shall accompany the notice.

Investigation by Local Authority.—(1.) The Local Authority on receiving in any manner notice of the existence or apparent existence of disease shall forthwith take such steps as may be necessary to determine on what premises the disease exists in the crops or soil, and shall cause notice of such determination to be served on the occupier of each of such premises, which, within the limits specified in the notice, shall

thereupon become "infected premises" and continue to be infected premises until the notice is withdrawn in accordance with Article 7, but the limits of the infected premises may be extended by a notice served by the Local Authority on the occupier of the infected premises.

(2.) The notice shall as far as practicable include in the infected premises only those lands in which there are or have been diseased tubers.

Action to be taken after Preliminary Investigation.—(1.) The Local Authority may at any time and from time to time by a notice served on an occupier of infected premises require him to adopt such measures for prevention of the spread of the disease as the Local Authority may consider necessary to prevent the disease being conveyed to other premises, and as may be specified in the notice.

(2.) Nothing in this Order shall prevent the destruction by the owner thereof, by fire or other effective method, of any diseased tubers.

(3.) A notice under this article may prescribe the time within which the adoption of any measure thereby prescribed shall be completed.

Provisions to prevent Spread of Disease by Diseased Potatoes.—An Inspector of the Local Authority, acting under their directions, may by a notice served on any person having in his possession or under his charge tubers which are diseased, or in a pit, bag or other receptacle with diseased tubers, or which the Inspector has reason to believe to have been in a pit, bag or other receptacle with diseased tubers, or otherwise exposed to infection with disease, prohibit the removal of the tubers from the premises on which they are when the notice is served, except under such conditions as the Inspector, acting under such directions, may consider necessary to prevent the spread of disease and prescribe by the notice.

Withdrawal of Notices of Infected Premises.—A notice constituting any premises infected premises may be withdrawn by a notice signed by an Inspector or other officer of the Board. Unless there are special circumstances, a notice of withdrawal shall not be issued as regards any premises until the expiration of three years from the date of the notice declaring the premises infected.

Copies of Notices and Returns of Proceedings to be sent to the Board.—

(1.) A copy of every notice served under this Order shall be sent to the Board by the Inspector or officer by whom the notice is signed.

(2.) The Local Authority shall, in a form to be provided by the Board, notify the Board of any outbreak of disease.

Information to be given as to Diseased Potatoes.—Every person who has or has had in his possession or under his charge any diseased tubers, and every person who as auctioneer, salesman or otherwise has sold or offered for sale any such tubers shall, if so required in writing by the Board, or the Local Authority, or an Inspector of the Board or of the Local Authority, give the Board, or the Local Authority, or the Inspector, as the case may be, all such information as he possesses as to the persons in whose possession or under whose charge they are or have been; Provided that any information given under this Article shall not be available as evidence against the person giving the same in any prosecution under this Order, except in respect of an alleged failure to comply with this Article.

Powers of Entry.—Any Inspector or other officer appointed in that behalf by the Local Authority, upon production if so required of his appointment or authority, may for the purpose of enforcing this Order enter any premises and examine any plant or tubers thereon.

Notification of Order.—This Order shall be published by the Local Authority in accordance with any direction given by the Board.

Powers of the Board and their Inspectors.—The powers conferred by this Order on a Local Authority or an Inspector of a Local Authority may be exercised by the Board or an Inspector of the Board respectively, and any notice served by a Local Authority or an Inspector of a Local Authority may be altered or revoked by a notice under this Order served by the Board or an Inspector of the Board.

Offences.—Every person shall be liable on conviction to a penalty not exceeding ten pounds, who—

- (1.) fails to give notification of disease as required by Article 3; or
- (2.) fails to adopt such measures for prevention of the spread of the disease as are specified in a notice served on him under Article 5; or
- (3.) removes any tubers in contravention of this Order or any notice served thereunder; or
- (4.) refuses or fails to give any information required under Article 9, or gives false information; or
- (5.) wilfully obstructs or impedes any Inspector or other officer in the course of his duties under this Order.

Execution of the Order.—(1.) Each Local Authority shall carry into effect this Order within their District, and shall appoint such Inspectors or other officers for that purpose as may be necessary.

(2.) Any duty or power imposed or conferred on a Local Authority by this Order may be performed or exercised by an Inspector of the Local Authority acting under and in accordance with any directions in that behalf given by the Local Authority.

(3.) For the purposes of this Order a notice shall be deemed to be served on a person if it is delivered to him personally or left for him at his last known place of abode or business or sent through the post in a letter addressed to him there, and a notice or other document purporting to be signed by the clerk or an Inspector of a Local Authority or an Inspector of the Board shall be prima facie evidence that it was signed by him and duly authorised by the Local Authority or the Board.

THE Board of Agriculture and Fisheries have addressed the following circular letter dated the 27th July, 1914, to Local Authorities in England and Wales on the subject of the issue of the Potatoes (Corky Scab) Order of 1914:—

Sir,—I am directed by the Board of Agriculture and Fisheries to send for the acceptance of your Local Authority six copies of an Order entitled the Potatoes (Corky Scab) Order of 1914 which they have recently issued. The Order, which does not come into force till the 1st September next, puts the disease known in England as Corky Scab and in America as Powdery Scab on the list of plant diseases which it is compulsory to notify to the Board or the Local Authority by the occupier of any premises where potatoes affected with this disease are grown. The disease affects the surface of the tuber only except in very bad cases, and produces characteristic scabs which are liable to be confused with the common scab due to the mechanical action of the soil or to the presence of the organism known as *Oospora scabies*. True Corky Scab is believed to be very rare in England, and except in the mildest form to be confined to districts with a heavy rainfall, but the Government of the United States have prohibited the importation of potatoes from England and thereby put a stop to what was at one time a large and important trade, until the Board are able to satisfy them that this disease is

unknown in the potato-growing districts, and that there is no fear that it will be introduced on consignments of potatoes sent to America. In order that the Board may be in a position to comply with the requirements of the American Government I am to ask you to move your Local Authority to give wide publicity to this Order, and to render them such assistance in enforcing it as may be in their power. They do not think it necessary to ask your Local Authority to appoint any officers or inspectors specially for this purpose, as they propose to instruct their inspectors to deal with any case that may arise, but they would be glad if your Council would authorise any officer who may already have been instructed to deal with cases of Wart Disease of Potatoes to acquaint the Board should the presence of Corky Scab be brought to his notice.

The Board propose also by the issue of posters and leaflets to explain the nature and appearance of this disease to potato growers and they will at a later date send you copies which they hope you will distribute, but in the meantime they will be glad if you will publish this Order in the manner best calculated to bring the matter to the attention of all persons concerned. I am, &c.,

T. H. MIDDLETON.

On the 17th July, an outbreak of foot-and-mouth disease was confirmed near Roscrea, county Tipperary, Ireland, and the Department of Agriculture and Technical Instruction for Ireland at once instructed their Port Inspectors to allow no further shipments of animals to Great Britain until further notice. On the following day an Order was made by the Board entirely prohibiting the landing in Great Britain of cattle, sheep, goats, or swine brought from any part of Ireland, and arrangements were made for tracing and detaining for examination all animals which may have been recently shipped to Great Britain from the Roscrea district.

On the 22nd July, the Board modified their Order of the 18th July so as to allow the landing on and after the 24th July, at certain landing places for slaughter within 96 hours after their landing, of animals shipped from any authorised port in Ireland except Dublin, Waterford, and Wexford. Similar facilities were granted for the landing of animals for slaughter from those three ports also, by an Order which took effect on the 31st July. The position remaining favourable, the Board made a further Order on the 4th August, taking effect on 6th August, allowing the shipment of animals from any Irish port to any landing place in Great Britain, but requiring that (a) animals landed at Avonmouth Dock, Cardiff, Deptford, Glasgow, Manchester and Woodside Lairage, Birkenhead, shall be slaughtered in the landing place within 96 hours after their landing, and (b) animals landed at other landing places shall be detained 96 hours in the landing place, after which they may be slaughtered in the landing place or moved by licence to any premises in Great Britain to be there detained and isolated, unless slaughtered on the premises, for a further period of 14 days under the supervision of a Veterinary Inspector of the Local Authority. Licences are not as a rule issued, however, for movement into the districts of Local Authorities who have informed the Board that they have Regulations in force prohibiting the entry of Irish animals into their District, but the Board's Inspectors at the landing places are permitted at their discretion to issue licences for the movement for immediate slaughter of animals to populous districts where the demand for meat is likely to be great, or for supplies for Naval or Military contractors. In such cases the animals are allowed to be moved out of the landing place after only 10 hours' detention therein.

In regard to the supply of poles suitable for telephone poles, the following circular letter was issued by the Postmaster-General on 8th July:—Sir,—In connection with the

Supply of Telephone Poles.

Telephone Development Scheme which is being actively carried out by the Post Office, the Postmaster-General has recently had to

place contracts for the supply of upwards of 100,000 wooden poles in addition to those deliverable (some 65,000) under the annual contracts placed last autumn for the normal needs of the service.

Mr. Hobhouse has felt the greatest regret that British forestry has had no share in contributing to this supply; and, in his desire to bring the subject once again to the notice of owners of woodlands and forests in the United Kingdom and of merchants concerned in finding markets for native timber, he seeks the good offices of the Press, in the hope that it will co-operate with him to encourage interest in British forestry.

Mr. Hobhouse is acquainted with the repeated efforts which the Post Office has made in the past to encourage British supplies, and with the very small amount of timber which has been obtained as the result of those endeavours. In particular, attempts were made in 1909 to attract supplies of home-grown timber, but with results deeply disappointing to the then Postmaster-General. The annual requirements of the Post Office in the matter of wooden poles amount to many thousands; but the yield from British sources has been a few hundreds only. So meagre a response to a constant and increasing demand can only be regarded with the keenest disappointment and regret, and to secure a larger measure of success for and from British growers, no effort will be spared by the Post Office.

The principal places where delivery is required are London, Hull, the Tyne District, Methil (Fife), Ardrossan, Ellesmere Port, Newport (Mon.), Southampton and Belfast.

In the opinion of the Department's expert officers two descriptions of timber stand out before all others as most suitable for the purpose in question, in respect both of weather-resisting properties and general shapeliness, viz., *Pinus sylvestris*, commonly known as Red Fir or Scotch Pine, and *Larix europea*, or Larch.

Both of these species are easily and commonly grown in the United Kingdom, but failure to meet the requirement of length and thickness combined have led to the rejection of much of the British timber offered to the Post Office by growers whose supplies the Postmaster-General would otherwise have been only too glad to accept at fair prices.

The specification includes 21 lengths ranging from 16 to 85 feet and provides for a minimum diameter at the top of the pole ranging from five inches in the case of the lightest to eight inches in the case of the heaviest.

In view of the Department's very large needs for wooden poles, it is to be hoped that home growers and merchants may yet make fresh or renewed efforts to compete for a share of the business; and to this end Mr. Hobhouse suggests that anyone desirous of further information on the subject should address an enquiry to the Controller, Post Office Stores Department, 17-19, Bedford Street, Strand, London, who will gladly afford all information in his power.

I am, &c.,

H. C. GUEST.

THE Board of Agriculture and Fisheries have expedited the tabulation of the agricultural returns collected in June last and are now able to give the following figures, subject to final revision, of the acreage of certain crops and the number of live stock in England and Wales this year. The corresponding final figures for last year are added.

—	1914.	1913.	Increase (+) or Decrease (—)	
	Acres.	Acres.	Acres.	Per cent.
Wheat ...	1,843,000	1,702,000	+ 141,000	+ 8.3
Barley ...	1,536,000	1,559,000	— 23,000	— 1.5
Oats ...	1,937,000	1,975,000	— 38,000	— 1.9
Beans ...	299,000	268,000	+ 31,000	+ 11.6
Peas ...	171,000	164,000	+ 7,000	+ 4.3
Potatoes ...	470,000	442,000	+ 28,000	+ 6.3
	Number.	Number.	Number.	
Cattle ...	5,880,000	5,717,000	+ 163,000	+ 2.8
Sheep ...	17,457,000	17,130,000	+ 327,000	+ 1.9
Pigs ...	2,516,000	2,102,000	+ 414,000	+ 19.7

On the basis of the above figures and of reports received from their Crop Reporters the Board are able to make an estimate of the total production of the following crops:—

—	1914.	1913.	Increase (+) or Decrease (—)	
	Quarters.	Quarters.	Quarters.	Per cent.
Wheat ...	7,320,000	6,642,000	+ 678,000	+ 10
Barley ...	6,140,000	6,323,000	— 183,000	— 3
Oats ...	9,100,000	9,379,000	— 279,000	— 3
Beans ...	1,080,000	915,000	+ 165,000	+ 18
Peas ...	435,000	422,000	+ 13,000	+ 3
	Tons.	Tons.	Tons.	
Potatoes ...	2,880,000	2,895,000	— 15,000	— 1

The wheat crop is not only 10 per cent. larger than in 1913 but is well above the average of the last ten years. The crop of Beans is the largest since 1907, while that of Potatoes is only slightly below that of last year, which was the largest on record.

In view of the special importance at the present time of securing that the home-grown supplies of food-stuffs are used to the best advantage in the public interest, with due regard to future requirements, the President of the Board of Agriculture and Fisheries has appointed the following gentlemen to serve as a Consultative Committee:—

Committee on Home-Grown Supplies of Food-Stuffs.
The Right Hon. Sir Ailwyn Fellowes (Chairman), Messrs. Charles Bathurst, M.P., Charles Bidwell, H. Trustram Eve, S. W. Farmer, C. B. Fisher, E. M. Nunneley, Francis H. Padwick, George Scoby, G. C. Smyth-Richards, R. Stratton, The Hon. Edward G. Strutt, and Mr. Christopher Turnor.

The first meeting of the Committee was held on August 10th, at the offices of the Surveyors' Institution, 12, Great George Street, Westminster, to which address any communications may be sent to the Joint Secretaries, Messrs. A. Goddard (Secretary to the Surveyors' Institution) and C. B. Marshall (Secretary to the Land Agents' Society).

IN view of the interest which has recently been shown in the question of seed testing the Board felt that it would serve a useful purpose if an enquiry were made into the working of seed control stations in certain European countries. They therefore instructed Mr. H. C. Long, one of their officers, to visit nine of the more celebrated and representative stations, viz., Copenhagen, Hamburg, Berlin, Breslau, Budapest, Vienna, Munich, Zürich and Wageningen.

Seed Control Stations on the Continent.

Some account of these stations, the work they do, and the success which has attended their efforts to improve the general quality of seeds sold in their respective countries is given in a supplement (No. 13) to the present issue of the *Journal*.

This supplement is published at 4d. post free. Subscribers to the *Journal* may obtain a copy free on written application.

THE Board of Agriculture and Fisheries desire to inform all farmers, especially those in Norfolk and Cumberland, that a leaflet on the Diamond Back Moth can be obtained post free and gratis on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

Injury by the Diamond Back Moth.

The larvæ of this moth have been doing great injury to swedes and turnips, especially in the districts mentioned, but the cause of the injury does not appear to be recognised in many cases, as the caterpillars are very small.

MISCELLANEOUS NOTES.

Importation of Potatoes into Porto Rico.—The Board have received information that, as no potatoes are grown in Porto Rico, the United States Department of Agriculture have decided that the provisions of the "Regulations Governing the Importation of Potatoes into the United States" shall not apply to Porto Rico, and that potatoes may be imported into that country free of restriction until otherwise ordered.

Importation of Plants into Fiji.—The Board have received a copy of the regulations under the Fiji "Diseases of Plants Ordinance, 1913." The chief provisions are as follows:—

All plants, vegetables, and parts of plants must enter the Colony through the ports of Suva, Levuka, and Lautoka, and their entry will be subject to examination and treatment and the issue of an inspectors' certificate authorising their removal.

Fruit imported into the Colony must be accompanied by a certificate by the Department of Agriculture of the country where the fruit was grown, stating that the fruit is clean and free from disease.

Plants affected by any species of fruit fly or borer will be destroyed; if affected with any other insect pest they will be fumigated. Plants affected with fungus disease will be treated with Bordeaux mixture. Potatoes affected by *Phytophthora infestans* (Irish blight) will be destroyed or re-shipped.

Agricultural Progress in India.—The recently issued "Statement Exhibiting the Moral and Material Progress and Condition of India" for 1912-13 [H.C. 288, 1s. 3d.], includes an interesting account of the work that is being done in the direction of improving and assisting agricultural industries.

Notes on Agriculture Abroad.

The officers directly under the Government include the Director of the Pusa Institute, who is also Agricultural Adviser to the Government, 3 entomologists, 2 mycologists, 2 agricultural chemists, 1 economic botanist and 1 cotton specialist. All these officers are recruited in England; there is also a number of locally-appointed officials.

There is a Board of Agriculture which publishes agricultural memoirs and an agricultural journal. The larger provinces have agricultural departments under a director of agriculture, with one or more deputy directors, the latter being trained agriculturists. Besides these there are various specialists attached to the provincial departments. In addition, six provinces possess agricultural colleges, besides the central college at Pusa, while in every province there are experimental farms, the ultimate aim being that there should be one such for each large tract of country in which the agricultural conditions are fairly homogeneous.

A scheme was formulated in 1905 for the development of agricultural experiment and instruction, and the greater part has now been put into operation. It is based on the principle that effective improvement in Indian agriculture depends mainly on the application of European science to Indian conditions. The necessary scientific knowledge must be obtained in the first instance by recruiting trained specialists from the United Kingdom; but it is an essential part of the scheme that the best agricultural training shall be made available in India, in order that the country may become self-supporting, so far as possible, in the scientific development of agricultural methods suited to local conditions.

Pusa Research Institute and College.—The College is chiefly a higher teaching institution for post-graduate studies in a special branch of research. During 1912-13 ten students were under training. Nineteen students attended the short courses, and several visitors also worked at the Pusa laboratories.

Experimental work is carried on at the Institute farm and laboratory by the Government specialists in questions relating to crops, soils, manuring, tobacco and other questions. "Pusa" wheat has been found to combine good yield and good milling qualities with great rust-resisting power and general hardiness. Large distributions of "Pusa" seed are being made in the great wheat tracts of India.

Agriculture in the Provinces.—There are numerous agricultural stations and experimental and demonstration farms throughout the various provinces. These institutions devote themselves chiefly to experiments and trials connected with the crops grown in the particular districts served by them, though work of a wider nature is also undertaken. Large quantities of seeds are distributed by the stations, while in one province 30,000 fruit trees were distributed free of cost during 1912-13. As already noted, six of the provinces possess an agricultural college.

Horse and Cattle Breeding.—Government stallions are allotted to certain selected districts, and stallions are provided in the non-selected districts, partly from district board funds and partly from provincial revenues aided by Government grants. Of the latter there were on the register at the end of 1912-13, 80 horses, 103 ponies and 106 donkeys.

There were at the end of 1912-13, 89 Government bulls and 753 bulls owned by district boards. There are six provincial cattle farms, besides

the Government Cattle Farm which contained 30 herd bulls and 1,292 cows, besides a large number of young stock and draught bullocks, and some mules, donkeys and sheep.

Imperial Forest Research Institute.—The work of the Institute comprises tuition and research in silviculture, forest economy, zoology, botany and chemistry.

In the Forest College a provincial service class has been started, which, with the classes for rangers made a total of 90 students on 1st March, 1913.

Wheat Production of India.—According to the "Statement Exhibiting the Moral and Material Progress and Condition of India," for 1912-13, wheat occupies about 10 per cent. of the whole cultivated area in India. The bulk of it is sown in autumn and reaped in April or May. The area under wheat has expanded greatly with the extension of irrigation. In the season of 1912-13, which owing to drought and hail was unfavourable to wheat, the area devoted to its cultivation was 29,542,000 acres, and the total yield was 9,598,000 tons, compared with 31,141,000 acres and 9,925,000 tons in 1911-12, and an average of 27,688,000 acres and 8,368,000 tons for the five years ending 1910-11.

The exports of wheat and wheat flour are subject to great fluctuations. The export demand for wheat has led to an extension of cultivation, and exports of flour are now beginning to expand. In 1912 the United Kingdom imported more wheat from India than from any other single source. The total exports of wheat from India in 1912-13 were 1,660,200 tons, and of flour 68,500 tons, against 1,361,200 tons and 51,500 tons in 1911-12, and an average of 821,670 tons and 36,700 tons for the five years ending 1910-11.

The *Bulletin of Agricultural and Commercial Statistics* for July, 1914, issued by the International Institute of Agriculture, gives estimates of the production of the cereal crops this year.

Notes on Crop Prospects Abroad. The countries for which it is possible to give an approximate estimate of the production are as follows:—

In *Europe*.—Prussia, Belgium, Spain, England and Wales, Hungary (proper), Italy, Luxemburg, Russia in Europe (63 governments), Switzerland; in *America*: United States; in *Asia*: India, Japan; in *Africa*: Tunis.

Wheat.—The total production in the above mentioned countries, excluding Prussia, is estimated to amount to 307,165,000 qr., as compared with 318,020,000 qr. in the same countries last year, the decrease being equal to 3.4 per cent. The area under production was larger than in 1913 by 1.3 per cent.

Rye.—The estimated production in the specified countries, with the exception of England and Wales, United States, India, Japan and Tunis, is placed at 164,525,000 qr., against 167,703,000 qr. in 1913, or a decrease of 1.9 per cent., while the area planted was practically the same as last year.

Barley.—The production in the above countries, excluding Prussia and India, is estimated at 120,075,000 qr., or a decrease of 5.7 per cent. as compared with last year, when the production was 127,344,000 qr. The area under production showed a decrease of 0.2 per cent.

Oats.—For the above named countries, with the exception of Prussia, India, and Japan, the estimated production is 241,478,000 qr., against

261,283,000 qr. in 1913, the decrease amounting to 7.6 per cent. The area planted, however, was slightly larger than last year.

Holland.—An official report, dated July 11th, gives the areas under the crops as follows (in acres and 1913 figures in brackets):—Wheat 144,660 (141,153), rye 559,882 (563,639), barley 66,939 (66,278), oats 345,664 (347,598), sugar beet 152,920 (148,941), and red clover 72,398 (72,144). Since the beginning of June the weather has generally been favourable and prospects are, on the whole, promising. (*H.M. Consul-General at Rotterdam.*)

Hungary.—The production of the cereals was officially forecasted on July 20th as follows (in quarters, and 1913 figures in brackets):—Wheat 15,676,000 (18,913,000), rye 5,567,000 (6,095,000), barley 8,055,000 (9,576,000), and oats 9,288,000 (10,234,000). (*Dornbusch, July 27th.*)

Rumania.—The *Moniteur du Commerce Roumain* of July 1st states that the condition of the crops at the end of June was, on the whole, fairly satisfactory throughout the country and barley and oats were expected to yield well.

Canada.—A bulletin, dated July 27th, issued by the Census and Statistics Office at Ottawa gives the area under wheat as 11,022,000 acres or 7,000 acres more than in 1913, under oats as 10,814,500 acres or 380,500 acres more, and under barley as 1,597,600 acres or 15,400 acres less. The condition of spring sown crops at the end of June was, on the whole, fairly satisfactory. The condition of the cereals on June 30th, (100 representing the promise of a full crop) was as follows:—Winter wheat 78.2, spring wheat 86.3, all wheat 84.5, oats 87.3 and barley 86.2.

United States.—The Department of Agriculture forecast the production of the crops, from their condition on August 1st, as follows (in bushels, and 1913 figures in brackets):—Winter wheat 675,000,000 (523,561,000), spring wheat 236,000,000 (239,819,000), total wheat 911,000,000 (763,380,000), oats 1,153,000,000 (1,121,768,000), barley 203,000,000 (178,189,000), maize 2,644,000,000 (2,446,988,000), rye 43,000,000 (41,381,000) and potatoes 370,000,000 (331,525,000). (*Dornbusch, August 8th.*)

Fruit, Potatoes and Hops.—*France.*—H.M. Vice-Consul at Cherbourg in a report dated July 15th, stated that the crop of cider apples in his district promised to be above an average and nearly as good as that of 1913, which was exceptionally large. There being a large reserve of cider from last year, growers would probably be glad to find an outlet for the 1914 crop, and there should be a fair amount of apples available for export from the district at reasonable prices.

Germany.—H.M. Consul-General at Munich, in a report dated July 10th, stated that although wet and cold weather during May delayed growth, prospects for the hop crop in Bavaria were very promising. Aphis attacks had been prevalent but were decreasing rapidly and not much damage had been done. At the beginning of July the plants looked healthy.

The official report relating to the condition of the crops at the beginning of July stated that potatoes in Germany frequently came up irregularly and were still patchy in places. The condition of the crop was given as 2.7 (2=good, 3=average).

Austria.—The official report relating to the condition of hops at the middle of July stated that the crop in Upper Austria and Styria, though still somewhat backward had made good progress with favourable weather. In Bohemia the hops were almost everywhere in excellent

condition, the plants being healthy and free from pests and the bine being as high and frequently higher than the poles or frames with many vigorous side shoots. In the Dauba district of this province, however, yards which had been attacked by pests last year were somewhat unsatisfactory as were also similar yards in Moravia. As a rule, however, in Moravia the plants were mostly as high as the poles and the side shoots vigorous. In east Galicia growth was hindered by cold, wet weather while in west Galicia prospects were very unfavourable owing to blight and pests. In Moravia also low-lying gardens had suffered from pests.

Holland.—H.M. Consul-General at Rotterdam stated that, according to a report of the Dutch Department of Agriculture of July 15th, the yield of apples and pears in Holland did not promise to be very abundant. Continued drought had caused the fruit to be small and much had fallen. On the whole, pears promised better than apples, plums were average to good and raspberries were good to very good almost everywhere. Grapes under glass were good in all districts.

A similar report relating to conditions on July 11th stated that eating potatoes were, on the whole, very good and that a heavy crop of factory potatoes might be expected. Prospects for beans and peas were good and for onions fairly good. The areas under the above crops were given as follows (in acres and 1913 figures in brackets):—Eating potatoes 338,175 (341,258), factory potatoes 77,736 (78,642), beans 39,913 (41,842), peas 65,166 (68,187) and onions 6,825 (6,526).

United States.—The Department of Agriculture gave the condition (expressed as a percentage of the ten year average) of apples in the United States on July 1st as 108.1, of pears as 110.0, of hops as 103.2 and of potatoes as 94.3. The average price received by growers on July 1st for potatoes was about 3s. 5d. per bushel and for apples, on June 15th, about 5s. 8d. per bushel, prices for both commodities being somewhat higher than usual. The area under potatoes on July 1st was estimated at 3,708,000 acres.

H.M. Consul at Portland, Oregon, reported (July 7th) that the hop crop in the states of Oregon and Washington was expected to yield 135,000 bales; and that should there be good rains during the present month, the yield would probably be increased to about 150,000 bales. A large acreage of hops would yield a crop this year for the first time, but there were many gaps in the old yards. Although no reliable estimate of the apple crop could be made until the beginning of August, prospects at the beginning of July were for a fairly large crop, considerably in excess of that indicated at the middle of June.

H.M. Consul-General at San Francisco reported (July 14th) that the production of the hop crop in California had been forecasted by the Clemens Horst Company of San Francisco at 100,000 bales or 20,000 bales less than last year. The current price for the new crop was 7d. to 8d. per lb. field run. The prune crop of California was expected to yield 120,000,000 lb. to 135,000,000 lb., the lower figure being probably the more correct.

The Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales on the 1st August, state that the wheat crop is forward and that the yield per acre

Agricultural Con- will be well over the average. The harvest
ditions on August 1st. has commenced in the southern counties.

Barley has improved during the past month, and will probably be up to the average. Oats are a fair crop, though

short in straw. Beans are an average crop, but peas are not quite so good. The potato crop is very strong and healthy, and there will be a full supply, without any addition from imports, for a whole year's consumption. The root crops look well, but require rain.

The apple crop, especially in the districts where it is chiefly grown, is considerably above the average, while the crop of pears is even more satisfactory.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on August 1st, 1914, certain diseases of animals existed in the countries specified:—

Austria (on July 22nd).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 1,788 Höfe infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period July 1st—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (2 outbreaks in 2 communes), Rabies.

Bulgaria (for the period July 6th—14th).

Anthrax, Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Swine Fever.

Denmark (month of June).

Anthrax, Swine Erysipelas, Swine Fever.

France (for the period July 12th—18th).

Anthrax, Blackleg, Foot-and-Mouth Disease (22 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period June 15th—30th).

Foot-and-Mouth Disease (1,311 infected places in 296 parishes), Glanders and Farcy, Swine Fever.

Holland (month of June).

Anthrax, Foot-rot, Glanders, Swine Erysipelas.

Hungary (on July 8th).

Anthrax, Foot-and-Mouth Disease (total of 6,973 "cours" infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period July 13th—19th).

Anthrax, Foot-and-Mouth Disease (352 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period June 1st—15th).

Sheep-pox.

Norway (month of June).

Anthrax, Blackleg,

Rumania (for the period July 6th—13th).

Foot-and-Mouth Disease (24,597 animals), Glanders and Farcy, Rabies, Sheep-pox, Sheep Scab, Swine Erysipelas, Swine Fever.

Russia (month of March).

Anthrax, Foot-and-Mouth Disease (9,857 animals in 266 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period May 9th—16th).

Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Spain (month of May).

Anthrax, Dourine, Foot-and-Mouth Disease, Glanders and Farcy,

Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of June).

Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (for the period July 6th—12th).

Anthrax, Blackleg, Foot-and-Mouth Disease (53 "étables" entailing 997 animals, of which 17 "étables" were declared infected during the period), Swine Fever.

The Weather in England during July.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
	°F.	°F.	Inches.	Inches.		Hours.	Hours.
<i>Week ending July 4th:</i>							
England, N.E. ...	62.3	+4.7	1.47	+1.03	3	7.6	+1.1
England, E. ...	66.5	+6.9	0.44	+0.07	2	8.7	+1.4
Midland Counties ...	63.8	+4.0	1.33	+0.85	3	8.1	+1.5
England, S.E. ...	64.6	+4.4	0.39	+0.02	2	9.7	+2.2
England, N.W. ...	60.1	+1.9	1.14	+0.55	3	6.9	+0.6
England, S.W. ...	61.3	+2.5	1.47	+0.96	4	7.6	+0.6
English Channel ...	62.2	+2.4	0.65	+0.25	3	8.6	+0.1
<i>Week ending July 11th:</i>							
England, N.E. ...	59.9	+1.3	0.17	—0.29	2	7.0	+0.3
England, E. ...	60.9	+0.4	0.37	—0.05	3	7.9	+0.5
Midland Counties ...	60.7	+0.8	0.56	+0.09	3	6.9	+0.2
England, S.E. ...	61.4	+0.4	0.54	+0.14	3	8.6	+1.0
England, N.W. ...	60.1	+1.4	0.41	—0.17	4	6.9	+0.5
England, S.W. ...	59.8	+0.4	0.76	+0.23	4	6.8	—0.2
English Channel ...	60.3	—0.3	0.89	+0.44	4	7.3	—1.2
<i>Week ending July 18th:</i>							
England, N.E. ...	61.6	+2.8	1.08	+0.60	4	3.4	—3.0
England, E. ...	64.4	+3.7	0.72	+0.20	3	6.3	—0.8
Midland Counties ...	62.2	+2.1	0.58	+0.08	4	3.8	—2.5
England, S.E. ...	63.2	+1.7	0.53	+0.06	3	6.7	—0.6
England, N.W. ...	60.6	+1.7	1.17	+0.54	4	3.6	—2.5
England, S.W. ...	61.3	+1.5	0.46	—0.18	5	4.5	—2.2
English Channel ...	61.3	+0.1	0.18	—0.34	4	5.4	—2.8
<i>Week ending July 25th:</i>							
England, N.E. ...	59.9	+1.2	0.24	—0.30	3	4.7	—1.5
England, E. ...	62.4	+1.7	0.23	—0.36	3	4.7	—2.0
Midland Counties ...	60.5	+0.4	0.76	+0.18	4	3.6	—2.2
England, S.E. ...	61.4	—0.2	1.00	+0.45	4	3.9	—3.9
England, N.W. ...	60.2	+1.2	0.80	+0.08	5	4.5	—1.2
England, S.W. ...	59.6	—0.4	1.45	+0.70	5	4.3	—1.8
English Channel ...	60.6	—0.9	1.08	+0.51	5	6.6	—0.9
<i>Week ending Aug. 1st:</i>							
England, N.E. ...	56.3	—2.4	0.54	—0.12	4	3.5	—2.2
England, E. ...	58.2	—2.5	0.45	—0.12	4	3.4	—2.9
Midland Counties ...	57.2	—2.8	0.66	+0.04	3	3.1	—2.4
England, S.E. ...	58.4	—3.2	0.28	—0.28	3	5.2	—1.3
England, N.W. ...	56.8	—2.2	0.80	+0.02	4	4.6	—0.8
England, S.W. ...	57.3	—2.7	1.33	+0.57	5	4.7	—1.3
English Channel ...	59.4	—2.2	0.58	+0.02	4	5.4	—2.0

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in July and June, 1914.

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

Description.	JULY.		JUNE.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots ...	9 3	8 10	9 2	8 10
Herefords ...	9 3	8 7	9 4	8 7
Shorthorns ...	9 0	8 3	9 0	8 2
Devons ...	9 1	8 4	9 0	8 1.
Welsh Runts ...	9 2	8 5	—	8 2
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves ...	9	8	9½	8½
Sheep:—				
Downs ...	9½	8½	9½	8½
Longwools ...	8½	8	8½	7½
Cheviots ...	10	9½	10½	9½
Blackfaced ...	9½	9½	10	9½
Welsh ...	8½	7½	9½	8½
Cross-breds ...	9½	8½	9½	8½
	per stone.*	per stone.*	per stone.*	per stone.*
	s. d.	s. d.	s. d.	s. d.
Pigs:—				
Bacon Pigs ...	7 0	6 7	7 3	6 10
Porkers ...	7 6	7 1	7 9	7 4
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	23 9	19 9	22 18	18 16
„ —Calvers ...	22 6	18 14	21 8	17 15
Other Breeds—In Milk ...	20 14	17 5	20 12	17 2
„ —Calvers ...	16 10	15 0	—	15 10
Calves for Rearing ...	2 15	2 3	2 17	2 4
Store Cattle:—				
Shorthorns—Yearlings ...	11 6	9 16	11 17	9 17
„ —Two-year-olds... ..	15 7	13 11	15 12	13 17
„ —Three-year-olds ...	18 10	16 19	18 19	16 18
Herefords —Two-year-olds... ..	16 0	15 4	16 14	15 2
Devons— „	16 5	13 19	16 6	14 19
Welsh Runts— „	—	14 5	16 8	15 4
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	41 0	34 1	43 10	40 10
Store Pigs:—				
8 to 12 weeks old ...	23 0	17 8	26 1	20 6
12 to 16 weeks old ...	33 4	26 2	38 0	29 11

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS IN ENGLAND in July, 1914.

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

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
BEEF:—		s. d.	s. d.	s. d.	s. d.	s. d.
English ...	1st	62 0	59 6	—	63 0	59 0
	2nd	57 6	57 0	—	59 0	55 6
Cow and Bull ...	1st	52 6	54 0	49 6	48 6	50 6
	2nd	45 6	49 6	44 0	43 6	45 6
Irish: Port Killed ...	1st	59 6	57 0	58 0	59 0	56 6
	2nd	55 6	55 0	54 0	55 6	52 0
Argentine Frozen—						
Hind Quarters ...	1st	45 6	46 0	46 6	44 0	46 6
Fore „	1st	35 0	35 0	34 6	33 0	35 0
Argentine Chilled—						
Hind Quarters ...	1st	55 0	55 6	54 6	57 6	54 0
Fore „	1st	34 0	34 0	33 6	34 6	33 6
Australian Frozen—						
Hind Quarters ...	1st	43 6	42 0	43 0	42 6	42 0
Fore „	1st	34 6	34 0	32 6	33 0	32 6
VEAL:—						
British ...	1st	72 6	69 0	81 0	68 6	75 0
	2nd	67 0	63 6	73 6	59 6	69 0
Foreign...	1st	—	—	—	73 0	—
MUTTON:—						
Scotch ...	1st	—	—	—	82 6	78 6
	2nd	—	—	—	77 6	74 6
English...	1st	76 0	79 6	—	75 0	74 6
	2nd	70 6	71 6	—	70 0	70 6
Irish: Port Killed ...	1st	73 0	74 6	76 0	71 0	72 0
	2nd	67 6	72 6	67 6	66 6	66 6
Argentine Frozen ...	1st	39 6	41 6	41 6	38 6	42 0
Australian „	1st	39 0	39 0	38 0	36 6	37 6
New Zealand „	1st	39 0	—	—	42 0	—
LAMB:—						
British ...	1st	81 0	88 6	80 6	85 0	83 0
	2nd	77 6	84 0	73 0	78 6	77 0
New Zealand ...	1st	60 6	60 6	57 0	59 6	58 0
Australian „	1st	56 6	55 6	53 6	55 6	53 6
Argentine „	1st	56 0	56 0	52 6	52 6	52 6
PORK:—						
British ...	1st	66 0	61 0	60 6	56 0	61 6
	2nd	60 6	57 0	56 0	52 6	56 0
Foreign...	1st	—	—	—	54 0	—

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 1912, 1913 and 1914.

Weeks ended (in 1914).	WHEAT.			BARLEY.			OATS.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Jan. 3...	s. d. 33 2	s. d. 30 5	s. d. 31 1	s. d. 33 3	s. d. 28 6	s. d. 26 2	s. d. 20 7	s. d. 19 10	s. d. 18 2
" 10...	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
" 17...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
" 24...	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
" 31...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb. 7...	34 0	31 0	31 0	33 2	28 10	26 7	21 4	20 1	18 9
" 14...	34 4	30 9	31 0	32 10	29 1	26 7	21 7	20 2	18 11
" 21...	34 6	30 11	31 0	32 8	28 8	26 7	21 9	20 7	18 11
" 28...	34 1	31 0	31 0	32 0	28 6	26 6	21 6	20 4	18 11
Mar. 7...	34 1	31 3	31 5	31 7	28 5	26 2	21 8	20 0	18 9
" 14...	34 0	31 1	31 6	31 2	27 11	26 0	21 8	20 2	18 7
" 21...	34 1	31 1	31 5	31 10	28 6	25 8	21 9	19 11	18 6
" 28...	34 4	31 3	31 4	30 3	27 6	25 7	21 8	19 7	18 8
Apr. 4...	34 10	31 4	31 6	30 9	27 0	25 6	21 11	19 2	18 5
" 11...	35 4	31 3	31 5	30 2	27 8	26 8	22 1	19 2	18 4
" 18...	36 7	31 6	31 7	29 11	26 11	25 4	22 4	18 10	18 4
" 25...	37 10	31 8	31 9	30 4	26 7	26 6	22 9	19 3	18 5
May 2...	38 1	32 2	31 9	30 2	25 11	26 0	23 1	19 6	18 5
" 9...	37 11	32 6	32 2	31 1	25 9	25 6	23 7	19 6	18 9
" 16...	37 8	32 10	32 7	31 2	25 4	26 3	23 7	19 9	18 11
" 23...	37 2	32 10	33 0	31 1	25 3	25 10	23 7	19 11	19 0
" 30...	36 10	32 7	33 9	30 0	26 1	26 1	23 9	20 1	19 4
June 6...	36 11	32 10	34 0	29 11	26 2	25 11	24 0	19 8	19 4
" 13...	37 0	32 8	34 1	30 8	24 7	24 11	23 10	20 2	19 8
" 20...	37 5	32 8	34 1	30 8	23 10	25 10	24 0	19 8	19 9
" 27...	37 10	32 8	34 3	30 2	24 3	25 4	23 11	19 1	20 0
July 4...	38 2	33 1	34 4	31 7	25 2	24 6	23 11	21 0	19 9
" 11...	38 3	33 4	34 2	30 2	25 10	24 9	24 1	19 4	20 0
" 18...	38 10	33 6	34 1	30 9	24 9	24 2	24 8	20 5	19 10
" 25...	38 9	33 10	34 0	30 9	24 1	24 7	23 4	20 8	19 9
Aug. 1...	38 4	34 1	34 2	28 6	24 5	25 9	22 2	20 3	19 8
" 8...	39 2	34 1		30 7	24 9		22 4	19 0	
" 15...	38 2	34 3		28 3	24 7		21 8	18 7	
" 22...	35 6	33 7		28 1	26 5		20 10	18 8	
" 29...	34 10	32 7		28 6	29 0		20 8	17 10	
Sept. 5...	35 1	31 11		29 9	30 11		21 8	17 8	
" 12...	33 5	31 9		29 0	31 5		20 5	18 0	
" 19...	32 7	31 7		29 6	30 9		19 10	17 11	
" 26...	31 7	31 6		29 9	30 1		19 5	17 9	
Oct. 3...	31 8	31 3		29 7	29 9		19 8	17 10	
" 10...	31 10	31 0		30 4	29 1		19 5	17 10	
" 17...	32 2	30 11		30 11	28 8		19 9	17 9	
" 24...	33 1	30 7		31 6	28 7		19 10	18 0	
" 31...	33 4	30 1		31 10	28 2		20 1	17 9	
Nov. 7...	33 1	30 0		31 11	28 1		19 11	17 9	
" 14...	32 10	30 1		31 2	27 8		19 9	17 11	
" 21...	32 1	30 4		30 11	27 5		19 11	18 1	
" 28...	31 9	30 9		30 8	27 0		19 8	18 4	
Dec. 5...	31 0	31 2		29 11	26 8		19 6	18 4	
" 12...	30 8	31 2		29 2	26 5		19 3	18 6	
" 19...	30 7	31 2		28 11	25 11		19 1	18 5	
" 26...	29 10	31 0		28 6	25 10		19 2	18 4	

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.

AVERAGE PRICES of **Wheat, Barley, and Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and BRESLAU.

		WHEAT.		BARLEY.		OATS.	
		1913.	1914.	1913.	1914.	1913.	1914.
France:	June	s. d. 48 10	s. d. 47 6	s. d. 29 11	s. d. 28 10	s. d. 23 9	s. d. 23 1
	July	48 4	—	29 9	—	23 8	—
Paris:	June	49 11	48 0	30 8	28 8	23 5	24 3
	July	50 2	—	30 8	—	24 11	—
Belgium:	May	36 1	34 6	29 8	25 1	23 2	21 8
	June	36 4	35 7	28 10	25 2	22 8	22 5
Berlin:	May	44 8	44 4	—	—	22 11	22 11
	June	43 10	44 10	—	—	22 3	23 9
Breslau:	May	39 2	42 3	26 8*	—*	21 0	21 8
	June	38 9	43 11	25 3†	25 0†	20 4	22 4

* Brewing.

† Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of July, 1913 and 1914.

		WHEAT.		BARLEY.		OATS.	
		1913.	1914.	1913.	1914.	1913.	1914.
London...		s. d. 35 9	s. d. 34 11	s. d. 26 1	s. d. 24 8	s. d. 20 8	s. d. 20 9
		34 0	34 2	25 5	25 0	20 5	19 3
Norwich		31 1	33 8	—	23 11	16 4	19 5
Peterborough		32 2	34 1	25 11	25 0	20 5	20 6
Lincoln		31 9	33 10	—	—	18 10	19 5
Doncaster		32 4	33 6	—	—	19 9	19 5
Salisbury							

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at
certain MARKETS IN ENGLAND in July, 1914.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER:—	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
British	per 12 lb. 13 6	per 12 lb. 12 6	per 12 lb. —	per 12 lb. —	per 12 lb. 13 6	per 12 lb. 12 6
Irish Creamery—Fresh	per cwt. 115 0	per cwt. 111 0	per cwt. 116 6	per cwt. 114 0	per cwt. 116 6	per cwt. 112 6
" Factory	105 0	99 0	102 0	96 6	107 0	99 6
Danish... ..	—	—	127 0	125 0	125 0	123 0
French... ..	—	—	—	—	115 0	109 0
Russian	105 0	100 0	106 6	102 0	105 0	101 0
Australian	110 0	105 0	—	—	112 0	107 6
New Zealand	117 0	110 0	—	—	119 6	114 6
Argentine	—	—	—	—	—	—
CHEESE:—						
British—						
Cheddar	77 6	74 6	75 6	71 6	71 6	66 0
Cheshire	—	—	120 lb. 65 0	120 lb. 60 0	120 lb. 73 6	120 lb. 67 6
Canadian	65 0	62 6	per cwt. 63 0	per cwt. 61 6	per cwt. 66 6	per cwt. 64 0
BACON:—						
Irish (Green)	76 0	72 0	73 0	65 6	76 0	70 0
Canadian (Green sides)	63 6	59 6	64 0	59 0	65 6	61 6
HAMS:—						
York (Dried or Smoked)	116 0	110 0	—	—	116 0	109 0
Irish (Dried or Smoked)	—	—	—	—	116 0	108 6
American (Green) (long cut)	77 0	73 0	77 6	73 0	79 0	75 0
EGGS:—	<i>per 120.</i>	<i>per 120.</i>	<i>per 120.</i>	<i>per 120.</i>	<i>per 120.</i>	<i>per 120.</i>
British... ..	10 5	—	—	—	11 3	10 5
Irish	9 9	8 9	9 6	8 6	9 8	8 10
Danish... ..	—	—	9 5	8 10	10 4	8 11
POTATOES:—	<i>per ton.</i>	<i>per ton.</i>	<i>per ton.</i>	<i>per ton.</i>	<i>per ton.</i>	<i>per ton.</i>
Early Eclipse... ..	116 6	95 0	80 0	70 0	110 0	101 6
Other First Earlies	116 6	81 6	113 6	101 6	83 6	73 6
British Queen	100 0	90 0	131 6	118 6	80 0	70 0
HAY:—						
Clover	—	—	87 6	65 0	85 6	77 0
Meadow	—	—	—	—	77 0	69 6

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked
or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	JULY.		SEVEN MONTHS ENDED JULY.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	39	28	480	345
Animals attacked	49	36	520	378
Foot-and-Mouth Disease:—				
Outbreaks	—	—	11	—
Animals attacked	—	—	74	—
Glanders (including Farcy):—				
Outbreaks	14	14	65	102
Animals attacked	32	31	169	274
Parasitic Mange:—				
Outbreaks	98	134	1,489	1,793
Animals attacked	127	295	2,615	3,677
Sheep-Scab:—				
Outbreaks	3	3	150	124
Swine Fever:—				
Outbreaks	329	244	2,517	1,474
Swine Slaughtered as diseased or exposed to infection	4,034	2,682	26,605	19,719
Tuberculosis:—				
Number of Premises notified...	757	519	3,744	*—
Number of bovine animals notified as for slaughter	807	555	3,992	*—

* The Tuberculosis Order came into operation on 1st May, 1913.

IRELAND.

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

DISEASE.	JULY.		SEVEN MONTHS ENDED JULY.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Foot-and-Mouth Disease:—				
Outbreaks	1	—	76	—
Animals attacked	2	—	955	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	5	1	54	93
Sheep-Scab:—				
Outbreaks	23	32	370	351
Swine Fever:—				
Outbreaks	22	12	138	97
Swine Slaughtered as diseased or exposed to infection	64	66	706	575

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ACCUMULATED FERTILITY IN GRASS
LAND IN CONSEQUENCE OF
PHOSPHATIC MANURING.

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DURING the past 20 to 30 years extensive areas of grass land have been treated with phosphatic manures, notably basic slag, and the results have, in the great majority of cases, left a large profit.* It would have been well for farmers and for the nation if every acre of grass land known to respond to treatment had been dressed with phosphates—slag or superphosphate—but unfortunately there are still wide areas on which nothing has been done. Plenty of instances are known where a farmer has doubled and even quadrupled the meat- and milk-producing power of his grass land, and has converted poor herbage into a tangle of white clover, and yet his neighbour on the other side of the fence has been content to leave his pasture unimproved, although it must be evident to him as to others that the enterprising farmer has had an ample return on his outlay.

There would appear to be various reasons for such neglect. It may be that in some instances a farmer fears that manifest improvement of the productive capacity of his land would result in a rise of rent, but even if this result should follow, the profits of the improvement are generally well able to bear a substantial rise. In the case of other farmers it may be natural inertia or conservatism that prevents their following the example of improving neighbours, and this cause is most apt to operate in the case of older men. The main reason,

* See Supplement to this Journal, Jan., 1911, "Influence on the Production of Mutton of Manures applied to Pasture."

however, why opportunities that are manifestly "golden" are so often neglected is to be found in the lack of the necessary capital. Farmers as a body are much like other business men; while some have command of reserve capital the majority have no more than enough to carry on their trade. Many farmers hold more land than their capital warrants, in which cases it would be better both for themselves and the country if they concentrated their attention on smaller holdings. Unless a farmer can put his hand on spare capital it is obvious that even an opportunity that promises a high return cannot be seized.

Those who are disposed to wonder at the apparent lack of enterprise on the part of many farmers perhaps under-estimate the amount of capital necessary to improve pasture by the use of phosphates. The first outlay, namely, the purchase of the manure, involving a cost of say, £1 per acre, is the smaller part of the expenditure. It is the provision of the extra stock necessary to consume the increased produce that makes the largest demand on capital, and, even if the stock-carrying power of the land is no more than doubled, extra capital under this head may easily run to several pounds per acre. It is not proposed, in the present instance, to discuss ways and means of bringing fresh capital to the improvement of grass land, though the subject is clearly one of first-class national importance that should be vigorously taken in hand as soon as circumstances permit. The purpose of this article is to direct attention to the accumulated fertility that has been stored up in those pastures which have during recent years been liberally treated with phosphates.

It has long been known that leguminous plants have the power of fixing free atmospheric nitrogen, and the most obvious and striking result that follows the use of a phosphatic manure on grass land is the great increase in clovers, trefoils, vetches, and other leguminous plants. These subsequently react on the grasses and encourage their growth, so that in a few years there is a marked accumulation of humus, as is evident from the thicker and closer sward or "sole." A grass field, especially where grazed, thus becomes a store of plant food, which, by the ploughing of the land, can at once be drawn on to produce wheat, or any other tillage crop; and, not only so, but the plant food has been stored up free of cost either to the farmer or the nation. This is said advisedly, because the initial cost of the manure is, in the great majority of cases, recovered with interest in the first 3 or 4 years from the time the improvement of the pasture

is taken in hand, so that the accumulated nitrogen and humus is practically a free gift of nature. The grass land has, in fact, become a savings bank, which has each year automatically received deposits, and these can either be left to accumulate at compound interest, or can be withdrawn at a time of national emergency, and directly utilised to produce cereals or other vegetable form of human food.

It cannot fail to be a matter of interest to many to speculate on the amount of such accumulated fertility, but, so far as I am aware, no attempt has been made to measure it in terms of crop-produce. This could be done by ploughing up a field partly treated with phosphate, and partly untreated, but there are difficulties in securing a field so treated for such a purpose. A simpler method of procedure is to obtain supplies of soil from treated and untreated portions of a field, to place those two soils with the disintegrated turf in pots, and to measure the fertility by growing cereals or other tillage plants. This is the method employed in the present instance, and although only one crop has so far been grown, the results are sufficiently definite to warrant their publication at the present juncture. One need have less hesitation now than formerly in breaking up grass land, for with the seed of wild white clover available as a commercial article much of the difficulty of laying down land to grass has disappeared.

In February, 1914, supplies of soil were sent to Oxford from five farms which included grass fields, part of each of which had been treated with basic slag once or oftener in previous years, while part had been left untreated. The moisture in each soil was determined, and, having regard to the figures so obtained, ordinary 7 in. flower pots were filled with the respective soils passed through a $\frac{1}{2}$ -in. sieve, the relative proportion of disintegrated turf being placed in the bottom of the pots. The two sets of 5 pots for each centre were so supplied with soil that each pot contained the same weight of dry soil. In the case of two soils (Stoke Talmage and Arncot) which were stiff clay, 10 per cent. of pure sand was added, in order to facilitate aeration and drainage. Where basic slag and rape meal were used, these manures were thoroughly mixed with the soil before the pots were filled. On March 7th, each pot was sown with 20 grains of Black Bell Oat. The pots were placed in a greenhouse at the School of Rural Economy, and all were watered with rain water. For the first six weeks the water was carefully adjusted so that each pot got twice weekly enough to bring its water content up to that naturally present in the moistest soil of each series, but it was found

later to be equally effective to give each pot daily (except Sundays) 30 c.c. of water. On May 4th the plants were thinned down to seven in each pot, and these continued to grow throughout the experiment, except in the case of two pots of the ten filled with soil from the farm of Arncliffe. Evidently a grub or other disturbing cause was at work in these two pots, for in one case the seven plants were reduced to five, while, in the other, only one plant finally survived. The Arncliffe series has, therefore, been eliminated so far as the results with oats are concerned, though this soil will probably be quite serviceable for the growth of subsequent crops.

When the plants were about ten weeks old the pots were all removed to a bird-proof enclosure in the open air.

The four soils that came successfully through the experiment were as follows :—

Denton Hill, Newhaven, Sussex.—Thin soil on Chalk, down to grass for about 8 years, received 7 cwt. per acre of basic slag in March, 1911. The excessive drought of that year prevented any effect being observable till 1912. Cut for hay, 1912 and 1913. Effects of slag very marked in these years.

Cockle Park, Northumberland.—Strong Boulder Clay, down to grass for many years. The untreated soil was taken from the permanently unmanured plot (No. 6) on Tree Field, while the treated soil was from Plot 3, which received 10 cwt. basic slag per acre for 1897, 1906, and 1912, a total, namely, of 30 cwt. per acre in the 17 years ending with the autumn of 1913. The slag cost £3 13s., and has been accountable for 1,518 lb. live weight increase of sheep, which, at 3d. per lb. amounts to £18 19s. 6d., a net gain of £15 6s. 6d. per acre in 17 years, or nearly £1 per acre per annum. I am indebted to Professor Gilchrist for this soil, and for the interest he has taken in the experiment generally.

Stoke Talmage, Oxon.—Heavy loam on Gault Clay, down to grass for many years, received 5 cwt. per acre of basic slag for 1910 and 1911, which markedly increased the quality, and on the average of the crops of 1910, 1911, and 1912, increased the yield of hay from 26 cwt. 41 lb. to 34 cwt. 72 lb. per acre per annum.

Lees Rest, Oxon.—Limestone brash on Great Oolite, received 5 cwt. per acre of basic slag for 1910, which produced a striking change in the herbage.

I am indebted to Mr. G. R. Bland, Staff Instructor in Agriculture for Oxfordshire, for the last two samples of soil, and for other assistance.

The scheme of the experiments was as follows. Five pots were filled with soil from unslagged pasture at each centre, while five were filled with soil that had in previous years—as shown above—been treated with slag. In the case of each of these two sets of soil, two pots received no direct manuring for the oats, one received directly 1 gramme of basic slag, one received directly $\frac{1}{2}$ gramme of rape meal, while one received directly 1 gramme of basic slag and $\frac{1}{2}$ gramme of rape meal. As the weight of dry soil in each pot averaged about 3 lb., and assuming that the dry soil in the top 9 in. of a field weighs about $2\frac{1}{2}$ million pounds per acre, 1 gramme of slag is equivalent to a dressing of about 15 cwt. per acre, while $\frac{1}{2}$ gramme of rape meal may be regarded as equal to about $7\frac{1}{2}$ cwt. per acre. It is not, however, suggested that these dressings should be translated into “per acre” equivalents, the intention rather being to make sure that ample dressings of phosphates and nitrogen were directly provided. The conditions of growth in the pots seemed to be more unfavourable to the production of grain than of straw, and for this reason it is believed that the figures dealing with the “total yield” are a more reliable indication of what may be expected in field practice than those dealing with the grain alone.

The oats were cut on July 20th, the weight of total produce being determined to the nearest gramme, while the weight of dressed grain was ascertained in milligrammes.

Before proceeding to discuss the results it may be well to look at the limits within which we may venture to interpret them. In pot experiments it is only to be expected that the degree of accuracy will be higher than in experiments in the open field. In the former case the pots of any one set are all supplied with soil that has been thoroughly mixed, and from which stones have been removed. Disturbance due to inequality of soil is thus reduced to a minimum. All pots are provided with a regulated supply of water, all are placed under similar conditions as regards light, all are similar in respect of aeration, and drainage, and all are equally protected against insects, birds, mammals, and the general vicissitudes of weather. The produce is all “harvested” on the same day, while weighing is done with the degree of accuracy that one associates with laboratory methods.

In the experiments under discussion the first two pots of each of the four series of untreated soil (“untreated” here and subsequently meaning soil from parts of pastures that had not been slagged) received no manures in the greenhouse, so that variations between the aggregate yield of the oats on

the four first pots, and that of the four second pots, should give some indication of the limits of the probable error. The total yield of grain and straw was precisely the same (41 grammes) in both cases, while the yield of grain alone was, in the one case, 10.645 grammes, and, in the other, 12.335 grammes, or in the proportion of 100 : 116.* Similarly the first two pots of each of the four series of treated soils ("treated" meaning soil from parts of pastures that had been slagged) received nothing in Oxford except water. The weight of total produce in one case was 66 grammes (=100), and, in the other, 70 grammes (=106), the grain weighing respectively 16.490 (=100) grammes and 17.650 grammes (=107). It would appear, therefore, that on the average of the four sets of pots, any increase of total yield that exceeds 10 per cent., or of grain-yield that exceeds 20 per cent., may confidently be regarded as due to treatment, and, of course, a smaller average percentage difference may be relied on where the number of tests compared is larger than four. Moreover, it was at once evident to anyone who inspected the oats during growth that the productive power of "treated" and "untreated" soil varied enormously, the plants growing on the former soil being strong, vigorous, and dark green, as compared with the pale weakly growth of the latter. (See illustration).

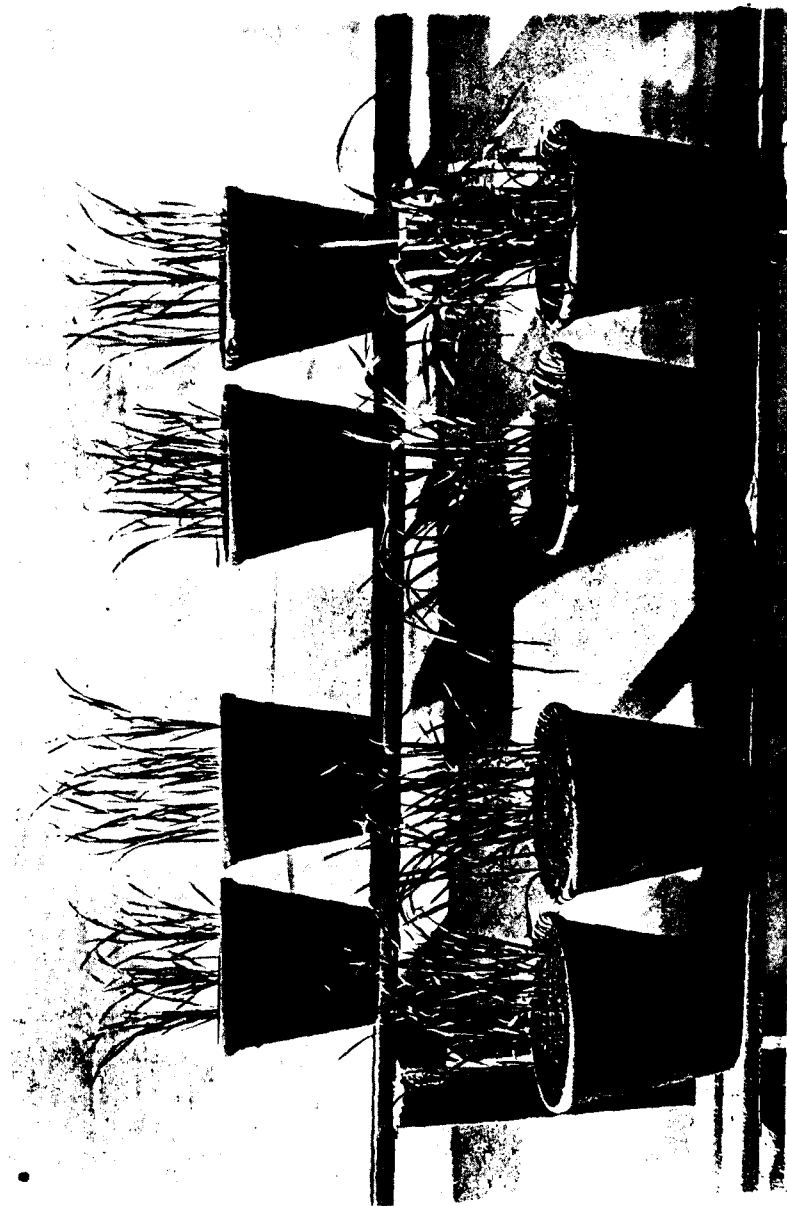
The main object of the experiment was to obtain a measure of the extent to which the use of slag on the pasture had increased the fertility. In the aggregate, eight pots dealing with the four stations contained soil from unslagged land, while other eight pots contained soil from slagged pasture—nothing being added in Oxford but water—and the average results of this test may be expressed in tabular form, thus :—

—		Total yield (grammes).		Grain (grammes).	
8 pots of untreated soil ..	82	or as 100	22.980	or as 100	
8 " treated soil ..	136	to 166	34.140	to 149	

The previous slagging of the respective pastures has thus increased the average total yield by 66 per cent. and the grain yield by 49 per cent. The individual "total yield" increases were: Cockle Park 153 per cent., Denton Hill 124 per cent., Lees Rest 31 per cent., Stoke Talmage 15 per cent.

Another way of obtaining a measure of the accumulated fertility is to compare the aggregate yield of the three pots

* Here, and subsequently, the weight of produce of one of the pots, or sets of pots, is calculated as 100, while the corresponding yield with which it is compared is stated in terms of 100, and thus we get a ready measure of the relative variations.



Pots Nos. 1 and 2, soil from "untreated" pasture at Denton Hill; Nos. 6 and 7, soil from "treated" pasture at Denton Hill; Nos. 11 and 12, soil from "untreated" pasture at Cockle Park; Nos. 16 and 17, soil from "treated" pasture at Cockle Park.
Photographed about eight weeks after sowing, and immediately before the plants in each pot were thinned down to seven.

for each station filled with soil from unslagged pasture, and to which (a) slag ; (b) rape meal ; (c) both slag and rape meal, were added in Oxford, with the three pots for each station filled with soil from slagged pasture, to which slag and rape meal were similarly added in Oxford. This has been done in the following table :—

—	Total yield (grammes).		Grain (grammes).	
12 pots of untreated soil, receiving direct manuring	143	or as 100	39·765	or as 100
12 pots of treated soil, receiving direct manuring	208	to 145	54·600	to 137

In the presence of direct applications of manure it was not to be expected that the stored-up fertility due to slag applied to the pasture would be able to assert itself to the same extent as where it had the opportunity to act alone, and this has proved to be the case ; but still, even under these circumstances it produced an average total increase of 45 per cent., and an increase of grain of 37 per cent. In this case the total increases for the individual stations were : Cockle Park, 133 per cent., Denton Hill 58 per cent., Stoke Talmage 17 per cent., Law Rest 9 per cent.

Finally, we may aggregate the results obtained from the five pots (two unmanured, three manured) filled with soil from unslagged pasture at each station, and compare them with those got from the five pots (two unmanured, three manured) filled with soil from slagged pasture at each station. This has been done in the following table :—

—	Total yield (grammes).		Grain (grammes).	
20 pots soil from unslagged pasture	225	or as 100	62·745	or as 100
20 pots soil from slagged pasture	344	to 153	88·740	to 141

These figures, dealing as they do with pots some of which received direct manurial treatment in Oxford, and some which did not, stand between the previous two sets of figures. On the basis of this test the increases of total produce at the individual stations were : Cockle Park 141 per cent., Denton Hill 78 per cent. and the other two places 16 per cent. each.

Summing up the results so far examined it is evident that the average yield of the first crop, oats, grown on the broken-up pasture has been increased by about 50 per cent. as a result of

the previous use of slag on the pasture. Of course, the results applicable to the individual stations vary greatly, as was to be expected when one considers the varying amounts of slag that had been used, and the varying time during which it had acted. This is summarised in the following table, which refers to the four pots for each station which got no direct manure :—

	Total yield (grammes).		Grain (grammes).	
Cockle Park, unslagged pasture	15	or as 100	4.625	or as 100
Cockle Park, pasture got 10 cwt. per acre slag 3 times in 17 years	38	to 253	9.405	to 203
Denton Hill, unslagged pasture	17	or as 100	5.450	or as 100
Denton Hill, pasture got 7 cwt. slag per acre once in 3 years	38	to 224	9.900	to 182
Lees Rest, unslagged pasture	16	or as 100	3.935	or as 100
Lees Rest, pasture got 5 cwt. per acre slag once in 4 years	21	to 131	5.080	to 129
Stoke Talmage, unslagged pasture	34	or as 100	8.970	or as 100
Stoke Talmage, pasture got 5 cwt. per acre slag twice in 4 years	39	to 115	9.755	to 109

It will be seen that at Cockle Park the total yield, and the yield of grain, are both more than doubled, but even at Denton Hill, where the slag has only been on the pasture for three years, the total yield has also been more than doubled. At Lees Rest and Stoke Talmage the results are less conspicuous. The fertility accumulated during 17 years at Cockle Park is so great that whereas, in its unimproved state, the soil of that place is about the most barren of all, it becomes as productive as any under the prolonged influence of basic slag.

To the question, "To what is this great increase of fertility due?" various answers may be given. It may be due, to some extent, to the residues of the slag which was applied in previous years to the pasture. In order to get information to test this point, slag alone (1 gramme per pot) was applied directly to two of the pots for each centre, once to "untreated" and once to "treated" soil. In the case of the "untreated" series of pots the direct addition of the slag produced an increase in every case, the mean increase being 37 per cent. of total

yield and 27 per cent. of grain. In the "treated" series of pots the direct use of slag also resulted in an increase in every case, the average increase being 19 per cent. of total yield and 1 per cent. of grain.

The same amount of slag was also used as an addition to a direct dressing of rape meal ($\frac{1}{2}$ gramme per pot). This slag produced an average increase in the total yield of 12 per cent. in the case of the "untreated" soil, and 20 per cent. in the "treated" soil.

The fact that the slag directly applied to the oat crop, and when used without added nitrogen (rape meal), produced a greater increase on the "untreated" than on the "treated" soil, would appear to indicate that the slagged pasture when broken up contained considerable slag residues, at least some of which were appropriated by the oat plants. But to show that there is something in the "treated" soil much more effective than slag residues, one has only to compare the yield obtained from "untreated" soil, plus direct slag for the oats, with the yield from the "treated" soil without any addition.

	Total yield (grammes).		Grain (grammes).	
4 pots of "untreated" soil receiving slag directly ..	56	or as 100	14.600	or as 100
8 (calculated as 4) pots of "treated" soil, receiving no slag directly ..	68	to 121	17.070	to 117

It is impossible that the direct residues of slag in the soil to which the second line of figures in the above table refers, can be so great as the phosphates in the gramme of slag (equivalent to some 15 cwt. per acre) directly applied to the oat crop, and yet the yield obtained without any direct application of slag is some 20 per cent. greater than in the other case. The accumulated fertility must therefore be due to conditions indirectly induced by the slag applied to the pasture, and of these conditions the accumulation of humus, and the fixation of free nitrogen are probably the most important, though the modification of the free micro-flora of the soil, as contrasted with the micro-organisms of leguminous root-nodules, may also play a large part.

That the nitrogen stored up in pasture that has been slagged is either much greater in quantity, or much higher in quality, than that in rape meal directly used ($\frac{1}{2}$ gramme per pot, say, some $7\frac{1}{2}$ cwt. per acre) is proved by the fact that in no case was the rape meal capable of increasing the yield beyond the limit of experimental error whether (a) used alone on

"untreated" soil, (b) used alone on "treated" soil, (c) added to a direct application of slag on "untreated" soil, (d) added to a direct application of slag on "treated" soil. The average figures for the four sets of soil are here tabulated:—

	Total yield (grammes).		Grain (grammes).	
"Untreated" soil, nothing directly applied ..	41	or as 100	11.490	or as 100
"Untreated" soil, rape meal directly applied ..	41	to 100	11.055	to 96
"Treated" soil, nothing directly applied ..	68	or as 100	17.070	or as 100
"Treated" soil, rape meal directly applied ..	60	to 88	17.605	to 103
"Untreated" soil, directly treated with slag ..	56	or as 100	14.600	or as 100
"Untreated" soil directly treated with slag and rape meal	46	to 82	14.110	to 97
"Treated" soil, directly treated with slag ..	81	or as 100	17.260	or as 100
"Treated" soil, directly treated with slag and rape meal	67	to 83	19.735	to 114

Finally, it is evident from the following tabular summary that the large manuring of 1 gramme of slag and $\frac{1}{2}$ gramme of rape meal, directly given to the oat crop, has produced much less effect than has the accumulated fertility consequent on the use of slag on pasture.

	Total yield (grammes).		Grain (grammes).	
"Untreated" soil, nothing directly applied to oats ..	41	or as 100	11.490	or as 100
"Untreated" soil, slag and rape meal directly applied to oats	46	to 112	14.110	to 123
"Treated" soil, nothing directly applied to oats ..	68	to 166	17.070	to 149

As soon as the oat crop was removed the pots were sown with white mustard, no direct manure being applied: When this, and a second crop of mustard, have been cut it is the intention to grow winter wheat, without any further manuring, in order that, in this way, information may be gained of the aggregate amount of accumulated fertility, the effects of which have, so far, only been determined for one crop.

Summary.—The results discussed above, and the inferences that may be drawn, may be thus summarised:—

1.—When basic slag, or other effective form of phosphate, produces a beneficial effect on grass land, it is not only directly profitable (often in a remarkable degree), but it also indirectly reacts on tillage crops grown on the broken-up pasture. These experiments show that the first tillage crop thus grown is likely to be improved by about 50 per cent.

2.—The amount of such improvement, however, will vary with circumstances, such as the amount of phosphate used on the pasture, the time during which it has acted, and the inherent suitability of the land to respond to phosphates. The productive power of Cockle Park, which has been dressed three times with 10 cwt. of basic slag during 17 years, was increased by 153 per cent.; while the soil from a pasture (Denton Hill), that had received 7 cwt. of basic slag only three years previously, was improved by 124 per cent. The other two soils showed improvement of 31 per cent. and 15 per cent. The accumulated fertility, which these improvements indicate, has only so far been determined for one crop, but it is evident from the appearance of a mustard crop that is now (end of August) being grown in the pots, that a single crop has not exhausted it.

3.—The accumulated fertility may be represented, as above, in the percentage increase of the first tillage crop. It was, however, also measured in terms of a direct application of artificial manure to the oat crop, when it was found that the accumulated fertility was much in excess of the effect produced by the direct use of basic slag and rape meal. These substances were used in definite amounts per pot, and although much uncertainty is involved in the translation of the term "per pot" into the term "per acre," it is believed that the doses of these manures were roughly equivalent to 15 cwt. of basic slag and $7\frac{1}{2}$ cwt. of rape meal per acre.

4.—While it would appear that the accumulated fertility is partly due to phosphatic residues, it is certainly due in most part to the secondary effects of the phosphates, of which the accumulation of humus, including the fixation of atmospheric nitrogen, is probably the most important.

5.—If, as a result of present circumstances, farmers proceed to break up grass land, it will be found that, where phosphates have been freely used on the pastures, the tillage crops will be largely increased. There may be a natural hesitation to plough up much-improved pastures, but it is evident that the contribution to home grain supplies will be much more

important from the cropping of such pastures than from the breaking up of those that are unimproved. Moreover, wild white clover seed has placed in the hands of farmers a new and effective means of again laying down land to grass, should such a course subsequently be deemed desirable, so that there need be less reluctance than formerly in setting the plough to work on grass land.

THE CULTIVATION AND COLLECTION OF MEDICINAL PLANTS IN ENGLAND.

W. A. WHATMOUGH, B.Sc.

MEDICINAL herbs were probably cultivated in this country to some extent even in Saxon times. A Saxon Herbarium of about the year 1000¹ mentions poppy, chamomile, dill, fennel, pennyroyal, and wormwood. At a later period, as wild plants became more scarce, herbs for medicinal purposes were grown in kitchen gardens attached to monastic establishments and the mansions of noblemen. The famous Chelsea Physic Garden was founded by the Society of Apothecaries in 1676. Medicinal herbs were grown at Mitcham in a fairly large way in 1756². Liquorice has been cultivated near Pontefract and rhubarb at Banbury since the eighteenth century. For several decades there have been materia medica (or drug) farms at Mitcham, Carshalton, Hitchin, Ampthill, Long Melford, Steppingly, Market Deeping, and Wisbech.

During recent years the acreage devoted to drug cultivation in Britain has been more and more restricted by competition with wild foreign products. English drugs and essences have still a reputation which enables them to command a market at about four times the price of the Continental article, but the cutting down of costs consequent upon severe competition in the wholesale drug trade has been slowly but surely ousting British-grown drugs from the market. When this article was first projected it was intended to be an appeal to wholesale druggists and drug merchants to make some effort to prevent the extinction of drug cultivation in England. The advent of a European war has completely changed the situation. Growers of medicinal plants are now being bombarded with inquiries for supplies, especially of Belladonna leaves and root. The recent history of the cultivation of Belladonna illustrates the situation well, although the shortage is not so serious in the case of other Continental drugs grown in England.

About the year 1900 the supply of home-grown Belladonna became in excess of the amount required for making green extract, and the price of the surplus leaves (after drying) was gradually reduced until, some five years ago, these leaves were selling in competition with the wild foreign supplies—at considerably below cost. The result was that cultivation was curtailed and became practically restricted to four drug farms having factories for making Belladonna preparations, and even at these farms the area grown was also cut down considerably. The English-grown herb would still have been sufficient for home demands except for two successive bad (wet) winters causing excessive loss among the growing plants. Of Belladonna root only a little is dug in England, the large supplies used being derived from the Continent. The Balkan War of 1912-1913 interfered with the continuity of Belladonna exports from Croatia and Slavonia in South Hungary, the chief centres for foreign Belladonna. Stocks of roots and leaves made shorter supplies eke out until 1914, when prices rose with increasing scarcity.

Root which realised 45s. per cwt. in January sold for 65s. in June, partly on rumours of changes in the British Pharmacopœia for issue in October (now postponed indefinitely). On the outbreak of war the price immediately rose to 100s. per cwt., and before the end of August 150s. had been paid. Belladonna leaves from abroad sell at normal times for 45s. to 50s. per cwt., but they are now unobtainable at 1s. per lb. It takes at least two years to grow Belladonna in quantity, and, unless the war terminates quickly, the drug grown next year will sell at very high prices.

The above remarks apply in lesser degree to chamomiles, dill, dandelion and valerian. The prices of colchicum, digitalis, fennel, henbane, stramonium, and "botanical herbs" will also be considerably affected.

The limited outlet for most drugs makes overloading the market a comparatively easy matter, and the story of alternate glut and shortage is met with in the history of all cultivated drugs and spices. Unremunerative prices restrict production, and when supply is less than the demand with prices ruling high, drug brokers and merchants ask why more of such paying produce is not grown.

The most important drug industry—cinchona bark production—has witnessed quite recently the fruits of co-operation between producer and manufacturer in restricting the output within reasonable limits. So far, consumers appear to be no worse off, while all other handlers of bark and quinine, other than speculators, are in a decidedly better position. The

santonine industry shows the effects of harmful monopoly, but this may react and right itself as in the case of the Japanese camphor monopoly. It remains to be seen if some arrangement cannot be made to ensure British drug growers at least a fair return for their efforts. The matter is one for co-operation between growers and wholesale druggists. In the meantime farmers and present growers will be fulfilling a patriotic duty by replacing the deficiency of healing drugs as far as possible.

At the British Pharmaceutical Conference in 1912, an arrangement was made for more extended drug growing within the British Empire³. Evidence on this point was heard by the Royal Commission on the Natural Resources, &c., of the Dominions⁴ when manufacturers of pharmaceutical preparations expressed a preference for cultivated drugs as being more uniform in activity.

Below is given information relative to the cultivation of such British drugs as are at present of most importance, with brief notes of others more or less affected by the war crisis. Farmers who can market supplies of the drugs in question during the next two years will almost certainly make large profits. The south of England is especially suited to drug growing and is further favoured in being close to the principal consuming market.

In these notes it is assumed that the soil is in good condition for ordinary farm crops. In general, care should be taken to keep down weeds and ensure a good tilth. In most cases a medium dressing of farmyard manure is advantageous, although not actually necessary, since most drug crops belong to the category of weeds. The greatest difficulty to be encountered by the grower will be to obtain sufficient seeds or dormant plants to start growing medicinal herbs.

The drying of medicinal herbs is a matter of great importance, and regular growers have proper drying plant, heated artificially, so that quantities of the drugs can be dried quickly and thoroughly in a current of warm air. Facilities for drying purposes are necessary to the grower of medicinal herbs. Glasshouses could readily be converted into drying sheds, especially if heated by pipes. Drying could be done in half shade in fine summer weather by spreading thin layers of the leaves on sheets in the open, or on racks or shelves in a freely ventilated shed, turning frequently until quite dry. The leaves or flowers must be kept under cover at night or during rain. Even colour is best retained by quick drying, and the brighter the colour the more saleable the product. Those who intend to market dry leaves or flowers could gather and dry in small portions, which are more manageable. Roots present less difficulty in washing and drying.

Aconite (*Aconitum Napellus*, L.).

Prospects.—Relatively small quantities of aconite root would suffice for making aconite tincture, but liniment of aconite, usually prepared from German or Japanese wild root, is freely prescribed. The chief collecting centres for the foreign root (usually worth about 50s. per cwt.) are the Swiss Alps, Salzburg, North Tyrol and Vorarlberg. Swiss supplies (which have come *via* Germany) may be cut off as well as the others. Supplies of Japanese aconite root are plentiful, and Spanish root is also coming into the market, so that the demand for English aconite will be restricted as formerly. The price of the foreign root is about 50s. per cwt., English being ordinarily worth 2s. per lb. Japanese aconite root (usually ascribed to *A. Fischeri*, Reichb.) sells at about 35s. per cwt. Cultivation of aconite has not paid in recent years, even with cultivated root four times the price of wild. Leaves are of little importance.

Cultivation.—The official aconite (*Aconitum Napellus*, L.) grows wild in some shady places in the west of England and in south Wales. It prefers a soil slightly retentive of moisture, and among the drug farms the moist loam of Ampthill or the dark soil at Market Deeping proved most suited to aconite cultivation.

Beds for growing aconite are all the better for being shaded. The soil should be well dug, and pulverised by early winter frosts. The digging in of rotted leaves or stable manure is advantageous. Aconite is almost invariably propagated from the smaller (daughter) roots which develop at the sides of old roots. The underground portions of the plants are dug up in autumn, after the stem has died down, and sorted over, the plumper roots being reserved for washing, splitting and drying to form the aconite root of commerce.

Replanting is usually done in December or January, the young roots being planted about a foot apart each way. The young shoots appear above ground in February. Aconite can be raised from seed, but it takes two or three years to flower. Although the plants are perennial, each root lasts only one year. The autumn dug daughter root crowned with undeveloped buds is official in the British Pharmacopœia, but German root is derived from plants gathered in flower. Any farmer who has a moist open wood sown with aconite would find it grow luxuriantly and yield returns with little further trouble than weeding, digging up and drying. A great

disadvantage of growing aconite from seed is the uncertainty as to correctness of the species, an important point as regards medicinal activity. There are some sixty species. (Figs. 1 and 5).

Anise (*Pimpinella anisum*, L.).

It is stated that Anise fruits are grown at Westington, near Chipping Norton, but the English climate is hardly hot enough to ripen the fruit properly. The price of Russian and Spanish fruits has almost doubled recently, but this temporary shortage is not considered to warrant further attempts at cultivation in England.

Belladonna (*Atropa Belladonna*, L.)

Prospects.—The bulk of the world's supply of Belladonna is derived from wild plants growing in quantity on waste stony places in Southern Europe. The industry is an important one in Croatia and Slavonia (South Hungary), some fifty exporters being engaged in buying the root and leaves from collectors and exporting the drug chiefly to Wurtemberg. One merchant in Slavonia, the largest exporter, sent out 13,557 kilogrammes (29,880 lb.) of dry Belladonna root in 1908.

Continued shortage will almost certainly exist during the next few years. Farmers who can obtain and sow seeds this year before October may obtain a small crop of leaves next year if plants grow strongly, and high prices will probably continue until the root is dug three or four years hence. Ordinarily it is difficult to obtain more than £10 per acre for a crop of Belladonna, but anyone who could contract to deliver Belladonna next year would get more than this for the sparse first year's cutting.

Cultivation.—Belladonna is grown from seed, and an initial difficulty will be to obtain supplies of fresh fruits or seeds. The plant grows wild in the Southern Counties of England, especially near old ruins, but it has become much rarer of late years. The fruits are now ripe and those who know the haunts of Belladonna would spend time profitably in gathering fruits for sale. The seeds taken from the berries are washed in a sieve and dried.

Belladonna (Fig. 2) grows on most soils but is partial to a chalky substratum. The seeds are slow to germinate and some autumn sowing is necessary, but sowing may also be done in spring. The seeds are drilled in the usual way in rows 3 ft. apart, using 2 to 3 lb. of seed to the acre. A reserve of plants is also grown in seed beds to fill in gaps due to dormant seeds and winter's losses. The young plants are



FIG. 1.—Aconite (*Aconitum Napellus*, L.): a. Seed natural size and $\times 5$; b. first-stage seedling $\times 1$; b'. separate cotyledon, enlarged; c. second-stage seedling $\times 1$; d. third-stage seedling with well-developed root $\times 1$; e. flowering head $\times \frac{1}{2}$.

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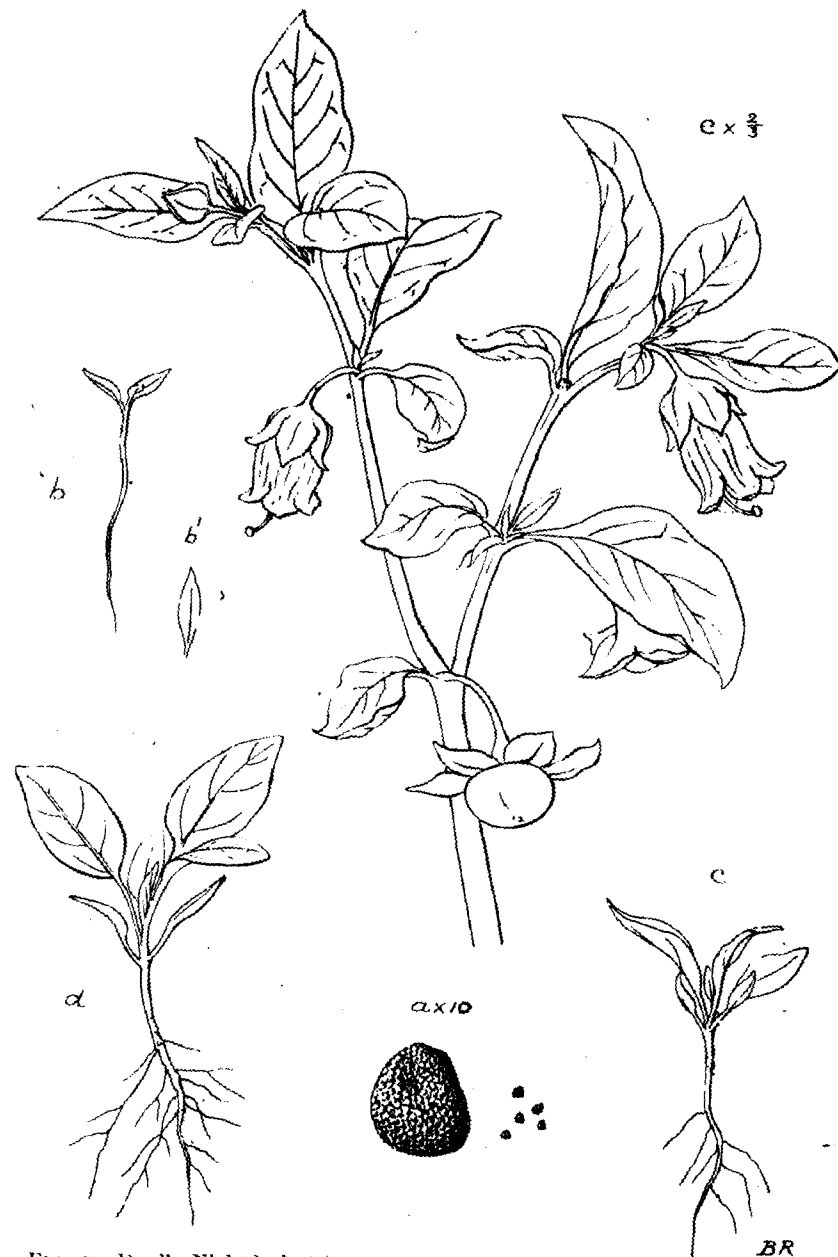


FIG. 2.—Deadly Nightshade (*Atropa Belladonna*, L.): a. Seed natural size and $\times 10$; b. first-stage seedling $\times 1$; b'. separate cotyledon $\times 1$; c. second-stage seedling $\times 1$; d. third-stage seedling $\times 1$; e. flowering branch $\times \frac{2}{3}$.

liable to injury by late frosts, and a top dressing of farmyard manure serves to preserve young shoots from injury during sudden and dangerous changes in temperature. Healthy young plants soon become re-established when transplanted, but require watering if the weather is dry at the time of transplanting. Great care must be taken that weeding is thoroughly done in spring, or the seedlings of *Belladonna* may be choked by weeds. The plants may be left 18 in. apart the first year and by September the single stem will be $1\frac{1}{2}$ to $2\frac{1}{2}$ ft. high. A gathering of leaves may then be made if the plants are strong, "leaves" meaning the broken-off tops of the plant, leaving the coarser stems on the plant. Any discoloured portions are also rejected. Women are employed for this kind of work. The distance apart of the plants should be regulated to $2\frac{1}{2}$ to 3 ft. before the approach of winter, or overcrowding will result in the second year, when the plants will bear one or two strong stems.

The English crop is cut with sickles (Fig. 3) in the second year while flowering in June, and is usually carted straight to the factory for extract making (*i.e.*, before it has time to 'heat'). The leaves (tops) lose four-fifths of their weight on drying, this being a difficult operation. Growers who intend to have their crop worked up into extract must arrange for delivery at the mills on the day it is cut, because heated material is useless for extracting. With modern motor traction it should be possible to deliver twenty miles away in a few hours.

The average crop of fresh herb in the second and third years is 5 to 6 tons per acre. A second crop is obtained in September in good seasons. The plant is dug or ploughed up during autumn in the fourth year, and the root is collected, washed, and sliced to accelerate drying. If great scarcity continues it would probably pay to dig up root in the third year. Three parts of fresh root yield a little over one part of dry drug. The greatest loss of plants is in wet winters. On the lighter soils there is less danger from winter loss, but the plants are more liable to damage from drought in summer on such soils.

Manuring.—Authorities differ on the question of manuring. English growers do little of this if plants are strong. Carr³ has found that fertilisers tend to lower activity as judged by alkaloidal content. With soil suited to the plant the effect of artificial manures on growth is often small, but if the soil is not already rich the crop may be increased several fold by the use of farmyard manure or a mixture of nitrate of soda, basic slag and kainit.

In experiments made by Ransom and Henderson⁶ artificial fertilisers did not materially alter the proportion of alkaloids in the green leaf, but in several cases the crop was largely increased in weight. Unfortunately, the results were partly vitiated by the death of a large proportion of plants in the third year, for some reason not definitely ascertained, though one possibility was over-feeding. Chevalier⁷ states that by using farmyard manure the amount of alkaloids in dried leaves of Belladonna grown at Houdan, France, was doubled, but this only raised the alkaloidal content to the standard of English leaf. Mitlacher⁸, from results on experimental plots at Korneuberg, Austria, considered that manuring increases the yield of the crop by weight, but his successor⁹ has failed to obtain definite results in this direction. The results of these researches seem to support the custom of Belladonna growers to manure if the soil is poor or the plants are weak.

Activity.—One result of the international inquiry set on foot in 1909¹⁰ is the statement by Carr¹¹ that there is no marked variation in the amount of alkaloids in Belladonna leaf and stem during different stages of growth from June to September. The time of collection is, therefore, not important, and may take place at any period before the annual portions of the plant begin to fade. Carr also draws attention to the fact that in the case of English, French, Austrian and Italian Belladonna root the proportion of alkaloid is lower the warmer the climate and that this would account for the high activity of the English plant.

In the English root Carr finds that seasonal variation is very small. Atmospheric conditions appear to have a marked influence, the highest percentage of alkaloid being yielded in plants grown in sunny and dry seasons. The low percentage of 1905 was held to be due to heavy rainfall, and that of 1907 to lack of sunshine.

Pests.—Belladonna is not ordinarily liable to insect pests, but it is sometimes attacked¹² by a small beetle (*Epitrix atropae*, Foudras) which infests the leaves and spreads with extraordinary rapidity under conditions favourable to its growth. Paraffin and soap emulsion is stated to kill the insects. These can be combated by the same methods as are used for the Turnip Flea Beetle (see the Board's Leaflet No. 3).

Caraway (*Carum Carvi*, L.).

Caraway fruits are derived from *Carum Carvi*, L., a biennial plant grown largely in the Netherlands. It has been cultivated



FIG. 3.—Cutting English Belladonna (*Atropa Belladonna*).



FIG. 4.—Harvesting English Dill (*Pucedanum graveolens*).

for so long a period in England that it appears naturalised in some parts of Lincolnshire. Essex and Kent produce most of the English caraway, but exports from Holland are far in excess of British production. As Germany is the chief consuming market there is no possibility of a call for the extension of the acreage under caraway in this country. The caraway industry of Holland was described in this *Journal* for May, 1911 (p. 134), where cultural details were given.

Chamomile (*Anthemis nobilis*, L.).

Prospects.—The demand for chamomile flowers, though slowly decreasing, is a steady and considerable one. Belgium is the chief grower, and on the outbreak of war the price rose from 55s. to 80s. per cwt. for fair average quality. By the end of August 120s. was asked for last year's Belgian flowers, best quality being 140s. per cwt. The new Belgian crop due this month can hardly be collected, so that a demand will exist for English chamomile, which is normally practically all used for distillation of oil. It will probably pay well to grow chamomile next year, though the labour entailed in collecting English-grown chamomile is more than the price normally obtained for the Belgian drug. English chamomile is worth about 3s. per lb., the very finest selling at still higher prices.

Cultivation.—Chamomile prefers a dry sandy loam, but stiffish black loam gives the best crop of flowers. The usual method of propagation is from "sets," each old plant in March being divided into ten or twelve portions, which are planted in rows 2½ ft. apart with a distance of 18 in. between each plant in the row. Chamomile may also be grown from seed, but some plants will produce the less desirable single flowers. Weeding is done by hand.

The flowers are picked in September, or earlier if the season is dry. Collection is done by women and children, payment being by the pound (up to 1½d.). Rapid drying is necessary if the flowers are to retain their purity of colour, the flowers being laid on canvas trays in a heated drying closet. From 5 to 6 lb. of fresh flowers yield 1 lb. of dry flowers. Farmers would probably get a fairly good product if the flowers were picked as they came in bright weather, which is the best time for drying, this being done in the open or in well ventilated sheds in as thin layers as possible. The yield of dry flowers is about 4 cwt. per acre. They are sorted and graded according to colour.

Coriander (*Coriandrum sativum*, L.).

Coriander is grown in Lincolnshire and East Anglia, and the English-grown fruits have the reputation of possessing the finest flavour. No doubt cheap Morocco fruits (13s. to 14s. per cwt.) will be substituted for the dearer German and Russian spice. There is little likelihood of extra demand for English coriander.

Caraway and coriander are often grown in conjunction, the former yielding its crop in the second year. The yield of coriander is about 15 cwt. per acre.

Dandelion (*Taraxacum officinale*, L.).

Dandelion has been scarce all this year. Ordinarily English roots are sold in competition with German roots at about 40s. per cwt., but 110s. is now being paid. Collection of next year's supplies will commence shortly, and unless these are much greater than usual the absence of German competition will keep prices high. Farmers might collect and dry the roots, or arrange with a middleman for this to be done for them. An advantage of this course is that the weed is reduced.

Cultivation.—About 4 lb. of seeds per acre are drilled in rows a foot apart. Hoeing is needed to keep the crop clean. Flower heads are picked off as they appear, before the winged seeds can be dispersed, otherwise the grower's own land and that of his neighbours will be smothered with the weed. The roots are dug the second year in autumn. They may be transported fresh for pressing out the juice or making dandelion extract, or be washed, sliced and dried. The yield should be 4 or 5 tons of fresh roots to the acre in the second year. A hundred parts of fresh root yield twenty-two parts of dry material.

In the early part of this year fresh root was worth 6s. per cwt.

Foxglove (*Digitalis purpurea*, L.).

Although the Continental supplies of *Digitalis* leaves from Thuringia and the Harz mountains are stopped, there should be enough of the wild plant in England to satisfy home requirements if it can be collected. Dry wild leaves would be worth 35s. per cwt. and upwards. Unless these are gathered in considerable quantity there will be a shortage next year. The Foxglove (Fig. 6) is cultivated by a few growers in this country for a very limited market, in order to provide a drug of more uniform activity from a true type of *Digitalis purpurea*.

Digitalis is cultivated in the partial shade of orchards, but it likes a moderate amount of sun. Its cultivation as a paying proposition to a fruit grower can hardly be recommended. Its culture is that of a garden plant. *Digitalis* grows best in a well drained loose soil, rich in leaf mould. It is said to dislike chalk but appears to grow well enough at Croydon and Darenth on calcareous soils. About 2 lb. of seed are required per acre, and in order to ensure even distribution the seeds should be mixed with fine sand as they are so small and light. They should be thinly covered with soil. The seeds are uncertain in germination.

The leaves are hand picked in the second year, from flowering plants, the yield being about 1 to 2 tons of fresh leaves per acre. Great care is necessary in collecting and drying quickly, and a reputation for care is necessary if the crop is to be sold at remunerative prices.

Dill (*Peucedanum graveolens*, B. & H.).

English Dill (Fig. 4) has long had a reputation of its own for distillation of essential oil. It is grown chiefly in East Anglia. Considerable shortage is already evident, following the stoppage of Continental supplies, the cheap Indian fruit not being an effective substitute. This annual is easily grown and should pay well in years to come.

Cultivation is similar to that of spring oats, 10 lb. of seed being drilled to the acre. Careful attention must be given to the destruction of weeds. The plants require much watching as the time for harvesting approaches. Mowing is begun as the lower "seeds" (fruits) begin to fall, the others ripening on the straw. In dry periods cutting is best done in early morning or late evening. The loose sheaves are built into small stacks of about twenty sheaves tied together. In hot weather thrashing may be done in the field. The straw and chaff are useless. The crop is rather exhaustive of soil fertility. The yield is 5 to 7 cwt. of dill fruits per acre, selling in normal periods at 30s. to 40s. per cwt.

Fennel (*Foeniculum capillaceum*, Gilibert).

The cessation of the supply of Fennel of best repute from France, Saxony and Russia, might tempt farmers to try and grow fennel in this country. Any crop produced is almost certain to sell well. The plant abroad is a perennial of short duration but in this country it behaves as an annual. Fennel likes plenty of sun and is adapted to dry and stony situations,

but gives best crops on rich soil on the stiff side. From $4\frac{1}{2}$ to 5 lb. of seed are sown per acre. In the mild climate of France sowing is usually done in August or September, but spring sowing would be necessary here. The fruit is heavy and a crop of 15 cwt. per acre would probably be obtained. Cutting should be done before the fruits are fully ripe (see Dill). Fennel is largely used for cattle condiments, and Indian or Levant produce will probably be used for these. The usual price for German fennel is about 35s. per cwt., and an English crop should be grown with good profit at this price. Levant fennel sells at 25s. and East Indian at 20s. per cwt.

Golden Seal (*Hydrastis canadensis*, L.).

Prospects.—Golden Seal is an American drug. It was formerly so abundant in Ohio as to be considered a pestilent weed, but the drug collector and the march of civilisation denuded the natural growing areas, the plant not thriving in open spaces. The price has risen from 5s. per lb. in 1905 to 20s. or more at present. Such a high price enables cultivation to be practised on a commercial scale in America and in England, even with the great expense of artificial shading in order to simulate natural conditions. Cultivation of this drug might become a paying proposition to anyone who could solve the problem of the correct conditions of shade and moisture. Several times the amount of drug now used would be absorbed for making fluid extract of hydrastis and the alkaloids hydrastine and hydrastinine.

Cultivation.—The native home of golden seal is in deep, shady nooks in American forests with rich, deep soil full of natural moisture but not waterlogged. To imitate natural soil conditions beds should be double dug in autumn and plenty of leaf mould or well-rotted peat manure should be dug in during autumn. Another like treatment with leaf mould is made before planting in spring. The beds may be arranged under artificial or natural shade. The Wellcome Materia Medica Farm, near Darenth, Kent, appears to be the only place where golden seal is cultivated commercially in England. Here plants are grown in a dell shaded by elms and bramble bushes and under lattice work (Figs. 7 and 8). The object aimed at is to protect plants from the heat of the midday sun, and from heavy rain and drying winds. Beds made in orchards and arranged so that the fruit trees shade them at midday would seem adapted for this purpose. The beds could be sunk several inches if deficient in natural moisture. A

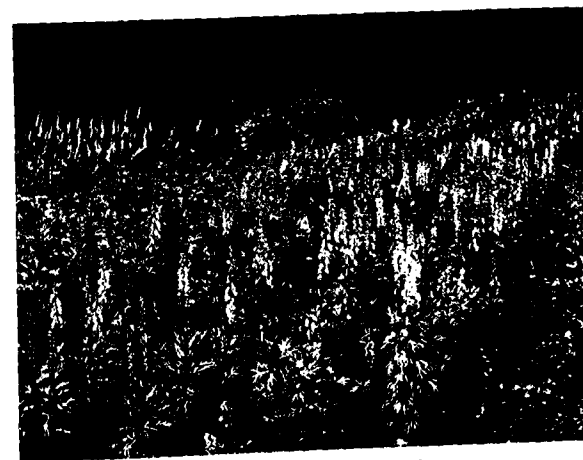


FIG. 5. — Cultivated Aconite.



FIG. 6. — A Field of Foxglove.



FIG. 7. — Golden Seal shaded by Elms.

2-in. drain with good fall 15 in. below the surface should prevent waterlogging on wet soils. Mr. W. Ferrein, a Russian pharmacist, has grown golden seal successfully in the shade of apple trees near Moscow.

Golden seal is propagated by dividing up the rhizomes of older plants in late spring (April or May). These bear prolific lines of dormant buds from end to end of the rhizome and a living piece containing one of these will grow under suitable conditions. These are planted in rows 6 in. apart with 1 ft. between the rows. The plant usually bears a single leaf the first year, and two leaves and a single flower the second year. Golden seal is a slow but persistent grower under suitable conditions, the time between planting and harvesting being three years. The plants should increase fourfold in two seasons by dividing up the rhizomes. A light mulch of leaves in autumn affords the best protection from frost.

Hydrastis can be grown from fresh seed, which is slow to germinate, but the seedlings do well if they get over the first season in a strong condition. The seeds are sown in fine potting soil and covered lightly. In all transplanting operations the growing beds must not be trodden upon. If artificial shade is necessary this could be given by slats overhead arranged to turn on edge or flat on the lattice window-blind principle.

The greatest initial difficulty will probably be to obtain a supply of cuttings of the living rhizome.

Yield.—After initial experiments commenced in 1899 on a small plot at Washington the United States Department of Agriculture gave the production as 5,120 lb. of fresh roots per acre, or 1,500 lb. of marketable roots. In 1912 the Department reported that the cultivation of golden seal was "successfully established."¹⁴

Henbane (*Hyoscyamus niger*, L.).

Prospects.—This biennial is cultivated in this country for extract making. There is a limited demand for the latter and the established drug farms will probably be able to meet it. The official henbane leaves of the British Pharmacopoeia are the leaves and flowering tops of second year plants of biennial henbane, but the dry commercial leaves imported from Germany and Russia are derived from the wild annual. Thus there should be no objection to growing this next year to make good any shortage providing seed can be obtained which will germinate. There will be a demand for dry leaves at enhanced prices next year.

The normal price of the Continental drug plant is 40s. to 45s. per cwt. English-grown drug is ordinarily worth 3s. to 6s. per lb.

Cultivation.—Henbane (Fig. 11) grows in similar situations to Belladonna, and its cultivation is much the same. The seeds, however, are prone to lie dormant, and the crop is tricky and uncertain, sometimes dying in patches. Commercial henbane seed is often kiln-dried and useless for sowing. The annual variety is smaller and does not branch so freely as the biennial plant, so that it may be sown in rows 18 in. apart, and the biennial 2 to 2½ ft. The leaves (flowering tops) are gathered (Fig. 9) when the plants are in flower (biennial June or July, annual August). The root is not used in medicine. The annual variety appears to be as active medicinally as the biennial plant, but opinions differ on this point. The fresh leaves lose 80 per cent. of their weight on drying.

Egyptian Henbane (*Datura Metel*, L.).

This plant is a valuable source of the mydriatic alkaloids hyoscine, hyoscyamine and atropine. At present it is grown in this country at the Wellcome Materia Medica Farm in Kent, where it luxuriates. (Fig. 10.).

Opium Poppy (*Papaver somniferum*, L.).

Prospects.—The white variety of the opium poppy is still grown in several parts of the country, notably Lincolnshire, for the sake of its capsular fruits. The crop is always a precarious one, but there is a steady market for poppy heads. The working classes are accustomed to relieve face-ache with fomentations of poppy head and chamomile, and they are not likely to forgo these in times of pain. Belgium ordinarily supplies a proportion of the poppy heads used in this country, but not sufficient to cause serious shortage next year. The price paid for poppy heads is 12s. to 15s. per 1,000 for large size, and 8s. to 10s. for medium.

Cultivation.—Poppies prefer rich, moist soil with plenty of sun, and the usual practice is to take a crop after wheat, oats or barley. The land is manured and ploughed in autumn to ensure a fine tilth in spring. Sowing is done at the end of March or in April according to weather, allowing 1 lb. of seed per acre and drilling in rows a foot apart. The whitest seeds are preferred. Plants which are too forward are liable to be cut down by late frosts, while, if seed is sown too late, the seedlings may become dwarfed if dry weather sets in before they



FIG. 8.—Golden Seal under Lattice Shade.



FIG. 9.—Picking Henbane Leaves.



FIG. 10.—A Field of *Datura Metel*.

become well established. A light roller is sufficient to ensure the seeds being covered.

When the plants are 3 or 4 in. high they are cut with a hoe into clumps about 6 to 9 in. apart and are afterwards "singled" by women or children, leaving a solitary strong plant from each group. Weeding is necessary. A dressing of soot or fertiliser may be given if support appears to be needed.

Poppy heads of pale colour are most desired, but a week's rain or even a few nights' heavy dew may spoil the colour of the ripening fruits. High winds and heavy rains are dreaded, as the plants become top-heavy. The capsules are harvested by women or children about September; they are broken off and placed in baskets, and are transferred to sacks to be conveyed to the drying floor. The yield is very variable. The drying floor is a boarded floor in a freely ventilated warehouse, and on it a thin layer of capsules is turned each day by shuffling the feet along the floor. The capsules usually take a fortnight to dry.

Thorn Apple (*Datura Stramonium*, L.).

Prospects.—The Thorn Apple (Fig. 12) is not grown on a commercial scale in this country. The principal use of the drug is as an ingredient in burning powders for asthma, considerable amounts of the wild leaves being imported from Germany and Hungary. The normal price of foreign *Stramonium* leaves is about 40s. per cwt., but 80s. is asked since the outbreak of war. The seed is also a commercial article, but demand is very limited. The plant is an annual and easily grown. The dry leaves would find a ready market next year.

Cultivation.—The seeds (10 lb. to 15 lb. per acre) are drilled in rows two feet apart. The plants grow well in sunny situations. The crop is cut with the sickle when in flower in late summer. The leaves are stripped off and dried as quickly as possible, usually by artificial heat. About 34 parts of dry leaves are produced from 100 parts of fresh leaves. The thorny capsules are gathered from plants allowed to stand, when full grown but still slightly green. They split and shed their seed on drying.

Datura Tatula, L.—A closely allied species with purple flowers (not white as in *D. Stramonium*) is occasionally used in medicine in place of *D. Stramonium*.

Valerian (*Valeriana officinalis*, L.).

Prospects.—Valerian (Fig. 13) is common in England in moist situations. Most of the drug plant of commerce consists of rhizomes from plants grown in Derbyshire²⁹, or imported from Holland, Germany and France. The foreign root was selling in January at 30s. per cwt., English being worth 1s. to 1s. 3d. per lb., about four times that price. Very little valerian is now cultivated in this country and great scarcity already exists. Abnormal prices will be paid for some time to come.

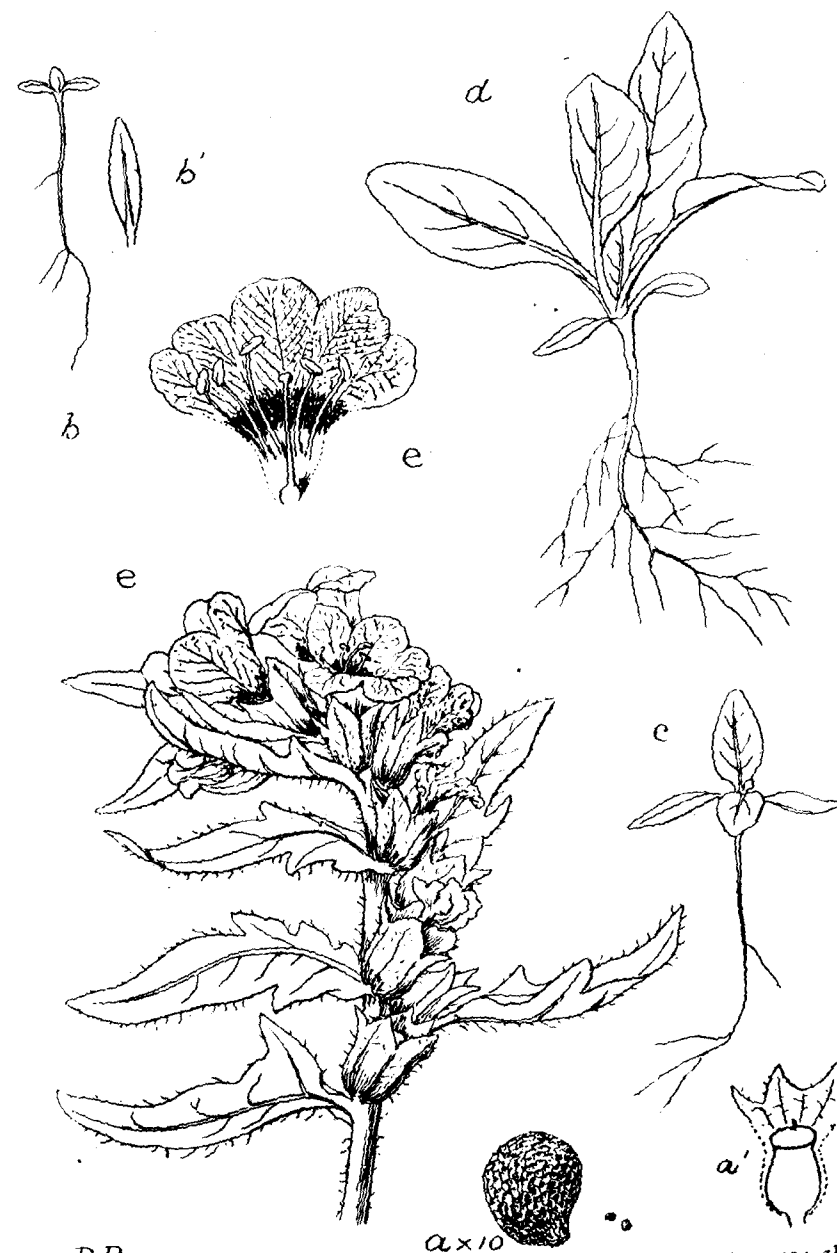
Cultivation.—In Derbyshire cultivation is from wild plants collected in local woods and transplanted to the prepared land. Preference is given in collecting to daughter plants and young flowering plants which develop at the end of slender runners given off by the perennial rhizomes of the parent plant. Many of the young plants do not flower in the first year, but produce a luxuriant crop of leaves and give rhizome of good quality in the autumn. Planting is usually done on land treated with farmyard manure. Weeding requires considerable attention, and it is advantageous to give plenty of liquid manure and artificial fertiliser from time to time. The plants require plenty of water. Any flowering tops are cut off, as they appear, to encourage the growth of the rhizome as much as possible. In September or October the tops are cut off with a scythe and the rhizomes dry up. The clinging character of the Derbyshire soil does not allow them to be left later.

The rhizomes are sliced longitudinally to facilitate washing, which is done in a large perforated wooden box 2 to 2½ ft. deep, secured by stakes in the bed of a local stream, a rake being used to stir up the "hearts." The rhizomes are dried on a shed floor about 6 ft. from the ground. The wet material is strewn on freely perforated boards, below which a large coke stove is kept going until the drying is complete. About 24 parts of the dry product are obtained from 100 parts of fresh rhizome. Derbyshire valerian plants are of two species, *V. Mickanii*, Syme, on limestone, and *V. sambucifolia* on the coal measures. The former yields most of the cultivated Derbyshire rhizome.

Other Medicinal Plants.

Experimental growing of some American drugs such as senega, grindelia, pokeroot, and lobelia, is made at Darent.

"Botanical herbs" for sale by chemists and medical herba-



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FIG. 11.—Henbane (*Hyoscyamus niger*, L.): a. Seed natural size and $\times 10$; a¹. capsule $\times 1$; b. first-stage seedling $\times 1$; b¹. cotyledon enlarged; c. second-stage seedling $\times 1$; d. third-stage seedling $\times 1$; e. flowering branch $\times 1$; e¹. section of flower, enlarged.

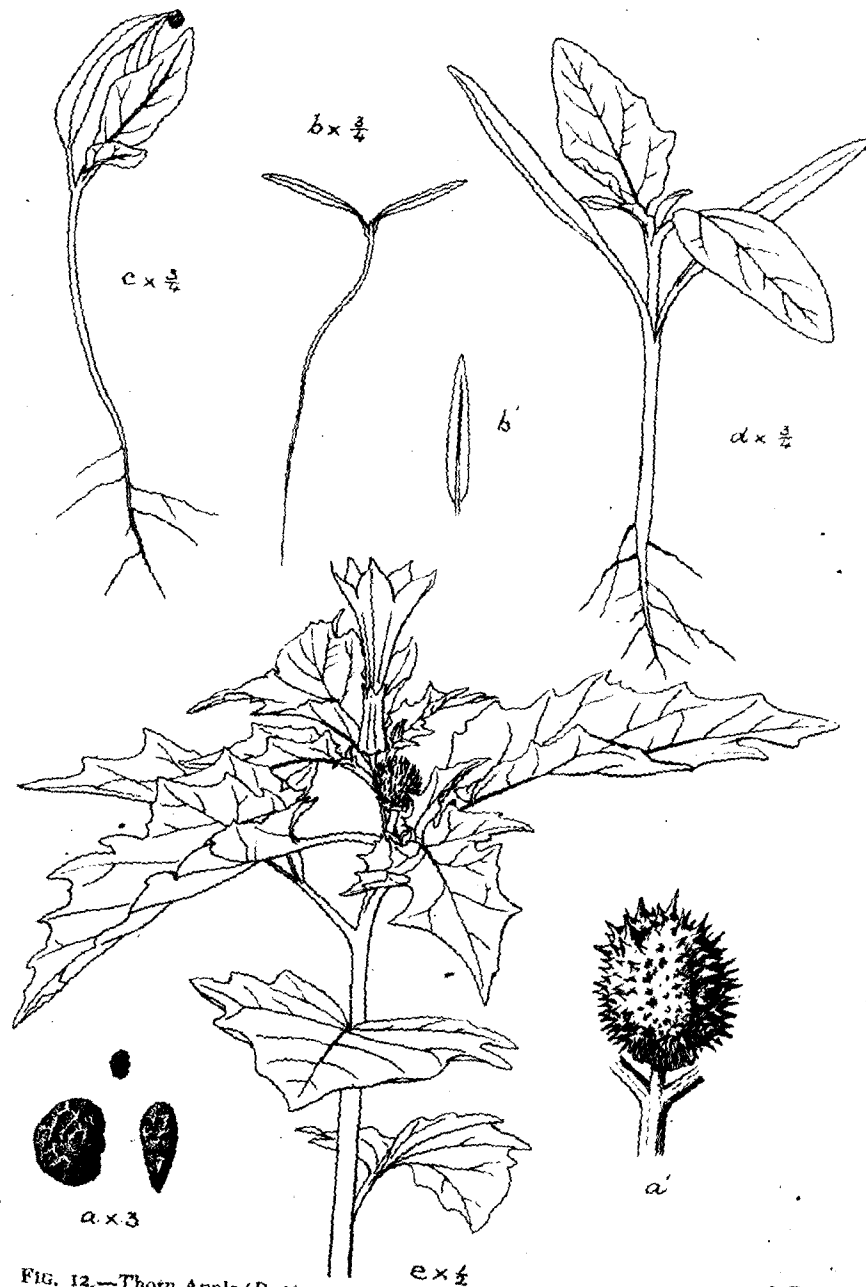


FIG. 12.—Thorn Apple (*Datura Stramonium*, L.): a. Seeds natural size and $\times 3$; a¹. fruit or capsule, reduced; b. first-stage seedling $\times 1$; b¹. separate cotyledon $\times 1$; c. second-stage seedling $\times 1$; d. third-stage seedling $\times 1$; e. flowering branch $\times \frac{1}{2}$.

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lists are cultivated at Carshalton. They are grown in rows, which are increased in number according to the demand. The following are regularly cultivated:—

- Balm (*Melissa officinalis*, L.), for herb.
- Comfrey (*Symphytum officinale*, L.), for root.
- Feverfew (*Chrysanthemum Parthenium*, L.), for herb.
- Greater Celandine (*Chelidonium Majus*, L.), for herb.
- Germander (*Teucrium Scorodonia*, L.), for herb.
- Marshmallow (*Althæa officinalis*, L.), for root and leaves.
- Mugwort (*Artemisia vulgaris*, L.), for root.
- Pennyroyal (*Mentha Pulegium*, L.), for herb.
- Rue (*Ruta graveolens*, L.), for herb.
- Southernwood (*Artemisia abrotaneum*), for herb.
- Tansy (*Tanacetum vulgare*, L.), for herb.
- Wormwood (*Artemisia Absinthium*, L.), for herb.
- Yarrow (*Achillea Millefolium*, L.), for herb.

These herbs and roots are in steady demand, and although English grown are preferred Continental supplies have to be imported to satisfy all needs. They are easily grown from seed, but propagation is commonly by division of old perennial plants. They succeed well from cuttings. Only pennyroyal presents uncertainty as regards crop, this species being diminished by drought. Most botanical crops are worth in the dry state from 20s. to 30s. per cwt. Considerable demand will occur next year, owing to short supply, for buckbean leaves, centaury, coltsfoot leaves, feverfew, figwort, marshmallow leaves and root, meadowsweet, wild carrot fruits, and yarrow. These include some of the commonest British wild plants, but in the ordinary way few are collected in England except by herbalists, or by herb gatherers on behalf of a few agents for wholesale firms.

The herb collector's calling is a poor one at the best of times, but there is now every prospect of a rich harvest for some time to come. His outfit consists of some old sacks and a "paddle"—a strong iron spud 10 in. long with a cross foot-piece and tough 4-ft. ash handle. With this a hard day's work may result in a hundredweight of dandelion roots being taken to a middleman for forwarding to the manufacturer. The latter will require more henchmen next year, the medicinal plants dealt with below being now in greater request than usual, besides wild aconite, Belladonna, henbane and Stramonium. Farmers and landed proprietors might be asked to allow free access to their estates to herb-gatherer or local botanist.

Barberry (*Berberis vulgaris*, L.): bark will be wanted next year. Ordinarily it is worth 40s. per cwt. in the dry state. Home supplies will be insufficient.

Bittersweet (*Solanum Dulcamara*, L.) grows wild in moist, shady situations, and is common in hedges and thickets throughout England. There is only a small demand for the drug, which is prepared from the smooth, two or three years old (about $\frac{1}{2}$ in. thick) branches collected in autumn after the fall of the leaves. The branches should be dried and cut into pieces about $\frac{1}{2}$ in. long with a chaff cutter.

Broom (*Cytisus Scoparius*, Link.).—The brush-like branches contain most alkaloid in winter, but are also gathered in June for expression of juice.

Buckbean (*Menyanthes trifoliata*, L.): leaves are generally collected in spring. The plant is a marsh herb distributed throughout Britain.

Burdock (*Arctium Lappa*, L.). The root is still used.

Centaurry (*Erythræa Centaurium*, Pers.) is common in this country, and the dry herb will be required next year.

Coltsfoot (*Tussilago Farfara*, L.): the leaves retain some reputation as a household remedy. Plenty are to be had for the trouble of collecting, the plant abounding on poor, stiff soils. The leaves are collected in June or July. The flowers which appear in spring are also used to a slight extent, as well as the root.

Elder (*Sambucus nigra*, L.) flowers will be needed more than usual. They are plentiful, but require quick collection and rapid transit if they are to be used fresh for making elder flower water. They can be preserved for future distillation by mixing them with 10 per cent. of common salt.

Figwort (*Scrophularia nodosa*, L.) occurs in moist situations throughout England.

Hemlock (*Conium maculatum*, L.) is a biennial growing wild on the banks of streams, along edges of fields or in neglected meadows. It is used chiefly for the expression of conium juice. It is collected in June from second year plants.

Horehound (*Marrubium vulgare*, L.) grows wild in this country but is not common. It might pay to cultivate next year, as it is in steady demand.

Male Fern (*Aspidium Filix-Mas*, Sw.) is one of our commonest indigenous ferns, growing luxuriantly in moist, sheltered situations. Germany (Harz and Thuringia) supplied all the male fern rhizome or extract used in this country, and any rhizome collected in this country will meet a ready demand.

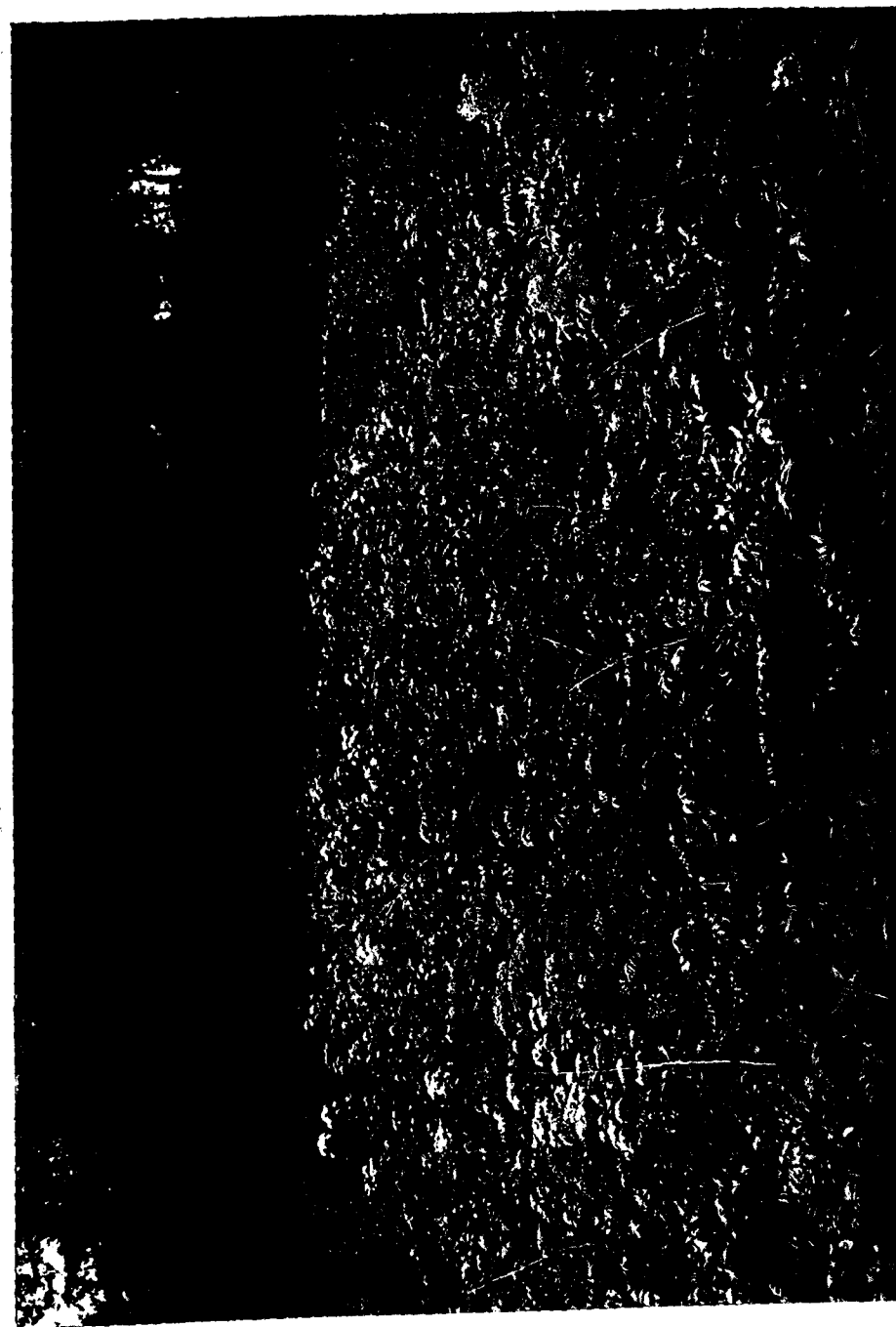


FIG. 13.—A Plantation of English Valerian (*Valeriana officinalis*, L.).

Meadow Saffron (*Colchicum autumnale*, L.) is abundant in moist meadows in some parts of England and will be much wanted. The corms (or underground "bulbs") should be dug up in July after the leaves have faded, but they are found with difficulty and are hence usually collected later when in flower.

Meadowsweet (*Spiræa Ulmaria*, L.). More than usual of this herb will need to be gathered.

Mullein (*Verbascum Thapsus*, L.). This biennial plant occurs fairly frequently on roadsides and waste places in Britain. There will be a good inquiry for dry leaves.

Red Poppy petals (*Papaver Rhoeas*, L.) find a steady if limited market. Farmers can arrange to deliver fresh petals to manufacturers. Children can gather the petals, placing them in a linen bag suspended round the neck, leaving both hands for work, and with a little education are a positive help in preventing the spread of this cornfield weed.

Rose petals will be keenly in demand this year on Continental supplies being cut off. They usually realise 3s. to 4s. per lb. when dry, but will be more valuable this year. Any dark red rose petals are suitable, and some organisation for collection and drying could be arranged in the rose-propagating centres of Oxford and Essex.

Sweet Flag (*Acorus Calamus*, L.) can be found in quantity along the edges of streams and lakes. The dried rhizome will be readily saleable.

Yarrow (*Achillea Millefolium*, L.) is one of the commonest British plants, and the dry flowering tops are utilised.

This by no means exhausts the list of British medicinal herbs. Others, such as squirting cucumber and *Lactuca virosa*, are cultivated in a small way, while bryony root, and buckthorn berries are among the wild products in very limited demand.

NOTE.—In the ordinary way a few pounds of dried herb are only disposed of with difficulty, buyers requiring hundred-weights or none. Next year, however, is likely to be the exception and such quantities as can be got will be saleable. In any case it is best to get into touch with a buyer before commencing to grow or collect medicinal herbs. The drug grower who has special facilities for dealing with these should be approached in the first instance.

The Board are indebted to Messrs. Stafford Allen & Sons, for the loan of Figs. 3, 4 and 13, which are from photographs taken on their farms at Long Melford, Suffolk; and to Messrs.

Burroughs, Wellcome & Co. for the loan of Figs. 5 to 10, which are from photographs taken on their Materia Medica Farm near Darenth, Kent.

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THE VALUE OF ACORNS, HORSE CHESTNUTS, AND BEECH MAST AS FOOD FOR STOCK.

Acorns.

It is an old established custom in Great Britain to collect acorns for pig-feeding, and to turn out cattle and pigs to gather up the fallen acorns. "In ancient days the annual crop of acorns in the woodlands was held to be of immense value for the 'pannage' of swine, which then formed the chief wealth of the rural population."¹

"*Acorn Poisoning*."—During the last thirty or forty years, however, there has apparently been a growing reluctance to utilise acorns to the extent which formerly prevailed, and this is certainly traceable to the fact that large numbers of young cattle under three years old have been lost owing to the so-called "acorn poisoning." So serious had this trouble proved that in the year 1893 the Board issued a leaflet dealing with the matter. In the years 1868, 1870, 1884 and 1900, all remarkable for a large yield of acorns after a long, dry and hot summer, serious losses among young cattle took place, notably in Middlesex, Kent, Hertfordshire, Warwickshire, Lincolnshire, Northamptonshire, Wiltshire, Gloucestershire, Devonshire, the New Forest, Sussex, Surrey, Suffolk, Norfolk and Derbyshire. Young cattle up to two years old suffered most severely while milch cows and cattle over three years old were seldom affected. Sheep and pigs did not appear to be susceptible to the poisonous action of the acorns and only two or three cases of the disease were reported in these animals, while entire herds of young cattle were attacked and a large proportion of them succumbed.

There is, in fact, a not inconsiderable risk of injurious effects from the consumption of large quantities of acorns by young cattle, though not apparently by old cattle, sheep and pigs. It should be noted, however, that the poisoning does not usually follow on consumption of acorns in small quantities, but is commonly due to full meals of acorns taken in periods when there is a dearth of herbage.

It appears to be fairly clear that "acorn poisoning" is distinct from indigestion which is due merely to the consumption of an excessive quantity of acorns, though Lander² states that "at present the commonly accepted explanation of the disorder, as one due to acute digestive derangement, is the best." Much, however, must depend on the interpretation placed on

the word "poison." The trouble may occur in any season when animals are first turned out to pasture where acorns abound. "Acorn poisoning" is, as a rule, distinguished by progressive wasting, entire loss of appetite, diarrhoea, discharge of an excessive quantity of pale urine, sore places inside the mouth, discharge from the nostrils, and also from the eyes, which are always sunken, giving the animal a peculiar haggard expression. No fever is present from first to last, but, on the contrary, the temperature is commonly below the normal standard, though in some cases stated to be above the normal.

On post-mortem examination it is frequently noticed that all traces of the acorns have disappeared. The morbid changes are such as are seen when an irritant poison has been given.

The following is an account of the symptoms noticed by various authorities, and of the causes to which the "poisoning" is ascribed.

Müller⁹ remarks on the severe constipation followed by dysenteric diarrhoea caused by acorns, especially when eaten in the half ripe condition, horses, cattle, sheep and goats being affected. He states that 10 litres (2 gallons) of acorns eaten within four days is sufficient to cause poisoning in cattle, but that pigs eat acorns without injury.

Pammel¹⁰ states that some species of acorns are injurious to cattle and that the fruits of European oaks produce death in pigs and cattle. It is suggested that this may possibly be due to the tannin and glucoside contained in the acorns.

In some parts of the South (United States) it is believed that the mast of oaks makes excellent feed for hogs but is poisonous to cows, a small amount merely decreasing the flow of milk while a greater quantity causes death. Some say that the coarse hulls or cups clog the digestive tract and cause unthriftiness; others that there is actual poison in the mast. That cattle are more seriously affected than hogs or horses may possibly be explained by the difference in the structure of the digestive organs.

Writing in the *Veterinary Journal* (February, 1902), Thorburn calls attention to the fact that acorn poisoning was very frequent in the autumn of 1901 in cattle. It is remarked that up to a certain point cattle seem to do very well when eating acorns and improve in condition, and it is only when acorns are exceedingly plentiful that cases of poisoning occur. In regard to the symptoms of poisoning, which have been constant in the cases he saw, he mentions loss of appetite, grunting, disinclination to move, prostration, icy coldness of extremities,

very rapid emaciation (this symptom was particularly noticeable), pulse very small and weak (in some cases almost imperceptible), temperature high (105° to 107° F.), and constipation succeeded by watery diarrhoea.

According to the *Modern Veterinary Adviser*, the symptoms of trouble following acorn poisoning are due to the large quantities consumed and are those of indigestion or even actual inflammation of the stomach, with constipation followed after an interval by diarrhoea with a good deal of straining.

Though it is generally believed that pigs suffer little or not at all from acorn poisoning, it has been stated¹ that swine fed too largely on or surfeited with acorns are apt to contract a distemper called "garget."

In addition to loss of appetite, diarrhoea, running at the nose, sore places on the mouth and sunken eyes in affected cattle, Damman² observed fever, and an animal which died after three or four days' illness showed inflammation of the stomach and intestines. He observed similar symptoms in horses after feeding with fresh acorns, but sheep and goats were not so much affected.

It is also stated² that characteristic constituents of acorns are tannic acid, and a bitter principle known as Quercetin, and that these two substances easily cause digestive troubles, especially constipation, in certain circumstances, e.g., when fed in large quantities. If the acorns are musty or mouldy as the result of bad storage, feeding may be attended with some danger.

Brookes and Yeomans¹¹ have described cases of poisoning. In one case, 30 cattle were affected and 9 died. The chief symptoms were a dull and depressed appearance, entire absence of appetite and rumination, a weak feeble pulse, sub-normal temperature and disinclination to move. Three cases showed a mucous and blood-tinged discharge from the nostrils and anus, and these all died. Obstinate stoppage was noticeable in all cases and the faeces were inky black, stinking and very thick. Yeomans observed that an affected animal seemed depressed and listless, with loss of appetite, constipation and a doughy condition of the rumen. The symptoms were those of acute digestive disturbance; later the eyes had a sunken appearance, diarrhoea set in, the faeces being dark-coloured, offensive and blood-stained. The temperature was at first normal and later sub-normal, and in fatal cases death took place in from about three to seven days.

Lander points out¹² that "acorn poisoning" does not affect sheep, deer or swine, but only cattle, and sometimes does not declare itself until all the ingested acorns have been expelled. The poisoning, he says, is distinguished by constipation in the earlier stages, followed by persistent diarrhoea with frequent small dark and bloody evacuations. There is loss of appetite, suspension of rumination, wasting, colic, and excessive urination. There is said to be no fever, and the temperature may be sub-normal. There is also soreness of the mouth, pallor of the membranes, and discharge from the nose and eyes, the latter being sunken.

A fairly full account of acorn poisoning in 1870 is given in the Journal of the Royal Agricultural Society of England for 1871.

Composition of Acorns.—The composition of acorns varies with the soil, the kind of oak and the climatic conditions. The following composition of acorns is given by Kellner⁸ :—

	Fresh with Husks.	Fresh without Husks.	Half dry with Husks.	Dried with Husks.	Dried without Husks.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Crude Nutrients—					
Water	50.0	35.0	35.0	15.0	15.0
Crude Protein	3.3	4.9	4.3	5.7	6.5
Crude Fat	2.4	3.5	3.2	4.1	4.6
N.-free extract sub- stances	36.3	50.1	47.1	61.6	65.5
Crude Fibre	6.8	4.5	8.9	11.6	5.9
Ash	1.2	2.0	1.5	2.0	2.6
Digestible Nutrients—					
Crude Protein	2.7	3.9	3.5	4.6	5.2
Crude Fat	1.9	3.1	2.5	3.3	4.0
N.-free extract sub- stances	32.6	46.1	42.4	55.5	60.3
Crude Fibre	4.1	2.8	5.3	7.0	4.8
Value	95.0	98.0	95.0	95.0	98.0
Digestible Protein	2.2	3.2	2.7	3.8	4.2
Starch equivalent	40.4	56.5	52.4	69.0	75.0

Wolff and Lehmann⁴ give the analysis of fresh acorns as :—Water, 55.3 per cent.; dry matter, 44.7 per cent.; crude protein, 2.5 per cent.; crude fibre, 4.4 per cent.; nitrogen-free extract substances, 34.8 per cent.; and fat, 1.9 per cent. Dried and shelled acorns are given as containing :—Protein, 5.1 per cent.; fat, 4 per cent.; nitrogen-free extract substances, 67.4 per cent.; and fibre, 4.5 per cent. The foodstuff is stated by these authorities to be from 87 to 91 per cent. digestible, so that dried acorns have the following content of digestible foods :—Protein, 5.4 per cent.; fat, 4 per cent.; and nitrogen-free extract substances, 76.6 per cent.

Hughes⁸ gives the analysis of well-ripened acorns picked up in Surrey on October 21st, 1906, as follows, the kernel composing 86.2 per cent., and the husk 13.8 per cent. of the whole.

	Kernels.		Husks.	
	Natural State.	Dried at 212° F.	Natural State.	Dried at 212° F.
<i>General Composition.</i>				
Water lost at 212° F. ..	40.42	—	32.65	—
Portion soluble in cold water	9.20	15.44	4.19	6.23
Portion soluble in hot water	27.83	46.72	6.19	9.20
Portion insoluble in hot water	22.55	37.84	56.97	84.57
<i>Detailed Composition.</i>				
Water lost at 212° F. ..	40.42	—	32.65	—
Oil and Fat	2.50	4.19	.36	.54
Soluble albuminoid com- pounds	3.12	5.23	.80	1.20
Insoluble albuminoid com- pounds	2.87	4.82	1.99	2.96
Sugar and glucose	2.77	4.65	.41	.61
Mucilage and gum	6.43	10.79	3.79	5.63
Starch, &c.	20.75	34.85	3.64	5.41
Digestible fibre	17.31	29.05	26.46	39.29
Indigestible woody fibre ..	2.37	3.97	28.53	42.32
Mineral matter	1.46	2.45	1.37	2.04
Potash	.72	1.21	.54	.80
Phosphoric acid	.14	.23	.05	.07

In a report by Engels of the Speyer Experiment Station² the analyses of various experimenters are given and an attempt made to arrive at an average composition. The averages were as given in the table on the next page.

Samples of acorns of *Q. pedunculata* and *Q. sessiliflora* from all parts of the Palatinate were examined at the Speyer Station with the following average results :—Weight, 5.47 grammes; ratio of kernel to husk, 84.9 : 15.1. The kernels and husks were dried at 100° C. The kernels contained :—Crude protein, 6.60 per cent.; fat, 3.41 per cent.; N.-free extract substances, 83.18 per cent.; crude fibre, 3.98 per cent.; and ash, 2.82 per cent. The husks contained :—Crude protein, 3.42 per cent.; fat, 1.58 per cent.; N.-free extract substances, 49.30 per cent.; fibre, 43.37 per cent.; and ash, 2.31 per cent. The whole acorn contained :—Crude protein, 6.12 per cent.; fat, 3.13 per cent.; N.-free extract substances, 78.11 per cent.; fibre, 9.92 per cent.; and ash, 2.74 per cent. The content of the ash in lime and phosphoric acid was found to be as follows (in the dry matter) :—kernels : lime, 0.13 per cent. and phosphoric acid, 0.34 per cent.; husks : lime, 0.36 per cent., and phosphoric acid, 0.14 per cent.; whole acorns : lime, 0.16 per cent., and phosphoric acid, 0.30 per cent.

Experiments were carried out in Germany (see *Landw. Jahrb.*,

	Fresh with Husks.	Fresh without Husks.	Dried with Husks.	Dried without Husks.
	Per cent.	Per cent.	Per cent.	Per cent.
Fresh or air-dried matter—				
Water	37.12	34.90	13.78	15.00
Crude protein	4.11	4.67	7.28	6.02
Fat	3.05	4.03	4.00	4.22
N.-free extract sub-				
stances	45.27	50.36	62.10	67.92
Crude fibre	8.95	4.17	12.20	4.87
Ash	1.50	1.87	2.20	1.97
Dry matter—				
Crude protein	6.54	7.17	6.07	7.09
Fat	4.85	6.19	4.67	4.97
N. - free extract sub-				
stances	72.00	77.37	72.45	79.89
Crude fibre	14.22	6.40	14.24	5.73
Ash	2.39	2.87	2.57	2.32

1879,) to determine the digestibility of acorns, on two Southdown-Merino wethers. The following proportions of nutrients were found to be digestible:—Dry matter, 88.02 per cent.; organic substances, 87.78 per cent.; nitrogenous substances, 83.33 per cent.; fat, 87.54 per cent.; N.-free extract substances, 91.4 per cent.; and crude fibre, 62.24 per cent.

Drying and Preservation of Acorns.—It will be seen from the above analyses that dried acorns have a much greater feeding value than fresh. The latter have an astringent property which is undesirable because large quantities may in certain cases and with certain animals cause illness, and the astringency also prevents the acorns being eaten as readily as if this property were absent. Drying the acorns not only removes this astringency but improves the preservability and feeding value. M. Magne⁷ has suggested that if the acorn is allowed to germinate it becomes a better food, having lost the tannin which it naturally contains.

Engels² found that acorns contained small quantities of free fatty acids, the amount of which is higher when the acorns are not sufficiently ripened. Storing for a long period, with sufficient moisture present, tends to an increase in the fatty acids. Further changes result in decomposition and the formation of strong-smelling substances: the fat and oil become rancid. Special care must therefore be taken in the storage of acorns. The astringent materials are from 6-8 per cent. of tannin and a substance known as Quercetin. These easily cause digestive troubles and constipation. In most cases where fresh, unhusked acorns cause harm it is due to the fact

that they are wholly or partly spoiled. The high content of the husks in fibre (43 per cent.) is sufficient reason for removing this part of the acorn.

Two methods of preserving fresh acorns for the winter are reported² as having been successful in N.W. Germany, viz., (a) The acorns were placed in a shallow pit in which oak leaves had first been laid. Leaves were also placed over the acorns, and a thin layer of earth over the whole. Water was frequently poured over the heap and after a few months the acorns presented a yellow appearance and were eaten without harm by swine and cattle. (b) In the second method the acorns were spread thinly on a dry floor in a covered-in shed, frequently turned until they were no longer sticky, and then kept on a layer of straw over the winter. An Algerian agriculturist mentioned by Engels² placed the acorns in large holes in the ground and allowed fresh spring water to run over them; fermentation ensued and after a few weeks the disagreeable smell and taste disappeared. So treated the acorns were used as food over the winter until the next autumn crop of acorns and were readily eaten by pigs, milch cows and oxen. They caused constipation at times, but no cases of poisoning occurred.

A very satisfactory method of preserving *fresh* acorns seems to be to spread them out in an airy, dry store house. Storing in pits as with potatoes and roots is also advocated; stored in this manner the acorns keep fresh a long time, and do not become mouldy. V. Cieslar² in preserving acorns for forestry purposes found them to preserve well in the open, covered with moss or sand or soil; or in pits covered with sand or soil; or in fresh water constantly renewed. Thus stored, it is stated that the acorns soon ferment, and develop an unpleasant smell, which, however, passes off. The shells become black, while the kernels retain their fresh colour and lose their bitter taste. The method of running water over the acorns has the disadvantage that some of the nutrients are lost by washing out.

Another good method of preserving acorns is by drying followed by shelling, which is easily done on a large scale by crushing and sifting, the kernels being shrunken and the husks cracking. They are then more readily eaten as they taste less bitter. Drying on a small scale can be done in an oven. On a large scale, drying entails some expense, but this is held to be amply repaid.

Hughes⁵ says that if acorns could be stored in thin layers on shelves in a large well-ventilated room, free from damp,

they would dry naturally, and probably lose from 15 to 20 per cent. of their original 40 per cent. of water. When large quantities have to be dealt with, as would be the case if acorn meal is to be prepared on a commercial basis, it would be necessary that the drying process should be done by artificial means, in the same way as hops are treated. He carried out laboratory experiments which showed that drying the crushed kernels at a temperature of 212° F., not only concentrated the material by the expulsion of water, but improved the flavour by the increase of the sugar compounds, and by the elimination of the bitter astringent principle due to the tannin, the acorns acquiring a sweet, aromatic, biscuit-like taste. In round numbers every 100 parts of acorns produced 50 parts of the prepared meal, so that it would require two tons of acorns to make one ton of the meal.

According to a report in the *Deutsche Landwirtschaftliche Presse* (13th July, 1912) cooking the acorn meal destroyed its preservability. In this experiment there was a loss of 49 per cent. on drying (in ovens), threshing and removing the shells.

Hughes⁸ analysed some acorns picked up in Surrey in October, 1911. They contained 41.41 per cent. of water, and were cut up into four quarters, dried, slowly baked at a temperature of 212° F., and then ground into a meal which gave the following results :—

Water (lost at 212° F.) ..	6.40	Starch and digestible fibre	61.02
Oil and fat	4.30	Indigestible fibre ..	8.17
Albuminoids	6.31	Mineral matter	3.20
Sugar, glucose & mucilage	10.60		

"This represents the composition of the *whole acorn* including the brown husk, dried and ground into meal, containing 6.40 per cent. of water absorbed from the air after being dried artificially. Such a meal, though low in albuminoids, is highly farinaceous in composition, fairly rich in oil and free from any excessive amount of indigestible fibre, and seems especially suitable for pigs or sheep."

Feeding Value.—As already indicated, it has long been recognised that acorns are of considerable value for feeding purposes. Their food value chiefly lies in their high content of carbohydrates. Animals which are receiving large amounts of green fodder or foods rich in protein may usefully have their rations supplemented by the addition of acorns. Fresh acorns should preferably be fed only to pigs, sheep, goats and adult cattle, in moderate quantities, along

with other foods, and the change to the ration containing acorns should be effected gradually. It is not safe to feed fresh acorns in any considerable degree to pregnant sows, dairy cows or young cattle. Where pigs are driven into woods they must be given green and other complementary food which will supply a sufficiency of phosphates and lime, which are present in acorns in only small quantities. Special care must be taken to withhold cattle from pastures where unripe acorns have been blown down.

It seems to be established that dried and shelled acorns may be fed in the ration to all animals without hesitation and with good results.

Kellner³ considers that on account of their high starch content and digestibility acorns form a most valuable food for the fattening of pigs and oxen, but owing to their astringent taste they are not always readily eaten. He suggests that when given fresh they should be crushed, and when dried they may be ground.

Wolff⁶ states that sheep and oxen willingly eat acorns in the form of meal.

Henry¹³ observes that the influence of acorns on the flesh of swine is uncertain, some people asserting that pork from acorn-fed swine is satisfactory, while others affirm that it is soft and undesirable. In this connection, Long⁷ states that pork produced from acorns is unusually lean, and this fact suggests that the value of the acorns is greater when mixed with a fat-producing food. For store pigs fed upon a green diet, acorns are considered useful and may be given morning and night, a few handfuls at a time.

Malden¹⁴ also considers acorns a good pig food. He suggests that they should be well ripened, and it is better for them to be stored, since they then become more digestible and more nutritious. He holds that in districts where acorns are abundant it is decidedly wasteful not to utilise them. Strong stores, he says, are required for the purpose of picking them up; they will not get fat in the process, but will grow strong frames on which meat can be laid cheaply subsequently. An advantage is that when turned out to pick up acorns, the pigs get other natural green food as well. It is important that a plentiful supply of water should be given. When other feeding stuffs are cheap acorns are not worth many pence a bushel, and Malden suggests that they are roughly worth per ton about half the price of maize.

According to a report in *Fühling's Landwirtschaftliche Zeitung*, 1904, when in Germany rye is 3s. per bushel and oats 1s. 10d. per bushel, acorns may be valued at 9½d. per bushel fresh, or 3s. 2d. per cwt. when dried and shelled.

"Gloucestershire farmers (*Farmers' Dictionary*) bestow nearly as much care upon the fruit of their oak trees as upon the produce of their orchards. They seldom sell their acorns nor can they find any in the market. They usually estimate their value at from 1s. 6d. to 2s. per bushel, and regard them as valuable for fattening hogs, for increasing their weight and for rendering the bacon firm. The acorns, however, must be fed with some caution, and the pigs must not be allowed to collect them unrestricted or they will remain lean and light."

After making some very exhaustive analyses of decorticated acorns, Hughes⁵ came to the conclusion that acorn meal should prove a most valuable food for horses and cattle as well as for other animals. He says that in their green, unripe state acorns have an acrid, disagreeable taste, but when fully matured and of a brown colour the decorticated kernel possesses an agreeable, nut-like and slightly bitter flavour. A bushel of acorns weighs about 56 lb., and at 6d. per bushel (the estimated cost of labour for collecting the acorns) represents £1 per ton which, he suggests, is a very small cost for a valuable feeding material, every 100 lb. of which contains 86.2 lb. of very nutritious, easily digested food, and only 13.8 lb. of indigestible husk. In fact, 9d. per bushel would be a very reasonable price for so valuable a feeding material. If the acorns are dried the kernels shrink and the husks crack so that the respective portions can be fairly completely separated by sifting after roughly crushing. As the meal prepared as indicated above is a partially cooked food it will keep much longer than raw acorns without fear of losing in condition. The following analyses of barley meal and oat meal are added for the purpose of comparison with acorn meal containing 5 per cent. of absorbed moisture:—

	Acorn Meal. Per cent.	Barley Meal. Per cent.	Oat Meal. Per cent.
Water	5.00	13.07	12.52
Oil	3.98	2.09	6.09
Albuminoids	9.54	12.09	12.66
Starch and digestible fibre ..	75.39	64.97	54.30
Indigestible fibre	3.77	5.14	11.01
Ash	2.32	2.64	3.42

A note in the *Deutsche Landwirtschaftliche Presse*, 1912, says that acorn meal has formed one-third of the concen-

trated food in the case of cows, or two-thirds in the case of pigs without consequent digestive troubles. In the case of cows, the additional foods were earth nut cake and bran, and in the case of pigs fish meal.

According to *Fühling's Landw. Zeitung*,² in the spring and summer following storage, acorns should be ground into a coarse, broken condition and mixed with oats, buckwheat, beans and peas in such a proportion that the acorns form one-quarter to one-third of the mixture, which is readily eaten by pigs, cattle and even horses.

L. Rost² recommends acorns as food for milch cows at the rate of 4 litres (7 pints) per head per day, cooked and mixed with chopped straw, or dried and ground, given with their water.

Wolff and Kreuzhage (*Deutsche Landwirtschaftliche Presse*, 1876) state that acorns were used largely for feeding wethers in Wurtemberg. The acorns were first air-dried and afterwards fed in winter without shelling in quantities of 1 lb. per day; they were given with aftermath, meadow hay, or, exceptionally, brewers' grains.

Petermann² says that shelled acorns form a good fattening food for pigs when mixed with potatoes, bran and meal, and for sheep when mixed with beet pulp or roots, beans and straw. He also considers them good for poultry when dried, ground into meal, and mixed with ordinary food.

A report in *Fühling's Landwirtschaftliche Zeitung* (1904, p. 808) states that when fed in too large quantities to hens acorns cause a more or less black coloration of the yolk of the egg.

Conclusion.—The above account of various investigations in relation to acorns tends to show that acorns are a useful food for fattening livestock, and considering that they cost little or nothing, more use might be made of them provided that care is exercised. The hesitation which attaches to the use of acorns at present is, perhaps, largely owing to the fact that farmers are not sufficiently clear as to their poisonous properties, their feeding value, and the way in which they should be fed to stock; and it is due also to some extent to the trouble often experienced in collecting them. Provided proper precautions are taken there would seem to be little fear of any ill effects resulting from the feeding of acorns to stock. Acorns are chiefly valuable for feeding pigs, but may also on occasion be usefully fed in small quantities to sheep and older cattle, replacing to a certain extent cereal and other foods containing a high proportion of carbohydrates.

Horse Chestnuts.

Composition.—Less than 20 per cent. of the horse chestnut consists of husk. The proportion of husk found by Kling¹⁵ was 17 per cent. and by Auld¹⁶ 18 per cent. when air-dried, and 16.9 per cent. when dried at 100° C.

Analyses of the ground air-dried kernel and husk of chestnuts procured in this country were carried out by Mr. E. A. Fisher, of Wye College, with the following results:—

	Kernel. Per cent.	Husk. Per cent.	Total Nut. Per cent.
Water	2.22	7.06	3.04
Ash	2.86	1.66	2.66
(P ₂ O ₅)	(29.11)	(12.19)	—
Crude protein	12.08	5.66	10.99
True protein	8.77	4.37	—
Crude fibre	2.13	13.15	—
Oil	6.26	0.89	5.34
Carbohydrates	74.45	71.58	73.97
Sugar	2.51	—	—

Kling's analysis in Germany of ground and dried horse chestnuts was as follows (reckoned in terms of the dry matter):—

Crude protein	8.94	3.80	8.08
Fat	7.55	0.28	6.36
Carbohydrates	78.47	70.62	77.16
Crude fibre	2.60	23.73	6.10
Ash	2.44	1.57	2.30

From the analyses of other German experimenters it appears that, stated as percentages of the total dry-matter, the content of *crude protein* varies from 6.10 to 8.24 in the kernel and from 7.26 to 12.60 in the whole nut; that of *fat* varies from 4.10 to 7.22 in the kernel, from 1.19 to 2.06 in the husk, and from 2.70 to 7.82 in the whole nut; that of *carbohydrates* from 79.72 to 84.70 in the kernel, from 18.47 to 28.92 in the husk, and from 76.60 to 81.30 in the whole nut; that of *crude fibre* from 1.60 to 3.30 in the kernel, from 18.47 to 28.92 in the husk, and from 3.20 to 5.70 in the whole nut; and that of *ash* from 2.45 to 3.50 in the kernel, from 1.80 to 2.46 in the husk, and from 2.20 to 3.10 per cent. in the whole nut.

The nitrogenous substances present in horse chestnuts consist almost entirely of albuminoids, very little amides being present; on the average about 9 per cent. of the nitrogenous substances in the kernel and 8 per cent. of those in the whole nut are amides.

The fat keeps well and does not readily become rancid.

The carbohydrates consist principally of starch, but there are not unimportant quantities of raw sugar present, invert sugar also being present in unripe nuts. A characteristic constituent of the N.-free extract substances is a non-nitrogenous glucoside "Saponin" akin to "Githagin" (found in corn cockle) but less poisonous. There are also present tannin and other astringents and a substance known as "Aesculin." According to one German analyst the N.-free extract substances contain 50 per cent. starch, 14 per cent. raw sugar, 13 per cent. glucoside, and 0.2 per cent. tannin. In Kling's analysis 12.29 per cent. of raw sugar was found in the dry matter, but very little invert sugar. The amount of tannin found (in percentages of the dry matter)

was 0.17 per cent. in the kernel, 0.91 per cent. in the husk, and 0.29 per cent. in the whole nut. The pentosans found were 6.18 per cent. of the kernel, 4.69 per cent. of the husk, and 5.93 per cent. of the whole nut (in percentages of the dry matter).

As regards the ash, the content of lime and phosphoric acid vary with the soil, but it may be said that while in general poor in lime the nuts have an average content of phosphoric acid—quite sufficient in fact for feeding purposes.

Digestibility.—Niederhausen¹⁵ found in horse chestnuts with 46.88 per cent. of water and 4.38 per cent. of protein that 3.91 per cent. of protein was digested (*i.e.*, 89 per cent.). Kellner gives the digestibility coefficient of the nitrogenous substances as 60 per cent., of the fat as 85 per cent., and of the carbohydrates as 93 per cent., viz.:—

	Fresh Chestnuts.		Dry Chestnuts.	
	Crude.	Digestible.	Crude.	Digestible.
Water	49.2	—	18.8	—
Crude protein ..	4.3	2.6	6.9	4.1
Crude fat	1.5	1.2	2.1	2.0
Carbohydrates ..	40.9	30.3	53.7	48.4

The albuminoid ratio of chestnut meal (see later—*Chestnut Meal*) is given by Auld¹⁶ as 1:8.6 and the starch equivalent, calculated on an average moisture content of 10 per cent. as 74. Calculated from this starch equivalent 1 lb., horse chestnut meal would be equal to 1 lb., 1 oz. of feeding barley, or 1 lb. 4 oz. of oats, or 1 lb. 8 oz. of bran, or 2 lb. 5 oz. of good meadow hay. A writer in *Fühling's Landwirtschaftliche Zeitung* (1904 p. 811) states that the nutritive value is equal to that of cereal grains. Kellner gives the the content of digestible protein and the starch equivalent as follows:—

	Dig. Protein.	Starch Equivalent.
Unshelled, fresh (49 per cent. water) ..	1.5	34.1
" dry (19 " " ") ..	2.4	54.6
Shelled, fresh (51 " " ") ..	1.3	44.2
" dry (10.5 " " ") ..	2.5	78.3

Feeding of Whole Unprepared Nuts.—Auld records that in his experiments, given whole or only roughly crushed, most animals refused the nuts or ate them sparingly. Schiller¹⁷ on the other hand states that horse chestnuts are best fed raw, fresh and broken up, when only small quantities are to be given. Mouldy chestnuts should, in no case, be fed unprepared. The quantities recommended were $\frac{1}{2}$ lb.—1 lb. to sheep, or up to 2 lb. to fattening sheep, 4–10 lb. to dairy cattle and up to 20 lb. per head per day to fattening cattle (these were most probably adult working oxen). Kling quotes a case in which one experimenter fed them in their natural form for eight years to cattle, at the rate of about 12 lb. per head per day, the animals never failing to consume them readily. Horses have also been given fresh nuts in quantities up to 6 lb. per head per day.

Chestnut Meal.—It appears that in the great majority of cases in which horse chestnuts have been fed, (and in all cases where large quantities have been given) it has been found

preferable to remove the husk and make the kernel into a meal. The following account of the preparation of the nuts is given by Auld :—"Air drying at ordinary temperatures is too slow and incomplete and recourse was had to drying with artificial heat. Experiment showed that this could be done in a hop-oast by using a good fire, but any oven in which the temperature can be raised to about 70° C. could, no doubt, be used. After drying and partial crushing the greater portion of the outer husks may readily be removed; the residue is then ground to a meal of any desired fineness. The grinding was in this case done in a hand mill in the laboratory.

"The ordinary chestnut meal prepared as above retains the bitter taste of the original nuts and attempts were made to remove or reduce the quantity of the bitter principles present in order to make the feed more palatable. Boiling the meal with water produces a thick porridge-like mass which is impossible to strain, and soaking in cold water alone has practically no effect. Extraction with alcohol is useful but does not wholly remove the bitterness; indeed, the extracted material when mixed with milk was refused by some young pigs.

"Eventually the partly crushed chestnuts were allowed to soak in cold water over-night, then boiled for half an hour or so and the water rejected. The residue material was dried, partially husked and reduced to a meal as before. This material is still bitter, but less so than the ordinary meal, and has a pleasant smell and appearance. An analysis of this mixture showed the following composition :—Water, 8.2 per cent.; ash, 2.5 per cent.; crude protein, 9.3 per cent.; oil, 6.3 per cent.; crude fibre, 9.5 per cent.; carbohydrates, 64.2 per cent."

The value of this meal (based on its composition, &c.) has been referred to above, and the meal would appear to be a fairly concentrated food. "For fattening purposes or for store cattle the high starch equivalent suggests that the nuts would prove very useful providing the animals can be induced to eat them. The great drawback is the bitterness."

With regard to Auld's statement as to the failure of alcohol to extract all the bitter materials, reference may be made to a paper¹⁸ presented before a meeting of the German Naturalists and Physicians in which attention was called to the food value of horse chestnuts which have been treated with alcohol to remove the glucoside and the bitter materials present.

In referring to a recommendation as regards the removal of the bitter taste, by cooking or steaming or steeping in water

for two to three days, Kling expresses the opinion that these processes remove too much of the nutrients. He states that although the dried and ground chestnuts are not at first readily eaten it is only in very few cases that the animals have refused them altogether; as a rule the animals soon become used to the characteristic taste and then consume the food with great relish, probably on account of the condimental foods present. Once taken they are always well utilised. It is, of course, possible to mask the bitterness by the addition of other foods.

The suitability of horse chestnuts as a supplementary food to watery foods, *e.g.*, green fodder, silage, root leaves or beet pulp, has been mentioned, and they would also be useful when feeding damp food or green food wet with rain. On the other hand, large quantities of chestnuts unaccompanied by watery foods often cause digestive disturbances, particularly stoppage. The addition of salt would not only prevent this but would have the effect, in addition, of making the ration more tasty.

Owing to their high digestibility the chestnuts would probably increase the total digestibility of a ration in which they are fed as a supplementary food. Oil cakes rich in protein, as well as hay and straw, seem suitable complementary foods.

Chestnuts do not appear to be poisonous; in Auld's experiments an extract of chestnuts was reabsorbed into bran and fed to guinea pigs; quantities of extract equivalent to 7 lb. of chestnuts were consumed by the guinea pigs without any ill effect.

An idea of the quantities of chestnut meal that may be fed to the different classes of stock, as also of the complementary foods, may be obtained from the following account of practical feeding experiments.

Practical Feeding Experiments.—In Auld's experiments pigs would not eat the meal satisfactorily and had to be left out. A calf and a sheep, after a preliminary period, were put on rations containing 2 lb. and 1 lb. of chestnut meal per day respectively; a small quantity of molascuit was added in each case to take off the bitterness, together with hay, and the calf had 1 lb. of linseed cake, while the sheep received $\frac{1}{4}$ lb. of dried grains and 2 lb. of mangolds. The sheep cleared up the chestnut ration moderately well, and during three weeks did not lose condition or suffer ill effects, but it never liked the food. The calf took the meal remarkably well. The amount given was slowly increased by $\frac{1}{2}$ lb. at a time every

five or six days up to 5 lb. (= $7\frac{1}{2}$ lb. fresh nuts) beyond which it would eat no further; the linseed cake had been dropped, the whole of the concentrated ration being thus in the form of chestnut meal; the best results were obtained when the meal was mixed with $\frac{1}{4}$ - $\frac{1}{2}$ lb. of molascuit and a handful of wet grains or wet beet pulp in order to moisten the mixture slightly.

There were no ill effects beyond a slight running at the eyes and nose during feeding, an effect which was transitory, and the calf's physical condition was very much better at the end of the experiment than at the beginning. Fed on chestnut meal and linseed cake a gain of 24 lb. was made in 19 days; when sufficient meal had replaced the cake an increase of 58 lb. was made in 34 days.

Experiments are quoted by Kling in which dried, husked and ground chestnuts proved a good food for cattle. An ox received about 8 lb. of the meal together with hay, straw chop, and cereal meal. The cereal meal was dropped after 60 days and the chestnut meal increased to 10 lb. and then $12\frac{1}{2}$ lb. After 135 days the ox had made a gain in live weight of 577 lb. In another experiment on much the same lines, in which brewer's grains at first replaced the cereal meal, an ox gained 617 lb. in 195 days. In a third experiment stoppage was noticed, but this vanished on increasing the allowance of salt. The increase in live weight was at the rate of $2\frac{1}{4}$ lb. per day, and no cereal meal was fed.

A dairy cow was fed meal in quantity which increased to 7 lb. per day. The meal proved very favourable for milk production (perhaps owing to its condimental nature), the quality was good and the taste normal. The meal had no harmful effect on the total digestibility or utilisation of the ration. The live weight increase was quite satisfactory. No bitter materials could be found in the urine, manure, or butter.

It is stated in the *Deutsche Landwirtschaftliche Presse* (1906, p. 772) that fattening cattle (probably working oxen) will eat up to 22 lb. per day and dairy cows up to half this amount.

Sheep are mentioned as having been fed $\frac{1}{2}$ lb. per day, along with hay and straw, with good results, but they seem to take some time to accustom themselves to the ration. Good flavoured mutton was obtained in one case where six sheep were stall-fed with the meal.

Two experiments with pigs are cited. One was unsuccessful and in the other a good increase in live weight was obtained from barley meal, brewers' grains, and chestnut meal up to $1\frac{1}{4}$ lb. per head per day.

Beech Mast.

Comparatively little seems to be known as to the value of beech mast as a feeding stuff, and no exact experiments appear to have been carried out with it. It can be definitely stated at once, however, that beech mast should on no account be fed to horses, which are particularly susceptible to a poisonous constituent of the mast known as Fagin. Further, sheep will either not eat the mast at all or can only be made to do so under compulsion.

The poison is present chiefly in the seed coat under the husk. Various authorities seem also to have found the poison in the husk, and Engels records it as present in the kernel but in smaller quantity than in the husk. The husk in addition has so high a content in crude fibre as to make it unsuitable for feeding purposes. The consideration of the utilisation of beech mast is therefore limited to the feeding of the kernel to cattle, pigs, rabbits and poultry. A very fine oil is obtained from the nuts and the residue is made into cake.

König's analysis of shelled beech mast and of cake therefrom is:—

	Nitrog. Subst. Per cent.	Crude Fat. Per cent.	Carbohy- drates. Per cent.	Crude Fibre. Per cent.	Ash. Per cent.
Shelled Beech Mast...	24.00	21.26	40.12		4.12
Shelled Cake	36.27	9.02	29.42	7.70	7.12

In an analysis carried out by Engels² in which the kernels formed 66 per cent. of the whole nut, the dry matter contained 28.52 per cent. of crude protein, 42.22 per cent. of crude fat, 13.23 per cent. of carbohydrates, 11.03 per cent. of crude fibre, and 5.00 per cent. of ash.

Kellner gives the following as the digestible constituents of husked mast (per cent.):—Crude protein, 32.0; fat, 8.6; carbohydrates, 22.0; crude fibre, 1.9; and the starch equivalent of the husked mast as 71.6.

The kernels are not only rich in protein, but they have also a high content of pure albuminoids. The proportion of fat is also very high, and as this does not easily become rancid the nuts should keep well. The content of carbohydrates in the kernel is low.

Engels found the tannin content of the kernels to be very low, viz., 0.61 per cent. of the original substance, and 0.7 per cent. of the dry matter, quantities that may be neglected by the feeder. The crude fibre in the kernels is not specially high, while the necessary mineral substances are present in sufficient quantity for feeding purposes.

As regards the results of feeding trials, Pusch¹⁷ records that a two-year-old bull was fed for ten days at the rate of 5 lb. per day, for five days on $7\frac{1}{2}$ lb., and for one day on 10 lb. It improved in condition and showed no digestive disturbances.

Other experimenters seem to have fed beech mast to cattle and swine without harm, cattle being stated to be not susceptible to the poisonous constituent. Poultry, especially turkeys, appear to eat the mast readily and to fatten quickly. There is a difference of opinion as to the effect on the bacon of pigs fed on beech mast, one writer¹⁷ stating that it is soft and spongy and does not keep, another² that the bacon is sweet and white.

Beech mast which has become damp or slightly mouldy should be cooked before feeding. Plenty of drinking water should be allowed the animals.

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SUGGESTIONS TO ALLOTMENT HOLDERS FOR AUTUMN TREATMENT OF LAND.*

THE following suggestions and recommendations have been prepared for the benefit of those who occupy small areas of land, such as allotments and gardens, or who wish to bring fresh land under spade cultivation with the view of increasing their supplies of vegetables during the coming autumn and winter, and thereafter. It should, of course, be borne in mind that the suggestions made are dependent upon local conditions.

Land which is available for spade cultivation in small areas may be divided into three classes, viz. :—

- (A) Land at present under spade or arable cultivation.
- (B) Good land which has been under permanent grass.
- (C) Derelict or waste land.

Class A.—Cultivated Land.

Assuming that land of this character has been well dug over and is in good heart very little additional cultivation will be required in the autumn. The ground should, however, be dug one spit deep, and a dressing of stable manure should be incorporated if the ground was not manured in spring.

For Sowing in August.—On such land the following crops might be sown immediately :—

- | | |
|------------------------|-------------------------|
| 1. Early Turnips | White and Purple Milan. |
| 2. Carrots | Early Horn. |
| 3. Onions | White Lisbon. |
| 4. Lettuce | Winter varieties. |
| 5. Radish | French breakfast. |
| 6. Spinach | Winter or Prickly. |

Seed should be sown at the following rates :—

1. Turnips.—Sow 1 oz. to 200 ft. of drill, $\frac{1}{2}$ in. deep. The drills should be 12 in. apart. Thin out to 5 to 9 in. apart according to variety.

2. Carrots.—Sow 1 oz. to 300 ft. of drill, $\frac{3}{4}$ in. to 1 in. in depth. The drills should be 12 in. apart. Thin out gradually to 5, 6, or 8 in. apart according to season and variety.

3. Onions.—Sow 1 oz. to 200 ft. of drill (10 lb. per acre), 1 in. deep. There should be 9 to 12 in. between the drills. Autumn sown varieties need not be thinned.

4. Lettuce.—Sow $\frac{1}{2}$ oz. to 160 ft. of drill, $\frac{1}{4}$ in. deep, in rows 9 to 12 in. apart. Thin out or plant out, leaving 6 to 8 in. between the plants according to variety.

* Issued by the Board last month as Special Leaflet No. 1.

5. Radish.—Sow 1 oz. of seed to 75 ft. of drill, 1 in. in depth, in rows 6 to 9 in. apart.

6. Spinach.—Sow 1 oz. of seed to 65 ft. of drill, about 1 in. deep, in rows 12 to 15 in. apart.

For Planting before Mid-September.—The following vegetables might be planted in August or early September :—

1. Early Cabbage Any early variety.
2. Broccoli Winter and spring varieties.
3. Borecole or Kale Winter and spring varieties.
4. Leeks Musselburgh.

They should be planted in the following way, viz. :—

1. Early Cabbage.—Plant in rows, leaving 15 in. between the plants and 18 in. between the rows. Very dwarf varieties, however, succeed if only 12 in. are left between the plants and 15 in. between the rows. Strong growing late varieties require 18 in. between the plants and 27 in. between the rows. The plants must be earthed up with a plough or hoe as the crop grows.

2. Broccoli.—Plant in rows, leaving 18 in. between the plants and 27 in. between the rows. The crop should be earthed up as in the case of cabbage.

3. Borecole or Kale.—Plant in rows the same as broccoli.

4. Leeks.—Plant in rows, leaving 4 to 6 in. between the plants and a foot to 15 in. between the rows.

For Sowing or Planting in October and early November.—The following vegetables might be sown or planted in October or the beginning of November :—

1. Broad Beans.
2. Early Peas.
3. All varieties of Cabbage and Kale raised from seed sown in July or August.*

These plants will yield crops in the following spring and early summer, but too late to allow of potatoes being successfully planted after them. They could, however, be succeeded by onions, broccoli, Brussels sprouts, kale, or carrots. Growers should remember that it is inadvisable that one crop of the cabbage family should be succeeded by another of the same kind. Beans and peas should be followed by cabbage, and cabbage by onions, carrots, or some kind of crop other than the cabbage tribe.

* NOTE.—If cabbage and kale plants are required for distribution on a large scale in October, seed should be sown in August at the rate of about 25 lb. per acre. Seed beds of one acre should furnish about 500,000 plants.

For Sowing or Planting in February and March.—Much land may not be ready for cultivation till the spring; the following crops are suitable for land that has been lying vacant during the winter. Work may begin in February or as soon as genial weather sets in :—

1. Potatoes Early varieties.
2. Beans Broad and kidney.
3. Peas Early and mid-season.
4. Cauliflowers Early.
5. Round Spinach.
6. Spinach Beet.

1. Potatoes.—The land should be thoroughly dug and forked during the winter and worked into a friable condition. The common distance to plant for first-early varieties is 4 in. in depth, 12 in. between the sets and about 20 in. between the rows. For mid-season and late varieties the sets may be 15 in. apart and 24 to 30 in. between the rows. For further information see Leaflet 173 on *Potato Growing*.

2. Broad Beans.—Plant $3\frac{1}{2}$ to 4 in. deep, with 18 to 24 in. between the drills and 4 in. between the seeds.

Kidney Beans.—Plant 2 in. deep, 2 to 4 in. apart in the drill and 18 to 27 in. apart in the rows. One pound will plant 150 to 200 ft. of drill.

3. Peas.—Sow in a flat drill from 2 to 3 in. in depth according to soil—in stiff soil shallow, and in light soil deep. Dwarf varieties should be sown in rows 18 in. to 2 ft. apart, tall varieties further apart according to height.

Early peas require 1 lb. to 70 ft. of drill. Late varieties 1 lb. to 85 ft. of drill.

4. Cauliflowers.—The distances are the same as in the case of cabbage.

5. Round Spinach.—Sow 1 oz. of seed to 65 ft. of drill, about 1 in. deep, in rows 12 to 15 in. apart.

6. Spinach Beet.—Sow as for round spinach, but thin out to 8 or 10 in. apart in the rows.

Information as to the application of fertilisers to these crops will be found in Leaflet 106.

Class B.—Good Grass Land broken up for Spade Cultivation.

A great extension of allotments and other holdings under spade cultivation may also take place. Many acres of grass land might be utilised in this manner, especially in the neighbourhood of large towns. Such land must be treated in a different way from the cultivated land described under the previous heading.

In the first place the land should be bastard trenched. To begin with the turf should be skimmed off in a thin layer 2 to 3 in. in depth from a trench which should be 18 in. to 2 ft. broad. The first spit of soil immediately below the turf should be removed. The bottom soil should then be stirred to a depth of 6 in. with a pick, digging fork or spade according to the nature of the subsoil. The turf layer from the next trench should then be laid upside down on the stirred bottom of the first trench and the first spit of soil placed above it. This process should be continued till all the land has been dug over, the turf and first spit of soil from the first trench being used to level up the last.

Land of this character is often very fertile and should give a good yield of potatoes or other planted crop the following summer. It can, however, seldom be used for crops raised from small seeds in the same year as it is broken up, for two reasons—(1) unless the turf is very good and free from weeds the result of the cultivation may be to bring up and favour the growth of a number of weeds which have hitherto been kept under. A good deal of hoeing may be necessary to keep these down and this may interfere with the seedlings. (2) Old grass land is often infested with wireworms (the young of the Click Beetle) and leather jackets (the young of the Daddy Long Legs). These insects may completely destroy the crop as soon as it begins to grow.

Treatment for these pests is given in Leaflets 10 and 11, but as the methods advised may not be available at the present time the land should be frequently hoed and the weeds kept down so as to deprive the insects of their food for some months. Lime may also be worked into the land.

Class C.—Derelict Land.

In many districts fertile grass land will not be available for cultivation by spade labour, and if additional land is to be brought under tillage poor soil or waste land must be broken up. There are many acres of land of this class available, especially in the neighbourhood of large towns, but care is needed in treating it if it is ever to bear a satisfactory crop. The following treatment is recommended:—

In the first place all rank growth of weeds should be cut down with a scythe. If the weeds are of a soft nature they might be put in heaps with any available grass for making into a compost, or if annuals and free from ripe seeds, they may be dug in at once. If of a fibrous or woody nature they should be burnt. The land might then be skimmed and bastard

trenched as advised above, but the greatest care must be taken (1) not to bring the subsoil to the top, and (2) to clear out the roots of such weeds as docks, couch grass, creeping buttercup, convolvulus, nettles, etc. Time spent in the careful eradication of such weeds will be well repaid.

Land of this character, when freed from weeds and properly trenched, will bear a useful crop the following year if properly manured. As stable or farmyard manure will probably not be available in such places it will be necessary to supply the plant food from other sources. The chief ingredients required to secure satisfactory growth are (1) nitrogen, (2) potash, (3) phosphates.

Nitrogen can be supplied by digging in all soft vegetable matter such as grass, leaves of trees, and decaying vegetable matter of any sort. The droppings of any kind of animal may be used. Poultry and pig manure should be well mixed with earth on removal from the pens or sties before applying it to the land.

Potash may be supplied by collecting and burning all kinds of woody material, such as hedge clippings, prunings from trees, etc. The ash should be carefully saved in bags and kept dry. It is especially useful on land that is to be cropped with potatoes. Seaweed is a valuable potash manure and should be collected at all rocky sea coasts (see Leaflet No. 254).

Phosphates will not be easy to supply from natural sources, unless large quantities of fish waste are available, but phosphatic fertilisers such as basic slag, superphosphate and bone-meal should be easily procurable through the usual trade sources.

Lime will be required in many cases and should always be applied to rich pastures after breaking up. It should be worked into the surface layer when the land is dug.

The advice as to insect pests and weeds under Class B applies with even greater force to this class of land, and great care should be taken to get rid of both before the land is sown or planted with any crop. It would be better to keep such land vacant till the spring, when potatoes might be planted.

Committees undertaking the organisation of the cultivation of such land as is described in Classes B or C may obtain expert advice at Agricultural Colleges or from the Instructors employed by County Councils.

Leaflets describing many of the common insect and fungus pests may be obtained on application to the Board, who are also prepared to give advice as to treatment in cases of special difficulty.

NOTES ON POULTRY FEEDING.*

THERE is always a danger at a time like the present, when poultry feeding-stuffs are in greater demand for other purposes, and are consequently high in price, that many poultry-keepers may be disposed to decrease the size of their flocks and restrict their operations in poultry keeping. *Such action would be against the best interests of both the individual and the nation*, since the greater the amount of human food produced in this country the stronger will be our position.

By making use of coarser foods than are usually employed the cost of feeding can be considerably reduced, whereas the yield need not fall off to any appreciable extent.

At the present time of year, with the hay and corn harvests over, there is no reason why on farms all poultry should not be kept out on the land. Under such conditions the birds will be able to forage for a very large amount of the necessary food, food that would otherwise be wasted. With all poultry-keepers the first consideration should be to distribute the birds over the land as far as possible. This can only be done as a general rule on medium-sized holdings and farms; allotment holders and backyard poultry-keepers are handicapped in this direction. Those who cultivate only a limited area of ground should make up for this by growing as much food for their fowls as possible.

Of the usual feeding-stuffs a number are now high in price, and until the demand in other directions decreases they may have to be omitted from the list of poultry foods, or be used only to a limited extent.

For many years wheat and its products have formed the principal basis of feeding, but for some time to come it will be necessary to curtail the use of these foods. Even foods not required for human consumption, such as bran and middlings or toppings, may be out of the reach of many poultry-keepers. To a lesser extent they may also have to dispense with oats and barley.

There is a large quantity of maize on the market. Though this is not an ideal poultry food, it will have to be used in larger proportions than heretofore. A number of smaller grains such as dari, Manchurian millet, kaffir corn, buckwheat and rice have not been seriously affected in price, and all are eminently suitable for poultry feeding.

* Leaflet No. 114 on *Feeding of Poultry* can be obtained free of charge on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

The soft mash is a necessary part of the diet and there is considerable difficulty in making up a mixture without barley meal, middlings or bran, since these are usually the chief ingredients. In place of these foods, however, a larger quantity of vegetables can be given, together with steamed hay and clover hay chaff. It is in this direction that crops grown by the small occupier can be utilised. Lucerne, cabbages, turnip tops, kale, roots of every kind, including potatoes, can all be turned to good account. The last named, if available, must be cooked. Green food can be fed either raw or cooked, and under the circumstances about one-half should be given in each form. If the supply of garden produce is limited such natural crops as nettles and grass may be substituted. When these are used they should be steamed for about half an hour and added to the soft mash.

Other substances that can be added to the ration are brewers' grains, malt combs, spent hops and yeast. The two first may be given as one-third of the soft mash, the last mentioned as one-fifth. These substances are bulky, and therefore rather more concentrated foods must be mixed with them. For the soft mash, soaked whole grains may be added and a small quantity of middlings should be used to bind the whole together into a crumbly state.

Silage* is not often used for feeding poultry, but it has been employed with excellent results and is worth the attention of large poultry-farmers. In feeding silage to poultry it has been found best to add 25 per cent. of whole grains. For this purpose any of the grain foods mentioned above may be used. Silage can be fed in place of the ordinary soft mash with some middlings added to make it crumbly.

Animal food is required by the birds, and there is *no better or cheaper way to feed this substance* than in the form of soured skim milk or butter milk. Whenever these can be obtained they should be fed largely. They may preferably be mixed with the mash, but may* be given in a liquid state in drinking fountains. In place of these, refuse from slaughter-houses may also be employed, the blood and intestines being the most valuable.

Household scraps can be used successfully by adding them to the soft mash, but it must be remembered that they are generally composed of fattening substances. The supply is more or less limited, and therefore endeavours should be made

* See Leaflet No. 9 (*Ensilage*), which may be obtained free on application to the Board.

to procure a supply from hotels, institutions, &c. They can usually be obtained for a nominal sum.

Since ordinary meals must be largely dispensed with, the ration will be on the bulky side, and hence special precautions should be taken to overcome any bad effects. Exercise is essential, and is best ensured by burying corn or seed in the litter of the house, thus inducing the birds to scratch for it. The aim should be to keep the fowls actively hungry all day, giving them the largest meal about an hour before they go to roost. By adopting a plan of this kind every ounce of food consumed will be utilised, and there will be no waste due to the birds storing up an excess of fat.

Feeding poultry will be rather more expensive than has been the case during recent years, and therefore great care should be taken to ensure that nothing is wasted. Food given should be supplemental to that which fowls can obtain by foraging.

All mashies should be fed in troughs, and only sufficient be given to satisfy the birds. Grain, except when buried in the litter, should be given in the same way. All foods should be stored in rat and mouse-proof bins or boxes, since these vermin cause great loss, not only consuming large quantities but spoiling a great deal more than they eat. (See also Leaflet No. 244, *The Destruction of Rats*.)

It is not possible to make any radical changes in the feeding of chickens, but a larger amount of green food may be employed and the young birds should be given as much liberty as possible. Arable land is rather better for this purpose than pasture, since it usually provides much more natural food, which is excellent for the chickens and reduces the cost of feeding very considerably.

POULTRY ON ALLOTMENTS AND GARDEN PLOTS.

THE attention of cottagers and allotment holders is directed to the importance of preserving, and if possible increasing, their stock of poultry, and of paying special attention to the management of their birds in order to stimulate increased production.

There is at the present time special need to increase home production, and an opportunity is afforded to all classes of the community to contribute to such an increase. Farmers and others who operate on a large scale would sell most of their produce. Smaller occupiers should first supply their

own households, disposing of whatever is in excess of the requirements of their own families.

Every additional egg laid and every additional chicken hatched helps the food supply, and the number of people who might keep poultry is so great that if all of them made but a slight effort a large addition to the country's resources would be secured.

Suggestions.

(a) To present breeders of poultry.

1.—Cockerels may be sold as soon as they are large enough to be disposed of profitably. Old hens and surplus cocks should also be sold. In this way room will be left for the more productive stock, and at the same time the food bill will be reduced.

2.—All healthy pullets should be retained for egg production, for breeding stock, or for sale to others.

3.—Care should be taken not to overstock the ground which is available for poultry. It is often the case that a dozen or a score of hens may be profitably maintained on a small area, say, 120 sq. ft., whereas double the number would involve loss. Management is important, but good management will not counterbalance the effect of overcrowding.

4.—One or two batches of chickens should be hatched as fertile eggs are obtained and hens become broody, or where an incubator is available. Chickens hatched in autumn and early winter will require care and good management if they are to make satisfactory progress.

(b) To those who do not at present breed poultry.

1.—The country is capable of producing four times its present yield of eggs and poultry. Many people have found poultry-keeping profitable, and many people who have not hitherto kept poultry can now increase the food supply by producing eggs and chickens for use in the household.

2.—Part of the allotment or garden ground available can be used for fowls without involving any very considerable expenditure. The time and effort will be well rewarded.

3.—If knowledge of poultry-keeping is limited, operations should at first be restricted, especially with regard to the number of birds kept. As experience increases the stock of poultry may be enlarged.

4.—Fowls will utilise profitably household scraps and surplus garden stuff. At a time like the present an effort

should be made to utilise all kinds of scraps and "waste" so that nothing may be lost that can possibly serve as food for poultry.

Present and prospective poultry-keepers whose available ground is very limited should endeavour to secure more land, or, in country districts, obtain permission from farmers and others to use their pasture and park lands temporarily.

Suitable Classes of Poultry.

Occupiers of allotments and gardens should endeavour to keep fowls.

Ducks are not likely to be in great demand for some time. They are, moreover, expensive to rear, and do not pay unless prices are good.

Residents near open land, such as commons, should breed geese. Where there is plenty of rough grazing these birds are profitable, as they forage for the greater part of their food, and are naturally grazers. Geese and turkeys are unsuitable for allotments and gardens, and it is in relation to fowls that development should be encouraged.

Area of Land required for Poultry.

The number of fowls to be kept must be determined by the area of the ground available. If the birds are suitable, are properly managed, are ensured plenty of exercise by the provision of scratching material in which grain is fed, and are used for egg production and not as breeding stock, as many as 400 may be kept on an acre of land for a period of twelve months. To state this in another way, 12 sq. yds. of pasture land should be allowed for every fowl. Where the land is ploughed or dug, then 8 sq. yds. for each bird will be enough. For permanent occupation fifty fowls per acre may be regarded as sufficient.

The occupier of an allotment, if a capable manager of poultry, may keep 100 fowls on a quarter of an acre for a year, *at the end of which time the ground would have to be vacated and cropped.* Larger holdings may be stocked on the same basis.

The garden poultry-keeper who can give a space of, say, 16 yds. by 10 yds. to the fowls, may keep 20 birds on dug ground, or even more if the position is changed every six months.

Half-a-dozen hens can be kept on a garden plot 20 ft. by 6 ft., provided the soil is dug over frequently and entirely renewed by fresh earth once every three months. Cottagers can frequently obtain range for their birds on adjacent land, in which case the renewal of the soil is not required so often.

How to Use the Ground.

The great danger of poultry-keeping on these intensive lines is from tainted soil, due to the accumulation of manure. Sanitary and hygienic conditions must, therefore, be maintained, otherwise disease and loss will result. Where a moderate number of poultry are distributed over a larger area, as on farms, this difficulty is not present. The safe plan is to run fowls over one-fourth of the land at a time, fully cultivating that not occupied by the birds. By such an arrangement much of the food for the fowls can be grown, serving the double purpose of keeping the soil sweet and clean and reducing the cost of feeding. The manure will largely increase the crops if the land is properly cultivated.

Under the conditions described an allotment should be divided into four parts, each to be used in succession. Upon that devoted exclusively to poultry, laying hens should be kept. As chickens are hatched they may be put out on the other sections during the growing stages. It is important to use houses which can easily be removed from place to place.

As a rule egg production would be found most profitable, for two reasons—(1) because the shortage is more likely to be felt in regard to eggs than to chickens, as the country is more dependent upon imported eggs than upon imported poultry, and (2) because the demand for table poultry is not likely to be so large as it would be under normal conditions.

Those who are so situated as to secure a ready sale for table fowls, should keep a modest stock of breeders on the open ground, and reserve one-fourth of the allotment for rearing chickens to a killing age. Chickens intended for table purposes might be raised on the system demonstrated by Mr. Paynter. Particulars of this system are described in a Leaflet which may be obtained free on application to the Board.* Only eggs produced upon the allotment should be used for hatching, as supplies may be very difficult to obtain and prices will be correspondingly high for some time. In this case as much food should be grown upon the land as possible, though it is improbable that grain will be unduly dear. Certain classes of food-stuffs will, however, be affected to a greater degree. The cost of equipment for the production of chickens on these lines is greater than where hens are kept for egg production. The method of feeding to be adopted is fully described in the Leaflet already referred to.

* These particulars were also published in this *Journal* for March, 1914, p. 1049, February, 1913, p. 902, and December, 1912, p. 721.

Garden poultry-keepers usually aim chiefly at producing eggs. In these circumstances the birds must be kept healthy and productive by abundant exercise. In smaller runs this is induced by burying grain in the sand or earth for the birds to find by scratching. Sometimes in manufacturing districts fine ashes are obtainable which may be used to cover the soil thickly; these should be renewed frequently. Where fowls are kept busily engaged in scratching among litter in light airy houses they do not wander nearly to the same extent as if fed only from troughs.

Houses and Runs.

On allotments and in gardens poultry should be confined in wire runs. The wire netting and rough posts can be easily and cheaply procured in most places. No skilled labour is required to erect the posts and attach the wire. The runs should be erected with a view to their removal to fresh ground when necessary.

On allotments portable houses should always be employed, in order that removal may be facilitated whenever required. The simpler the form the better. One such house should be provided for each 25 birds. A useful size is 10 ft. from back to front by 8 ft. wide, thus allowing rather more than 3 sq. ft. of floor space for every bird. The house should be 7 ft. 6 in. high in front, sloping to 5 ft. at the rear, and be "open-fronted," that is, not boarded in in front, but made of 1-in. mesh wire netting, this ensuring an abundant supply of fresh air and complete ventilation by constant atmospheric circulation. The perches are placed at the back, and on one side are nest boxes raised about a foot above the ground. No floor is necessary, the house resting upon the ground, which is littered thickly (say, to the depth of 8 in.) with cut chaff, under which some road scrapings may be placed. Care should be taken to avoid the use of road scrapings which contain petrol or oil.

Smaller houses on the same plan may be used if the scratching space is omitted, though that is undesirable, since it is an integral part of the system. These houses should always be open-fronted, and allow 10 c. ft. of air space for each fowl. To put it in another way, there should be 2 sq. ft. of floor space for each bird, and the height should be not less than 5 ft. to the eaves. Where these smaller houses are in use an addition of a separate scratching shed may sometimes be made.

Wood is, of course, the material of which poultry-houses are built. With a little ingenuity and labour excellent houses for the fowls can be made even with very rough timber. Packing-cases can often be purchased cheaply and answer the purpose if the principles laid down are observed. Even with new deals the cost is small if the house is built on the spot. In all cases the framework should be stout to stand the strain of removal.

Hatching and Rearing.

If it is intended to raise table chickens every effort should be made to hatch early, say, from November onwards. In that case an incubator is indispensable and it speedily repays its cost. For artificial rearing a brooder is requisite.

Eggs for hatching should always be from stock at liberty or in very large runs, and not from yearlings.

It is important that whether chickens are reared naturally or artificially they should be given fresh ground and be kept apart from the older birds, or they will be liable to disease or fail to make satisfactory growth.

Hints for Practical Management.

Cleanliness is one of the most important factors for successful poultry-keeping. Dirt means disease, and when disease appears the death-rate is usually high.

Houses should be kept clean by sweeping down the walls, by removal of all rubbish, by renewal of the materials in nest-boxes, and by occasional lime-washing. Disinfectants are most valuable, but do not remove the cause.

The air in houses must be purified by constant circulation, and plenty of sunlight should reach every part of the house.

The soil must be kept sweet by cultivation, or, in the case of small plots, by removal and renewal.

All appliances of whatever kind must be kept clean. Parasites cannot live unless the conditions are favourable. Food troughs and water vessels should be regularly washed in hot water.

The body feathers of fowls must be kept clear of parasites by Nature's own method, a dust bath.

The food should be carefully prepared, the birds should be fed regularly, and they should receive just as much as they will *clear up readily*.

POULTRY AS FARM STOCK.

THE increased production of food supplies is a most important consideration at the present time, and among perishable foods eggs and poultry hold a leading position. Hitherto upwards of 40 per cent. of the annual consumption of these products in the United Kingdom, valued at perhaps £25,000,000 yearly, have been imported. As three-fourths of these supplies are affected by War conditions the need is greater than ever for development of our own resources.

The Poultry Census of 1908 made it clear that upon the farms and holdings in England and Wales over one acre in extent there were 595 head of adult poultry (inclusive of ducks, geese, and turkeys) per thousand acres of cultivated land. These two countries could maintain three adult fowls per acre without displacement of any other stock or interference with any crop. In addition there are large areas of rough grazings and open lands upon which poultry could profitably be maintained and reared.

Any advance in the cost of foodstuffs is much more than compensated for by the advanced value of eggs. When conditions have returned to the normal, there is no probability that the demand will decline.

Points for the Consideration of Farmers.—Every farmer should increase his stock of poultry as opportunity arises. All healthy, well-grown pullets should be retained as breeding or laying stock, while suitable male birds should be selected for mating later on. In order to economise the food bill, all surplus cockerels or hens should be gradually disposed of, except where the hens are likely to be useful as sitters and mothers.

When the stock of poultry on the farm is increased, the birds should be distributed over the land and should not be allowed to congregate round the homestead, as that would involve overcrowding and tainting of the soil. Poultry should be moved over the farm in rotation; this would enable full advantage to be taken of the value of the manure distributed by them. (A hundred large fowls will produce four tons of moist manure in a year, worth for many purposes 30s. per ton.)

Apart from the work of hatching and rearing, which should be carried out nearer home, the cost of management of distributed flocks of poultry is not great. In this direction women and the older girls and boys may be employed. Among farmers' families there are generally some members to whom this work may be committed.

Poultry distributed over the farm would find a large part of their own food, more especially if the position of poultry houses is changed from time to time. Except on poor land or in winter it is only necessary to supply food once a day, preferably in the afternoon when the eggs are gathered. Grain is to be preferred if available. Soft food may, however, be given to effect economy, while household scraps, vegetables and roots may be used in preparing the mash. Even with an advance in the price of food-stuffs the cost of feeding fowls on farms should not exceed 3s. 6d. to 4s. each per annum.

What Farmers should Produce.—In the majority of cases egg production will be found most profitable, as the imports of eggs are much larger than those of poultry. In 1913 the eggs received from other countries were valued at £9,590,602, and poultry at £992,463.

In one direction farmers can render most important service, namely, by hatching and rearing birds suitable as breeding or laying stock for sale to small holders, allotment holders and other poultry keepers. In many instances younger members of the family can undertake the work, and build up a connection which should, in the future, be very valuable.

Methods to be Adopted.—Distribution over the land involves the use of portable houses by which mobility in relation to cultivation can be secured, and the manure produced will thus be utilised to the full. Unless it is desired to retain breeding-pens near the farm buildings for special purposes, it is unnecessary to provide runs enclosed by wire netting. In fruit orchards fowls render great service by the destruction of pests which prey upon the fruit trees.

Portable houses can be built or purchased inexpensively. An excellent size is 6 ft. by 8 ft., and 5 ft. high to the eaves. Half of one side should be formed of wire netting, left uncovered all the time, as this ensures light and free circulation of air. To facilitate removal the house should be upon wheels and have a wooden floor. Such a house will accommodate twenty-five adult fowls or forty growing chickens.

If eggs are available every hen that becomes broody should be utilised for hatching. In addition, one or more incubators should be in use. The following suggestions are important in this branch of the operations:—

1. As far as possible only selected hens which are over one year old should be used as breeding stock, hardy, active

birds being chosen. These may be mated with a vigorous, early-hatched male bird. Pullets should be kept only as layers until next year.

2. Eggs to be placed under hens or in the incubator should be carefully selected. Those chosen should be well shaped, with strong shells, and slightly over the average size for the breed.

3. Where eggs are the chief consideration it is best to mate only hens that have proved to be good layers, or those which as pullets began to lay early in the autumn. The male bird used should also be bred from a hen known to be a good layer. The aim should be to build up a flock with a good laying average.

4. If table chickens are desired, selection should be from those which develop quickly and which carry an abundance of flesh.

Ducks.—Under normal conditions the raising of ducklings, for early marketing, is very profitable where the work is conducted satisfactorily. Farmers who have running streams or large ponds in which the ducks can find the greater part of their food, may be advised to keep flocks for the sake of the eggs produced, as these can be sold at good prices. Several lots of ducklings should be hatched, otherwise these birds will not prove profitable, as they are expensive to feed. Owing to economic reasons the demand for ducks will probably be limited for some time to come.

Turkeys.—With few exceptions the larger farmers have hitherto failed to realise the profitable nature of turkey raising, which is not suited to small holdings as the birds require an abundance of range. It is possible that in spite of reduced imports for the Christmas markets the demand at that season may be much less than in previous years, and that prices may be comparatively low.

Farmers may take the opportunity of increasing the general stock of turkeys throughout the country. A larger proportion than usual of the young hens should be selected as soon as possible, giving them free range until next spring, and keeping them for breeding or selling them to other farmers for that purpose. As a rule it is inadvisable to use yearling turkeys for breeding, but the present conditions are exceptional.

On the 14,513 agricultural holdings in England and Wales above 300 acres in extent, comprising 25 per cent. of the total cultivated land, if only one adult turkey were kept for every

10 acres, there would be 673,676 birds all told. According to the Poultry Census of 1908 there were only 172,000 on all holdings above one acre in extent. There is, therefore, very great room for increase.

Geese.—As geese are unprofitable unless they can be fed cheaply, they are not recommended for ordinary farms. Much might be done on common or rough grazing land, where these birds would find their food during the growing stages, and provide a cheap supply for our markets.

Feeding Poultry.—On farms where poultry are at liberty the birds will find a large part of their food. Much loss arises from supplying food too abundantly. Young birds must be fed until they are able to obtain food for themselves. Older stock should only be supplied with the limited amount of extra food which they may require. Small corn, green foods, and roots grown on the farm may be given freely. In case of shortage, cut steamed hay (clover hay for preference) is a valuable food; it may be dried off with a little meal. On dairy farms soured skim milk and butter milk are valuable foods for poultry, and may be freely used.

Home production would be greatly increased if agricultural labourers were encouraged to keep a few fowls, and if farmers gave permission for these to run over pastures or arable lands after the crops are harvested. *If in this way each agricultural labourer were enabled to keep, say, ten fowls, production would be increased to a very considerable extent.*

It is believed that there is a very large number of gardens and small orchards in which apple and pear trees are to be found, the fruit of which is not put to its most profitable use by the owners. Much is wasted altogether, and more suffers in quality through the neglect of certain simple precautions.

Storage and Disposal of Apples and Pears.

Picking the Fruit.

In the first place many varieties of apples and pears are picked too soon. The reasons which make it sometimes necessary for a large grower to pick his fruit before it is ripe seldom apply in the case of the small grower. Early varieties can be picked before they are fully ripe and allowed to mature in a cool room. All late varieties, however, should be allowed to hang on the tree as long as possible. Such varieties are, among apples, Lane's Prince Albert, Newton Wonder, Wellington, Norfolk Beefing, Claygate Pearmain, Winter

Pearmain or Duck's Bill, Mannington, Sturmer, Alfriston, and Court Pendu Plat; and among pears, Catillac, Easter Beurré, Beurré Rancie, Chaumontel, Beurré Diel, Duchesse d'Angoulême, and Doyenné du Comice.

These and other late varieties should be allowed to remain on the trees till the fruit comes off easily when the apple or pear is lifted and given a slight twist. Care should be taken not to break off the young fruit buds at the base of the stalk, and of course fruit should never be gathered by shaking the tree or other violent method. Fruit which is to be kept must be gathered into a basket, preferably lined with some soft material, such as a piece of cloth, to prevent bruising. Diseased and damaged fruit should be placed in a separate basket.

Storing the Fruit.

The requirements for the proper storage of apples and pears are not the same. Apples require to be kept in a cool and rather moist place, where there is enough ventilation to prevent saturation. Pears require warm, dry surroundings, but even under the most favourable conditions they will not keep long.

A few days after apples are put in store they begin to "sweat," and continue to do so for about three weeks. During this time there must be a free current of air round them which must not be too dry or they will begin to shrivel. After the "sweating" period is over this is not so important. Small growers who have only a few apples to keep will find that a good method is to wait till "sweating" is over and then pack them as closely as possible in a large earthenware jar. The jar should be covered with a piece of roofing slate or stone and stored in a cool shed or cellar, and the apples will keep plump and good as long as it is possible to keep the variety. For larger growers a shed or storehouse is required if no cool cellar is available, and in preparing a store the following points should be remembered:—

1. The fruit must be protected from frost, but subject to this precaution the temperature should be as low and equable as possible. A cave in a sand or chalk bank makes an excellent storehouse.

2. A moist atmosphere is necessary. The best kind of floor is the bare earth, which may be damped occasionally.

3. Ventilation to prevent stagnant and heated air is necessary, especially during the "sweating" period.

4. Apples easily absorb flavours from their surroundings. They should not be put on new wooden shelves, or on straw or

hay, nor should any strong-smelling vegetable or other material be kept in the same room. They should be placed on slate shelves, or old seasoned wood may be used.

A useful apple store may be made by digging a large trench about 10 ft wide and as long as is required. The depth should be about 2 ft. A wall one brick thick and about 4 ft. high should then be built on either side, and the soil that has been dug out should be heaped up against the outside of the wall. A roof of rough rafters thickly covered with thatch should be built over the top, and shelves can then be fitted inside on which the apples may be heaped. There should be a door at each end so arranged as to admit air and exclude light.

Apples should never be stored in an attic or top room of a house.

Grading of Apples and Pears.

If the fruit is to be consumed by the grower there is no advantage in selecting the fruit beyond the fact that it is better to eat the riper specimens first. If the fruit is to be sold it is very important that all the apples or pears offered for sale should be of similar size and quality. The practice of "topping" the consignment with a better class of fruit cannot be too severely condemned.

The following recommendations are offered for the guidance of growers who consign their fruit to market:—

1. Apples and pears should be packed in boxes of uniform size which should contain as far as possible the same number of fruits. It is more important, however, that the net weight of the consignment should be the same than that the number should be constant. A convenient size for the boxes is 20 in. long, 10 in. deep and 11 in. broad—all inside measurement; these will hold about 40 lb. They can be obtained from box-making firms.

2. The approximate weight should be put on the outside of the box as an indication to the seller of its contents.

3. The name of the consignor, or some mark by which the salesman can identify him, should be put on the box.

Fruit thus consigned should secure a more ready sale than fruit badly and irregularly packed, and will lead to better prices and further orders.

Small growers are strongly advised to satisfy the local demand for fruit before consigning to large markets, as the risk of a glut and consequent unremunerative prices is thereby avoided.

At the present time there is a large supply of English fruit, of both eating and cooking varieties, full use of which should be made. Much of this may be wasted unless proper steps are taken to preserve it against decay. Large growers should arrange for the storage of their produce in properly constructed fruit sheds, or cold storage; or for drying plums, &c., in evaporating machines, hop oasts, and by other means. The following methods are suggested for the use of small holders:—

(1) Apples, especially those of the later varieties, should be carefully stored in cool dry sheds, with a free circulation of air. Bruised and decayed fruit should be removed at once.

(2) Even with sugar at the present high price a certain quantity of fruit should of course be made into jams and jellies. In the case of those who have to purchase their supplies, the low price of fruit will compensate for the high price of sugar. If the price of sugar should rise, or if difficulty is experienced in securing sufficient quantities, liquid (syrup) glucose may be partially or even entirely substituted for cane sugar. Glucose is made in this country in large quantities from maize and other starchy materials.

In making jam, first rate results may be got by replacing from a quarter to a third of the sugar by syrup glucose, and very fair preserves may even be made without any sugar by using $1\frac{1}{4}$ to $1\frac{1}{2}$ parts of syrup glucose to 1 part of fruit according to its sweetness.*

(3) A part of the fruit supply should be bottled. There are several old-fashioned methods which might be adopted where no proper sterilising apparatus can be obtained, but these are all attended with considerable risk of the fruit being rendered tasteless and unsightly or of decay from exposure to the air. A proper sterilising apparatus can be obtained for about 10s., while air-tight quart bottles cost about 3s. 6d. to 4s. a dozen. No sugar is required for this process. Simple directions for use are given with the outfit by makers of sterilising apparatus, and a full description is given in Leaflet No. 250 (*Fruit Bottling for Small Holders*), which can be obtained on application to the Board. The process consists in filling the bottles with fruit, adding water to within half-an-inch of the rim, and putting them in the steriliser, the temperature

* If jam made in this way is intended for sale it should be labelled as containing glucose.

of which should be raised slowly to about 165° Fah. to 170° Fah. for about ten minutes. The bottles are then securely fastened down, being screwed or capped according to the system adopted, and allowed to cool. Apples and pears must be peeled and quartered—a silver or plated knife being used—and dropped into water directly afterwards or the flesh will be discoloured. Large plums may be cut in half and stoned. The stalks should be removed in every case.

(4) In some cases it may be preferred to dry the plums or even the apples. The simplest method is by means of an evaporator. The apparatus, which costs from about £1 10s to about £3, can be used on a kitchen stove. Larger evaporators are made costing from about £4 to about £20 according to size, for use with an independent stove. The method, which is fully explained in the publications issued by the manufacturers, is as follows:—Apples are first pared, cored and sliced, and then put into a tub of water to which a little salt has been added. They are then placed in a tray which is put into the machine and left there for about five minutes till the second tray is ready; the second is then inserted under the first. This is repeated till the oven is full. The top tray is then taken out and put into another part of the machine till all the rings are dry. The degree of heat used for drying apples is from 175° Fah. to 244° Fah. and the time occupied varies from two to four hours according to the variety of the apple. Whole apples require from about eight to ten hours. Plums are dried in the same way and should be quite ripe. During the process of evaporation the plums must be removed once or twice, when they swell, to prevent them bursting. The temperature required is from 240° Fah. to 300° Fah., and the time taken is from six to ten hours. A hundred lb. of fresh plums will give about 30 lb. of dried fruit.

In addition to the above, apricots, peaches, pears, cherries and damsons, as well as French beans, peas, cauliflowers, carrots, and other vegetables can also be dried.

(5) Another method of dealing with plums is known as prune making. By this method the sugar in the plum is used in preserving the fruit, and there is less risk of subsequent decay if the fruit gets damp.

The apparatus in this case is of the simplest character, a few shallow trays being all that is required if the fruit is to be dried in an ordinary oven. A special apparatus can be obtained, if desired, for about £3.

Ripe fruit should be selected, but it must not be over-ripe, or decayed or injured in any way. The temperature of the oven when the plums are first put in should be about 100° Fah.,* and the fruit should be kept at this temperature for about eight hours. Care must be taken to examine the fruit from time to time since after a few hours it begins to swell. The fruit must be watched and should be taken out before the skin bursts and replaced when the puffy appearance has subsided.

At the end of the first shift the trays are taken out and the fruit is allowed to cool. The oven should then be heated to a temperature of about 130° Fah. and the trays are replaced for a second shift of from eight to ten hours, at the end of which time they are again withdrawn and allowed to cool. The fruit is then turned by placing an empty tray upside down on the top of a full tray and reversing them together. The oven should then be heated to a temperature of 170° Fah., and the trays inserted for a third shift of eight hours. This is continued till the fruit is dried, but the more slowly it is done the higher is the quality of the prune. Some plums dry more quickly than others and these should be removed as soon as ready. The fruit when cool should be graded and packed in boxes and then stored in any place where a perfectly dry atmosphere can be secured.

THE International Institute of Agriculture at Rome owes its foundation to the King of Italy, who, inspired by the far-reaching ideas of Mr. David Lubin, a citizen of the United States of America, invited the attention of his Government to the desirability of establishing an International Bureau, which would study the conditions of agriculture in the various countries of the world, and would publish accurate information regarding the area and out-turn of the crops, the trade in agricultural produce, the measures to be taken for preventing the spread of diseases of plants and cattle, the development of rural co-operation, and other questions relating to the soil and its products, with the object of increasing the welfare of the agricultural classes throughout the world. An International Conference on Agriculture accordingly assembled at Rome in 1905, and prepared a draft Convention, to be adopted by

* A thermometer registering to 250° Fah. and cased in metal can be purchased for about half-a-crown.

any States that might choose to take part in the movement, the King himself offering a munificent grant of £12,000 per annum towards the cost of the proposed Institute. Several States soon signified their approval of the Convention, and by the year 1908, when the first General Assembly of the delegates of the adhering countries was held at Rome, a handsome building had been erected as an office, and the Institute was in a position to begin work. The number of States now adhering to the Convention is fifty-four, their annual contributions to the Institute amounting to about £34,000. To this has to be added the King of Italy's personal contribution of £12,000 a year, making with other items a total income for the current year of £47,000. The annual expenditure now amounts to about £37,000, of which £24,000 is allotted to the payment of the polyglot staff, consisting of about a hundred educated men and women of various nationalities, among them being seven British subjects.

The ultimate control of the Institute rests with the General Assembly, which meets every two years and is composed of delegates specially appointed by the adhering Governments; but its practical working is in the hands of the Permanent Committee, to which each adhering Government appoints a representative, and which sits at Rome from October to June each year. As the delegates, both to the General Assembly and to the Permanent Committee, are the official representatives of their respective Governments, the Institute as a whole is a purely official body, dependent upon the contributions and subject to the instructions of the Governments which have adhered to the Convention. The adhering British States are Great Britain and Ireland, Canada, India, Australia, New Zealand, South Africa and Mauritius, which between them subscribe £3,900 annually towards the cost of the Institute. During the greater part of the recent session, these States were jointly represented by an official of the Board of Agriculture and Fisheries.

The main object of the Institute may be said to be to disseminate, as widely and as promptly as possible, accurate information on all matters affecting the interests of the agricultural classes throughout the world. The chief means it employs to communicate that information is the publication of three monthly Bulletins, or reviews, called respectively "The Bulletin of Agricultural and Commercial Statistics"; "The Bulletin of Agricultural Intelligence and Plant Diseases"; and "The Bulletin of Economic and Social Intelligence."

These Bulletins are now published in five languages—French,

Italian, English, German and Spanish—and are in increasing demand. The information contained in them is quoted in numerous newspapers, journals and reviews, and so reaches a very large number of people who never see the Bulletins themselves. For instance, the Canadian Government publishes every month a full summary of the information contained in them, and sends it free to nearly 10,000 farmers throughout Canada; and the Hungarian Government has made an arrangement under which copious extracts from the Bulletins, translated into Hungarian, are placed free of charge in the hands of 10,000 farmers and 5,000 members of co-operative societies in Hungary.

The Statistical Bulletin contains up-to-date official figures obtained from the Governments of the adhering States, showing the area, condition and out-turn of the principal crops in the different countries, statistics of import and export of agricultural produce, customs duties, and prevalent prices in the principal markets, and it is now proposed to include statistics of the maritime freights charged on such produce for transport between the principal ports. These statistics are widely recognised as being much more complete and trustworthy than any previously available; and, since they are generally quoted in the leading newspapers and periodicals which deal with agriculture and the trade in agricultural produce, their monthly publication, and communication by telegraph to the chief market centres of the world in an official and authoritative form, must already have a considerable effect in discouraging reckless and ruinous speculation, and in steadying prices all over the world, to the great benefit of both producers and consumers.

The Technical and Economic Bulletins contain a summary of information extracted from periodicals obtained from many different countries on subjects likely to be useful to agriculturists and all interested in agricultural affairs, along with original articles written by experts on such questions. Their aim is to communicate to each country the results of the experience of all other countries in relation to agricultural matters, and the hope is that the information thus communicated will in time filter down through experts and students, administrators and practical farmers, to the agricultural masses, and gradually enable them to obtain a larger out-turn from their fields, to protect their crops from the ravages of destructive pests, to secure better prices for their produce, to obtain the credit required for their agricultural operations at low rates of interest, to insure their cattle, to co-operate in various directions

for the common good of themselves and their neighbours, and so to increase their general welfare, and at the same time teach them self-reliance, make them more independent, and raise their moral and intellectual standard—in short, make them wealthier, happier, and better men and women.

In addition to these monthly Bulletins the Institute publishes year-books of agricultural statistics and agricultural legislation, and monographs on various subjects. It is largely owing to its influence that interest in European forms of co-operation in agriculture has been widely stimulated in America, and that a Conference on the best means of coping with plant diseases was recently assembled at Rome.

During its recent session the Permanent Committee, which is partly composed of experienced officials specially selected by their Governments, and partly of the diplomatic representatives at Rome of the several countries, devoted much of its attention to carrying out the resolutions passed by the General Assembly of 1913, and to making preparations for the General Assembly which is due to meet in May, 1915, while at the same time carefully supervising the work of the permanent staff and gradually extending the scope of the Institute's operations. Most of the members of the Permanent Committee had been appointed by their respective Governments as delegates to the International Conference on Plant Diseases, which was held in February last, and which drew up a draft Convention. It is hoped that its recommendations will be approved by a large number of the Governments, and will lead to general measures being taken on uniform principles for the prevention of the spread of insect pests and diseases of plants, whether within each individual country or from one country to another. As an enormous amount of damage is done to crops of all kinds by injurious insects and fungi, the labours of this Conference may in time result in a considerable increase in the out-turn of crops, and therefore prove of great benefit, both to producers and consumers, all the world over.

The Committee carefully scrutinised the Budget of the year, with the object of avoiding any unnecessary expenditure, while at the same time providing for a steady expansion in the utility of the Institute. It reaffirmed the principle that the Institute will not incur any expense in the publication of editions of the Bulletins in languages other than French, which has been adopted as the official language, until the cost of those editions has been guaranteed by the Governments and the various bodies interested.

At present the crop statistics are published in the Statistical

Bulletin on the Saturday nearest to the 20th of each month, and as it is recognised that the information given would be much more valuable if the figures could be announced by an earlier date, the Institute has communicated with the different Governments with a view to establishing a system under which it may be possible to advance the date of publication. On a motion brought forward by the delegate of the United States of America and supported by those of France, Germany and Great Britain, it was agreed that arrangements should be made for the periodical publication of the rates of freight for agricultural produce between the chief exporting and importing ports, and the permanent staff were instructed to submit a report on the question to enable the Committee to put specific proposals on this subject before the next General Assembly.

A proposal made by the delegate for France, that milk and its principal products should be included among the articles of agricultural produce regarding which statistics are published by the Institute, was so far approved by the Committee that they issued instructions for the preparation of a report as to the statistics at present available relating to these articles, with the view of placing before the next General Assembly definite proposals for the periodical publication of statistics of the production and consumption of milk, and the trade in butter and cheese.

At the desire of the Board of Agriculture and Fisheries, the Committee agreed to publish in its monthly Bulletin statistics and information relating to the area and out-turn of the hop crop, and they expect to commence publication next January. The production of hops in different countries often varies considerably in consecutive seasons. It is consequently useful to hop-growers to be in possession of reliable information concerning the crops of other countries, and the regular publication by the Institute of official data regarding the crop should tend to minimise the violent fluctuations in price which at present occur. Although the total area under hops in the world is comparatively small, the crop is one of great importance to its growers, and its out-turn has considerable influence on the price of beer and therefore of barley, and so affects a large number both of producers and consumers.

The Committee had received an invitation to appoint a representative of the Institute to attend the International Congress of Tropical Agriculture, which was held in London in June last. While, in accordance with its settled policy, declining to appoint an official representative to the Congress, the

Committee requested the British delegate to submit to it a report on its proceedings, and he took the opportunity, as a member of the Congress, of bringing to the notice of his fellow members, who represented many tropical countries and Colonies, the work which is already done by the International Institute at Rome for the benefit of agriculture in the tropics as well as in temperate regions, and the importance of securing for tropical countries the great advantages which that Institute, owing to its official character, its large income and its permanent staff, is able to offer. He suggested that the Governments of those countries lying wholly or partly within the tropics, which have not yet adhered to the Institute, should be urged to do so without delay in order to secure on that body a due representation of tropical agriculture.

At the instance of the British delegate, arrangements were made for a more thorough audit of the annual accounts of the Institute by a sub-committee appointed from among the delegates, and for the addition of a certificate signed by them to the annual accounts, to the effect that they had been duly audited.

It was resolved that a monograph on fodders and concentrated cattle-foods should be published before the next General Assembly, and arrangements were made for the preparation of reports to be submitted to it regarding the collection of statistics relating to cattle, meat, milk, prices, imports and exports of agricultural produce, visible and invisible stocks, the organisation of markets, ocean freights and manures. A long discussion took place on the question of crop statistics generally, and the adhering Governments have been asked for very full information as to the system on which they classify areas and crops and collect information regarding their out-turn, with the object of obtaining more uniform returns and reports from the different countries than are at present available.

The Board have already drawn attention at various times to the great utility of the Institute's monthly Bulletins to all interested in agriculture and in the trade in agricultural products, and are prepared to arrange for the supply of copies of the Bulletins direct to subscribers in this country on payment of an annual subscription for the three Bulletins of £1 8s. 6d., which should be forwarded to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W., and made payable to the Board or order. Particulars of other publications of the Institute are given in the Board's Leaflet which may be had free of charge on application.

556 IMPORTS OF GRAIN IN THE CEREAL YEAR 1913-14. [SEPT.,

THE extent to which this country has been dependent on the Colonies and foreign countries for grain to supplement the harvest of 1913 may conveniently be considered at the end of the cereal year (1st September to 31st August).

Imports of Grain in the Cereal Year 1913-14. The imports of wheat into the United Kingdom amounted to 23,267,175 qr. (of 480 lb.), these being less by 3,233,400 qr. than the imports of 1912-13, and by 842,100 qr. than the imports of 1911-12. Converting the imported flour into an equivalent quantity of wheat, the total quantity of imported wheat available for consumption in the United Kingdom was 26,921,223 qr., compared with 30,149,450 qr., in 1912-13, and 27,433,400 qr. in 1911-12. Similar figures for recent years are given in the following table:—

Harvest Year.	Imports of Wheat during the Cereal Year Sept. 1- Aug. 31.	Imports of Wheat Flour in equivalent Weight of Grain.	Total Imported Wheat and Flour in equivalent Weight of Grain.
	Qr.	Qr.	Qr.
1904-5	24,529,170	3,526,620	28,055,790
1905-6	22,063,580	4,677,330	26,740,910
1906-7	22,105,180	4,284,490	26,389,670
1907-8	21,362,720	4,339,090	25,701,810
1908-9	21,727,220	3,554,650	25,281,870
1909-10	24,099,060	3,501,520	27,600,580
1910-11	23,516,140	3,263,380	26,779,520
1911-12	24,109,260	3,324,140	27,433,400
1912-13	26,500,565	3,648,883	30,149,450
1913-14	23,267,175	3,654,048	26,921,223

The fall in the imports of wheat during the cereal year cannot be ascribed to the outbreak of war, since the imports of August, 1914 (10,295,000 cwt.) were above those of August, 1913 (10,132,000 cwt.).

With regard to the countries from which the supply of wheat was drawn, the receipts from each of the principal sources of imported wheat are given below:—

Country of Export.	Thousands of cwt.			
	1913-14.	1912-13.	1911-12.	1910-11.
India	11,477	23,152	21,468	21,460
Russia	9,566	7,379	8,520	25,728
Argentina	6,991	18,617	16,823	16,983
United States	30,496	31,569	16,619	9,479
Canada	24,977	21,249	19,819	13,826
Australia	14,300	9,738	15,170	10,418

The feature of the cereal year's trade in wheat was the large decrease in the imports from India and Argentina. The supplies from India have not been so small since the years 1908-9 and 1907-8, nor those from Argentina since 1901-2. There was a continuous decrease in the imports from the United States in the four years prior to 1911-12, but the receipts in 1912-13 were pretty well maintained in 1913-14. The imports from Canada in the last four years show a progressive increase, those in 1913-14, 24,977,000 cwt., being the largest yet recorded from that country. The imports from Australia, after having dropped in 1912-13, rose again in 1913-14 nearly to the figure of 1911-12.

The price of home-grown wheat rose during the year, but there was, on the contrary, a fall in the value of imported wheat, viz., from 36s. 2d. per qr. in 1912-13 to 34s. 7½d. in 1913-14. The average declared value of imported wheat in previous years was 35s. 11d. in 1911-12, 33s. 10d. in 1910-11, and 37s. 5d. in 1909-10. English wheat averaged 32s. 4d. per qr., a rise in price of 4d. per qr., compared with 1912-13. There was, in general, a fall in the price of home-grown wheat between September and November, 1913, but there was thereafter a strong upward tendency in the price until the end of the cereal year (see p. 581). The lowest price recorded was in the week ended 8th November, 1913, viz., 30s. per qr., and the highest that in the week ended 15th August, 1914, viz., 40s. 3d. per qr. Comparing the prices of home-grown wheat in 1913-14 with those in 1912-13 it may be said that from September to November the prices were lower in 1913 than in 1912, while from December to August the prices were higher in 1913-14 than in 1912-13.

English barley averaged 26s. 10d. per qr. (a fall of 1s. compared with the preceding year), while English oats averaged 19s. 1d. (a fall of 6d.). The value of imported barley was 24s. 1½d. per qr., and of imported oats 16s. 7d. per qr., compared with 27s. 11½d. and 18s. 3d., respectively, in the previous year.

The following table shows the average prices of English wheat, barley and oats ascertained under the Corn Returns Act in each of the cereal years since 1904-5. The quantities given in the table are the quantities returned as sold, from which the averages are calculated:—

Harvest years.	Prices per quarter.			Quantities sold at certain markets.		
	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
Sept. 1-Aug. 31.						
	s. d.	s. d.	s. d.	Quarters.	Quarters.	Quarters.
1904-05	30 7	24 6	17 0	1,746,927	3,141,058	1,178,154
1905-06	28 9	24 2	18 5	2,940,263	3,202,613	940,015
1906-07	28 1	24 5	18 4	2,830,991	3,376,615	1,219,419
1907-08	32 9	25 8	18 2	2,944,256	3,564,908	1,530,848
1908-09	36 6	26 11	18 10	2,962,825	2,972,889	1,054,318
1909-10	32 6	23 10	17 8	3,144,873	2,988,483	795,824
1910-11	30 11	24 9	17 8	2,799,763	2,992,128	831,898
1911-12	34 10	31 2	21 6	2,944,995	2,645,477	719,495
1912-13	32 0	27 10	19 7	2,324,474	2,489,932	630,276
1913-14	32 4	26 10	19 1	2,746,702	3,438,159	850,308

The aggregate imports of the principal cereals in each of the past ten years are given below :—

Harvest year.	Millions of cwt.				
	Wheat.	Wheat Meal and Flour.	Barley.	Oats.	Maize.
1904-05	105.1	10.9	21.0	17.2	42.3
1905-06	94.6	14.4	20.3	16.0	47.1
1906-07	94.7	13.2	19.5	10.9	51.7
1907-08	91.6	13.4	17.5	13.2	39.5
1908-09	93.1	11.0	22.0	15.5	39.0
1909-10	103.3	10.8	19.9	19.6	34.6
1910-11	100.8	10.1	20.1	16.6	46.0
1911-12	103.3	10.3	21.9	18.4	32.1
1912-13	113.6	11.3	22.4	20.0	49.5
1913-14	99.7	11.3	21.2	15.4	40.2

Thus, with the exception of wheat meal and flour (the imports of which remained stationary), the decline in the wheat imports was accompanied by a fall in the supplies of the other cereals. Previous to 1912-13, in the case of flour, the imports had, on the whole, been declining since 1900-01, when 23,000,000 cwt. were imported. Flour comes chiefly from the United States and Canada; the imports from both these countries showed increases, viz., from 5,583,000 cwt. in 1912-13 to 5,605,000 cwt. in 1913-14 in the case of the United States, and from 3,850,000 cwt. to 3,995,000 cwt. in the case of Canada.

OFFICIAL NOTICES AND CIRCULARS.

THE Board of Agriculture and Fisheries issued on the 26th August a statement, subject to final revision, of the acreage of certain crops and of the number of live stock, in the United Kingdom, together with the estimated production of each of the crops, as follows :—

ACREAGE AND LIVE STOCK.

	1914.	1913.	Increase (+) or decrease (—).	
	Acres.	Acres.	Acres.	Per cent.
Wheat	1,940,000	1,790,000	+150,000	+ 8.4
Barley	1,904,000	1,930,000	— 26,000	— 1.3
Oats	3,886,000	3,961,000	— 75,000	— 1.9
Potatoes	1,206,000	1,173,000	+ 33,000	+ 2.8
	No.	No.	No.	
Cattle	12,152,000	11,896,000	+256,000	+ 2.2
Sheep	28,109,000	27,552,000	+557,000	+ 2.0
Pigs	3,971,000	3,294,000	+677,000	+20.6

ESTIMATED PRODUCTION.

	Qr.	Qr.	Qr.	Per cent.
Wheat	7,799,000	7,087,000	+ 712,000	+10.0
Barley	7,927,000	8,204,000	— 277,000	— 3.4
Oats	19,333,000	20,660,000	—1,327,000	— 6.4
	Tons.	Tons.	Tons.	
Potatoes	7,228,000	7,605,000	— 377,000	— 5.0

The wheat crop is 10 per cent. larger than that of 1913, and is considerably above the average of the last 10 years. The production of barley although less than in 1913, is larger than in either of the three preceding years. Oats are under average. The potato crop in Ireland is estimated at about 10 per cent. less than last year so that the total for the United Kingdom falls about 5 per cent. below 1913, when the crop was the largest on record. In 1912 the total crop was only 5½ million tons.

The number of cattle in the United Kingdom is larger than in any previous year.

An earlier statement, issued on 11th August, gave the estimated acreage and total production of beans and peas in England and Wales as follows :—

	1914.	1913.	Increase (+) or Decrease (—).	
	Acres.	Acres.	Acres.	Per cent.
Beans	299,000	268,000	+ 31,000	+ 11·6
Peas	171,000	164,000	+ 7,000	+ 4·3
	Qr.	Qr.	Qr.	Per cent.
Beans	1,080,000	915,000	+ 165,000	+ 18
Peas	435,000	422,000	+ 13,000	+ 3

THE Board of Agriculture and Fisheries have organised a Special Enquiries Branch for the purpose of dealing with all matters affecting supplies of home produce, and of collecting and compiling information from farmers and others on questions affecting agricultural interests at the present time. Officers of the Board have been stationed in different districts to keep in close touch with the Board's staff of Crop Reporters, Market Reporters, Small Holdings Commissioners and Agricultural Correspondents, and also with the Agricultural Colleges and Provincial Councils. They will also supplement the information as to prices of live stock and agricultural produce which is regularly received from the Board's Market Reporters by reporting any instances of local or exceptional disturbance of prices or supplies, whether of commodities sold by farmers or of feeding stuffs, &c., bought by them.

All communications on such matters should be addressed to the Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W., marked "Special Enquiries Branch."

THE Board have received the following from the Agricultural Consultative Committee :—

Use of Surplus Milk for Cheese-Making. Milk-sellers or others who have a surplus of milk to dispose of are strongly urged to take steps to have it converted into cheese either in their own dairies or co-operatively.

This method of dealing with surplus milk beyond what is required for immediate consumption will not only be found more remunerative than separating the milk and making the cream into butter, but will also be a useful means of contributing to the conservation of the food supply of the nation.

The types of cheeses most suitable for manufacture under the circumstances are Cheddar, Cheshire, Derby, Leicester

and Gloucester, or such other varieties as do not deteriorate under reasonably prolonged storage.

THE Board of Agriculture and Fisheries have given careful consideration to the question of the present and prospective supplies of feeding-stuffs for live stock.

Supply of Feeding-stuffs for Live Stock. The large number of cattle in the country renders it necessary to conserve materials required for their maintenance throughout the winter, so as to avoid any excessive

rise in the price of meat. The powers given to the Board by the Slaughter of Animals Act, 1914, will, if necessary, be used to prevent the wasteful depletion of the home meat supply, but it is important to ensure so far as possible that the cost of feeding-stuffs shall be kept at a reasonable level. With this object the exportation of feeding-stuffs for animals is generally prohibited, but the Board are prepared to consider applications for licence to export small quantities of certain feeding-stuffs, so long only as the prices at which they can be obtained by farmers in this country are fair and moderate.

THE Board of Agriculture and Fisheries and the Scottish Office, in co-operation with the Admiralty and the Board of Trade, are making such arrangements as the circumstances permit to secure the daily supply of fresh fish in the United Kingdom.

Value of Fish as Food. In spite of the diminution of the supplies of fish which has recently occurred, prices have not been above, and for part of the time at least have been below, the normal. Since fresh fish is a perishable commodity, it is reasonable to suppose that no considerable rise in the prices of fish is likely to occur. Moreover, an undertaking has been widely signed by fish merchants in England, Scotland, and Ireland to the effect that there shall be no attempt to corner supplies, that no large quantities of fish shall be withdrawn from sale and placed in cold stores with the object of enhancing prices, and that no large merchant will purchase large quantities for that purpose.

In these circumstances the attention of the public is directed to the value of fish as a food, which may well be used in substitution for any other forms of food the prices of which may be enhanced. Moreover, not only is fish a highly nutritious and wholesome food, but, the supply being drawn for the most part from international waters, and being constantly replenished by the ordinary processes of Nature, the consumption of fish involves no depletion of the national stock of food supplies.

THE Board of Agriculture and Fisheries estimate, on the basis of reports received from their Crop Reporters, that the hop crop in Kent and neighbouring districts will be well above average. Hop-pickers will be required as usual, and the Board understand that those who have been employed in previous years will be informed by growers either by post or through their agents of the date of picking. The usual arrangements for the conveyance of pickers by train to the large hop-picking centres will, it is expected, be made in due course.

Hop-Picking.

Board understand that those who have been employed in previous years will be informed by growers either by post or through their agents of the date of picking. The usual arrangements for the conveyance of pickers by train to the large hop-picking centres will, it is expected, be made in due course.

THE Board of Agriculture and Fisheries desire to draw the attention of farmers and gardeners to the need for seeking new sources of potash manures. This country's supply of artificial potash manure comes almost entirely from Germany; the existing stock is very small and no further importation is possible for the present.

Potash Manures.

supply of artificial potash manure comes almost entirely from Germany; the existing stock is very small and no further importation is possible for the present.

The chief natural sources of potash immediately available are (1) seaweed, and (2) weeds, prunings, hedge-clippings, brush-wood, leaves, and vegetable refuse generally.

Seaweed is already extensively used as a manure on the coasts. All who have access to this source of supply should collect it in quantity. Broad weed may be used direct as manure. Grassy weed and tangle should be dried and burnt wherever possible. A ton of fresh weed should yield 20 to 30 lb. of potash (enough, for example, to manure from a quarter to half an acre of potatoes).

Inland farmers and gardeners may obtain potash by burning all kinds of vegetable refuse not suitable for direct application to the soil. The percentage of potash in vegetation varies very widely; among ordinary weeds, for example, thistles might yield 5 per cent. and nettles 2.5 per cent. of their weight as potash; timber contains very little potash, cord-wood a considerable quantity, and brushwood still more; ordinary wood ashes might contain from 5 per cent. to 10 per cent. according to their source. The natural variations are so great that it is not possible to state definitely the composition of the ashes resulting from the burning of the weeds, prunings, hedge-clippings, &c., but they may be expected to contain from 10 to 15 per cent. of potash, *i.e.*, they might be worth as much as an equal weight of kainit (last spring, kainit sold at about £2 10s. per ton). It is absolutely essential, in the absence of

full supplies of farmyard manure, that potash should be provided for such farm crops as potatoes and (on light soils) turnips, and that it should be available in gardens for potatoes, carrots, parsnips, onions and many other crops.

In view of the lack of employment for unskilled labour in many districts farmers might well begin by collecting all readily available vegetable refuse with the view of drying and burning it and storing the ashes for early spring use before the winter sets in. Similarly, during the winter much labour might be employed in rooting out old hedges and clearing off other coarse vegetation in itself objectionable. All these cleanings might be burnt and the ashes used in late spring at a time when potash manures may be of great value.

The ashes must be stored in a dry place. The carbonate of potash present in ashes is very soluble, and would quickly wash out if exposed to rain.

The following Leaflets dealing with the uses of potash manures may be obtained, post free, on application to the Secretary, Board of Agriculture and Fisheries. Letters of application need not be stamped:—

- Leaflet 80. Use of artificial manures.
- „ 106. Fertilisers for market-garden crops.
- „ 254. The use of seaweed as manure.

THE Agricultural Consultative Committee, the appointment of which by the President of the Board of Agriculture and Fisheries was notified in this *Journal* for August, 1914, p. 464, have thought it advisable, at the earliest stage of their proceedings, to review the position with regard to the food stocks at present available for consumption.

Food Supplies.

The Board of Agriculture and Fisheries, whose sources of information are of the widest character, have already issued reassuring statements on this subject, and the practical knowledge of the Committee, together with the information from official and other sources which has been freely placed at their disposal, has led them to form similar conclusions.

They are of opinion, therefore, that in existing circumstances any considerable increase in the price of ordinary food-stuffs would be unjustifiable; and they would add that there is no occasion whatsoever for public alarm.

The Committee welcome the steps which have been taken by His Majesty's Government with a view to preventing excessive prices being charged for food-stuffs.

THE Agricultural Consultative Committee fully realise the handicap imposed upon farmers in getting in the harvest by the depletion of skilled agricultural labour owing to the mobilisation of the army, &c. Active steps are being taken to supply the deficiency thus created by means of special instructions issued to the Labour Exchanges. All possible use should be made of these organisations, which are making special efforts to organise a supply of suitable labour.

It is also realised that the type of labour most acceptable to the farmer at this juncture will be skilled or, failing that, knowledgeable labour. The Committee therefore confidently appeal to land-owners to facilitate the employment of members of their estate staffs (such as keepers, woodmen, gardeners, &c), upon the neighbouring farms; and to the agricultural community generally to encourage and induce all inhabitants of country villages, not of necessity otherwise employed, to lend a hand.

Incidentally the Committee have welcomed a timely offer which they have received from the Boy Scouts Association, to include immediately among the list of the more important matters in which the Scouts can at the present time render themselves most useful in agricultural districts, the "conveyance of messages between farmers and possible sources of labour" and other like tasks. They hope that this expedient may do something to overcome the practical difficulty of communication. The Boy Scouts Association are urging their local associations to encourage Scouts to assist farmers in their own neighbourhood in any way in their power. The Scouts would be entitled to receive fair remuneration for their work.

THE following recommendations must in all cases be dependent upon—(1) local conditions, and (2) the circumstances of the individual holding;

General Recommendations as to the Supply of Home-Grown Foods. but, generally, the Agricultural Consultative Committee are of opinion that, in the existing circumstances, agriculturists should do all in their power to secure that the supply of home-produced food-stuffs may be in excess of the normal. In this respect, the requirements of the future with regard both to cropping and to the maintenance of the fullest complement of live stock that holdings can usefully carry, must be carefully borne in mind.

1. The acreage under wheat should be largely increased wherever practicable. In this direction it should not be forgotten that on clean land, and by the aid of suitable artificial manure, good crops of wheat can be obtained in successive years. Attention is drawn to Section 26 of the Agricultural Holdings Act, 1908, which permits any system of cropping, subject to the holding being protected from deterioration.

2. Where wheat cannot be grown, the sowing of winter oats, winter barley and rye might be substituted. These crops ripen early, and allow the labour on harvest to be evenly distributed.

3. The cabbage crop is also one to be considered where land can be spared. It provides a considerable weight of food suitable for either human or animal consumption.

4. There is much land of a certain class now under grass which would probably pay for breaking up. If this land is scheduled as arable in the farm agreement the tenant has the option of ploughing it up. If it is scheduled as grass the Agricultural Consultative Committee suggest co-operation between owner and occupier as to the advisability of breaking up certain fields in view of the national question of increasing home-grown food-stuffs.

5. Where a surplus of grass or clover exists, silage might be made. Particulars of the best methods can be obtained from the Board's Leaflet No. 9.

6. The slaughter of immature or breeding stock of every description should be avoided. Where circumstances permit, the total head of live stock should be increased, particularly in the case of animals, such as pigs, which multiply quickly.

Ewe lambs might with advantage be put to the ram towards the end of the year.

7. While there should be no diminution in the numbers of live stock kept, the strictest economy (subject to proper conditioning) and foresight with regard to feeding is advocated.

The cheapest efficient forms of food should be used, and no waste spaces capable of producing food for animals should be allowed. No recommendation is attempted as to the exact description of the food-stuffs to be grown, as this must depend on the special circumstances of each case, of which generally the individual farmer will be the best judge; if in doubt, he can obtain advice gratis from the recognised Agricultural College in his "Province" or from the County Agricultural Organiser. But the following crops, among others, are worthy of consideration:—trifolium, vetches, rye for spring feeding, and Italian rye-grass. By adopting such measures the more

valuable foods would, so far as possible, be freed for human consumption.

As some misapprehension appears to exist among farmers and others concerned in questions relating to supplies of home-grown food-stuffs, the President of the Board of Agriculture and Fisheries desires to make it known that all communications on such matters should be sent direct to the Board of Agriculture and Fisheries. The Agricultural Consultative Committee, under the chairmanship of Sir Ailwyn Fellowes, have been closely engaged in considering all the subjects referred to them by the Board, and are rendering most valuable assistance in an advisory capacity, but they have no executive functions.

THE Board of Agriculture and Fisheries are about to issue a series of Leaflets on agricultural and horticultural subjects for the purpose of suggesting to farmers, gardeners, smallholders, allotment holders and private individuals, methods by which they may increase their production of crops and live stock, and fully utilise such food-stuffs as are available. Leaflets dealing with the cultivation of vegetables for late autumn and winter use, and with poultry-keeping, are now available and others will follow shortly.

To facilitate the early distribution of these Leaflets the Board would be glad of the assistance of secretaries of allotment societies, trades unions and other societies whose members have allotments, and of ministers of religion and other people in responsible positions who would undertake the distribution of copies to those to whom they would be of service.

Letters of application for Leaflets should state the number of copies which can be usefully distributed, and give particulars of the persons or group of persons to whom copies will be given. Such letters should be addressed to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W., and need not be stamped.

The following six Leaflets, reproduced in this issue of the *Journal*, have been issued up to the present :—

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|------------------|--------|--|
| Special Leaflet. | No. 1. | Suggestions to Allotment Holders for Autumn Treatment of Land. |
| " | " | 2. Special Notes on Poultry Feeding. |
| " | " | 3. Poultry on Allotments and Garden Plots. |
| " | " | 4. Poultry as Farm Stock. |

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| Special Leaflet. | No. 5. | Fruit Preserving for Small Growers or for Domestic Use. |
| " | " | 6. Storage and Disposal of Apples and Pears. |

Other Leaflets which farmers might read with advantage at the present time are as follows :—

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| No. 215. | How to obtain an Allotment or Small Holding. |
| " 231. | Cheese-making for Small Holders. |
| " 179. | The Making of Soft and Cream Cheeses and Clotted Cream. |
| " 192. | Farm Butter-making. |
| " 100.† | The Breeding and Management of Pigs. |
| " 142.† | Calf Rearing. |
| " 272. | Supply of Store Cattle and Slaughter of Young Calves. |
| " 128.† | Advice to Beginners in Bee Keeping. |
| " 141. | Preparation of Honey for Market. |
| " 265. | Utility Rabbit Breeding for Small Holders. |
| " 7. | Autumn Catch Crops and Fodder Supply. |
| " 74.† | The Composition and Properties of Concentrated Feeding-stuffs. |
| " 79.† | Rations for Farm Stock. |
| " 9. | Ensilage. |
| " 153. | Storing Turnips. |
| " 264. | The Cultivation of Onions. |
| " 268. | The Cultivation of Field Beans. |
| " 72.† | Purchase of Artificial Manures. |
| " 80.† | Use of Artificial Manures. |
| " 93.† | Farmyard Manure. |
| " 106. | Fertilisers for Market Garden Crops. |
| " 175. | Waste Organic Substances as Manures. |
| " 254. | The Use of Seaweed as Manure. |
| " 267. | Basic Slag. |
| " 70.† | Winter Washing of Fruit Trees and Treatment of Neglected Orchards. |
| " 134. | Apple Culture. |
| " 148. | Planting Fruit Trees and Bushes. |
| " 250. | Fruit Bottling for Small Holders. |
| " 203. | Utilisation of Peat Lands. |
| " 114.† | Feeding of Poultry. |
| " 129.† | Winter Egg Production. |

Copies of these Leaflets may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W. Letters of application so addressed need not be stamped.

THE Board of Agriculture and Fisheries are in receipt of frequent communications respecting the effect of the mobilisation of the Army on the number of horses available for carrying on the farming operations of the country, and as a great deal of misconception appears to exist in respect of the number of heavy draught-horses actually required by the Military Authorities, the Board

† Also issued in Welsh.

think it desirable to publish the approximate position so far as heavy horses are concerned.

The returns obtained by the Board in June last show that the estimated number of horses used for agriculture, including mares kept for breeding, but excluding saddle horses, carriage or trap horses and vanners, is 793,436.

The number of heavy draught-horses that have been obtained recently by the Military Authorities from agricultural holdings is estimated at 9,000, or only slightly over 1 per cent. of the whole. It is clear, therefore, that the number of heavy draught-horses on agricultural holdings is amply sufficient to meet the requirements of the Army without interfering seriously with the cultivation of the land.

It has come to the notice of the Authorities that persons purporting to represent the purchasers who are buying horses that have been impressed for the Army, are either obtaining or seeking to obtain commission from farmers on the price paid for the horses taken. Action of the kind is quite irregular and unauthorised.

Farmers are informed that all impressing is done by constables, who issue an order in accordance with a magistrate's warrant to each owner whose horse and vehicle is impressed. Without this order served by a constable owners need not give up their animals and vehicles and they should insist on seeing it. During the recent mobilisation however, the rush of willing people to help has often meant that this procedure was not followed.

Voluntary sale and purchase of horses will, of course, now continue in the ordinary course of business.

THE Board of Agriculture and Fisheries desire to draw attention to a movement initiated in Cumberland and Westmorland for assisting workers to add to their food supplies by cultivating allotments. In this case members of local authorities, landowners, manufacturers, agriculturists, and horticulturists have formed a committee for the purpose. Teachers of agriculture and horticulture residing in the counties, and a county land agent have been appointed technical advisers. The county instructor in horticulture is secretary. Landowners are asked to provide land free of rent, rates and taxes for a year. The Committee

supply technical advice, organise a supply of seedling plants, provide a form of agreement, and generally take steps to ensure that any able-bodied and willing worker, who has spare time on his hands, may utilise it under skilled guidance in providing an additional food supply for home use.

The Board hope that this example may be widely imitated, and with the assistance of the agricultural colleges and of county council instructors they will endeavour to arrange for skilled advice to be placed at the disposal of committees formed to carry out such schemes.

THE Military Authorities are purchasing large quantities of farm and market garden produce for the use of H.M. Troops throughout the country. For the purpose of facilitating supply and of preventing, as far as possible, a scarcity of produce arising in one district while there is a surplus in another, farmers are urged to assist the War Office by stating the quantity of produce they have to sell at fair market price.

Forms for the purpose can be obtained either from any Post Office or direct from the Board of Agriculture and Fisheries, 3, St. James's Square, London, S.W.

THE closing of the Baltic ports and the shortage of labour in the Bordeaux district of France have greatly reduced the normal supply of pit props. As the provision of an adequate supply of mining timber is of great importance, the Board of Agriculture and Fisheries, in co-operation with the English Forestry Association, are taking steps to stimulate the marketing of home-grown timber.

The timbers most in demand are larch, Scotch pine and spruce of 3-in. diameter and upwards at the small end, but small hardwood timbers, such as oak, coppice and beech are used to some extent. The standard lengths of pit props differ in the various districts.

In view of the fact that the larger sizes of timbers may be more usefully employed for other purposes it is probable that thinnings provide the most remunerative source of pit props.

Owners of extensive woods who may have timber which they consider suitable for this purpose, but who are in doubt as to the best method of marketing it or of obtaining it with least damage to the future welfare of their plantations are invited to communicate at once with the Secretary of the Board of

Agriculture and Fisheries or with the Secretary, English Forestry Association, Farnham Common, Slough, Buckinghamshire.

THE existence of foot-and-mouth disease amongst cattle and pigs on a farm at Stallingborough, near Grimsby, in the Lindsey Division of Lincolnshire, was confirmed on the 28th August. The usual precautions were at once taken to prevent the spread of the disease, and an Order was made prohibiting entirely the movement of animals in a large area surrounding the infected farm. The Prohibition Order has, however, since been modified so as to allow the movement of animals in certain parts of the Scheduled District. Ten further outbreaks of the disease have (up to the 11th inst.) occurred in the Scheduled District—nine of which were on premises in and around the village of Stallingborough.

Foot-and-Mouth Disease.

No outbreak of foot-and-mouth disease has been confirmed in Ireland since the 17th July last. On the 13th August the Board made an Order, taking effect on the 14th August, which modified their Order of the 4th August restricting the landing of animals from Ireland. Under the new Order such animals were allowed to be landed from any Irish port at any British landing place. After ten hours' detention in the landing place—during which time they were required to be under the supervision of Veterinary Inspectors of the Board—the animals could either be slaughtered in the landing place, or be moved out of the landing place, by Licence of a Veterinary Inspector of the Board, (a) to slaughter houses for slaughter within 96 hours after arrival at the slaughter house, or (b) to other premises where they were required to be detained and isolated, unless slaughtered on the premises, for a further period of 14 days, under the supervision of a Veterinary Inspector of the Local Authority. Special arrangements were made for the licensing out of the landing places of animals purchased by Government Contractors for the purpose of supplying meat for the Army and Navy.

The Order of the 13th August was subsequently revoked by an Order dated the 7th September which operated on the 9th September, and which also released from the requirements of detention and isolation, or slaughter, any animals previously removed from landing places under the Order of 13th August.

Animals brought from Ireland are required to be detained in the landing places for at least ten hours after landing, under the supervision of Veterinary Inspectors of the Board, before being permitted to be removed therefrom.

The Board have been officially informed that the importation of ruminants and swine from the United Kingdom into the United States of America has been suspended owing to the existence of foot-and-mouth disease in this country.

THE Board of Agriculture and Fisheries have awarded Research Scholarships in Agricultural and Veterinary Science of the annual value of £150, tenable for three years, to the following candidates, viz. :—

Agricultural Science—

J. Ll. Evans, B.Sc. (Wales).
S. M. Wadham, B.A. (Cantab.).
J. W. Munro, B.Sc. (Edinburgh).

Veterinary Science—

R. Daubney, M.R.C.V.S.
A. H. Adams, M.R.C.V.S.

They have also awarded Mr. E. W. Jeffreys, M.Sc. (Wales), an Agricultural Scholarship, tenable for two years, to fill a vacancy caused by the resignation of a scholar selected last year.

The scholarships have been established in connection with the scheme for the promotion of Scientific Research in Agriculture, for the purposes of which the Treasury have sanctioned Grants to the Board from the Development Fund, and they are designed to provide for the training of promising students under suitable supervision, with a view to enable them to contribute to the development of Agricultural and Veterinary Science.

THE following circular letter to Local Education Authorities in England and Wales, on the provision of Technical Instruction in Agriculture for Small Holders was issued by the Board on August 27th :—

SIR,

I am directed by the Board of Agriculture and Fisheries to say that they have had under consideration the arrangements made in England and Wales for providing technical instruction in agriculture for small holders.

It appears to them that, notwithstanding advances recently made, there is still much room for enabling the small holder to improve his condition by assisting him with suitable instruction, so as to enable him to increase the production of his holding and to market his produce satisfactorily. In the Board's view it is desirable that continuous efforts should be made to effect these objects through the Education and Small Holdings Committees, who are charged with the administration of laws enacted for the purpose of promoting the welfare of rural workers.

Out of a total of 435,700 holdings above one acre in England and Wales, 292,400 are under 50 acres, while in addition there are over 118,000 allotments under one acre belonging to local authorities, apart from a large number of allotments let by private land owners. Judged by numbers alone it is obvious that there is an extensive field of work for the teacher, while in addition it must be remembered that of all classes of the agricultural population the small holder and rural labourer have the least opportunity of obtaining instruction and skilled advice, and are consequently most in need of assistance.

The Board, therefore, invite Education Committees, in arranging their schemes of Agricultural Education, to give special consideration to the needs of small holders and allotment holders, and with this object in view they would suggest that the Small Holdings Committee and the County Land Agent should be asked to indicate districts where instruction might suitably be given, and also the type of instruction most needed.

Small holders and allotment holders are usually to be found in groups or colonies, and these would afford a convenient centre for organised day and evening classes and for courses of instruction in such subjects as horticulture, poultry-keeping and dairying. A small holding colony is also a most appropriate centre for demonstration holdings or plots illustrative of the best methods of growing and manur-

ing market-garden crops, fruit, &c. Demonstration holdings or plots can also be used to introduce to the notice of small holders crops not usually cultivated by them but which have proved successful elsewhere. When well managed and properly supervised by the instructors they are likely to be of greater use in educating cottagers and small holders than instruction of the class room type. Especially is this the case where the instructor visits the land of the small holder and discusses the application to it of lessons taught by the demonstration plots.

In making the above general observations the Board recognise that the conditions of each county vary, but they think it would serve a useful purpose if the County Organiser or the Director of Education could be instructed to consult the County Land Agent and to report how far the existing facilities in the county meet the needs of small occupiers and what steps can be taken to extend them for the benefit of all sections of the labouring classes.

The Board desire me to say in this connection that they think it will probably be found that an opening exists in most counties for the appointment of an officer, acting under the County Organiser, who could devote himself especially, and in some cases entirely, to the needs of small holders and allotment holders.

The appointment of a Small Holdings' Instructor would ensure that the small holders in the county, who might otherwise be neglected, were benefited by the educational work of the local authority. Being in constant touch with the small holding community, he would be able to make a special study of their needs and of the best way of advancing their interests; he would thus supplement and further the work of the Small Holdings Committee by helping their tenants to cultivate their land in the best way possible. This instructor should not, however, confine his attention to the statutory small holders. His services should be equally available to all small occupiers.

Without necessarily being a specialist in any particular branch, he should possess such a general knowledge of market gardening or of agriculture as would enable him to furnish small holders with advice as to the selection of their crops and as to the best means of cultivating and marketing them. With the latter object in view he would endeavour to promote and organise co-operation, both for purchase and sale, amongst the small holders of the district.

It will be seen that the suggestion of the Board amounts in effect to the appointment of an assistant to the Agricultural Organiser who would devote himself more especially to the needs of small growers, and spend much of his time visiting their holdings, discussing their difficulties, and securing for them the full benefits of the educational facilities provided by the Authority.

The Board recognise the great efforts that have recently been made in many counties to further the interests of agricultural education, but they are convinced that further provision is required for the smaller agriculturists, and in view of the substantial grants which the Farm Institute Fund provides in aid of additional expenditure, they hope that your Authority will give their careful consideration to the above suggestion and will co-operate with them in endeavouring to promote the well-being and prosperity of the rural population.

I am, &c.,

SYDNEY OLIVIER.

Destructive Insects and Pests Order of 1914.

THE Destructive Insects and Pests Order of 1914, dated 25th July, extends the Order of 1910* to include the Japanese Fruit Scale (*Diaspis pentagona*, Targioni-Tozzetti).

THE Corky Scab of Potatoes (Scotland) Order of 1914, dated 6th August, 1914, came into force on 1st September, 1914. In this Order references to "The Board" relate to the Board of Agriculture for Scotland; otherwise the provisions of the Order are identical with those of the Potatoes (Corky Scab) Order of 1914, applying to England and Wales, which was noted in this *Journal* for August, 1914, p. 459.

PARTICULARS of the trade of the United Kingdom in agricultural produce during 1913 and previous years are given in Part IV. of the Board's Agricultural Statistics for 1913 [Cd. 7,551, price 5½d.], entitled "Imports and Exports of Corn, Live Stock and other Agricultural Produce."

THE Board of Agriculture and Fisheries have published a Return in chronological order of all acts passed for the inclosure of commons or waste lands, separately, in England and Wales, arranged under the headings of the counties in alphabetical order, and distinguishing the parishes in which the same were situated, and incorporating the information contained in Lord Worsley's Return, No. 325, of 9th and 14th June, 1843. The present Return [H.C. 399] may be obtained from Messrs. Wyman & Sons, price 9d.

Inclosure Acts.

MISCELLANEOUS NOTES.

THE *Bulletin of Agricultural and Commercial Statistics* for August, 1914, gives estimates of the production of the cereal crops this year.

The countries for which it is possible to give an approximate estimate of the production are as follows:—In *Europe*—Prussia; Hungary (proper); Belgium; Spain; England and Wales; Italy; Luxembourg; Netherlands; Russia in Europe (63 governments); Switzerland; in *America*—United States; in *Asia*—India; Japan; in *Africa*—Tunis.

Wheat.—The total production in the above-mentioned countries, excluding Prussia, is estimated to amount to 306,764,000 qr., as compared with 318,655,000 qr. in the same countries last year, the decrease being equal to 3.7 per cent. The area under production was larger than in 1913 by 1.3 per cent.

Rye.—The estimated production in the specified countries, with the exception of England and Wales, United States, India, Japan and Tunis, is placed at 165,952,000 qr., against 169,644,000 qr. in 1913, or a decrease of 2.2 per cent., while the area planted was practically the same as last year.

Barley.—The production in the above countries, excluding Prussia and India, is estimated at 119,828,000 qr., or a decrease of 6.2 per cent.

* See *Journal*, June, 1910, p. 233.

as compared with last year, when the production was 127,718,000 qr. The area under production showed a decrease of 0.3 per cent.

Oats.—For the above-mentioned countries, with the exception of Prussia, India and Japan, the estimated production is 242,956,000 qr., against 263,449,000 qr. in 1913, the decrease amounting to 7.8 per cent. The area planted, however, was slightly larger than last year.

New Zealand.—The final figures of the harvest of 1913-14 place the production of wheat at 745,000 qr., or an increase of 15.1 per cent. as compared with 1912-13. Barley amounted to 165,000 qr., a decrease of 4.3 per cent., and oats to 2,037,000 qr., an increase of 20.0 per cent.

United States.—The Department of Agriculture forecast the production of the crops, from their condition on 1st September, as follows (in bushels and final figures for 1913 in brackets):—Spring wheat 221,000,000 (239,819,000), winter wheat 675,000,000 (523,000,000), total wheat 896,000,000 (763,000,000), oats 1,116,000,000 (1,121,768,000), barley 200,000,000 (178,189,000), maize 2,598,000,000 (2,446,988,000), and linseed 15,000,000 (17,853,000).—(*Dornbusch*, 9th September.)

Holland.—H.M. Minister at The Hague reports (29th August) that actual estimates of the production of this year's crops not being available, the Director-General of Agriculture considers the average production during the years 1911, 1912, and 1913 to represent fairly well the production in 1914. The figures are as follows:—Wheat, 674,000 qr.; rye, 1,884,000 qr.; barley, 391,000 qr.; oats, 2,054,000 qr.; beans, 171,000 qr.; brown beans, 62,000 qr.; peas, 228,000 qr.; potatoes, 2,398,000 tons; and linseed, 11,000 tons. The quality of wheat is probably below that of 1913, that of barley rather poor, and that of oats very good. All the cereals except oats have been secured, and, so far (26th August), none of the grain has been exported.

Germany.—The President of the German Agricultural Council forecasts the production of the wheat and rye crops at 73,000,000 qr. The production last year was estimated at 77,500,000 qr.—(*Broomhall's Corn Trade News*, 18th August.)

Russia.—A semi-official report, published on 1st August, relating to conditions on 13th July, states that in the 604 districts of European Russia the winter crops were bad in 56 (9.3 per cent.), medium in 36 (5.9 per cent.), satisfactory in 296 (49 per cent.), good in 174 (28.8 per cent.), and excellent in 32 (5.3 per cent.). Spring grain is reported good in 100 districts (16.5 per cent.), excellent in 10 (1.7 per cent.), satisfactory in 236 (39.1 per cent.), medium in 46 (7.6 per cent.), and bad in 202 (33.4 per cent.).—(*Broomhall's Corn Trade News*, 20th August.)

India.—Since the final General Memorandum on the wheat crop of 1913-14 was issued revised figures have been received from several districts, and the total yield is now estimated at 39,326,000 qr. from an area of 27,697,000 acres, compared with 45,337,000 qr. from 29,524,000 acres in 1912-13.

Canada.—A bulletin issued by the Census and Statistics Office at Ottawa gives the condition of the crops on 31st July (100 representing the average condition on 31st July for the six years 1908-13) as follows: Winter wheat 90, spring wheat 93, oats 89, barley 92, and rye 94. The crops have suffered during July from excessive heat and continuous drought.

A preliminary estimate places the production of winter wheat in Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia at 20,394,000 bushels compared with 22,592,000 bushels, the final estimate of 1913. For Canada as a whole the hay crop is estimated at 8,220,000 tons, compared with 9,696,000 tons last year.

Argentina.—The *Review of the River Plate* of 7th August stated that ploughing and seeding operations were being carried out without difficulty and heavy frosts were curtailing the too-rapid growth of the young crops. It is probable that the wheat area will show a decrease of about 1,250,000 acres, which area will probably be sown with maize.

H.M. Minister at Buenos Aires reports (29th July), that the "*Times of Argentina*" estimates the quantity of this year's maize crop available for export at 22,000,000 qr.

THE Crop Reporters of the Board generally state that the weather during August was very favourable to harvesting operations, and to the development of growing crops, nearly all of which show an improvement as compared with a month ago.

Agricultural Conditions in England and Wales on September 1st. The wheat harvest suffered few interruptions, and the corn was nearly everywhere cut, and most of it has been carried, in excellent condition. In the northern districts, some work has of course still to be done. Prospects now are for a crop about 4 per cent. above average, the total crop about 10 per cent. more than last year, when increased acreage is taken into account. Barley and oats have also been largely got in; the barley being rather later than the other two cereals. As in the case of wheat, their prospects have improved, although the yield is below the average. Barley will, however, probably be only about 1 per cent. below the normal; it is best in the north, where also the quality appears better: elsewhere the quality seems very variable. Oats are the poorest of the three cereals, being about 5 per cent. below the mean, though there are some good crops in many parts. Beans are a promising crop and should be fully average or a trifle more, although they are poor in Lincoln and some other counties where they are largely grown. Peas on the other hand are a poor yield, and are, in fact, the only crops to show worse prospects than a month ago.

Potatoes have been suited by the weather, and prospects are now for a yield well over average. Disease has appeared in some western districts, where there has been more rain; but most parts of the drier eastern half of the country are very free from it.

Prospects for roots are variable, but, on the whole, better than a month ago. The great differences are due to the rainfall having been too unevenly distributed. In the districts between Tees and Trent, and again in the western and south-western counties of England, turnips, swedes and mangolds are all expected to be well above the average; but the droughty conditions of the eastern side of England have been detrimental, and very poor yields of roots are looked for, especially in the south-east. On balance, turnips and swedes, on present appearances, appear likely to yield 4 per cent. below average; mangolds are better and should be very little below average.

The promise of hops has greatly improved during the month: no reporter expects an under average yield anywhere. There has been unusually little aphid during August, although there is some mould. The cones have ripened well and are expected to be of good quality. The western district holds out promise of relatively heavier yields than the Kent hop-yards. Picking was beginning at the date of the reports. Crops of apples, pears and plums are mostly heavy, especially the last named.

Pastures in the east of the country have become rather bare owing

to the dry weather; but many districts in the west have plenty of keep. Stock have generally done very well during the month.

Summarising the returns, and expressing an average crop by 100, the condition of the crops on the 1st September indicated probable yields which may be denoted by the following percentages: Wheat, 104; barley, 99; oats, 95; beans, 101; peas, 93; potatoes, 102; turnips and swedes, 96; mangolds, 99; hops, 109.

THE supply of agricultural labour in England and Wales during August was, according to statements in the Board's Monthly Agricultural Report (1st September), quite sufficient during harvest, largely on account of the fine weather enabling the work to be done with a minimum of interruption.

The following are the summaries for the different localities:—

Northumberland, Durham, Cumberland, and Westmorland.—The supply of labour for harvest was rather deficient in some districts, but with the fine weather less was needed than usual, and little delay was caused. Skilled labour was deficient in a few districts.

Lancashire and Cheshire.—Generally the supply of labour was sufficient. Deficiencies which were occasioned in some districts were made up by the supply of Irish labour and of persons thrown out of employment by the war. The employment of self-binding machines and the fine weather enabled harvesting to be carried on very well.

Yorkshire.—The supply of labour was sufficient in general, but some scarcity of skilled labour was experienced in certain districts. Casual labour was obtained from the towns, and assistance was also received in some cases from estate workmen.

Shropshire and Stafford.—Labour was sufficient in most districts. In some there was a shortage, which was, however, made up from outside sources. In south-east Stafford the supply is plentiful.

Derby, Nottingham, Leicester and Rutland.—Except in north-west Derby and north Notts, where more men could have been employed, the supply of labour for harvesting was about sufficient, but owing to favourable weather, less labour was required this year than usual.

Lincoln and Norfolk.—The supply of labour was for the most part sufficient, except in two or three districts.

Suffolk, Cambridge and Huntingdon.—The supply of labour was sufficient for the corn harvest and other current work.

Bedford, Northampton and Warwick.—With some exceptions there was a sufficient supply of labour for current requirements. A scarcity of skilled men is occasionally reported.

Buckingham, Oxford and Berkshire.—The supply was rather short in many districts, but owing to the fine harvest weather it was usually sufficient; all the crops stood up well, so that machines did almost all the cutting, and less labour than usual was required.

Worcester, Gloucester and Hereford.—The supply of labour was generally sufficient, though occasional shortage of skilled and casual labour occurred. No serious difficulty in gathering in the crops was experienced in this respect.

Cornwall, Devon and Somerset.—Labour was short in places, but local assistance in most places made good the deficiency. In a few districts there is a scarcity of skilled labour.

Dorset, Wiltshire and Hampshire.—Owing to the favourable weather, the supply of labour proved generally sufficient, though a shortage was experienced in some districts, especially of casual labour.

Surrey, Kent and Sussex.—With a few exceptions there was sufficient labour for the harvest season.

Essex, Hertford and Middlesex.—The favourable harvest weather diminished the demand, and the supply of labour was sufficient for all purposes practically everywhere. In west Essex labour was short in some places.

North Wales.—In most districts the supply of labour for harvesting was sufficient although there was some scarcity in the eastern districts of the division.

Mid Wales.—The supply of labour was sufficient on the whole; in one or two districts, however, a slight scarcity was reported.

South Wales.—In the majority of districts there was some slight shortage of labour, particularly of the skilled sorts, but no serious inconvenience appears to have been experienced.

Prevalence of Animal Diseases on the Continent.

The following statement shows that according to the information in the possession of the Board on September 1st, 1914, certain diseases of animals existed in the countries specified:—

Austria (on July 22nd).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 1,788 Höfe infected), Glanders and Farcy, Rabies, Sheep-scab, Swine Erysipelas, Swine Fever, Tuberculosis.

Belgium (for the period July 16th—31st).

Anthrax, Blackleg, Foot-and-Mouth Disease (4 outbreaks in 3 communes), Rabies.

Bulgaria (for the period July 21st—29th).

Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Denmark (month of June).

Anthrax, Swine Erysipelas, Swine Fever.

France (for the period July 12th—18th).

Anthrax, Blackleg, Foot-and-Mouth Disease (22 outbreaks), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever, Tuberculosis.

Germany (for the period July 1st—15th).

Foot-and-Mouth Disease (1,807 infected places in 304 parishes), Glanders and Farcy, Swine Fever.

Holland (month of July).

Anthrax, Foot-rot, Glanders, Swine Erysipelas.

Hungary (on July 8th).

Anthrax, Foot-and-Mouth Disease (total of 6,973 "cours" infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (for the period August 10th—16th).

Anthrax, Blackleg, Foot-and-Mouth Disease (459 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (for the period June 1st—15th).

Sheep-pox.

Norway (month of July).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period July 6th—13th).

Foot-and-Mouth Disease (24,597 animals), Glanders and Farcy, Rabies, Sheep-pox, Sheep Scab, Swine Erysipelas, Swine Fever.

Russia (month of April).

Anthrax, Foot-and-Mouth Disease (18,355 animals in 359 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (for the period May 9th—16th).

Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Spain (month of May).

Anthrax, Dourine, Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of June).

Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (for the period August 17th—23rd).

Anthrax, Blackleg, Foot-and-Mouth Disease (114 "étables" entailing 5,303 animals, of which 23 "étables" were declared infected during the period), Swine Fever.

The Weather in England during August.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
<i>Week ending Aug. 8th:</i>	°F.	°F.	Inches.	Inches.		Hours.	Hours.
England, N.E. ...	58.3	-0.4	0.58	-0.11	4	4.3	-1.3
England, E. ...	59.9	-0.6	0.74	+0.25	5	5.0	-1.2
Midland Counties ...	57.7	-2.1	0.70	+0.14	6	5.0	-2.1
England, S.E. ...	59.7	-1.8	0.84	+0.36	5	5.6	-0.8
England, N.W. ...	58.0	-1.0	1.00	+0.22	5	5.4	0.0
England, S.W. ...	58.0	-1.9	1.04	+0.37	6	6.0	-0.2
English Channel ...	59.8	-1.9	1.03	+0.50	5	5.6	-2.4
<i>Week ending Aug. 15th:</i>							
England, N.E. ...	61.1	+2.7	0.01	-0.59	1	9.3	+3.8
England, E. ...	63.3	+3.1	0.01	-0.48	1	9.0	+2.9
Midland Counties ...	62.1	+2.7	0.17	-0.37	2	8.3	+2.7
England, S.E. ...	64.3	+3.0	0.33	-0.13	1	8.7	+2.3
England, N.W. ...	62.8	+4.2	0.07	-0.70	1	9.4	+4.1
England, S.W. ...	62.4	+2.8	0.88	+0.23	3	7.8	+1.6
English Channel ...	64.6	+2.8	0.79	+0.23	3	8.6	+0.5
<i>Week ending Aug. 22nd:</i>							
England, N.E. ...	58.2	+0.2	0.26	-0.32	2	7.3	+2.0
England, E. ...	60.1	+0.1	0.12	-0.43	2	7.1	+1.0
Midland Counties ...	59.2	+0.1	0.10	-0.49	2	6.7	+1.2
England, S.E. ...	60.7	-0.4	0.05	-0.50	1	7.5	+1.0
England, N.W. ...	59.1	+0.8	0.14	-0.66	2	7.7	+2.6
England, S.W. ...	60.1	+0.8	0.20	-0.53	1	7.6	+1.4
English Channel ...	62.6	+0.9	0.05	-0.55	2	7.9	0.0
<i>Week ending Aug. 29th:</i>							
England, N.E. ...	62.2	+4.7	0.56	-0.06	4	5.4	+0.4
England, E. ...	63.5	+4.1	0.20	-0.36	3	5.1	-0.8
Midland Counties ...	62.2	+3.8	0.68	+0.03	3	6.2	+0.9
England, S.E. ...	63.4	+2.8	0.30	-0.33	2	6.8	+0.6
England, N.W. ...	61.0	+3.1	0.74	-0.15	4	6.1	+1.3
England, S.W. ...	60.9	+2.0	0.70	-0.16	3	6.4	+0.5
English Channel ...	62.7	+1.3	0.48	-0.17	2	8.9	+1.7

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES OF LIVE STOCK in ENGLAND and WALES in August and July, 1914.

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

Description.	AUGUST.		JULY.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots ...	9 5	9 1	9 3	8 10
Herefords ...	9 4	8 9	9 3	8 7
Shorthorns ...	9 4	8 7	9 0	8 3
Devons ...	9 5	8 7	9 1	8 4
Welsh Runts ...	9 4	8 6	9 2	8 5
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves ...	9	8½	9	8
Sheep:—				
Downs ...	9½	9	9½	8½
Longwools ...	9½	8½	8½	8
Cheviots ...	10	9	10	9½
Blackfaced ...	9½	9	9½	9½
Welsh ...	8½	8½	8½	7½
Cross-breds ...	9½	8½	9½	8½
	per stone.*	per stone.*	per stone.*	per stone.*
	s. d.	s. d.	s. d.	s. d.
Pigs:—				
Bacon Pigs ...	7 9	7 3	7 0	6 7
Porkers ...	8 2	7 8	7 6	7 1
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	23 5	19 3	23 9	19 9
„ —Calvers ...	21 9	18 13	22 6	18 14
Other Breeds—In Milk ...	20 15	17 8	20 14	17 5
„ —Calvers ...	17 5	14 10	16 10	15 0
Calves for Rearing ...	2 13	2 1	2 15	2 3
Store Cattle:—				
Shorthorns—Yearlings ...	11 12	9 16	11 6	9 16
„ —Two-year-olds... ..	15 19	13 15	15 7	13 11
„ —Three-year-olds ...	17 10	—	18 10	16 19
Herefords —Two-year-olds... ..	16 19	15 0	16 0	15 4
Devons— „	16 12	13 12	16 5	13 19
Welsh Runts— „	15 0	12 18	—	14 5
Store Sheep:—				
Hoggs, Hoggets, Togs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	39 2	34 8	41 0	34 1
Store Pigs:—				
8 to 12 weeks old ...	21 7	16 1	23 0	17 8
12 to 16 weeks old ...	33 4	26 0	33 4	26 2

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in August, 1914.

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

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
BEEF:—		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
English	1st	s. d. 65 6	s. d. 64 6	s. d. —	s. d. 66 0	s. d. 61 0
Cow and Bull	2nd	62 0	62 6	—	62 0	58 6
	1st	56 6	58 6	52 6	54 0	53 0
	2nd	52 0	53 6	48 0	49 6	48 6
Irish: Port Killed	1st	62 6	61 0	59 6	64 6	59 0
	2nd	59 0	59 0	55 0	60 0	55 6
Argentine Frozen— Hind Quarters	1st	62 6	65 6	64 6	62 6	64 6
Fore	1st	50 0	50 6	52 0	45 6	52 0
Argentine Chilled— Hind Quarters	1st	63 6	61 0	63 6	65 0	63 6
Fore	1st	48 0	48 0	49 6	48 6	49 6
Australian Frozen— Hind Quarters	1st	59 0	61 0	61 6	62 6	61 6
Fore	1st	49 6	47 6	47 6	50 0	47 6
VEAL:—						
British	1st	73 0	68 0	76 6	71 6	74 6
	2nd	66 6	63 0	71 0	64 0	70 0
Foreign	1st	—	—	—	74 6	—
MUTTON:—						
Scotch	1st	—	—	—	84 0	77 6
	2nd	—	—	—	79 6	74 0
English	1st	77 6	85 0	—	81 0	74 0
	2nd	70 0	81 6	—	81 0	74 0
Irish: Port Killed	1st	74 6	79 6	72 6	78 0	71 0
	2nd	63 0	77 0	66 6	73 0	66 0
Argentine Frozen	1st	49 0	48 6	49 6	48 6	49 6
Australian	1st	48 0	45 6	46 0	47 0	46 0
New Zealand	1st	48 0	—	—	49 6	—
LAMB:—						
British	1st	81 6	90 0	76 6	86 0	83 6
	2nd	78 0	84 0	71 6	80 6	76 6
New Zealand	1st	64 6	66 0	67 6	66 0	68 0
Australian	1st	60 0	60 0	62 6	58 6	62 6
Argentine	1st	60 6	60 6	63 6	53 6	63 6
PORK:—						
British	1st	72 6	62 6	60 6	65 0	63 6
	2nd	67 6	59 6	56 6	59 0	59 6
Foreign	1st	—	—	—	60 6	—

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 1912, 1913 and 1914.

Weeks ended (in 1914).	WHEAT.			BARLEY.			OATS.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Jan. 3...	s. d. 33 2	s. d. 30 5	s. d. 31 1	s. d. 33 3	s. d. 28 6	s. d. 26 2	s. d. 20 7	s. d. 19 10	s. d. 18 2
" 10...	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
" 17...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
" 24...	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
" 31...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb. 7...	34 0	31 0	31 0	33 2	28 10	26 7	21 4	20 1	18 9
" 14...	34 4	30 9	31 0	32 10	29 1	26 7	21 7	20 2	18 11
" 21...	34 6	30 11	31 0	32 8	28 8	26 7	21 9	20 7	18 11
" 28...	34 1	31 0	31 0	32 0	28 6	26 6	21 6	20 4	18 11
Mar. 7...	34 1	31 3	31 5	31 7	28 5	26 2	21 8	20 0	18 9
" 14...	34 0	31 1	31 6	31 2	27 11	26 0	21 8	20 2	18 7
" 21...	34 1	31 1	31 5	31 10	28 6	25 8	21 9	19 11	18 6
" 28...	34 4	31 3	31 4	30 3	27 6	25 7	21 8	19 7	18 8
Apl. 4...	34 10	31 4	31 6	30 9	27 0	25 6	21 11	19 2	18 5
" 11...	35 4	31 3	31 5	30 2	27 8	26 8	22 1	19 2	18 4
" 18...	36 7	31 6	31 7	29 11	26 11	25 4	22 4	18 10	18 4
" 25...	37 10	31 8	31 9	30 4	26 7	26 6	22 9	19 3	18 5
May 2...	38 1	32 2	31 9	30 2	25 11	26 0	23 1	19 6	18 5
" 9...	37 11	32 6	32 2	31 1	25 9	25 6	23 7	19 6	18 9
" 16...	37 8	32 10	32 7	31 2	25 4	26 3	23 7	19 9	18 11
" 23...	37 2	32 10	33 0	31 1	25 3	25 10	23 7	19 11	19 0
" 30...	36 10	32 7	33 9	30 0	26 1	26 1	23 9	20 1	19 4
June 6...	36 11	32 10	34 0	29 11	26 2	25 11	24 0	19 8	19 4
" 13...	37 0	32 8	34 1	30 8	24 7	24 11	23 10	20 2	19 8
" 20...	37 5	32 8	34 1	30 8	23 10	25 10	24 0	19 8	19 9
" 27...	37 10	32 8	34 3	30 2	24 3	25 4	23 11	19 1	20 0
July 4...	38 2	33 1	34 4	31 7	25 2	24 6	23 11	21 0	19 9
" 11...	38 3	33 4	34 2	30 2	25 10	24 9	24 1	19 4	20 0
" 18...	38 10	33 6	34 1	30 9	24 9	24 2	24 8	20 5	19 10
" 25...	38 9	33 10	34 0	30 9	24 1	24 7	23 2	20 8	19 9
Aug. 1...	38 4	34 1	34 2	28 6	24 5	25 9	22 4	20 3	19 8
" 8...	39 2	34 1	34 9	30 7	24 9	25 2	22 4	19 0	19 1
" 15...	38 2	34 3	40 3	28 3	24 7	29 4	21 8	18 7	25 1
" 22...	35 6	33 7	38 9	28 1	26 5	29 10	20 10	18 8	24 3
" 29...	34 10	32 7	36 2	28 6	29 0	30 3	20 8	17 10	23 5
Sept. 5...	35 1	31 11	36 5	29 9	30 11	30 6	21 8	17 8	23 9
" 12...	33 5	31 9	—	29 0	31 5	—	20 5	18 0	—
" 19...	32 7	31 7	—	29 6	30 9	—	19 10	17 11	—
" 26...	31 7	31 6	—	29 9	30 1	—	19 5	17 9	—
Oct. 3...	31 8	31 3	—	29 7	29 9	—	19 8	17 10	—
" 10...	31 10	31 0	—	30 4	29 1	—	19 5	17 10	—
" 17...	32 2	30 11	—	30 11	28 8	—	19 9	17 9	—
" 24...	33 1	30 7	—	31 6	28 7	—	19 10	18 0	—
" 31...	33 4	30 1	—	31 10	28 2	—	20 1	17 9	—
Nov. 7...	33 1	30 0	—	31 11	28 1	—	19 11	17 9	—
" 14...	32 10	30 1	—	31 2	27 8	—	19 9	17 11	—
" 21...	32 1	30 4	—	30 11	27 5	—	19 11	18 1	—
" 28...	31 9	30 9	—	30 8	27 0	—	19 8	18 4	—
Dec. 5...	31 0	31 2	—	29 11	26 8	—	19 6	18 4	—
" 12...	30 8	31 2	—	29 2	26 5	—	19 3	18 6	—
" 19...	30 7	31 2	—	28 11	25 11	—	19 1	18 5	—
" 26...	29 10	31 0	—	28 6	25 10	—	19 2	18 4	—

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.

AVERAGE PRICES of **Wheat, Barley, and Oats** per Imperial Quarter in FRANCE and BELGIUM, and at PARIS, BERLIN, and Breslau.

		WHEAT.		BARLEY.		OATS.	
		1913.	1914.	1913.	1914.	1913.	1914.
France:	June	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
	July	48 10	47 6	29 11	28 10	23 9	23 1
Paris:	June	48 4	46 6	29 9	28 6	23 8	22 10
	July	49 11	48 0	30 8	28 8	23 5	24 3
Belgium:	May	50 2	47 3	30 8	28 1	24 11	24 1
	June	36 1	34 6	29 8	25 1	23 2	21 8
Berlin:	May	36 4	35 7	28 10	25 2	22 8	22 5
	June	44 8	44 4	—	—	22 11	22 11
Breslau:	May	43 10	44 10	—	—	22 3	23 9
	June	39 2	42 3	26 8*	—*	21 0	21 8
				25 3†	25 0†		
				25 2†	26 3†	20 4	22 4

* Brewing.

† Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the Belgian quotations are the official monthly averages published in the *Moniteur Belge*; the German quotations are taken from the *Deutscher Reichsanzeiger*.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of August, 1913 and 1914.

		WHEAT.		BARLEY.		OATS.	
		1913.	1914.	1913.	1914.	1913.	1914.
London...	...	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
	...	34 4	36 6	24 8	29 4	19 9	24 1
Norwich	...	34 1	35 11	28 1	27 5	19 2	21 7
	...	32 4	37 2	29 11	28 3	17 4	21 10
Peterborough	...	32 2	35 6	28 7	27 8	18 5	21 5
	...	32 7	36 4	—	—	19 0	21 8
Salisbury	...	32 9	35 2	24 6	28 6	19 4	22 8
	...	32 9	35 2	24 6	28 6	19 4	22 8

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in August, 1914.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER:—						
British...	s. d. per 12 lb. 15 9	s. d. per 12 lb. 14 9	s. d. per 12 lb. —	s. d. per 12 lb. —	s. d. per 12 lb. 15 0	s. d. per 12 lb. 14 0
Irish Creamery—Fresh	per cwt. 137 6	per cwt. 129 6	per cwt. 133 6	per cwt. 129 6	per cwt. 135 0	per cwt. 127 0
" Factory ...	121 0	115 0	124 0	119 6	122 6	113 6
Danish...	—	—	141 6	137 6	141 0	135 0
French...	—	—	—	—	131 0	124 6
Russian ...	136 6	129 0	142 0	138 0	130 0	122 6
Australian ...	135 0	125 6	—	—	131 0	123 0
New Zealand ...	140 6	133 6	—	—	124 0	120 0
Argentine ...	—	—	—	—	—	—
CHEESE:—						
British—						
Cheddar ...	82 6	79 6	82 0	78 0	82 6	77 6
Cheshire ...	—	—	120 lb. 76 0	120 lb. 71 0	120 lb. 81 6	120 lb. 77 0
Canadian ...	75 6	71 6	per cwt. 74 6	per cwt. 71 0	per cwt. 73 0	per cwt. 70 6
BACON:—						
Irish (Green) ...	94 0	89 6	91 6	86 6	92 0	87 6
Canadian (Green sides)	93 6	90 0	87 6	83 6	88 0	76 6
HAMS:—						
York (Dried or Smoked) ...	126 6	120 0	—	—	128 0	120 0
Irish (Dried or Smoked)	—	—	—	—	125 0	119 6
American (Green) (long cut) ...	93 6	88 0	90 6	84 6	90 0	85 6
EGGS:—						
British...	per 120. 15 0	per 120. —	per 120. —	per 120. —	per 120. 15 10	per 120. 13 9
Irish ...	14 0	13 3	12 3	11 3	14 6	12 6
Danish...	14 2	12 10	11 4	10 0	13 9	12 7
POTATOES:—						
Early Eclipse...	per ton. 90 0	per ton. 77 6	per ton. 75 0	per ton. 66 6	per ton. 80 0	per ton. 73 6
Other First Earlies ...	81 0	72 6	71 6	63 6	72 6	65 0
British Queen	86 0	75 0	76 6	71 6	78 6	71 0
HAY:—						
Clover ...	—	—	76 0	66 0	98 6	91 0
Meadow ...	—	—	—	—	91 0	81 6

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	AUGUST.		EIGHT MONTHS ENDED AUGUST.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	38	36	518	381
Animals attacked	44	42	564	420
Foot-and-Mouth Disease:—				
Outbreaks	3	—	14	—
Animals attacked	14	—	88	—
Glanders (including Farcy):—				
Outbreaks	9	13	74	115
Animals attacked	10	17	179	291
Parasitic Mange:—				
Outbreaks	†49	119	†1,538	1,912
Animals attacked	†58	178	†2,673	3,855
Sheep-Scab:—				
Outbreaks	3	5	153	129
Swine Fever:—				
Outbreaks	304	242	2,821	1,716
Swine Slaughtered as diseased or exposed to infection ...	2,334	3,393	28,919	23,112
Tuberculosis:—				
Number of Premises notified...	†166	446	†3,944	*—
Number of bovine animals notified as for slaughter ...	†179	483	†4,207	*—

* The Tuberculosis Order came into operation on 1st May, 1913.
 † The Parasitic Mange Order, 1911, and the Tuberculosis Order, 1914, were suspended as from 6th August, 1914.

IRELAND.

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

DISEASE.	AUGUST.		EIGHT MONTHS ENDED AUGUST.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Foot-and-Mouth Disease:—				
Outbreaks	—	—	76	—
Animals attacked	—	—	955	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	8	5	62	98
Sheep-Scab:—				
Outbreaks	20	21	390	374
Swine Fever:—				
Outbreaks	20	15	158	112
Swine Slaughtered as diseased or exposed to infection ...	108	100	814	675

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THE IMPROVEMENT IN THE

STANDARD OF QUALITY OF

AGRICULTURAL SEED IN IRELAND.

THE Board of Agriculture and Fisheries are much indebted to the Department of Agriculture and Technical Instruction for Ireland for the following account of the measures adopted by that Department to improve the standard of quality of the agricultural seed used in Ireland.

I.—General Policy of the Department.

The Department's policy in this, as in other branches of its work, has been to proceed as far as practicable by educational methods and by bringing the several interests concerned to co-operate voluntarily in effecting the reform intended. The Weeds and Agricultural Seeds (Ireland) Act, 1909, confers upon the Department certain powers of sampling agricultural seeds at shops and stores, and of publishing the results of tests of these seeds with the names and addresses of the vendors. Although the Department have, so far, thought fit to exercise the power of publication in only one instance, the possession of this power and the energetic exercise of the authority to sample seeds in shops and warehouses throughout the country have been of much assistance to them in giving effect to their general policy. In pursuance of this policy the Department have, in season and out of season, used all the means at their disposal to convince the farmer, on the one hand, and the seed merchant on the other, that the trade in inferior agricultural seeds is prejudicial to their interests.

2.—*The Farmer.*

One of the first steps taken by the Department on its inception was to establish a system of agricultural instruction by means of visits to farmers by Itinerant Instructors in Agriculture. A large corps of these County Instructors, supplemented in the congested districts in the west (where most of the very inferior seed was sold) by a number of Agricultural Overseers and their assistants, is employed to advise farmers on all matters relating to practical agriculture. The Instructors having been farmers themselves, or being the sons of farmers, the advice they give carries great weight with the average farmer, and is one of the most powerful means of getting him to realise that it is false economy to buy inferior seeds, even though the price paid may, apparently, be a low one. In addition, there are the Winter Agricultural Classes, organised by the County Committees of Agriculture throughout the country, as well as the classes in the Department's Agricultural Colleges and Schools, at all of which young farmers are taught the importance of utilising good seed. Agricultural Overseers lay down plots of land with good and with bad seed, so that the differences in the crops serve as an ocular demonstration of the folly of using inferior classes of seed.

It is necessary not only that farmers should be convinced of the wisdom of securing good seed at a fair price rather than bad seed at a low price, but also that they should have the means of ascertaining the quality of the seed supplied to them by the merchant. The Department, accordingly, simultaneously with providing the system of instruction above referred to, set up a Seed Testing Station, where, for a nominal fee of 3d., a farmer can have the seed offered to him by a merchant tested for purity and germination. It is part of the duty of the Itinerant Instructor to make these facilities known to the farmer and to induce him to avail himself of them. As might be expected, statistics show that the proportion of bad seed sold is least in those counties where farmers are most alive to the advantage of consulting the Seed Testing Station.

3.—*The Merchant.*

The Weeds and Agricultural Seeds (Ireland) Act, 1909, provides, *inter alia*, as follows :—

Section 5.—(1) Any officer of the Department shall have power at all reasonable hours to enter the shop, store, or other premises of any person who sells or exposes or keeps for sale agricultural seeds for sowing, and to examine and take samples of any agricultural seeds that are upon the premises.

(2) The person on whose premises a sample of agricultural seeds is taken under this Section shall, if the officer requires, give the name and address of the person from whom he procured the seeds; and if he refuses to give such name and address, or wilfully gives a false name or address, he shall be guilty of an offence under this Act, and shall be liable on summary conviction to a penalty not exceeding ten pounds.

Section 6.—The Department may cause any sample of agricultural seeds taken under this Act to be tested for purity and germination, and may publish in such manner as they think fit the results of the tests and the names and addresses of the persons upon whose premises the samples were taken, and of the persons from whom the seeds were stated to have been procured.

The term "agricultural seeds" is defined, for the purposes of the Act, as meaning the seeds of grasses, clovers, flax, cereals, turnips, rape, mangolds, carrots, cabbage or parsnips.

The powers of sampling conferred upon the Department enable them to ascertain not only the quality but also the source of supply of the seeds sold by every retail and wholesale vendor in the country. The Itinerant Agricultural Instructors, assisted by a number of the Agricultural Overseers, and by officers specially appointed for the purpose, visit the shops and stores of seed merchants throughout the country and take samples at the proper season each year. The number of officers engaged in taking samples in 1913 was 69, and as many as 6,246 samples were taken by them at the shops and stores of seed merchants in that year. These samples represent the stocks of 1,535 vendors of agricultural seeds, but the stocks of a much larger number were inspected, there being no necessity in many cases to take samples. The information thus obtained showed that the great bulk of the seed which reaches the retailer is procured directly or indirectly from about 16 wholesale firms. With a few exceptions, these are Irish firms, the majority of them being "Seed Cleaners," *i.e.*, firms who buy the seed crop directly or indirectly from the grower and prepare it for the market by means of machinery specially adapted for the purpose. Examination of the samples taken under the Act disclosed the fact that a proportion of the trade in grass seeds of most of these firms consisted in the sale for use as agricultural seeds of very inferior stuff, *e.g.*, "Cleanings" or "Blowings," sold as Perennial and Italian Ryegrasses of low bushel weights, or under such designations as brown and white hayseed, and *Holcus*.

Further, it was found that a considerable proportion of the unsatisfactory seed sold in Ireland (though by no means the whole) consisted of practically worthless rubbish of this kind. It appeared to the Department that the quickest and most

effective way of dealing with such a state of affairs was to stop the supply, if possible, at its source. Accordingly, they decided to approach the firms concerned and to place the position before them. This was done, in the first instance, by a series of interviews at the Department's offices with representatives of each of the firms. They were shown samples of inferior seeds which were stated by the retailers to have been procured from their respective firms, and for the most part they admitted that the materials in question could not be regarded as satisfactory for use as agricultural seeds. At the same time, they pointed out the demand which existed for this class of stuff, and explained that so long as other firms continued to supply it they could not discontinue doing so without losing not only this trade but also some of their trade in good seeds, since supplies of both classes were usually purchased by a customer, who, if he were unable to obtain his full requirements from one firm, would transfer his whole order to another.

Conferences of the trade were subsequently arranged through the medium of the Department, and finally the firms concerned formally agreed to discontinue entirely the sale, for use as agricultural seed in Ireland, of Perennial Ryegrass below 20 lb. weight per bushel and Italian Ryegrass below 16 lb. bushel weight, as well as all such materials as white and brown hayseed, "cleanings," "blowings," and *Holcus*. The importance of this agreement will be obvious; and it may be stated that, although it has been in operation only for a short period, there is already observable a very considerable improvement in the grass seeds handled by retailers throughout the country. The fact that this agreement was arrived at voluntarily is very creditable to the seed trade in Ireland, and is regarded by the Department as an indication of the willingness of the trade to co-operate with them in the future for the further improvement of the standard of the agricultural seeds sold in Ireland.

The Department have not confined their attention to the wholesale firms. They have also sought to effect improvement through the retailer. For instance, they have provided special local classes for traders at which instruction is given in regard to the characteristics of good seeds, the methods of identifying the more important classes of seeds and their principal impurities, seed testing, and the facilities afforded by the Department in this connection, as well as the provisions of the Weeds and Agricultural Seeds (Ireland) Act. The visits of the Itinerant Instructors in Agriculture to shops for the examination

of the seeds sold are also a most successful means of impressing upon traders the importance of stocking only seeds of the best quality, and in one district the retailers themselves have voluntarily agreed not to supply in future the inferior classes of seed which hitherto had a ready sale among some of their customers.

The Department, except in one instance, have not so far exercised the powers of publication conferred upon them by the Weeds and Agricultural Seeds (Ireland) Act. In accordance with their general policy, they have preferred, in the first instance, to endeavour to bring the trade with them in raising the standard of the agricultural seeds sold in Ireland. This policy, so far, has been fully justified by its success, as shown by the very striking result referred to in the preceding paragraphs. No doubt the power of "black-listing," as it has been termed, is salutary as a weapon, *in terrorem*, and one that may be resorted to if, and when, other methods fail.

4.—*The Seed Grower.*

Another means by which the Department seek to improve the quality of the seed consists in carrying out plant-breeding on scientific lines.

A division of the Department's Agricultural Branch is specially devoted to this work. Ground and necessary equipment, in the way of threshing and cleaning machinery, have been provided for the purpose.

The first step in the improvement of crops in general cultivation is to ascertain the variety or varieties of each species of plant best suited to the country. Attention was primarily given to cereals, and since 1901 extensive variety experiments have been conducted with barley, wheat and oats. As a result of these tests, the number of desirable varieties has been narrowed down to one or two for each cereal.

The next line of improvement was the introduction of pedigree seed, as opposed to the ordinary commercial seed in use. Further tests designed to illustrate the greater value of pure or pedigree seed in yielding capacity and quality, as compared with such seed as was at the time generally used, were successful in bringing this aspect of the seed question to the farmer's attention. Having created a demand for such seed, the Department sought to supply it by propagating the best varieties from single ears, and, when sufficient seed was obtained to sow large plots in the country, the produce was placed in the hands of persons interested in the distribution

of good seed in their respective districts; by them it was further propagated, until now there are many thousand acres sown with the strains of the three cereals originally raised by the Department.

The plant breeding division has further concerned itself with raising seed of still better strains than those the Department have already circulated, and these will, in time, find their way into the growers' hands in the same manner as detailed above. It is hoped that the hybridising experiments carried out during the past five years will produce still better varieties in the near future.

Attention is also being directed to the improvement of flax and clover seed.

The policy of the Department in this branch has been to demonstrate by actual experiments the advantages the farmer gains by the use of *pure pedigree* seed. The general improvement, especially in Irish barley, is largely due to this work, and there has been little difficulty in gaining the farmer's attention and co-operation when once the results of the various pure seed experiments were brought home to him; and while the Department have taken upon themselves the duty of providing the initial stocks of pure seed, they have entrusted the further propagation and distribution of them to maltsters, millers, and others with whom they have been able to co-operate for this purpose in an entirely satisfactory manner.

The Department also encourage improvement in the condition in which ryegrass seed is marketed by the growers by offering prizes for competition at the principal seed markets.

5.—*The Department's Seed Testing Station.*

Recognising how important it is that the farmer should be able to get seed of the best quality, and should know what he is getting, the Department, as previously stated, established a Seed Testing Station very soon after they came into existence in 1900. This station was the first and for many years the only official one in the United Kingdom.

During the fourteen years that the Irish Seed Testing Station has been in existence, considerably over 19,000 samples of agricultural seeds have been tested, the average number tested during the past four years being over 2,000 per annum.

The station was started primarily for the use of farmers in Ireland, and the fee for testing a sample for germination and for purity is the merely nominal one of 3d. Suitable bags are supplied free of charge on application (but their use



Large Laboratory, Seed Testing Station of the Department of Agriculture and Technical Instruction for Ireland.

is not compulsory), and no postage has to be paid. Seed vendors, however, are also able to make use of the station, the fee charged being the low one of 2s. per sample; and many of them have made good use of the facilities offered. Full details of the regulations governing the use of the Department's Seed Testing Station are given in Leaflet No. 59, which can be had free of charge and post free on application to the Secretary of the Department.

The work of the station at present may be divided into three main divisions:—

- (1.) Testing samples of seeds for farmers and Irish seed merchants.
- (2.) Examining and testing samples of seeds taken under Part II. of the Weeds and Agricultural Seeds (Ireland) Act, 1909.
- (3.) General advisory work, involving seed-testing.

The following table shows the number of samples submitted and tested each year since 1910:—

Year.	Number of samples submitted to Seed Testing Station.		Number of samples tested.	
	Act Samples.	Samples submitted by farmers, merchants, and officers of the Department.	Act Samples.	Other Samples.
1910 ...	800	1,453	498	1,453
1911 ...	1,700	1,407	682	1,407
1912 ...	2,342	1,320	788	1,320
1913 ...	6,246	1,709	862	1,709

As the object of Part II. of the Weeds and Agricultural Seeds Act is to deal with the sale of unsatisfactory seeds, only those "Act samples" are tested, for the most part, which are considered as being probably unsatisfactory. The results of the tests of Act samples are intended for the information and use of the Department alone. They are not necessarily communicated to the merchants and shop-keepers from whose stocks the samples have been taken. Occasionally, however, this has been done, and in some cases the gratifying result has been that the seedsman, on learning of the poor quality of the seeds he was selling, has taken steps to secure a better class of material for the following season.

The station is at present located in the new buildings of the Royal College of Science in Upper Merrion Street, Dublin,

adjoining the Department's offices, and occupies one large laboratory, shown in the accompanying illustration, together with two smaller ones, and, in addition, has greenhouse accommodation on the spacious flat roof of the College.

The staff of the station consists of the head of the Department's "Seeds and Plant Disease Division," who acts as director, one principal assistant, three seed analysts, three seed enumerators, one attendant, and one cleaner. The station is fully equipped with all the necessary requisites for the testing of agricultural seeds and, in addition to the usual germination incubators heated by gas, has an experimental incubating chamber heated and automatically controlled, on the Grundy system, by electricity.

The records of the work done at the station are summarised in the Department's Annual General Reports, and the work done in connection with the Weeds and Seeds Act has been dealt with more fully in the "Reports of the Proceedings under the Fertilisers and Feeding Stuffs Act, 1906, and under Part II. of the Weeds and Agricultural Seeds (Ireland) Act, 1909," published in 1912 and 1913.

At a seed testing station, as is well known, the seeds are primarily subjected to tests for (a) purity, and (b) germination. The purity test is determined by weight, all the seeds not of the kind named in the designation of the sample, such as weed seeds, etc., being removed from a weighed portion of it, together with other impurities, such as sand, dirt, or debris of any kind. By weighing these impurities and making a simple calculation the percentage of purity can easily be ascertained. The percentage of germination is determined by placing a given number of the seeds from which the impurities have been removed (at the Irish station this number is not less than 500, and in certain cases is 900) under optimum conditions for growth, and counting how many of them sprout or germinate in a given period of time.

Seed testing stations have been established on the Continent of Europe for many decades, and some of them—notably the Swiss one near Zürich—make a point of testing samples for clients of all nationalities. (See Supplement to this *Journal*, August, 1914. "Seed Control Stations on the Continent." Price 4d., post free.)

Although in the main the principles adopted at the best of these Continental Stations are the same as those in vogue at the Irish Station, yet there are two important respects in which those of the latter station do not coincide with Continental practice.

The first of these is in connection with the tests made of the larger and commoner grass seeds. At most Continental stations, in testing such seeds for purity, not only are the real impurities, such as weed seeds, dirt, &c., removed and weighed as such, but so are also all the grass seeds which do not, or appear not to, contain a kernel or caryopsis. Since the germination test is carried out on the pure seed after the impurities have been removed, it follows that by the Continental method the germination test is made on *selected* seeds, and that therefore (particularly in relatively inferior samples) the percentage of germination will be higher than if the sample were tested by the Irish method. By the Irish method the germination test is carried out on the grass seed just as it is sold to the farmer after only the real impurities have been removed, and the result gives a fairer indication of the quality of the seed in the matter of germination. Of course, as regards purity, the Continental method gives lower percentages than the Irish does.*

The second point of divergence is in the matter of controls.

At the Irish Station there is tested side by side with every sample under examination a portion of a sample known as a "control," the germination of which is already known from previous repeated testings. If the control does not come up to its reputation when germinated alongside of the given sample, the test is discarded and a fresh one instituted. The "control" sample, therefore, affords tangible and convincing proof of the perfection or otherwise of the conditions under which the germination test is being made. Owing to the fact that the best conditions for the successful germination of the commoner kinds of agricultural seeds are now so thoroughly well known from years of experimental work, it is found in practice that the failure of the control is of the utmost rarity; nevertheless its employment is a valuable safeguard against unforeseen and exceptional contingencies.

In addition to the purely routine work of seed testing, other work is done at the station in connection with seeds as far as time and opportunity permit. Thus, for example, during the present year a good deal of work has been done in connection with the Celery Leaf Spot disease. It has been proved definitely that this disease may be transmitted by

* It is not possible in this article to summarise the arguments in favour of the Irish method, but those interested are referred to the following paper where they are given—Pethybridge, G. H., "The Methods Employed in Testing Grass Seeds," *Journal of Economic Biology*, Vol. VII., Part 2, June, 1912.

sowing affected seeds, and methods of seed treatment have been worked out which enable such affected seed to be rendered free from the parasite, and when sown to produce a disease-free crop.

From what has been said, it will be seen that in Ireland the importance of having agricultural seed of the best quality is fully recognised, and that by means of educational and other measures considerable improvement has taken place already in the trade in the agricultural seeds used, an improvement which is likely to extend in the near future, and to produce far-reaching and beneficial results.

THE AMERICAN ENQUIRY INTO AGRICULTURAL CO-OPERATION IN EUROPE.

I. MORTGAGE-CREDIT.

The two Commissions.

SOME two years ago the Southern Commercial Congress of the United States undertook to assemble delegates from various States in the Union for the purpose of making a tour of Europe to study on the spot the results of co-operation in agriculture. These delegates, with the addition of representatives of some Canadian Provinces, numbered about 70, and formed "The American Commission on Agricultural Credit and Co-operation," which made enquiries during the summer of last year in most European countries, including Great Britain and Ireland. They were accompanied by a "United States Commission," officially appointed by Congress to make a similar study of co-operative institutions. This latter Commission has reported its findings and recommendations to the Congress of the United States, while the American Commission has issued a separate report addressed to the American people.

Report of the Official Commission.

The official Commission, which consisted of seven members, and included two Senators and one Member of the House of Representatives, confined its attention chiefly to the question of agricultural credit. The object of its enquiry was to ascertain how far the lessons to be learned from the working of co-operation in Europe could be applied to American conditions.

The Commission divided its subject under two heads. The first was "long-term" or "land-mortgage" credit organised with the view of meeting the capital requirements of farmers, such as the comparatively large sums of money used in aiding to pay the purchase price of the farm, in improving the farm by erecting new farm-buildings, draining, irrigating or clearing, or in equipping the farm so as to bring the farmer's operations to the highest state of efficiency. The money needed for these purposes must (the Commissioners say) be in the shape of a more or less permanent investment, or in the shape of a loan extending over such a long period of time that it can be gradually reduced and paid off out of the increased earnings derived from the improvements made or the equipment added by the farmer-owner from the proceeds of the loan.

The second head of credit is "short-term" or "personal" credit, designed to meet the temporary or annually recurring requirements of the farmer (whether owner or tenant), by which is meant the money needed by him to finance his operations during the time the crops are being produced, such as preparing the land, or sowing, cultivating, and harvesting the crops. A contrast is made between the short-term credit of the farmer, which may be required from the time the crops are planted until they are harvested, say from 90 days to one year, and the similar credit required by the merchant or manufacturer, who can usually dispose of the stock acquired and repay the loan after 30, 60, or 90 days.

The Commissioners made a special study of the remarkable results obtained in Germany, doubtless to a large extent owing to the growth of agricultural credit. They were, however, careful to keep in mind the essential points of difference between the conditions in Germany and in the United States: such as the much greater extent to which intensive farming is practised in Germany; the homogeneous and settled character of the population; the comparative ease with which the value of land can be ascertained; the smallness of the farms in Germany, where the average farm is about 20 acres, as compared with 138 acres in the United States; the general knowledge a German community possesses of the credit and resources of each of the individuals comprising it; and the comparative readiness with which the people in Germany accept supervision and control of their individual operations. The two countries are, however, similar in this important respect, that, both in Germany and in the United States, the land is mostly owned by the farmers themselves.

Land-mortgage Credit.

After discussing the characteristics of the land-mortgage institutions found to exist in the different countries of Europe, and their application to American conditions, the Commissioners record their conclusions in the matter. They point out the great necessity, in the general interests of the population of the United States, of aiding the farmer-owners to obtain sufficient free capital to enable them to maintain or restore the fertility of the soil and increase its out-turn, whether in grain or in meat; and they declare that agriculture has been the one great national industry which has been without organisation, and has therefore been absolutely helpless in view of the wonderful growth of the country, so that the financing of the farms has become a national problem. The savings of the people must, they say, flow out to the farms in order to put agriculture on a proper basis as compared with other organised industries, and this can only be secured by wise and patriotic legislation. They, therefore, hold that there should be no hesitation in enacting laws which will give land-mortgage bonds that favourable position which is always accorded to State and Federal bonds, seeing that both are based on the public wealth, and are issued to strengthen and to protect the nation. They anticipate that, should their proposals be carried out, the American farmers, who are parting with their proprietary rights and sinking into the position of tenants, will be enabled to remain owners of the land they cultivate, and, by the regular payment of small annual instalments, to reduce on favourable terms their outstanding obligations (estimated to exceed £400,000,000, secured by mortgages on their farms), many of which were negotiated under very unfavourable circumstances, and at very high rates of interest. The Commission accordingly submits for the consideration of Congress a Bill to provide for the establishment of a National Farm-Land Bank system in the United States of America, as an outline of the legislation required to provide adequate facilities towards meeting the needs of the farmers for long-term or land-mortgage credit.

Proposed Legislation.

In drawing up this Bill, they were confronted by a difficulty often met with in America, where Federal legislation has to take account of the limitations imposed by the written constitution on the legislative powers of Congress. The Commissioners recognise that mortgage-credit deals of necessity

with land, that there are 48 States in the Union in which the laws governing conveyancing, registration, foreclosure, exemption, taxation, and other subjects relating particularly to land are under State control, and differ in various particulars, so that the problem must of necessity be largely modified by State laws and State requirements. They also recognise that conditions in the various States are different, that the rates of interest paid for money vary in different localities between wide extremes, so that in one State the legal rate may be 6 per cent., while in another State it may be as high as 10 per cent. For these and other reasons they propose that any Bank formed under the Bill should be required to confine its operations to one particular State. They recommend, however, that Federal control should be exercised over all such Banks mainly in the way of supervision and the enforcement of regulations, so as to prevent the misuse of powers granted.

The form of Bank recommended by the Commissioners is what they call a "National Farm-Land Bank," which may either be a profit-making institution somewhat similar to the ordinary Joint Stock Bank, or a co-operative Bank in which the owning of shares by an individual stock-holder is limited to 10 per cent. of the share-capital, each member has a single vote whatever be the number of shares he owns, and the distribution of profits is made on the co-operative principle, each stock-holder to receive a return on his investment equal to the general prevailing rate of interest in the particular community, while the remainder of the net earnings is distributed among the borrowers in proportion to their borrowings. A National Farm-Land Bank will make loans only to farmer-owners and only on agricultural land, the amount of the loan being limited to 50 per cent. of the value of improved farm lands or 40 per cent. of unimproved lands, the value to be determined by an appraisal. No loan can be made for more than 35 years, and all loans must be secured by first mortgages and taken only for the purpose of completing the purchase of the lands mortgaged, improving and equipping such lands for agricultural purposes, or discharging debts secured by previous mortgages on those lands. Loans made for more than five years must contain a provision for the gradual reduction of the loan by annual or semi-annual payments on account of principal. An important provision is that every such loan may be paid off in whole or in part by the borrower at any interest-period, after the loan has

continued for five years. The instalments for repayment of the principal are to be regulated by amortisation tables approved by the Government, and each amortisation payment is to be recorded on the mortgage-deed.

The Bank is empowered to issue National Land Bank Bonds, secured by the deposit of these first mortgages to an amount equal at least to the face-value of the bonds so issued and sold by the Bank. All such bonds shall be payable on a date specified and redeemable at par at any interest-period after the date of issue, due notice being given. As the amortisation payments are credited upon the mortgage-deeds deposited as security, the bonds issued by the Bank must be called in and paid, or purchased in the open market and cancelled, to the extent of the amounts thus credited, so that the total face-value of the bonds outstanding will always be approximately equal to the value of the loans still secured by the first mortgages held by the Bank. The Bill further provides that the amount of the bonds outstanding must never exceed fifteen times the capital and accumulated surplus of the Bank.

As regards the rate of interest to be paid by the farmer-owner to the Bank for his loan, it is provided that it shall not exceed the rate of interest paid on the bonds issued by the Bank by more than 1 per cent. per annum upon the amount unpaid on the loan, this 1 per cent. to cover all charges of administration.

The National Land Bank bonds issued by the Bank will be for sale in the open market, and as they will be fully secured by the first mortgages of farm-land held by the Bank, it is expected that they will be considered a safe form of investment, and will command a full and steady price. The Commissioners point out that the ultimate security for these land-mortgage bonds will be the contract-payments to be made by the borrower to the Bank, and the sale of the land in case of default of such payment. They state that in European countries such default is of rare occurrence, and the sale of mortgaged property very exceptional, but that the existence of a legal process for prompt relief, in case such a default should occur, is imperative for the protection of the Bank, which has guaranteed these payments to the holders of the bonds. They therefore provide that the privileges to be given to National Farm-Land Banks under the provisions of their Bill shall be extended only to Banks operating in those States which, by the passage of suitable laws, have met the requirements of the Federal Commissioner of Farm

Land Banks as to the simplification of land-title, registration, and conveyancing, and, secondly, as to the simplification, promptness and economy of methods of securing farm-land loans and of foreclosing mortgages in case of default.

Privileges of Land Banks.

The Commissioners propose that certain privileges should be conferred upon these National Land Banks by providing that their bonds should be made a legal investment for all classes of savings and for insurance reserves, so as to make the savings deposits, which are accumulated to a large extent in urban centres, available for the development of rural communities; and that their bonds should be made a legal investment for Trust Funds and estates under the charge of the Courts, and a legal security for loans from National Banking Associations either to Farm-Land Banks or to individuals. They point out that if laws simplifying the registration of titles, conveyancing of lands and foreclosure of mortgages can be brought about in the various States, and if the National Land Bank bonds are made an authorised investment for the funds accumulated in State and other Savings Banks and in the reserves of Insurance Companies, these bonds will become a recognised security of the highest class, and the farmer-owner will have obtained access to the greatest accumulations of capital in the country, just as the big Joint-Stock Company, or large merchant, now has access to these or similar funds.

State Assistance and Control.

After discussing the question of whether financial aid should be given by Government to these National Land Banks, the Commissioners are convinced that not only is it unnecessary, but that it would be unwise. They point out that the security of the farms of the country, the value of which is reported to be over £8,000,000,000, yielding an annual product of a gross value approaching £2,000,000,000, is ample for the creation of a liquid security, which will be readily accepted by investors, and which will enable the farmer-owner to use his asset of land as readily as the merchant uses his stock of goods. They say that the farmer-owner needs no special privilege and wants no special privilege, and none should be extended to him. They argue, however, that a tax on a mortgage-credit by the farmer-owner upon his land, or a tax upon the Land Bank bond issued by the Bank on the security of such mortgage, must ultimately be paid by the

farmer himself in the shape of increased interest charges, and so would practically be an additional tax upon the land itself. They therefore provide in their Bill for the exemption from taxation not only of the Capital Stock of the Banks, but also of all the mortgages held by the Banks, and of all the Land Bank bonds issued by the Banks against such mortgages. Otherwise the connection of the State with these Institutions will only be one of supervision, to be exercised by the Federal Commissioner of Farm-Land Banks and by a Federal Fiduciary Agent to be appointed by him to each Bank, who will certify each National Land Bank bond issued by the Bank, have joint possession with the Bank of the mortgage-deeds deposited as security for the bonds, and control all entries in the mortgage-ledger kept by the Bank.

Application to Conditions in England.

The scope and character of this branch of the Commissioners' recommendations may be better understood if we suppose it applied to England, remembering that it deals only with the provision of long-term credit based upon mortgages of agricultural land, and, therefore, so far as it goes, would assist only landowners and those who wish to become owners of agricultural land. If their proposals were adopted here, there would be established one or more English Agricultural Land Banks with power to issue bonds saleable in the open market. Such a Bank would be prepared to grant a loan on a first mortgage to the owner of any agricultural land up to 50 per cent. of the value of his property, and could not charge him a rate of interest higher than 1 per cent. above the rate obtainable on its own bonds at their current market price. Each such loan made by the Bank to the landowner would have a condition attached to it that the capital of the loan should be repaid by yearly or half-yearly instalments, so that after a certain number of years, not exceeding 35, the whole of the loan would have been repaid with interest, and the land would thereupon be free from mortgage. The security for the bonds issued by the Bank would be, first, the Bank's own capital, and second, the periodical repayments made to the Bank by the borrowing landowners, secured by these first mortgages on their land. Legislation would be necessary, making these bonds a legal form of investment for Savings Banks, Insurance Companies, Trustees, and Societies of all kinds. According to the Commission's anticipations, such bonds, being secured by the first mortgages, which on the whole would always be equal in

amount to the total face-value of the bonds outstanding, would be recognised as a thoroughly sound security and would command a good and steady price in the market. The Bank would lend money only to owners of land and only for the purpose of completing the purchase of the land, improving and equipping it for agricultural purposes, or discharging a previous mortgage. The advantage to the landowner would be that he would, in return for a mortgage of his land, obtain a loan from the Bank at a comparatively low rate of interest, under an arrangement which would enable him to pay off the principal of the debt by small instalments; and so long as he did not make default in the repayment of an instalment, the Bank would have no power to call up the balance of the capital or to foreclose the mortgage. On the other hand, the landowner would be at liberty at any time that suited him, after the first five years, to pay off the balance of the loan and free his land from mortgage. As each instalment of the repayment of the principal was paid, the amount of the debt outstanding would be gradually reduced and the net transferable value of the landowner's interest in the land would steadily increase.

If it be supposed that the bonds were issued as carrying 4 per cent. interest, and were selling at par, and that the Bank charged the maximum additional rate of 1 per cent. allowed to it by the proposed law, so that the rate of interest it charged to the borrower would be 5 per cent., a total annual payment by the landowner to the Bank of £6 10s. 1½d. for every £100 originally borrowed would suffice to pay off the loan, capital and interest, in 30 years. If the Bank's 4 per cent. bonds sold in the market above par, or if the Bank were content to charge less than the full 1 per cent. allowed it for administration expenses and profit, the landowner would obtain the benefit of these changes by a reduction either in the amount of his annual instalment or in the number of instalments he would require to pay to extinguish the debt. According to experience on the Continent of Europe, when such a Bank is run co-operatively, so that administration expenses are kept down and the landowners themselves, who are the borrowers, get the benefit of any profits that may be made, a much smaller charge than 1 per cent. is sufficient for expenses and profits, and in such a case the amount of the annual instalment or the number of years for which it has to be paid is correspondingly reduced. For instance, if the Bank succeeded in selling 3½ per cent. bonds at par, and in reducing

its charge for administration expenses and profits to $\frac{3}{4}$ per cent., making the interest rate it charged to the borrower $4\frac{1}{2}$ per cent. instead of 5, then the borrower, by making to the Bank an annual payment of £6 2s. 9½d., could clear off a loan of £100, principal and interest, in thirty years, or if he chose to pay annual instalments of £6 10s., his land would be free of debt and mortgage in 27 years.

On the other hand, as the Commissioners point out, in order to obtain the best results from such a Land Bank, it is necessary to have a system providing that the registration of title, the transfer of land and the foreclosure of mortgages shall be carried out as simply, as cheaply, and as promptly as possible. Such a system does not exist in England generally, although it is to be found not only in several Continental countries but in some of the Colonies and of the Indian Provinces, and according to the Commission's proposals it would be necessary to provide by legislation for its introduction before establishing the sort of Land Bank which they contemplate. This would be a very difficult matter and would take many years to accomplish; but after all it is only a question of degree. It is at present possible in England, as a rule, although no doubt at the cost of some delay and expense, to make certain for all practical purposes of the title of agricultural land proposed to be mortgaged; and also possible, in the improbable event of its becoming necessary to foreclose such a mortgage, to enforce the foreclosure with certainty, although it may be at some considerable expense. It is, therefore, quite possible to start a Land Bank on the basis proposed by the Commission, without waiting for any reform in the system of recording titles in land or in the procedure for foreclosure; but in such a case there would be less probability of the Bank's finding the 1 per cent. proposed by the Commission more than necessary to provide for administration expenses and profit, so that the landowner's prospect of getting his instalments reduced by a saving under this head would be lessened. Indeed, unless the whole of the legal expenses involved in proving a good title were thrown on the land-owner borrower, the Bank might have to be allowed to charge more than 1 per cent. for expenses and profit.

If the Commission's proposals were adopted in this country, no financial assistance or guarantee would probably be given by the Government, but a Government official might be attached to each Land Bank, who would watch over the mortgages, see that the regulations were duly carried out, both in the interests of the bond-holders and of the borrowers,

and certify every bond as being covered by first mortgages not exceeding in any case 50 per cent. of the ascertained value of the land mortgaged.

To judge from Continental experience, the existence in this country of Banks of this kind would be likely to enable land-owners, and especially those who own comparatively small areas of land, to obtain money on mortgage at a lower rate of interest than they at present pay, and would further benefit them by freeing them from the risk of being suddenly called upon to repay in a lump sum at short notice the outstanding amount of the mortgage debt; but whether the establishment of such Banks here is either desirable or feasible could only be decided after a thorough enquiry into the existing system of mortgaging agricultural land and a careful consideration of all the many important interests involved.

THE UTILISATION OF CEREAL OFFALS AND CERTAIN OTHER PRODUCTS FOR FEEDING PURPOSES.

THE Board desire to draw the special attention of farmers to a number of useful feeding stuffs, some of which have hitherto been largely exported, but which will in all probability now be obtainable in this country at relatively low prices.

The feeding stuffs dealt with in this article are:—

- ✓1. Wheat Bran.
2. Sharps and Middlings.
3. Dried Grains.
4. Dried Yeast.
5. Gluten Meal and Gluten Feed.
6. Soya Bean Cake and Meal.
7. Coco-nut Cake.
8. Palm-nut Cake.
9. Fish Meal.

1. *Wheat Bran*.—Bran is one of the principal "offals" obtained in the milling of wheat. Two forms of bran are sold—the "broad" and the "medium." The former consists mainly of the larger flaky particles of the outer coats of the wheat grain, and specially finds favour for feeding horses; the latter, which consists of the finer particles of the same material, constitutes the bulk of the bran made in this country, and is used mainly for dairy cattle. In composition bran

closely resembles the other wheat offals, viz., sharps and middlings, and is not unlike oats. The manurial value of bran, however, is higher than that of oats; according to Hall and Voelcker, the respective values per ton of bran and oats when made into dung are 31s. 3d. and 17s. 11d.

While it is well known that two foods may have very much the same chemical composition and yet differ materially in nutritive value, there is no reason to suppose that foods of such similar character as the principal wheat offals might not be more generally substituted for one another for feeding purposes, should their relative prices become widely different.

Bran is particularly rich in mineral ingredients (lime and phosphates), and it is therefore specially well suited for young growing animals and for brood animals of all kinds both before and after parturition. It is a very palatable food, and this fact, coupled with its well-known laxative influence, peculiarly fits it for feeding in association with such concentrated foods as cotton cakes, bean meal and maize, or with coarse fodders, such as wheat or barley straw, when the supply of roots is restricted. In experiments conducted by the Edinburgh and East of Scotland College of Agriculture in 1910-11 and 1911-12, with two-year-old fattening bullocks, bran proved equal to linseed cake in respect of the quantity and quality of the beef produced, and was slightly the more profitable feeding stuff.* In America bran has been extensively used as a partial substitute for oats in feeding heavy horses, and has resulted in a very considerable saving in the cost of maintenance. It was found that these two foods might suitably be mixed in equal proportion for horses.

2. *Sharps and Middlings*†.—Sharps is a wheat offal of a grade intermediate between bran and middlings, and it consists, mainly, of fine particles of bran with a certain amount of adherent meal. Middlings represents the innermost layers removed from the wheat grain when making flour, and this offal closely approaches flour in its general character. Sharps contains as a rule slightly more fibre than middlings, but in all other respects the two are very much alike in composition and may conveniently be considered together. In general character and feeding properties they closely resemble bran,

* See Mixture No. 3, p. 609. The experiment is summarised on p. 643.

† There is considerable divergence in the grading of milling offals in different parts of the country, but for general purposes they may be grouped into the three classes of bran, sharps (or shorts) and middlings, the last named being the most like flour in character, whilst sharps (or pollards) is intermediate between this and bran.

being rather more nutritious than bran, but lacking in some of the special qualities possessed by that feeding stuff. Sharps and middlings are mainly used in the feeding of pigs and poultry.

Probably these offals constitute the safest "dry" food for pigs for a few weeks both before and after weaning, and also for sows suckling their young. For young pigs they are best fed along with skim milk, buttermilk or whey. After weaning, an excellent ration consists of the by-products of the dairy with a mixture of bran or sharps and barley meal. When no dairy by-products are available, a mixture of brewers' grains (fresh), barley meal and bran or sharps may safely be used.

3. *Dried Grains*.—Dried grains constitute a by-product of the brewing and distilling industries, and represent the dried residues of the grains (chiefly barley) which have been converted into malt and subjected to thorough extraction with water. They contain all the husk of the barley, a considerable proportion of which, however, is digestible, and also the bulk of the albuminoids or flesh-forming substances present in the original grain; the greater part of the starch has been removed.

As a feeding stuff dried grains are intermediate between undecorticated cotton cake and sharps; in round figures the relative feeding values of the three may be placed at 4:5:6. There is a good deal of difference of opinion as to the relative feeding value of distillers' grains and brewers' grains. The former are generally the more expensive to buy, but if the foods are judged by their chemical composition there can be very little difference between the two. It must be remembered, however, that while chemical analysis is useful as a guide, it does not afford complete information as to the relative feeding value of different commodities.

Dried grains are much liked by stock and are generally recognised as an excellent feeding stuff for fattening cattle, milking cows, and especially sheep. As a food for horses they are perhaps less widely known; theoretically 5 lb. of oats should equal 6-7 lb. of dried grains, but numerous experiments both in America and on the Continent have shown that, pound for pound and in moderate quantities, they may be equal to oats for feeding horses at ordinary work. At present they are very much cheaper. The manurial value of dried grains consumed at the homestead is, according to Hall and Voelcker, 29s. per ton.

4. *Brewers' Dried Yeast*.—This by-product of brewing is widely utilised on the Continent as a feeding stuff for cattle and pigs. It contains approximately 50 per cent. of albu-

minoids, 5 per cent. of oil and 35 per cent. of carbo-hydrates. The percentage of ash (mainly phosphates) is high. This feeding stuff does not appear to have been used in England, but its composition, and the fact that it is very palatable and has given excellent results with all classes of live stock on the Continent, shows that it is clearly worth the attention of farmers in this country.

5. *Gluten Meal and Gluten Feed*.—These feeding stuffs are residues from the manufacture of starch from maize and one or two other cereals. The former consists mainly of the gluten layer, and is therefore rich in albuminoids. Gluten feed, on the other hand, is the result of a less complete separation of the gluten layer, and contains more fibre and less albuminoids than the meal. Both "meal" and "feed" are fairly rich in oil, but are relatively poor in mineral matter.

Gluten meal is largely used in this country as a nitrogenous ingredient in compound feeding cakes, and is to some extent fed alone to dairy cows. Both of the by-products are extensively used in America and on the Continent for feeding to fattening stock and to dairy cows, the best results being obtained when they are given in conjunction with other concentrated foods. In mixtures they are also suitable for feeding to sheep, pigs and poultry. Gluten meal and gluten feed may be used in part to replace beans and peas, which they resemble in composition.

6. *Soya Bean Cake and Meal*.—Soya bean cake is made from the bean of a leguminous plant (*Soya hispida*). This bean has long been extensively grown in the East, where it forms an important article of human food, but only since 1908 has it been imported in quantity into this country. It differs from the common field bean in being rich in oil. To a small extent the soya bean itself is used as a cattle food, but, as a rule, the greater part of the oil is first removed by seed crushers, the residual cake or meal being used for feeding purposes. In the ordinary course the oil is removed by heat and pressure, the residue being in the form of a cake which still contains a considerable percentage of oil. A soya bean meal, however, is also sold, and from this nearly the whole of the oil has been extracted by means of a chemical solvent.

Soya bean cake usually contains 40–45 per cent. of albuminoids and 6–8 per cent. of oil. It therefore approaches decorticated cotton cake in composition and should be fed in the same way in moderate quantities along with starchy foods, such as the ordinary cereals and their offals, and with

roots, hay and straw. "Extracted" meal is much poorer in oil than the cake, containing only about 2 per cent., but it is correspondingly richer in albuminoids. It should be fed in moderate quantities along with other less concentrated foods. Soya bean cake and meal have a high manurial value, similar to that of decorticated cotton cake, and considerably higher than that of linseed cake.

7. *Coco-nut Cake*.—Coco-nut cake is made from the fleshy portion of the coco-nut after the oil has been extracted. It is not largely used for feeding in this country but is in considerable request on the Continent.

An average sample of coco-nut cake may contain 22 per cent. of albuminoids and 10 per cent. of oil; it is thus not so rich in flesh-forming substances as linseed cake, but in other respects is not dissimilar to that feeding stuff. On the Continent coco-nut cake is favoured as a food for dairy stock. It is fed in quantities of from 3 to 4 lb. a day, and is said to be eaten readily. Reliable data as to its uses for stock feeding in this country are lacking. Theoretically it should be about equal to linseed cake, and farmers would be well advised to give it a trial if it can be purchased, as it is not unlikely that it may be, at three-fourths of the price of linseed cake.

8. *Palm-nut Cake*.—Palm-nut cake is made by pressing the kernels of the nuts of the oil palm, a species of palm that is grown extensively in the West African Colonies and Protectorates. Almost the whole export of this product has hitherto gone to Germany, where large factories have been erected for crushing the kernels and preparing the products for market. It is hoped that it may now be possible to arrange for the crushing of palm-nut kernels in this country. The kernel contains about 50 per cent. of oil, and after crushing is sold in the form of either cake or meal containing about 10 per cent. of oil and 16 per cent. of albuminoids. The meal is sometimes further treated with chemical solvents and its content of oil may then be reduced to as little as 1.5 per cent.

Palm-nut oil, which is largely used for human food, is very suitable for certain classes of stock, and while there is not sufficient information available to enable a definite comparison to be made between palm-nut and linseed oils, the experience of foreign stock-feeders would appear to indicate that palm-nut cake would make a very good substitute for linseed cake in feeding dairy cattle. Cows may receive up to 5 lb. per head per day.

Palm-nut cake does not keep so well as linseed or cotton cakes, and users should not lay in large stocks.

9. *Fish Meal*.—Fish meal is produced from fish offal, and from whole fish which is unsaleable owing to an excessive supply. Provided it has been carefully prepared, fish meal forms a suitable supplementary feeding stuff for farm animals, and may, with advantage, be used for cattle, pigs and poultry. As most of the fish meal manufactured in England has hitherto been taken by the Continent, it is likely that in the coming winter it will be available in some quantity, and that farmers may find it a cheap feeding stuff. The richness of fish meal in readily digestible protein (50 per cent. or more) renders it specially suitable for combination with other foods relatively poor in this ingredient, such as roots, potatoes, hay, straw, and the starchy cereal grains and offals. If fed in too large quantities, or if it contains too high a percentage of oil, both meat and milk are liable to be tainted. High grade fish meal should not contain more than 2–3 per cent. of oil. Among the mineral constituents present are phosphate of lime and salt, both of which are necessary in the feeding of farm animals. In the case of salt, however, an excess may cause illness, especially in pigs, and for this reason the proportion of salt in fish meal should not exceed 3 per cent. As a result of the experiments which have been conducted by stock feeders it is suggested that the following quantities might be given daily to the different kinds of farm stock:—

Cattle—2 lb. for every 1,000 lb. live weight.

Pigs— $\frac{1}{4}$ to $\frac{1}{2}$ lb., according to weight.

Sheep— $\frac{1}{10}$ to $\frac{1}{5}$ lb. for every 100 lb. live weight.

For poultry feeding, fish meal with a low percentage of oil and salt should be selected, and the birds should be gradually accustomed to the food. Adult fowls should receive not more than 10 per cent., and chickens not more than 5 per cent. of their whole diet in this form.

Rations.

Some mixed rations, showing how the foregoing feeding stuffs may be used, are given below. In each case Ration 1 represents a common daily diet for a full grown animal, and the alternative rations show how by using other feeding stuffs the diet may be cheapened. In the great majority of cases the cheaper diet will serve the purpose just as well as the expensive one; but farmers are not likely to forget that

animals have individual tastes and needs, and that food which suits most of them may not suit all. The appetite of the individual requires much more attention in the case of horses than in cattle and sheep, and in feeding light-legged horses on hard work special care is required to ensure the best results. Nine horses out of ten might do just as well on the daily ration costing 1s. 3d. as on the more expensive mixture, and possibly five out of ten would thrive as well on a still cheaper mixture from which oats had been altogether omitted. The cost of a diet and the suitability of the foods to be employed cannot be considered apart from the competence of the master and his men. The rations suggested below suppose an average master as well as an average animal.

The costs are given to the nearest halfpenny (less in the case of the sheep). The price of roots, hay and straw have been taken as 10s., 60s. and 30s. per ton respectively. The prices of other feeding stuffs were those ruling in London in September.

Farm Horses.

Ration 1.	s.	d.	Ration 2.	s.	d.
18 lb. Hay ...	1	8	18 lb. Hay ...	...	...
14 " Oats ...	...	...	6 " Dried Grains ...	...	...
			2 " Sharps ...	1	2
			4 " Bran ...	...	...
			2 " Maize ...	...	...

Light-legged Horses.

Ration 1.	s.	d.	Ration 2.	s.	d.
10 lb. Hay ...	1	7	10 lb. Hay ...	...	...
16 " Oats ...	...	...	6 " Oats ...	...	...
			2 " Beans ...	1	3
			5 " Dried Grains ...	...	...
			2 " Bran ...	...	...

Fattening Bullocks (2½–3 years old).

Ration 1.	s.	d.	Ration 2.	s.	d.
70 lb. Swedes or Mangolds	...	...	70 lb. Swedes or Mangolds	...	...
16 " Oat Straw ...	...	...	16 " Oat Straw ...	...	...
2 " Uncorticated Cotton Cake.	1	0	2 " Uncorticated Cotton Cake.	0	10½
3 " Maize ...	...	...	3 " Dried Grains ...	...	...
2 " Linseed Cake ...	...	...	3 " Bran ...	...	...
* Ration 3.	s.	d.	Ration 4.	s.	d.
90 lb. Swedes ...	...	...	35 lb. Swedes or Mangolds	...	...
12 " Oat Straw ...	...	...	7 " Hay ...	...	...
4 " Uncorticated Cotton Cake.	0	10½	10 " Oat Straw ...	...	...
4 " Bran ...	...	...	2 " Uncorticated Cotton Cake.	0	10½
			2 " Soya Bean Cake ...	...	...
			2 " Sharps ...	...	...
			2 " Dried Grains ...	...	...

* A Ration used in the Experiments referred to on p. 604.

Cows.							
Ration 1.		s.	d.	Ration 2.		s.	d.
42 lb.	Swedes or Mangolds	I	2	42 lb.	Swedes or Mangolds	0	11
5 "	Hay			5 "	Hay		
14 "	Oat Straw			14 "	Straw		
4 "	Crushed Oats			4 "	Coco - nut Cake or		
4 "	Decorticated Cotton				Palm-nut Cake.		
	Cake.			3 "	Dried Grains		
				2 "	Bran		
Ration 3.						s.	d.
28 lb.	Swedes or Mangolds	I	2				
14 "	Hay						
7 "	Straw						
2 "	Coco-nut Cake						
2 "	Undecorticated Cotton Cake						
3 "	Dried Grains						
3 "	Bran						

The following are suggested as suitable rations for sheep, to be fed along with grass, or roots and hay at times when concentrated foods are necessary.

Breeding Ewes.

Ration 1.—From $\frac{1}{2}$ lb. to 1 lb. per head per day, of oats, bran, and decorticated cotton cake, mixed in the proportion of one-fifth decorticated cotton cake to two-fifths of each of the others— $\frac{4}{5}$ d. per lb.

Ration 2.—The same weight of a mixture of equal parts of soya bean cake, bran, and dried grains— $\frac{3}{5}$ d. per lb.

Fattening Sheep.

Ration 1.—From $\frac{1}{2}$ lb. to 1 lb. per head per day of a mixture of equal parts of maize and decorticated cotton cake—1d. per lb. (nearly).

Alternative Ration.—The same weight of a mixture of dried grains and soya bean cake— $\frac{3}{4}$ d. per lb. (nearly).

For further information concerning the composition, properties and use of feeding stuffs, readers are referred to the following leaflets, which may be had free on application—

- No. 74. The Composition and Properties of concentrated Feeding Stuff.
- „ 79 Rations for Farm Stock.
- „ 114 Feeding of Poultry.
- „ 129 Winter Egg Production.
- „ 142 Calf Rearing.
- „ 176 Poultry Fattening.

POULTRY COLONIES ON FARMS.

EDWARD BROWN.

THE attention of farmers has already been directed* to the importance of increasing the home supply of eggs and poultry, of selecting and retaining productive stock, and of increasing the quantity of such stock. The present article deals with methods of utilising land for poultry with the objects of:—

1. Facilitating systematic management of farm flocks.
2. Utilising poultry to a greater extent for the improvement of the land in order that they may serve as a definite aid in the economy of cultivation.
3. Increasing the number of birds kept on the farm.
4. Affording the birds protection from destruction by foxes.

Poultry on Pasture Land.

Poultry are frequently provided with portable houses placed in grass fields over which the birds have free range. Under this system, which may be described as distributive, the number of fowls is usually small when considered in relation to the number of birds per acre which might be kept on the holding without detriment to other stock or to the usual system of cultivation. Even where grass land is reasonably stocked in this way it would be possible to increase the number of birds by utilising arable land for the purpose. It is not the general practice to utilise arable land for poultry, owing to the belief that growing crops are injured by the birds. Poultry should not have access to land under crops until these are well established, when they will do little direct damage, and the crop will benefit by the distribution of manure and by the destruction of pests which provide the birds with natural sources of food. The distributive method may be applied to arable land with advantage in the case of fowls, but ducks, geese and turkeys should not be kept on land while the crops are growing.

This system of distributing the birds in scattered flocks has many advantages on large farms where grass land is abundant, but it does not provide for utilising the manure to the full extent, and scattered flocks involve a good deal of labour if they are to be systematically managed. In cases where a large amount of land comes under the plough the colony system is likely to afford a favourable method for the extension of poultry keeping.

* *Journal*, September, 1914, p. 542, Poultry as Farm Stock.

The Colony System.

Under the colony system a certain area of land is devoted to poultry, and is heavily stocked for a limited period, which should not usually exceed 12 months, but which may be varied in accordance with the general scheme of cropping.

It is necessary to point out, however, that the greater the number of poultry which are maintained upon any given area the shorter must be the period during which it is occupied by them. Many serious outbreaks of disease can be traced directly to the use of the same land year after year. Where land is heavily stocked it should be systematically cultivated when the birds are removed, and poultry will then serve a most useful purpose in the rotation, and possess an added value as a definite means of enriching the soil. A hundred hens of the heavier breeds are calculated to produce four tons of moist manure in a year, and the value of this manure, if proper advantage is taken of it, may be fairly estimated at 1s. 1d. per bird per annum.

Example.—One of the most notable instances of success as a result of adopting the colony system is to be found in the Little Compton district of the State of Rhode Island, in the United States of America, where it has been extensively adopted and continuously used for upwards of seventy years as an integral part of farm operations. The farming is mixed, arable and pasture land being general in the district. There is a considerable amount of stock feeding and grain growing. As a rule the farms vary from 60 to 120 acres in extent. The plan adopted is to set aside different fields for poultry each year, both for laying stock and for chickens, and thus to give poultry a regular place in the rotation of crops. Where other live stock occupy the same ground, 40 adult fowls per acre are kept for one year. If the land is given up wholly to poultry, as many as 100 per acre are maintained for the period named. Fields are divided by stone fences and very little wire netting is used.

Method.—When fowls are kept on the colony system it is best to allow the birds to occupy the land for a year, the area being determined by the number to be maintained. Where an entire field can be devoted to this purpose the work is simplified; it will only be necessary to run netting 3 ft. high by the side of the hedges. The larger the field or plot the less danger is there of the fowls evincing any desire to wander outside, and to stray on to cultivated sections of the farm.

If there are no hedges or natural fences, or if only part of a field is to be used for the fowls, the whole of the area must be enclosed by wire netting, which should be five to six feet high, in accordance with the class of fowl kept. Wherever possible the ground should be selected so that when removal takes place the adjoining land can be used the following year, and one side of the netting may remain in place. Gates should be provided with a view to economising the labour of feeding the birds and cleaning the houses.

The main point is that the same ground shall not be occupied by fowls again until three years have elapsed, as that period of time is required to exhaust the manure. Thus, in a field of twenty acres, five would be in use by the fowls annually.

In this system wheels are not required on the houses, and floors can be dispensed with. Upon arable land scratching sheds need not be used. The most useful form of house is one with a gabled roof, and an open front—that is, a front formed mainly of wire netting. Two square feet of floor space, with a height of 5 ft. to the eaves, or rather more than ten cubic feet of air space, must be allowed for each fowl. Useful sizes are 9×6 ft., 9×8 ft., and 10×8 ft., which will accommodate 27, 36 and 40 fowls respectively. To facilitate removal it is an excellent plan for these houses to be built in sections, as they are somewhat heavy when erected. Otherwise a strongly built sled, either with wheels or on runners, may be employed for removing the houses.

Area and Numbers.—A hundred fowls can be kept on an acre of pasture land for twelve months. Good arable land that has been well cropped will carry twice the number for the same period. For instance, if on a farm of 300 acres ten acres were annually given up to poultry, even on the basis of 100 fowls per acre, a thousand adult fowls could be kept, which would work out at an average of $3\frac{1}{3}$ fowls per acre of the entire occupation. At the present time the average on such farms is not more than one adult fowl to every 12 acres. Such a system would require efficient management, and would not permit of slipshod methods, but the majority of farmers could provide suitable labour and supervision to secure its success.

Land would also be required for the raising of chickens, and for this purpose fresh land should be utilised each season. Wherever possible the birds raised as breeding or laying stock should be given free range until they have developed. A thousand chickens can be reared up to marketable age in one

season on an acre of land, which should not be occupied by chickens again until three years have elapsed.

Whilst fowls kept under the colony system can be used for breeding stock, provided that a sufficient number of male birds are included during the breeding season, it is always a mistake to use the entire flock for breeding purposes. So far as possible only selected birds should be mated, and it is desirable that these be kept in portable houses on a free range for some weeks before the eggs are required for hatching. Failing that arrangement, quarter-acre runs may be erected, in each of which a dozen birds can be enclosed. As soon as the hatching season is at an end these will be available for cockerels that are destined for killing.

Cost of Equipment.—The colony system involves greater capital expenditure than the distributive system, owing to the wire netting employed, though the cost of houses is not quite so great as under distributive methods. The larger the area enclosed the less is the cost of netting and stakes. For instance, to enclose an acre will require six rolls of netting, each of 50 yards; a block of two acres, if oblong, would need $8\frac{1}{2}$ rolls; and a square comprising four acres, about 11 rolls. Good stakes for netting cost about 3s. per doz., and at least $1\frac{1}{2}$ doz. will be required to each roll. Houses of a substantial type will involve an expenditure of from 1s. 6d. to 2s. per square foot of ground space, which will be in this case, also, proportionately less as the size increases.

Taking a four acre block, the cost for fencing may be estimated as:—

	£	s.	d.
11 rolls wire netting, 6 ft. high, 2-in. mesh, 16-gauge, at 30s.	16	10	0
18 doz. stakes, at 3s.	2	14	0
6 gates, at 10s.	3	0	0
	£22	4	0

In addition, there will be the cost of erection in the first place and the annual removal, while the life of such netting when moved yearly will not exceed five years. Therefore, the expenditure, apart from labour, will be equal to nearly 3d. per hen per annum.

Effect on Inferior Land.—A consideration which demands the attention of those occupying land of a poor quality, is the effect of the manure produced. In this respect poultry contribute to increased fertility. A proportion of the areas

recorded as either rough grazing or waste land could thus be utilised, and in the course of a few years could be brought into cultivation. Farmers who keep poultry on progressive lines find that they render great service in the direction indicated.

Ducks.—The colony method of raising ducklings for market has been successfully adopted in our own and other countries. In this case, also, the rotation should be one in four—that is, the ground is only used for this purpose one year out of four. Remarkable crops can thus be secured on grass land or pastures. Wire netting 18 in. high is employed to enclose runs, each of one-eighth of an acre in extent, in which 50 ducklings can be kept from two weeks old until they are ready for killing. In this way a thousand to twelve hundred ducklings can be reared per acre in a season. Simple houses, or even adapted packing cases, provide the requisite housing accommodation.

Summary.

From such evidence and experience as is available the following conclusions have been reached:—

1.—That the colony system of poultry-keeping is specially suited to larger farms, not only because of the economy of labour, and the complete utilisation of manure, but because it affords a greater measure of protection against enemies, as compared with the distributive method. By its adoption, also, a large addition might be made to the production of eggs and poultry in this country.

2.—That an integral part of the system is that where fowls are kept thickly on land for one year, say, at the rate of 100 to 200 per acre, the ground must not be occupied by poultry or other stock for at least three seasons, during which period it should be cropped.

Leaflets.

A large amount of other information will be found in the Poultry Leaflets issued by the Board. Copies can be obtained post free on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

THE CATTLE TESTING STATION OF THE BOARD OF AGRICULTURE AND FISHERIES.

Need for the Efficient Testing and Treatment of Animals.—The regulations of many colonies and foreign countries relating to the importation of live stock prescribe the examination of all imported animals with a view to the certification of the absence of certain diseases. The examination must be carried out either in the country of origin, before shipment, or in the country of destination on landing at the port, or in both countries. This fact points to the need for the thorough and reliable examination, before shipment, of all valuable animals to be exported from this country. Without such examination the stock are liable to become a total loss through rejection and slaughter in the importing country.

Exporters have hitherto run considerable risk, since, while they may have taken every precaution to make certain that a valuable animal is free from disease before leaving the country, such animal may nevertheless be condemned and slaughtered on arrival. Further, an animal which has been thoroughly examined may be exposed on board ship to infection from animals not properly tested.

Again, in the case of tuberculosis, for instance, serious frauds have been committed by dishonest persons who employ certain means whereby the tuberculin test is rendered ineffective. On the other hand, if reliable testing could be guaranteed, trade should be much facilitated and increased, while great expense would be saved by the removal of the element of uncertainty and the consequent lowering of the rates of insurance. Confidence would also be given to the foreign breeder, and there would be the possibility that foreign and colonial governments would in time relax their restrictions as to examination on landing.

The case of South Africa may be instanced. Serious inconvenience and expense, as well as bitter disappointment, have been caused in the past by the reaction to the tuberculin test of cattle imported into South Africa from Great Britain, despite the fact that the animals were accompanied by certificates to the effect that they had passed the test immediately

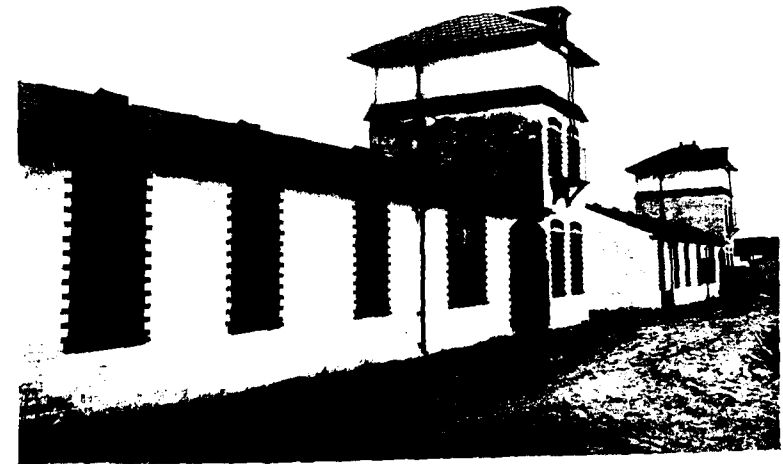


FIG. 1. —View of the Front, with Water Towers.



FIG. 2. —Isolation Boxes.

before leaving England. The same state of affairs was previously experienced in regard to Dutch cattle imported into South Africa, but after the establishment of the Netherlands cattle testing station matters greatly improved.

Another cause which acts as a deterrent to the export trade in valuable animals, especially where the trade is with tropical or sub-tropical countries, is that foreign breeders are loath to import susceptible pedigree animals when they are likely to come in contact with natural infection in the importing country itself. It is well known that considerable losses have occurred in this direction, and the question arises as to whether it is possible to render animals going to tropical and sub-tropical countries resistant to the diseases prevalent in those countries. It seems that in some cases in Rhodesia immunisation of cattle had been attempted after importation, with the result that the mortality was great and farmers were much discouraged in their attempts at securing live stock from Great Britain.

The Board's Cattle Testing Station.—The various considerations discussed above have led to the foundation by the Board of an Official Cattle Testing Station. This Station is situated at Pirbright, Surrey, and has accommodation for 100 head of cattle. The work carried out at the Station is at present confined to the testing of cattle for tuberculosis, and to the immunisation of cattle against Red Water. It is hoped, however, to provide further facilities if necessity arises, both as regards accommodation and as to the tests and immunisation.

An account of the immunisation may be of interest. It may be explained that the virus of tropical Red Water has been effectively maintained at the Board's Veterinary Laboratory for nearly nine years, and the strain has been reduced in virulence to the extent that it will not cause fatalities among the animals inoculated with it. When animals receive this virus they suffer from a more or less mild attack of the disease and recover without being seriously impaired in health. After recovery they are highly resistant to a second attack of the disease, whether an attempt is made to infect them by inoculation or whether they are exposed to natural infection. The time required for an animal to undergo the immunising process and be fit for shipment is from three weeks to a month. It is admitted by veterinarians and importers that animals which have been immunised before leaving England are highly resistant to Red Water when put to graze on infected areas.

Through the instrumentality of the Chief Veterinary Officer of the Board no less than 328 animals have been immunised in the last few years and shipped to South Africa, Rhodesia, East Africa, Brazil and Argentina, and reports on these animals after landing in infected countries have been highly satisfactory.

A disease which is found in the same districts as Red Water, and which was at first confused with that disease, is Anaplasmosis, and if an animal contracts the two diseases together the results are often fatal. There is a certain amount of evidence, however, to show that animals which have previously been immunised against Red Water have a better chance of recovering from Anaplasmosis than animals not so immunised.

Fees for Testing and Arrangements at the Station.—The regulations of the Board regarding the fees to be paid for testing, the periods during which animals are to be kept at the Station, the arrangements to be made by owners sending their animals for testing and the conditions with which they must comply, were given in this *Journal* for June, 1914, p. 258.

Note.—Arrangements are made by the Governments of Australia and the United States whereby their own agents test in this country cattle for exportation to these two countries.

The Board are indebted to the Sport and General Press Agency, Ltd., for the use of the photographs illustrating the Station.

SOME OBSERVATIONS ON THE FOOD OF NESTLING SPARROWS.

WALTER E. COLLINGE, M.Sc.

IN 1912 the writer recorded in this *Journal** a series of observations on the food of nestling birds, founded upon an examination of the stomach contents of 179 nestlings, of which 42 were those of the house sparrow.

Subsequently the work on the food of nestling sparrows was continued, and the following is a record of the work carried out during 1913 and 1914.

In all upwards of 280 specimens have been examined, viz., 139 in 1913, and 148 in the present year.

The importance of this investigation will be apparent when it is mentioned that of the total number, 98 specimens were obtained from fruit-growing districts in 1913, and 102 in 1914, leaving a balance from suburban districts of 41 in 1913 and 46 in 1914.

* *Journal*, 1912, Vol. xix, p. 460.



FIG. 3.—A Range of Fifty Boxes in the Exercise Court Yard.



FIG. 4.—A Range of Fifty Boxes in the Exercise Court Yard.

CATTLE TESTING STATION OF THE BOARD OF AGRICULTURE AND FISHERIES.

The results are so interesting, and moreover, so important from the standpoint of the fruit-grower, that the stomach contents of each series examined are given in detail.

It has not always been possible to examine the material when fresh, although most of it has been so examined, while

RECORD FOR 1913.

I. *Ninety-eight specimens from Fruit-growing Districts.*

Article of Diet.		Times occurred.	Number occurred.
April 29	18 specimens.		
	Wings of Aphids	11	68
	Lepidopterous larvæ	8	23
	Larvæ of small Dipterous Fly	6	22
	" " Crane Fly	7	16
	Spiders	2	3
May 2..	22 Specimens.		
	Wings of Aphids	8	52
	Remains of Beetles	3	8
	Lepidopterous larvæ	14	57
	Fragments of small Dipterous Fly	12	80
	Larvæ of Crane Fly	4	11
	Remains of Earthworms	4	—
May 3..	20 specimens		
	Wings of Aphids	14	86
	Remains of Beetles	2	7
	Lepidopterous larvæ	16	60
	Fragments of small Dipterous Fly	18	100
May 5..	14 specimens.		
	Wings of Aphids	8	40
	Remains of larvæ of Winter Moth (<i>Cheimatobia brumata</i> , Linn.)	10	47
	Spiders	1	2
May 6..	16 specimens.		
	Fragments of Beetles	5	20
	Remains of larvæ of Winter Moth	11	46
	Small Lepidopterous larvæ	4	15
	Fragments of small Dipterous Fly	3	17
	Vegetable matter	1	—
May 10	8 specimens.		
	Remains of larvæ of Winter Moth	8	22
	Small Lepidopterous larvæ	3	12
	Remains of Earthworm	1	—
	" " Slug	1	—
	Bread	1	—
Summary for 98 specimens.			
	Wings of Aphids	41	246
	Remains of Beetles	10	35
	Remains of larvæ of Winter Moth	29	115
	" " Lepidopterous larvæ	45	167
	Fragments of small Dipterous Fly	33	197
	Larvæ of small Dipterous Fly	6	22
	Larvæ of Crane Fly	11	27
	Spiders	3	5
	Remains of Earthworms	5	—
	" " Slug	1	1
	Bread	1	—
	Vegetable matter	1	—

the remainder has been preserved in alcohol. The records for the two years are given in the tables on pp. 619 to 622.

RECORD FOR 1913.

2. Forty-one specimens from Suburban Districts.

Article of Diet.		Times occurred.	Number occurred.
April 30	6 specimens.		
	Wings of Aphids	4	17
	Remains of Lepidopterous larvæ ..	6	26
	" " Dipterous larvæ ..	4	15
May 8..	Kitchen refuse (bread, rice (?)) ..	5	—
	12 specimens.		
	Aphids	10	60
	Remains of Beetles	2	5
	" " Lepidopterous larvæ ..	9	38
	Earthworms	2	—
May 12.	Kitchen refuse (bread, potato, rice, meat)	10	—
	15 specimens.		
	Aphids	2	21
	Wing-cases of Beetles	3	7
	Larvæ of Winter Moth	3	13
	Remains of Lepidopterous larvæ ..	9	39
	Wings of small Moth	1	5
	Remains of Dipterous larvæ ..	12	70
May 14.	Kitchen refuse	3	—
	8 specimens.		
	Remains of Beetles	2	6
	" " Lepidopterous larvæ ..	4	17
	Spider	1	1
	Kitchen refuse	7	—
	Summary for 41 specimens.		
	Aphids	16	98
	Remains of Beetles	7	18
	Larvæ of Winter Moth	3	13
	Remains of Lepidopterous larvæ ..	28	120
	Wings of small Moth	1	5
	Remains of Dipterous larvæ ..	16	85
	Spider	1	1
	Remains of Earthworms	2	—
	Kitchen refuse	25	—

Summary.—On the assumption that the food found in the stomach of each nestling represents that of half a day* (in nearly every case they were collected in the evening), the *Summary of Tables* on p. 622 shows the food consumption for approximately a hundred nestling birds from fruit-growing districts and nearly half that number from suburban districts.

A careful examination of this *Summary* brings to light some interesting facts, which may be summarised as follows:—

1. In a single day one hundred nestling house sparrows require nearly 2,000 insects for food in fruit-growing districts, and about a third of that quantity in suburban districts.

* As feeding commences at day-break and continues until sunset, these figures might reasonably be doubled.

2. Excepting for a few spiders and earthworms, the whole of the food consists of injurious insects.

RECORD FOR 1914.

1. One hundred and two specimens from Fruit-growing Districts.

Article of Diet.		Times occurred.	Number occurred.
May 1..	24 specimens.		
	Wings of Aphids	16	110
	Remains of Beetles (Weevils) ..	7	33
	Lepidopterous larvæ	17	69
	Fragments of small Dipterous Fly ..	14	130
	Larvæ of Crane Fly	9	29
May 2..	18 specimens.		
	Beetle larvæ	3	11
	Lepidopterous larvæ	18	52
	Wings of Moth	3	7
	Larvæ of small Dipterous Fly ..	11	59
	Wasp	1	1
May 4..	22 specimens.		
	Wings of Aphids	3	17
	Remains of Apple Blossom Weevil (<i>Anthonomus pomorum</i> , Linn.) ..	10	49
	Larvæ of Winter Moth (<i>Cheimatobia brumata</i> , Linn.)	19	72
	Spiders	2	14
May 6..	5 specimens.		
	Remains of Apple Blossom Weevil ..	5	29
	Lepidopterous larvæ	3	11
May 9..	14 specimens.		
	Lepidopterous larvæ	9	33
	Larvæ of Winter Moth	11	46
	Remains of earthworm (?)	2	—
May 11.	19 specimens.		
	Remains of small Beetles	16	81
	Lepidopterous larvæ	12	42
	Dipterous larvæ	2	7
	Larva of Gooseberry Sawfly (<i>Nematus ribesii</i> , Scop.)	1	1
	Summary for 102 specimens.		
	Aphids	19	127
	Remains of Beetles	26	125
	Apple Blossom Weevil	15	78
	Larvæ of Winter Moth	30	118
	Lepidopterous larvæ	59	207
	Wings of Moth	3	7
	Dipterous larvæ	13	66
	Small Diptera	14	130
	Larvæ of Crane Fly	9	29
	Larva of Gooseberry Sawfly	1	1
	Wasp	1	1
	Spiders	2	4
	Remains of earthworm (?)	2	—

It may be said that during the whole of the nesting period the parent birds are feeding upon food similar to that fed to the young.

RECORD FOR 1914.

2. Forty-six specimens from Suburban Districts.

Article of Diet.	Times occurred.	Number occurred.
May 2.. 11 specimens.		
Remains of Lepidopterous larvæ ..	11	39
Kitchen refuse (bread, potato, etc.) ..	10	—
May 5.. 10 specimens.		
Larvæ of Apple Ermine Moth (<i>Hyp-</i> <i>nomenuta malinella</i> , Zell.) ..	10	46
Spiders ..	2	5
Remains of young Slugs ..	3	3
May 7.. 11 specimens.		
Wings of Aphids ..	7	46
Remains of small Beetles ..	2	7
" " Lepidopterous larvæ ..	4	15
Kitchen refuse (bread) ..	4	—
May 8.. 8 specimens.		
Remains of Dipterous larvæ ..	8	43
Remains of small Earthworms ..	5	—
Kitchen refuse (bread, rice, etc.) ..	8	—
May 13.. 6 specimens.		
Remains of Lepidopterous larvæ ..	5	19
Kitchen refuse (bread and potato) ..	6	—
Summary for 46 specimens.		
Wings of Aphids ..	7	46
Remains of small Beetles ..	2	7
" " Lepidopterous larvæ ..	20	73
Larvæ of Apple Ermine Moth ..	10	46
Remains of Dipterous larvæ ..	8	43
Spiders ..	2	5
Remains of small Earthworms ..	5	—
" " young Slugs ..	3	3
Kitchen refuse ..	28	—

Summary of Tables.

Article of Diet.	Fruit-growing Districts.		Suburban Districts.		Total.
	1913.	1914.	1913.	1914.	
Wings of Aphids ..	246	127	98	46	517
Remains of Beetles ..	35	125	18	7	185
Apple Blossom Weevil ..	—	78	—	—	78
Larvæ of Winter Moth ..	115	118	13	—	246
" " Apple Ermine Moth ..	—	—	—	46	46
Lepidopterous larvæ ..	167	207	120	73	567
Wings of Moths ..	—	7	5	—	12
Larvæ of Crane Fly ..	27	29	—	—	56
Dipterous larvæ ..	22	66	85	43	216
Dipterous Flies ..	197	130	—	—	327
Larvæ of Gooseberry Sawfly ..	—	1	—	—	1
Wasp ..	—	1	—	—	1
Slugs ..	1	—	—	3	4
	810	889	339	218	2,256

In spite of all that has been written with reference to the depredations of the house sparrow, we do not yet possess that completeness of knowledge that justifies us in condemning it as an "avian rat," or a bird that should be exterminated. That it is far too plentiful no one doubts, but seeing that practically all modern houses provide numerous and safe nesting places for it this is scarcely surprising.

It is extremely difficult to arrive at any satisfactory and convincing conclusion as to the precise economic status of this species, but after carefully considering the results obtained from an examination of the stomach contents of 404 adult birds,* and of 42† and 287 nestling birds, and also from an examination of the faeces, the writer is of opinion that if this species were considerably reduced in numbers, the good that it would do would probably more than compensate for the harm, especially in fruit-growing districts.

In carrying out the investigation here recorded, it has been very forcibly suggested that before any reliable conclusions can be formed respecting the economic status of any species of wild bird, something more must be secured than the mere details of the stomach contents of adult birds, from various districts, during each month of the year, important and necessary as these undoubtedly are. Any investigation on the economic status of most species of wild birds is incomplete, and to a large extent misleading, that does not deal with the question of the nature of the food fed to the young bird or nestlings, for during the nestling period the food of the parent birds consists largely of insects, slugs, spiders, and worms, and that of the young almost entirely so, and the amount of food consumed is greater than at any other season of the year.

THE majority of poultry-keepers will find that under the most thrifty and intelligent methods of management it is necessary to purchase a proportion of the food required for their stock. At the present time the cost of these supplies is of more importance than usual, and any practical method of reducing the cost of feeding, or of obtaining more suitable food for the same outlay, is a matter of direct concern where poultry are kept for profit.

* The Food of Some British Wild Birds, W. E. Collinge, 1913.

† *Journal*, 1912, Vol. xix, p. 460.

Classes of Food.—The foods required by poultry may be roughly divided into three classes: (1) green food, (2) animal food, and (3) grain and its products.

Grit is essential for the assimilation of food, and oyster shell or some equivalent is necessary to provide the material for shell formation.

Green Food.—Even on the smallest holding green food can be supplied for the poultry from home-grown produce, if a little care and forethought are exercised. Such crops as cabbages, kale, roots of various kinds and potatoes are generally available. These crops will provide valuable food for the poultry without materially reducing the quantity destined for use by the household. Where the birds are confined they must be supplied with green food. Cabbages or mangolds may be split and hung up in the runs, while roots, sound leaves of vegetables and small potatoes may be cooked and added to the mash. A satisfactory form of soft food may be prepared by boiling small potatoes in their skins and mixing them with an equal quantity of bran. This mixture may be used with advantage as an occasional feed in cold weather.

Animal Food.—Adult birds and chickens on free range will obtain a considerable supply of animal food during the greater part of the year. Where birds are confined they should be supplied with animal food.

Skimmed milk or separated milk is often available, or may be obtained cheaply and may be used in preparing the soft food.

Trimnings of meat and other household scraps may be boiled and incorporated with the soft food, while the liquor should be used for mixing. Where large numbers of poultry are kept, supplies of animal food may have to be purchased, either through the butcher or in the form of meat meal or fish meal.

Grain.—Where grain is produced on the holding the poultry frequently have to consume the worst samples.

Small wheat which is sound and free from an undue mixture of impurities may be used with advantage. Light oats, in which the percentage of husk is high, are not suitable for feeding as grain. Musty grain of any kind should not be used.

The amount of home-grown produce available for poultry-feeding will vary considerably according to the circumstances of each case, but an endeavour should be made to increase the supply of food from this source as much as possible.

The Purchase of Foods.—Meals such as ground oats, barley meal and wheat offals (including middlings, pollards and bran),

form valuable foods, and in the case of the great majority of poultry keepers those selected for use must be bought.

Meals and milling offals should be used when fresh, since they do not improve by keeping, and, unless they are carefully stored, will deteriorate. They should consequently be procured only in such quantities as may be necessary for a few weeks' supply. The disadvantages of buying small quantities are well known: the price must of necessity be proportionately higher than that for large quantities, and the difficulty of getting freshly milled samples is greater.

Methods of Purchase.—In this direction there is an excellent opportunity for the poultry keepers of a village or of a group of allotments to co-operate. One man buying a few pounds of barley meal, middlings and maize meal each week is unlikely to buy on as advantageous terms as he could if he were placing an order for hundredweights instead of pounds. A dozen poultry keepers, each requiring small amounts and deciding to co-operate in purchasing their total weekly or monthly requirements, will be in a position to purchase on very advantageous terms, and to secure supplies of the quality they require and in the best condition.

Where co-operative agencies exist those who keep poultry on allotments and gardens should utilise them to the full in purchasing foods, but where no such agencies exist at present, there should be no serious difficulty in making local arrangements for obtaining supplies. A small committee with a business-like secretary could readily make the necessary arrangements. In order to ensure success it is essential that those who combine should be loyal to one another, and that each should bear in mind that, if the greatest advantage is to be reaped by the members as a whole, individuals must be willing to make minor concessions.

Where grain has to be bought, the restrictions as to quantity do not apply to the same extent, as grain in good condition may be purchased in comparatively large quantities if it can be properly stored.

Selection of Foods for Purchase.—In deciding what is to be bought the purchaser should consider local conditions and be prepared to take advantage of any special local supply which can be utilised. His requirements will also be determined to some extent by the class of birds with which he is dealing.

In regard to grain, experience tends to show that a mixture gives better results in the case of growing chickens and laying

hens than the use of only one kind of grain. Experiments carried out in Cornwall indicate that a mixture consisting of one part of white oats and one part of small maize is a very suitable grain food for laying hens kept in an exposed situation. It gave consistently better results in regard to egg production than where the grain used was wheat alone, or oats alone, or barley alone, or maize alone, or a mixture consisting of one part of maize and two parts of oats.

Barley meal, middlings and bran will afford suitable materials for the preparation of the soft food, if soft food is used in preference to the dry mash.

Barley meal and middlings in equal parts form a good foundation for the mash, to which scraps or boiled vegetables may be added. Maize meal, if used at all, may be mixed in the proportion of one part of maize meal to two parts of bran, with the addition of a little animal food.

Full particulars of rations suitable for feeding various classes of young and adult stock will be found in Leaflet 114 (*Feeding of Poultry*).

Preparation of Soft Food.—In preparing soft food the meals may be mixed at the time of its preparation. Where bran is one of the ingredients it is desirable to allow it to steep in boiling water for 15 minutes before mixing. The proper consistency for soft foods will be best obtained by pouring the hot water or liquor little by little over the meals and stirring them; they should then be allowed to stand for a short time and the mixing should be completed by using the hands. The final condition of the mixture should be crumbly, and if too much fluid is used this consistency will not be attained. The fluid should therefore be added gradually and only sufficient should be used to moisten the meals thoroughly without rendering them sloppy.

Method of Feeding.—Various opinions are held as to whether it is better to supply soft food in the morning or in the afternoon. Recent practice seems to favour the use of soft food in the afternoon, with grain (in litter) as the morning feed. If the mash is fed in the morning the birds should not have such a heavy meal as to make them listless. Growing chickens and laying hens need good food, but they must always be kept keen and active.

In feeding, the best results cannot be obtained merely by following a routine; the constitution of the rations and the method of preparation and feeding must be checked and modified by intelligent interest in the stock, and observation

of the individual birds, and by a readiness to appreciate and to take advantage of any favourable condition in regard to local supplies. This involves a little forethought and care, but the exercise of these qualities makes for success in the feeding of poultry.

If simple accounts of receipts and expenditure are kept, showing the cost of feeding, a study of them will do much to indicate the directions in which improvement may be introduced.

It is probable that no branch of animal husbandry can be more usefully extended at the present time than that of pig-keeping.

Pig-keeping for Cottagers and Small Holders. Few animals are capable of giving a quicker return for foods consumed and none is better adapted for turning into

wholesome meat much material that is usually regarded as of little or no value. While pig-keeping, generally, might well receive increased attention, it is intended in this article to deal with the subject mainly from the standpoint of the cottager and rural householder whose facilities for keeping pigs are relatively limited. In so far as the same method of pig-keeping is applicable, however, the suggestions made may also prove useful to the small holder with more land and other facilities at his disposal.

It is usually well within the means of most people who possess a fair-sized garden, and who can conform with the regulations of the local sanitary authority, to keep at least one pig. The garden and kitchen will supply a considerable proportion of the animal's food. Should circumstances, however, necessitate the purchase of the whole of the food material, pig-keeping will not be so profitable.

Type of Pig.

One of the first points to consider is the type of pig which should be kept.

There are many breeds and crosses to choose from, but for the purpose of the small pig-keeper, pigs of Large White Yorkshire or Large Black breeding will usually be found the most suitable. It is advisable to start with a newly-weaned pig, about 8 weeks old, care being taken to secure as good a specimen as possible. An extra shilling or two spent on a good pig will be amply repaid; the temptation to be

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satisfied with an unthrifty weakling, merely because it is to be had for less money, should be stoutly resisted. At the same time the buyer should not devote too much attention to fancy points. Above all he must have an animal with a vigorous constitution—a greedy, lusty fellow, active on his legs, lengthy and round in shape, with a clean and pliable skin covered with a fine coat of soft, glossy hair.

Feeding.

For several weeks after weaning the pig should receive its food in a moderately sloppy condition, slightly warm if the weather is cold. The food should be easily digestible and may consist of potatoes, turnips and other vegetables, together with table scraps and grease from the kitchen, and a little middlings or sharps. The roots and vegetable matter should be boiled together and afterwards well mashed and mixed, the meal being incorporated at the same time. Sufficient water should be added, or preferably a little skim milk if it is available, to give the whole the consistency of gruel. A newly-weaned pig will usually require about 2 lb. of food per day, irrespective of added water, and, in the absence of milk, half the food should consist of middlings or similar material.

The young pig should be fed regularly three times a day, the food being gradually increased, as much being given at each meal as it will readily clear up. Caution is necessary in the use of kitchen waste, as such material frequently contains salt and soda in such quantities as to be highly prejudicial to young pigs. Dried blood, meat meal and fish meal all have a high content of easily digestible flesh-forming material, and are therefore suitable for feeding to young pigs, a little at a time, in the absence of dairy waste. As the pig is naturally a grazing animal it is important that succulent vegetable food should form part of its ration at all seasons of the year.

In the summer succulent green food is generally plentiful enough. Young grass from the wayside, weeds from the garden, and similar material, will all be picked over by a young growing pig to its advantage. Tender young clover and lucerne are excellent green foods for pigs. Lucerne especially is valuable in that it is available early and late in the year, several cuts being obtainable annually. A small patch of ground could well be spared for this highly nutritious forage plant.

Rape, vetches, and rye, or a mixture of these, if sown in small plots which would otherwise be left bare throughout the winter, will supply highly nutritious green food at times when such material is scarce. For the supply of the necessary succulent food in the dead of winter recourse must be had to potatoes, turnips, mangolds, sugar beet, artichokes, &c. Of these, potatoes and sugar beets are the most valuable, 4 lb. of either being considered equivalent to 1 lb. of cereal meal.

For the first month or two the pig should be allowed a moderate amount of exercise. An occasional run outside its sty will tend to promote a healthy appetite and to encourage growth.

When the pig reaches about 100 lb. in live weight this form of exercise should be considerably curtailed, and feeding should be rather more forced. Wheat offals, accompanied by a little rice meal, maize meal, or barley meal, whichever is cheapest, may be given more freely, and the supply of the more bulky vegetable foods should be correspondingly reduced. There is no more suitable food for the final stages of fattening than maize, but sometimes other and cheaper foods can be substituted.

With pigs of the weight stated the possibility of utilising such materials as acorns, horse chestnuts, and beech mast should be considered. Acorns have long been recognised as a suitable food for pigs, and in many parts of the country they still form a regular portion of the pigs' diet during the autumn and winter. Their value as gathered has been put at from 1s. 6d. to 2s. a bushel, or about half the value of maize, which they resemble in composition, but 1s. per bushel is commonly paid for collecting them. Before using, they should be spread out in thin layers to dry, as in the dry condition they are both more palatable and less astringent than in the fresh state. Their chief value for feeding lies in their high starch content and digestibility. They are best adapted for feeding along with the more laxative vegetable foods and foods rich in flesh-forming material, such as the wheat offals and gluten meal. From 1 to 2 lb. daily per pig may be fed in this way.

Horse chestnuts dried, husked and ground constitute an even richer feeding stuff than acorns. On the basis of analysis 1 lb. of chestnut meal is said to be equal to 1 lb. 1 oz. of barley meal, or 1 lb. 4 oz. of oats, or 1 lb. 8 oz. of bran.

Chestnut meal, however, is bitter to the taste and stock will not readily eat it if unaccompanied by other more palatable foods. Up to $1\frac{1}{4}$ lb. per head, per day, has been fed to pigs with good results.

Little is known as to the food value of beech mast. Only the kernel, which is extremely rich in nitrogenous substances and in fat, should be fed. In small quantities accompanied by starchy foods it may safely form part of a pig's daily ration.

It should be remembered that the pig is an omnivorous eater and requires variety in its food. Care should, however, be taken to avoid sudden changes in diet. Another important point to remember, especially with pigs confined to sties, is the necessity of supplying a regular allowance of gritty material, preferably small coal or wood ashes, or, failing these, earthy turf. Such material has a valuable tonic effect.

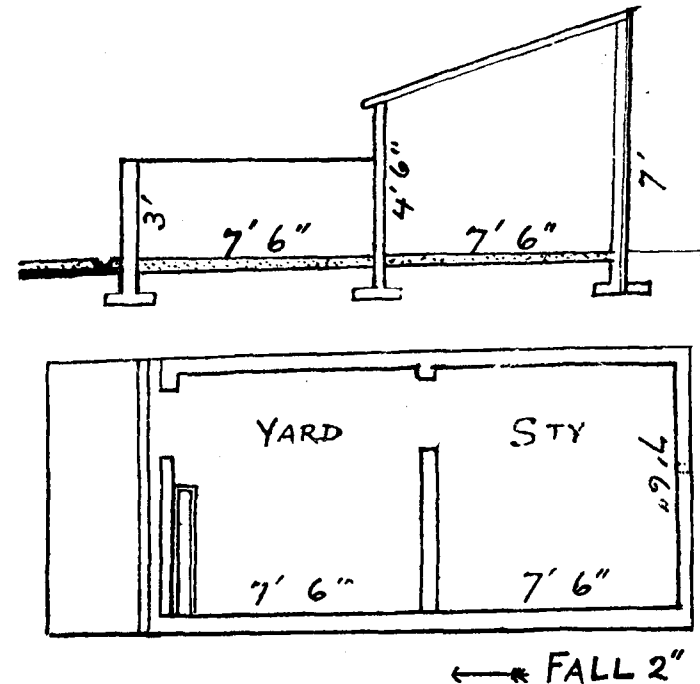
If carefully fed from the start a pig should weigh from 170 lb. to 180 lb. live weight at from 5 to 6 months old, when it should be ready for killing. The amount of food required at this stage will be from 5 to 6 lb. of meals or their equivalent daily, and the dressed carcass should weigh from 130 lb. to 140 lb. Beyond this point the rate of increase gradually slackens, while the amount of food required to produce 1 lb. of increase becomes greater. Fat bacon and fat pork are more valuable as food than lean, especially in winter, and the cottager who fattens only one pig for his own use may well bear this in mind.

Housing.

In respect of housing no elaborate structure is necessary, the main essentials being comfortable and clean conditions. A dry bed, combined with suitable ventilation and the absence of draughts, promotes the general health of the animal, prevents chills and rheumatism, and minimises risk of disease.

The foundation must be dry and, if conditions permit, the piggery should face the south. Access to a small paddock is a distinct advantage; where, however, this is impossible the following arrangement, providing sufficient accommodation for two store pigs, should answer the purpose of the cottager or small holder.

Openings in the walls and roof through which the passage of air may be easily regulated should be provided in order that the temperature may be kept as even as possible through-



A Simple Pigsty for two Store Pigs : Section above, ground plan below.

out the year. A close stuffy atmosphere destroys the appetite and is as harmful as a cold sty. Provision for suitable lighting may be made either in the wall or in the roof. The walls will usually be built of brick, concrete or wood, or wood on a brick foundation, and the building may often conveniently take the form of a lean-to. It should be high enough to obviate all difficulty in cleaning out. For the roof slates, tiles or thatch may be used, or corrugated iron is suitable if the inside is lined with wood. A roof of wood, covered with thick tarred felt, will also suffice to keep out cold and wet.

There is less choice in respect of the floor, which is the most important part of the sty. From a sanitary point of view concrete is the most suitable. This should be grooved to afford a foothold. Part of the floor, sufficient to provide bed accommodation for the pig, should be of wood or, at all events, it should be covered with a wooden platform, cement alone being too cold and liable to give rise to rheumatism. Hard bricks are more comfortable than cement and make a suitable floor. Earth or clay, however well beaten, is liable to get broken up and become puddled. The floor should

slope gently to the front of the sty to help drainage. Surface drains are to be preferred, as they can readily be kept clean. The drainage should not be lost, but should lead into some convenient receptacle for use in the garden with the solid excrement.

Bedding.

In the absence of straw, dried bracken, grass and leaves make thoroughly efficient bedding. Every effort should be made to provide an abundant supply, especially in cold weather, when the pig prefers to curl up in bed and is content with the minimum of exercise. When it is remembered that food is more expensive in winter than in summer, and that it takes more food in winter to produce 1 lb. of pork, the supreme importance of comfort during the coldest season of the year is apparent.

To be successful in pig-keeping the beginner must bear in mind local circumstances and conditions, which are best known to himself; he must study the individuality of the animal and the properties of the feeding material at his disposal, and direct his energies to securing the maximum production of pork at the minimum of expense.

Where circumstances permit, breeding combined with feeding, or even breeding alone, will be found preferable to feeding alone. This further aspect of the subject is dealt with at length in Leaflet No. 9 (*Pig Keeping for Small Holders*), issued by the Board of Agriculture for Scotland. Copies of this leaflet may be obtained on application.

Rations

A few examples of basal rations are appended. In each case Ration 1 represents a mixture of feeding stuffs in common use, and the alternative (Ration 2) shows how by using other feeding stuffs the diet may be cheapened. The prices were those ruling in London in September.

In addition to the foods specified the pigs will require moderate allowances of potatoes or other roots, and such green forage and waste material as may be available. For pigs up to 3 months old, at least, a little skim or separated milk is most beneficial, and when procurable at from one-sixth to one-eighth of the cost per lb. of mixed meals, it will invariably prove economical. (1 gallon of milk weighs 10 lb. approximately).

For Pigs of 25-60 lb. Live Weight.

Ration 1.			Ration 2.		
$\frac{3}{4}$ lb. Middlings ..	..	$\frac{3}{4}d.$	$\frac{1}{4}$ lb. Middlings ..	..	$\frac{3}{4}d.$
$\frac{1}{4}$ „ Barley Meal ..	..		$\frac{1}{4}$ „ „ Gluten Meal ..	..	
			$\frac{1}{4}$ „ „ Rice Meal ..	..	

For Pigs of 60-100 lb. Live Weight.

Ration 1.			Ration 2.		
1 lb. Sharps ..	..	$1\frac{1}{2}d.$	$\frac{1}{2}$ lb. Sharps ..	..	$1\frac{1}{2}d.$
1 „ Barley Meal ..	..		$\frac{1}{2}$ „ „ Bran ..	..	
			$\frac{1}{2}$ „ „ Gluten Meal ..	..	
			$\frac{1}{2}$ „ „ Rice Meal ..	..	

For Pigs of 100-180 lb. Live Weight.

Ration 1.			Ration 2.		
1 lb. Sharps ..	..	$2\frac{2}{3}d.$	1 lb. Sharps ..	..	$2\frac{2}{3}d.$
1 „ Barley Meal ..	..		1 „ „ Rice Meal ..	..	
1 „ „ Maize Meal ..	..		$\frac{1}{2}$ „ „ Gluten Meal ..	..	
			$\frac{1}{2}$ „ „ Bran ..	..	

AN Act known as the Smith-Lever Act was passed by the United States House of Representatives on January 19th, 1914, and by the Senate on February 7th, 1914, and was signed by the President on May 8th. Broadly speaking, the Act, which took effect from July 1st, may be described as providing funds to enable certain agricultural colleges already receiving State aid to undertake extension work, that is "the giving of instruction and practical demonstrations in agriculture and home economics to persons not attending or resident" in such colleges.

The measure owes its inception to a report of a committee on extension work of the Association of American Agricultural Colleges and Experiment Stations. This committee, after an inquiry into the status of agricultural teaching, recommended in 1906 that each agricultural college should organise, as soon as practicable, a department in extension teaching in agriculture co-ordinate with other departments or divisions. This recommendation was repeated in 1907, and in 1908 the committee expressed itself in favour of a moderate grant being made by the Government to the land-grant colleges for extension work in agriculture. In 1909, the committee drew up a detailed plan for Federal aid. Public attention then began to be attracted and the increase of the work of the experiment

* U. S. Experiment Station Record, 1914.

† These are the Morrill Land-Grant Colleges—see penultimate paragraph.

stations leading to their disclosures of the inefficient, uneconomic and wasteful practices often followed by farmers, and the presentation of statistics of farm conditions, enforced the conviction that agriculture was not keeping pace with modern progress and that further means were indispensable for reaching and influencing the mass of farmers. As a result of this, several Bills proposing aid for extension work were brought forward, and finally the Smith-Lever Act was passed, and came into effect less than five years from the time the movement for such a measure was inaugurated in Congress.

The Act provides that "in order to aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics and to encourage the application of the same," there may be inaugurated in connection with certain* State colleges receiving Federal aid, agricultural extension work to be carried on in co-operation with the Department of Agriculture.

For the maintenance of the work £100,000 per annum is permanently appropriated, or £2,083 for each State which accepts the provisions of the Act. In addition, there is provided £125,000 for the second fiscal year of operation of the Act, and for each year thereafter for seven years an additional £104,166, until a total of £854,166 is reached, which with the £100,000 makes a total of £954,166 per annum, which sum will continue as a permanent annual provision. Unlike the initial appropriation of £100,000, these additional sums are to be allotted annually by the Secretary of Agriculture to each State in the proportion which its rural population bears to the total rural population of the country.

The grants are conditional upon the provision by the States of an equal sum for maintenance of the work. The extension work authorised is to be carried on in such a manner as may be mutually agreed upon by the Secretary of Agriculture and the colleges, and before the funds appropriated become available, plans for the work must receive the approval of the Secretary.

No part of the grant can be used in the purchase, erection or repair of buildings, the purchase or rental of land, college-course teaching, promoting agricultural trains or other purposes not specifically authorised, and not more than 5 per cent. for the printing and distribution of publications. A financial report and a report of operations under the Act are required annually from each college, while the Secretary of Agriculture in turn must make an annual report to Congress.

* See footnote, p. 633.

The funds payable under the Act are not given directly to the Department of Agriculture, but are paid half-yearly to the authorities of each State on the warrant of the Secretary of Agriculture, who is charged with the proper administration of the law. The extension divisions at the various colleges will be State and not Federal organisations, and the grants supplied under the Act become the funds of the colleges, subject to certain conditions and to a measure of Federal control.

The Department of Agriculture has separate funds granted to it by Congress for extension and demonstration work, and hitherto the Department's work has been conducted in part independently of the colleges; no co-operation has, therefore, up to the present existed in the varied activities in extension work. An administrative agency in the Department has now been established, to which will be assigned both the supervision of the activities of the Department in extension work, and the general administration of the new extension fund under the Smith-Lever Act. The Department also proposes to make the agricultural colleges centres of all its demonstration and other extension work. It is felt that such a combining and co-ordinating of these efforts will materially strengthen the effectiveness of the undertaking as a whole.

No better evidence is needed of the importance to which agricultural education has attained in the United States than the passage of the Smith-Lever Act, and it is of interest to trace the steps which have led up to its enactment. The Morrill Land-Grant Act of 1862 provided for the establishment of agricultural colleges and authorised the Federal Government to aid agricultural education in the various States. Since that time further legislative measures having the same end in view have been enacted, and the present Act is the sixth Act since 1862 recognising agriculture as an appropriate subject for promotion by the Government, and the fifth to provide permanent grants from the Treasury to be used through the system of State institutions established by the Land-Grant Act. The passage of the Smith-Lever Act was in response to a widespread public demand expressed by farmers generally as well as by the various agencies which are closely related to agriculture. It thus expresses a very general realisation of the fundamental relation of agriculture and of the people connected with it to the welfare and prosperity of the whole country.

The fear has been expressed that the experiment stations attached to the colleges might suffer from the popularity of extension work, and that attention would be diverted from them

and from the need of their further support. It is evident, however, that the new work will make enlarged demands upon these stations, since it will add a vast number of workers to their clientèle, who will realise their ultimate dependence on experiment and research, and who will be in closer touch with the people than any similar body yet organised.

THE following note has been prepared by Mr. J. C. F. Fryer, the Board's Entomologist :—

An Insect Harmful to Newly-budded Rose, Apple and Plum.

During the last two years complaints have been received of a small maggot which has caused numerous failures in newly-budded rose, apple and plum stocks. In the case of an attack the bud dies, even after it has become partly welded to the stock, and on examination a number of small bright-red maggots are found underneath the bud or under the bark of the stock, where the incision has been made. This pest has been provisionally identified as *Clinodiplosis oculiperda*, Ruebs., a fly belonging to the Cecidomyiidae or Gall Midge family. Specimens have been received by the Board from localities in Suffolk and Essex; while Theobald¹, who describes the insect as "the red bud borer," notes its occurrence in Hereford and Surrey. Whether the insect is a native of Britain is not known, but it is said that some growers have been aware of its presence for several years. The pest was first described in Germany by Ruebsammen⁵, but it does not seem to have been noticed elsewhere until Vuillet² recorded it in 1913, at Angers, in France. In Sorauer's *Pflanzenkrankheiten*, Reh³ gives the following account of the insect, based apparently on the work of Binnenthal⁴. The flies appear from the middle of June to the middle of August and lay eggs, six to twelve in number, in the wounds in rose trees produced in the process of budding or by other means. The larvæ on hatching attack the stock and feed on the sap, thus separating the stock and scion, with the result that the latter withers and dies. After from four to six weeks the larvæ leave the stock and pass to the soil, in which they pupate. No mention is made as to the number of broods in the year, nor is the entire life history given.

As a preventive against this insect it is suggested that the usual raphia fibre used to tie up the buds should be replaced by woollen thread which has previously been dipped in turpentine mixed with a little linseed oil and naphthalene, the

threads to be thoroughly dried before using. Whether this method has actually been found successful in practice is not stated. It is evident that the complete protection of the wound made in the process of budding is the most certain method of preventing attack, and in this connection the use of grafting wax naturally suggests itself. Any practical notes which growers can make on this subject would be of interest, as also would further records of the distribution of the insect in England.

References.

1. *Report on Economic Zoology*, 1913, p. 100.
2. Vuillet, *La Revue de Phytopathologie Appliquée*, Vol. I., No. 8, p. 112.
3. *Handbuch der Pflanzenkrankheiten*, Vol. III., p. 448.
4. Binnenthal, *Die Rosenfeinde*, pp. 278-279.
5. Ruebsammen, *Entomologische Nachrichten*, xix. (1893), p. 161.

THE Board recently received an enquiry from a correspondent in North Devon concerning the edibility of the berries of the Mountain Ash (*Pyrus Aucuparia*). As

Mountain Ash Berries as Food. these berries appear to be very plentiful this year the following notes, taken from various sources, may prove of interest.

The berries of the Mountain Ash are consumed with avidity by birds and poultry, but they are not often eaten by human beings owing to their bitter taste and peculiar flavour, which has been compared to the smell conveyed by green or recently cut wood. In Wales and the Scottish Highlands they seem to be liked, and have even been exposed for sale in the streets of Glasgow.

This well-known fruit is popularly supposed to be poisonous. It contains a large quantity of malic acid, and some prussic acid, but the latter is in small proportion and is probably not sufficient to render the berries deleterious unless to children.

In various parts of the north of Europe these berries are dried and ground into flour and used in times of scarcity. When distilled the berries yield a strong spirit, and in Wales a beer or ale was formerly brewed from them.

The chief use of the berries seems to be for the preparation of a jelly, which serves as a substitute for red-currant jelly for game. It has an astringent flavour, however sweetened, but is said to be by far the best jelly for use with venison. The recipe for the jelly given by one authority is as follows :—Boil the berries in water (cold at first) till reduced to such a consistence that the fluid can be strained through a canvas

bag; to every quart of the fluid add 2 lb. of loaf-sugar, then boil again for ten minutes. The following recipe is in use in Scotland:—Put the ripe berries in the preserving pan with just enough water to keep them from burning (about $\frac{1}{2}$ pint to 2 lb. of berries) and let simmer. Stir and break the berries up to make the juice flow freely. When the berries are quite soft and well broken up, turn them into a jelly-bag and drain as usual, but slowly and without handling. Return the juice to the pan with 1 lb. sugar to each pint of juice. Boil for nearly an hour, or till it "jellies."

The fruits of the variety *rossica* are sweet, and the variety is said to be planted in Southern Russia, where, at Kiev, the berries, powdered with sugar and packed in small boxes, are sold and exported.

The variety *moravica* has larger fruits than the type, and these are less harsh to the taste. They are said to be used extensively in some Continental countries.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Influence of Salt on Plants (*Jour. Dept. of Agric., Victoria, A. J. Ewart, D.Sc., Ph.D.*).—When salt is added to the soil, it may act in various ways upon the crops. As regards its injurious action, when in excess it tends to form with the soil particles impermeable crusts, which interfere with the aeration of the soil. In addition, it raises the osmotic concentration of the soil moisture, and so tends to make the soil physiologically dry to the plant roots, even while it still contains a fair percentage of free moisture. This effect is naturally more pronounced with freely transpiring plants, such as peas and lucerne, than with drought resistant ones, such as rye and wheat. These two injurious actions will be feeble when the rainfall is abundant, but pronounced when it is scanty. As regards its beneficial effect, a solution of common salt increases the solubility of many of the mineral constituents present in the soil. Further, although salt itself is not generally considered to be a food substance to plants, it is always present in the ash, and since it is capable of influencing certain oxidase actions it may also affect the respiration and growth of the plant.

The salt used in these experiments contained calcium, magnesium and sodium sulphates, but in insufficient amount to affect the physical action of the salt; in addition to which a dressing of magnesium sulphate, at the rate of $\frac{1}{2}$ cwt. per acre, previous to the application of the salt, ensured that the magnesium in the salt could exercise no appreciable stimulating or nutrient action. There was no potassium, phosphoric

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

acid, nitric acid or iron in the salt. The rainfall during the period April, 1912, to October, 1913, during which the experiments lasted, was 35 $\frac{1}{2}$ in.

The crops under trial in 1912 and 1913 were lucerne, rye grass, rye, silver beet, wheat, rape, Toowoomba canary grass, and field peas, the crop on each plot being changed in the second year. In the case of each crop one plot was left untreated with salt, and to six other plots salt was applied at the rate of 2, 4, 8, 16, 32 and 64 cwt. per acre respectively in the earlier of the two years.

In all cases moderate dressings of salt distinctly increased the yield in the first year, but with increasing doses this was ultimately replaced by a decreased yield, except with silver beet. Strong dressings retarded germination in all cases, and the failure to produce a crop in some of the plots was due to germination being retarded until the seeds rotted, as well as to a direct injurious action on the young seedlings. The dressings which gave the largest yields in the first year were: lucerne 4 cwt., rye grass 4 cwt., rye 16 cwt., silver beet 64 cwt., wheat 8 cwt., rape 16 cwt., canary grass 32 cwt., and field peas 2 cwt. of salt.

The plots were dressed with artificials previous to the cropping in 1913, but received no salt. In the second year insufficient salt remained, as a rule, directly to injure the crops. Thus good yields were given by rye grass, rye, wheat, and canary grass on the plot to which 64 cwt. had been previously applied; by rape on the 32 cwt. plot; and by field peas on the 8 cwt. per acre plot. The highest yields resulted from the following previous dressings: lucerne (after rye-grass) 4 cwt., rye-grass (after lucerne) 64 cwt., rye (after rape) 32 cwt., silver beet (after field peas) 4 cwt., wheat (after canary grass) 64 cwt., rape (after silver beet) 32 cwt., canary grass (after wheat) 32 cwt., and field peas (after rye) 2 cwt. The only 64 cwt. plot which gave a high yield in the first year (silver beet) gave an almost negligible yield of rape in the following season, indicating that where the addition of salt increases the yield, it does so at the expense of the food materials present in the soil, and therefore acts as an exhausting and not as a replacing manure.

FIELD CROPS.

Varieties of Mangolds (*Lindsey C.C. Educ. Committee, First Ann. Report of the Organiser of Agricultural Education, 1913-14*).—These trials were carried out in order to test the yield of different varieties of mangolds and to compare the yield of roots per acre with the yield of the actual dry matter per acre. The results obtained represent the averages of three farms situated on different soils, viz., clay with clay subsoil, heavy clay loam with clay subsoil, and deep loam. The wet winter and early spring of 1912-13 made it difficult to get a good seed-bed on the heavier soil, while the drought in the summer of 1913 resulted in poor root crops generally in this district. The average yields of roots and dry matter per acre of each variety at the three centres were as follows:—

Toogood's Masterpiece Yellow Globe: roots 24 tons 5 cwt.; dry matter 5,084 lb.

Pennell's Giant Prize-winner Yellow Globe: 22 tons 17 cwt.; 5,492 lb.

Carter's Red Globe: 22 tons 17 cwt.; 5,113 lb.

Garton's Red Globe: 22 tons 16 cwt.; 4,913 lb.

Sutton's Prize-winner Yellow Globe: 22 tons 8 cwt.; 4,877 lb.

Webb's Lion Yellow Intermediate: 19 tons 12 cwt.; 4,163 lb.

Carter's Dreadnought Yellow Intermediate: 19 tons 11 cwt.; 3,910 lb.

Sutton's Golden Globe: 19 tons 2 cwt.; 4,817 lb.

Pennell's Golden Tankard: 18 tons 14 cwt.; 4,922 lb.

Sutton's Golden Tankard: 15 tons 19 cwt.; 4,044 lb.

It is concluded that for general purposes the Globe and Intermediate types are most suitable. The Tankard varieties are valuable for keeping purposes when wanted for summer use and, owing to their higher percentage of dry matter, are more valuable per ton than Globes or Intermediates.

Varieties of Swedes (Lindsey C.C. Educ. Committee, First Ann. Report of the Organiser of Agricultural Education, 1913-14).—This experiment was carried out in order to ascertain the relative yields of different varieties of swedes, and to find by analysis which variety yielded the most dry matter per acre. The average yields of roots and dry matter per acre of each variety, at one centre only, were as follows:—

Holborn Invicta: roots, 19 tons 3 cwt.; dry matter, 4,341 lb.

Purple Top: 18 tons 3 cwt.; 3,659 lb.

Golden Melon: 17 tons 13 cwt.; 3,479 lb.

Incomparable: 17 tons 4 cwt.; 3,275 lb.

Magnum Bonum: 16 tons 17 cwt.; 3,698 lb.

King George: 16 tons 15 cwt.; 2,558 lb.

Darlington: 16 tons 10 cwt.; 3,637 lb.

Imperial Lord Derby: 15 tons 18 cwt.; 3,348 lb.

British Lion: 15 tons 14 cwt.; 3,481 lb.

Top-Dressing of Mangolds (Lindsey C.C. Educ. Committee, First Ann. Report of the Organiser of Agricultural Education, 1913-14).—This trial was carried out on a stiff clay loam. The mangolds were top-dressed on July 9th and lifted and weighed on November 4th. The top-dressing and yield of mangolds per acre were as follows:—

No dressing, 12 tons 17 cwt.; 1 cwt. nitrate of soda, 16 tons 15 cwt.; 102 lb. nitrate of ammonia (a new manure), 14 tons 3 cwt.; 135 lb. nitrate of lime, 19 tons 8 cwt. It is considered that this trial is not sufficient to demonstrate the value of one manure over another, but the figures may be taken as showing the value of top-dressing mangolds even in such an abnormally dry summer as that of 1913.

DAIRYING.

Cost of Food in the Production of Milk (Leeds Univ. and Yorks. Council for Agric. Educn., Bull. No. 91; Charles Crowther, M.A., Ph.D., and A. G. Ruston, B.A., B.Sc.).—During 1911-12 and 1912-13 careful investigations were carried out on a number of farms in the North Riding of Yorkshire respecting the cost of feeding cows and the yield and quality of the milk produced by them.* The present report deals with the continuation of those investigations during the year April 1st, 1913 to March 31st, 1914. As before, each farm was visited once a fortnight for the purpose of weighing, sampling and testing the milk of each cow, and recording the amount and nature of the foods consumed.

Nine herds, comprising 278 cows in all, were tested, but complete records for twelve months are available for only 141 cows; the remaining 137 represent first calving heifers coming into milk after April,

* See *Journal* for January, 1914, p. 905.

1913, cows purchased after that date, or cows sold before the end of March, 1914. Four of the herds were composed of non-pedigree Shorthorns, one of pure-bred Shorthorns, one of pure-bred Guernseys and 2 of non-pedigree Shorthorns, Guernseys and Jerseys.

Yield of Milk.—To obtain the total yield for the year the yield recorded at each fortnightly visit was multiplied by 14 and the result thus obtained by 26. For the purpose of comparison the milk was valued at a uniform rate of 8d. per gallon. The highest average yield per herd was given by a herd of non-pedigree Shorthorns, viz., 854 gallons of a value of £28 9s.; in this herd the highest individual yield was 1,314 gallons, valued at £43 16s., and the lowest 616 gallons, valued at £20 11s. This herd also gave much the highest yield both in 1911-12 and 1912-13. The lowest average yield—namely, 478 gallons valued at £15 19s.—was obtained from the herd of pure-bred Shorthorns; this herd, however, included one cow that was in milk for only 26 weeks and yielded only 192 gallons.

Nine cows, all Shorthorns, achieved yearly records exceeding 1,000 gallons. Of the Jerseys and Guernseys the highest yield was 755 gallons, recorded by a half-bred Jersey, a second calver and in milk 42 weeks. The highest yield recorded by a pure-bred Guernsey was 718 gallons. The 118 Shorthorns included in this year's tests gave an average yield of 725 gallons per head, and the 23 Guernseys and Jerseys averaged 584 gallons per head. It was found in 1913-14 as in the two previous years that the average output of more than one-half of the total number of cows fell between 500 and 800 gallons.

Figures were compiled showing the influence of the age of the cow upon the milk yield. In these tests it was found that the average yield per head increased definitely each year up to the fifth calf, rising from an average of 399 gallons for the first period of lactation to 719 gallons during the fifth period of lactation. After the fifth calf there were signs of a falling off in the output. The records also furnished evidence that the time of calving exerts a considerable influence upon the total milk yield. The tests gave effect to the theory that cows calving just after the grass is at its best will not, as a rule, maintain their yields as successfully as those which calve late in the season and which, on being turned out in the following spring, are still giving a fair quantity of milk, and are capable of profiting by the abundant supplies of green food. The returns showed that the cows calving in the six months March to August gave an average yield of 516 gallons per head, while those calving from September to February yielded an average of 686 gallons per head.

Cost of Food.—As is usually the case in experiments involving the use of home-grown foods, it was found impossible to obtain a precise estimate of the actual cost of the food. The following arbitrary scale of values per ton was, therefore, adopted:—Hay, 55s.; oat straw, 30s.; barley straw, 25s.; swedes, 10s.; mangolds, 10s. 6d.; turnips, 8s.

The total cost of feeding during the year varied from £14 3s. 4d. to £21 10s. 2d. per cow, limits closely in agreement with those of the previous years, viz., approximately £15 to £23 in 1911-12 and £14 to £20 in 1912-13. The range of variation in the estimates of cost of food per gallon of milk (from 5.3d. to 7.8d.) also agrees with the previous results (5.2d. to 8.7d. in 1911-12 and 5.0d. to 7.9d. in 1912-13). A point of considerable interest is that although the herd already referred to as giving the highest yield of milk had a food bill of £21 10s. 2d.

per head, over £2 per head higher than any other, it nevertheless produced milk at the lowest price per gallon, viz., 5.3d.; further, in the case of the herd producing the least milk the cost per gallon was 7.8d. On the farms where butter was made, the average cost of the food required to produce 1 lb. of butter was approximately 1s., the range being from 8.7d. to 16.7d.

On the average the cows were 28 weeks on grass at an estimated cost per cow of £4 19s. The average values per cow of the other foods consumed for the whole year were: hay, £3 10s. 10d.; straw, 17s. 1d.; roots, £2 0s. 10d.; cakes, etc., £5 14s. 6d. Each cow on an average, in addition to pasturage, consumed roughly 1½ tons hay, 12 cwt. straw, 4 tons roots and 17 cwt. concentrated food, or, in other words, she consumed approximately the produce of 1 to 1½ acres of grass, ¾ acre of hay, ½ acre of straw, ¼ acre of roots, in addition to cakes, etc.

Percentage of Fat in Milk.—The average percentages of fat in the total output of milk for the year show a wide range of variation, the extreme percentages for Shorthorns being 3.09 per cent. and 4.6 per cent.; and for Jerseys and Guernseys 3.88 per cent. (half-bred Jersey) and 5.71 per cent. (Guernsey). Though high yield and low fat content and low yield and high fat content do not invariably go together, it was found that whereas in the case of cows yielding under 400 gallons of milk, the milk contained an average percentage of 3.92 of fat, the percentage decreased with an increased milk production, until the milk of cows yielding over 1,000 gallons contained only 3.48 per cent. of fat.

The percentage of fat varied in the morning milk from 2.6 to 6.8 (average 3.52), and in the evening milk from 3.0 to 6.6 (average 4.14). Excluding the herd of Guernseys, the highest value recorded for the mixed milk was 4.96 per cent. The importance of milking at regular intervals was shown by the fact that of the 18 samples containing less than 3 per cent. of fat in the morning milk no fewer than 13 were contributed by a farm where the intervals were very unequal. In no instance did the evening milk contain less than 3 per cent., nor did this ever occur where the morning and evening milk was combined.

It was observed that while the lengthening of the night interval tends to raise the yield of milk and lower the percentage of fat in the morning milking as compared with the evening milking, it has little effect on the total weight of fat given at each milking. Thus, if by lengthening the period between two milkings the yield of milk is increased at the second milking, the gain is effected at the expense of the quality of the milk.

Ability of Streptococci to Survive Pasteurisation (*Jour. of Agric. Research*, July, 1914, S. H. Ayers and W. T. Johnson).—The thermal death points of 139 cultures of streptococci isolated from cow faeces, from the udder and the mouth of the cow, and from milk and cream showed a wide variation when the heating was carried out in milk for 30 minutes under conditions similar to pasteurisation. At 60° C., the lowest pasteurising temperature, 89 cultures, or 64 per cent., survived; at 62.8° C., the usual temperature for pasteurising, 46, or 33 per cent., survived; and at 71.1° C. 2.58 per cent. of the culture survived; all were destroyed at 73.9° C.

The streptococci from the udder were, on the whole, less resistant, and those from milk and cream more resistant to heat than those from the mouth of the cow and from cow faeces. When heated to 60° C. all

the cultures from milk and cream survived; at 62.9° C. 94.44 per cent.; at 68.3° C. 50 per cent.; while all were destroyed by heating to 73.9° C. for 30 minutes.

The typical streptococci (forming long chains) were much less resistant to heat than the atypical.

Two classes of streptococci seem to survive pasteurisation: (a) Those which have a low majority thermal death point but among which a few cells are able to survive the pasteurising temperature. This ability of a few bacteria to withstand the pasteurising temperature may be due to certain resistant characteristics peculiar to a few cells or may be due to some protective influence in the milk. (b) Those which have a high majority thermal death point which is above the temperature used in pasteurisation. This ability to resist destruction by heating is a permanent characteristic of certain strains of streptococci.

LIVE STOCK FEEDING.

A Comparison of Coconut Cake, Wheat Bran and Linseed Cake for Cattle Feeding (*Edin. and E. of Scot. Coll. of Agric., Report XXVII*).—

The supply of bran, it is stated, has enormously increased in this country in recent years, owing to the great development of the British milling industry; and its proper utilisation is at present a question of considerable economic importance to agriculturists. Beyond a somewhat limited use in the feeding of dairy cows, and the employment of an even smaller amount in the case of other classes of farm stock, bran has hitherto received little attention from the stock feeders in this country. In composition bran is more like oats than any other feeding stuff. To make up for its low nutritive value, as compared with linseed cake and coconut cake a slightly larger quantity was allowed in these experiments. The bran used was what is known as medium bran. The supply of coconut cake is gradually increasing, and analysis indicates that it is a rich feeding stuff containing about 10 per cent. oil, 22 per cent. albuminoids and 36 per cent. carbohydrates.

Forty-two two-year-old Irish-bred bullocks were divided as equally as possible into six lots each of seven cattle, two lots being fed on each foodstuff. The basal ration was 4 lb. cotton cake, 90 lb. swedes and 12 lb. oat straw; and, after a preliminary period, the quantities of the foods under trial fed were 4 lb. per head per day of each, the quantity of bran being increased to 5 lb. at the end of the second month and to 6 lb. at the end of the third. The bran was fed dry, and the cattle ate it readily out of their ordinary troughs without waste. The coconut cake was steeped in twice its weight of water, but it is stated that the utility of this measure was doubtful seeing that the animals received plenty of swedes.

The increases in live weight were determined after the experiment had proceeded for four months, as some of the animals were then fat. The average increase in live weight per head per day was from linseed cake 2.25 lb.; from coconut cake 1.91 lb.; and from bran 2.02 lb. In reckoning the cost of the increase these foods were taken at their actual cost less the estimated value of their manurial residue; this gave a net food value for linseed cake of £8 13s. 9d., coconut cake £6 15s. and bran £5 1s. 3d. per ton. The cost of feeding per cwt. live weight increase was:—linseed cake 44s. 4½d., coconut cake 48s. 5d., and bran 44s. 1½d.

Twenty-seven of the cattle, representing equally each kind of feeding were marketed for comparison; the average prices realised per cwt. were:—linseed cake lot 42s. 8d., coconut cake lot 42s. 10d., and bran

lot 43s. 4d. These prices were not, however, made a basis for comparison, the live weight in all cases being reckoned at 41s. per cwt., with the following financial results:—

	Linseed Cake.		Coconut Cake.		Bran.	
	c.	q. lb.	c.	q. lb.	c.	q. lb.
Weight at start—14 store bullocks	126	2 26	129	1 11	128	2 2
Weight at finish—14 fat bullocks	158	1 3	156	0 2	156	3 10
Total increase	31	2 5	26	2 19	28	1 8
Net cost of food consumed ..	£	s. d.	£	s. d.	£	s. d.
Value at start at 34s. per cwt.	70	0 0	64	11 6	62	10 2
Value at finish at 41s. per cwt.	215	8 10	219	17 10	218	9 7
Difference = Gross Profit ..	324	9 4	319	16 9	321	7 0
Gain (+) or loss (—) compared with linseed cake fed cattle..	39	0 6	35	7 5	40	7 3
	—		—3 13 1		+1 6 9	

These figures indicate that the outlay on bran brought £1 6s. 9d. more profit, and on coconut cake £3 13s. 1d. less profit than the outlay on linseed cake. The experiment shows that when linseed cake costs £10 11s. 3d. per ton, coconut cake and bran are worth respectively £7 1s. 5d. and £6 16s. 10d., whereas the prices actually paid for these two foods were respectively £8 7s. 6d. and £6 8s. 9d. The feeder could, therefore, have afforded to pay 8s. 1d. more per ton for his bran and yet have made the same profit as from linseed cake.

Reports as to the quality of the beef were obtained from purchasers, who in most cases not only killed the animals but cut up the beef and retailed it from their shops. These reports testified to the high quality of the beef, no distinctions being made. The cattle fed on linseed cake yielded 58.55 per cent. of the live weight as dressed carcass, those on coconut cake 58.67 and those on bran 60 per cent.

NOTES ON AGRICULTURAL CO-OPERATION.

IN 1880 a number of horse-owners at Newark, in Nottinghamshire, founded an unregistered mutual insurance society on co-operative principles for the insurance of their horses. This Society proved so successful that by 1898 it had accumulated a reserve fund of about £600. Some of the members then wished to divide up the fund, and in order to avoid

Newark Horsekeepers' Insurance Company, Limited.

this suicidal action, it was resolved to form the society into a limited liability company. No money was paid to the members, nor were they required to pay any money for their shares in the new company. The shares were allotted to the then members of the old society in proportion to the amount each member had paid in insurance contributions during its existence.

The company, which still resembles in some respects a co-operative society, was incorporated under the Companies Acts to carry on the

business of insurance of horses, cattle, sheep, pigs and other animals against death, loss or damage from any cause whatsoever, and to provide veterinary medical attendance on the illness of any animal insured. Power was also taken to lend money to customers and others having dealings with the company on such terms as might seem expedient. The capital was declared to be £1,000, divided into 1,000 shares of £1 each, and the liability of members was limited. According to the Articles of Association a member has one vote for every share he holds, and the quorum of a general meeting is five. The number of directors is to be not less than three nor more than seven, and they are to receive as remuneration £10 a year (since raised to £21), to be divided among them as they shall determine. The term of office is three years and the directors retire by rotation and are eligible for re-election: a director must hold six shares in his own right. The profits of the company in each year are to be divided amongst the members in proportion to their shares and according to the amount paid up thereon, but so that no higher dividend than 6 per cent. shall be paid, except by way of making up a deficiency in the dividend for a previous year. The members have power, before recommending any dividend, to set aside out of the profits of the company such sum as they think proper as a reserve fund to meet contingencies, or for equalising dividends or other purposes, with power to divide the remaining profit by way of bonus to members; all surplus income accruing after payment of dividends, and bonus to policy holders is to be carried to the reserve fund. A member desiring to transfer his shares must first offer them to some other member, and, failing a sale, he must offer them to the directors of the company. If the Directors do not agree to purchase the shares within twenty-one days, he is at liberty to transfer the shares to any other person, but the directors may refuse to register a transfer to a transferee of whom they do not approve.

Re-valuation.—The horses insured are re-valued every year in December, and the amount of the valuation determines for the next twelve months the amount payable on any claim made regarding the horse. In the event of a claim being made good the company pays only two-thirds of the market-value of the horse at the last valuation, and the rate of premium (which is payable quarterly on 25th March, June, September and December in each year) varies with the value then put on the horse. The rate charged is approximately 5½ per cent. per annum on the market value of the horse, which is equivalent to 8½ per cent. per annum on the amount claimable in case of death. Thus on a horse valued at £24, on which £16 is payable in case of death, the quarterly premium is 7s., equivalent to £1 8s. per annum. In return for this premium the member not only has his horse insured for two-thirds of its market value, but is entitled to veterinary attendance and medicine from the company's veterinary surgeon and to veterinary expenses incurred with any other veterinary surgeon when the animal is taken ill in another district, and can also, when he purchases a horse, have an examination made by the company's veterinary surgeon at a fee of 5s. for each horse. He may also receive a bonus out of the profits of the company, when the directors are of opinion that the profits warrant such a course.

Claims.—Claims are payable in the event of accidental death or of an accident necessitating the immediate destruction of the insured

animal, or in the event of its death from disease (glanders and farcy excepted) at any time from noon on the twenty-first day after acceptance of the proposal and payment of the premium, but no claim is payable if the animal dies outside the United Kingdom, or from neglect or improper use or unskilful treatment, or from improper loading of any vehicle to which it may be harnessed, or by reason of its being left unattended, or of the intoxication of the rider or driver, or from malicious or wilful injury; nor does the policy cover the risks of or arising from the effects of foaling or castration, except under special conditions. If the animal is covered by any other insurance the company contributes only its rateable proportion, so that the owner may not receive more than two-thirds of the market value.

Notice of Accident.—Notice of any accident to, or illness or death of the horse insured must be immediately given to the company at its registered office, and in case such notice is not given within twelve hours, or if the animal is destroyed without a written authority from the company's veterinary surgeon or secretary, all right of claim is forfeited. Notice must also be immediately given to the company's veterinary surgeon.

Receipts and Expenditure.—On the average of the 12 years ending 1913 the working of the society was as follows. The average receipts were :—

Premiums	£	s.
Entry fees	196	10
Sale of carcasses	1	6
Interest	2	3
Miscellaneous	21	12
	0	8
Total receipts	£221	19

and the expenditure, other than expenditure on dividends and bonuses, averaged as follows :—

Audit fee	£	s.
Salaries	2	2
Veterinary surgeon's fee	22	12
Income Tax	56	1
Paid on claims	5	10
Printing, postages, &c.	43	18
Directors' fees	5	17
	18	5
Total expenditure	£154	5

so that on the average the company made an annual profit on its working, available for dividend, bonus and reserve fund, of £67 14s. For the 12 years taken together the total profit amounted to £811 10s., which was disposed of as follows :—

Dividend to shareholders	£	s.
Bonuses to policy holders	465	15
Carried to reserve fund	275	11
	70	4
Total	£811	10

According to the balance sheet for the year 1913 the company then possessed assets amounting to £830, viz., cash, £222; investment, £600; loan to insurer, £8; against which the only liability was £647 due to shareholders, thus leaving a balance of profit up to date, after payment of dividend and bonus, of £183, of which £102 was classed as reserve and £81 as profit of the year. Of this amount £77 13s. has since been paid as dividend to shareholders and the remainder carried to the reserve fund, which now amounts to £106.

Share Capital.—The share capital consists of 647 £1 shares, all paid up. The shareholders have received a dividend of 6 per cent. in 10 of the 12 years, and of 12 per cent. last year, so that they have received an average of 6 per cent. on their share capital for the whole period. The policy holders have received a bonus in 9 of the 12 years varying from 5 per cent. to 20 per cent. of the amount paid by them in premiums, so that their bonuses averaged for the whole period 11 per cent. of their premiums, and as they paid a premium of 5½ per cent. on the market value of their horses, the net premium actually paid by them, after allowing for the bonus, was 5½ per cent. of the market value, in return for which they not only received two-thirds of the market value of any horse that died, but also had the benefit of veterinary attendance on any insured horse that fell ill.

The average number of horses insured was 170, and the average number of horses on which claims had to be paid was 3.9, so that the average casualty rate per annum was 2.3 per cent.; in the best year, 1913, no death occurred; and in the worst year, 1912, the casualty rate was 5 per cent. The total number of losses in the 12 years was 47, and the total amount paid on claims was £526 14s., so that the average amount paid per claim was £11 4s., and as the amount payable is two-thirds of the market value it appears that the average market value of the horses that died was about £17. The worst year of the series, financially, was 1911, in which of 140 horses 6 died, requiring payment by the company of £93, or an average of about £15 10s. per horse, so that the average market value of the horses that died in that year was about £23. This was the only year of the series in which the society's accounts showed a loss on the working of the year, amounting to £8 5s., and in that year neither bonus nor dividend was paid. For the whole period the amount paid on claims averaged £43 18s. per annum, and as on the average 170 horses were insured, the compensation paid on claims by the company averaged only 5s. 2d. per annum per horse insured. For the disposal of the carcasses a contract has been made with a knacker, who pays £1 10s. for a large carcass and £1 5s. for a small one.

Veterinary Inspection.—The arrangement made with the veterinary surgeon is that the company pays him quarterly at the rate of 7s. 6d. a year for each horse insured. In return for this contract-fee he engages to give veterinary attendance and medicine free to every insured horse, a privilege highly valued by the insurers, who pay nothing extra for it, so that this amount may be considered to be a payment for veterinary services and deducted from the premiums they pay to the company to get the amount really paid for insurance. The Company also gets from the veterinary surgeon in return for this contract-fee the following services, free of further charge: He examines and passes or rejects all horses presented for insurance, keeps a list of them with their age, description and value, takes part in the annual valuation, and decides

valuation disputes. The Company owes much of its success and popularity to his skilled supervision of its interests on the veterinary side.

The valuation is made annually in December and takes effect for premiums and compensation from the 25th of that month. The area covered by the Company, which extends to a distance of about 8 miles from Newark, is divided among the veterinary surgeon and the directors, who go in pairs or threes, visit the horses on their owner's premises without notice, and after considering the value placed upon them at the last valuation, fix the value of each animal for the coming year. A number of the insured horses are worth £60 or more, but the owner is allowed to fix the amount for which he will insure his horse, so long as it does not exceed the value put upon it by the valuing committee, and as a matter of fact no horse is insured at a higher amount than £45. The reasons given for this tendency on the part of the owners of the better horses are that they are content, by payment of a lower premium, to secure free veterinary attendance for the insured horse together with the prospect of receiving a substantial fraction of its value in case of death, and that they do not wish to risk wrecking the society by making heavy claims upon its funds. At the other end of the scale, horses are not admitted to insurance unless they are worth at least £15, and as a horse gets old its value is not written down below £12, so that in any case, however old a horse, once it is insured its owner will receive at least £8 if it dies on his hands. Statistics are available for 109 of the insured horses, of which 31 were valued for insurance last December at £15 or less, 15 at over £15 and not over £20, 55 at over £20 and not over £30, and only 8 at more than £30. The average value for insurance of the 109 horses was £23, but their real value would be somewhat higher.

There is no definite rule as to the age above which a new horse will not be accepted for insurance, but unless it belongs to a man who already insures with the company, a horse over 15 years of age is rejected. Once insured a horse is never struck off the list owing to old age. Of the 109 horses for which statistics are available, the youngest is 3 and the oldest 29 years old: 38 are over 12, and of these 8 are over 20 years old.

Of these 109 horses 48 are employed in heavy work such as carting coals, building materials, flour, &c., and 61 in light work such as that of butchers, bakers, milk dealers, fishmongers, grocers, cab drivers, &c. No difference is made in the premium whatever be the kind of work for which the horse is used. Very few ordinary farm horses are insured, and the company is rather a town and village society than an agricultural society. In 1913 the number of policy holders was 69 and the number of horses insured was 134, an average of 2 per insurer. One policy holder has as many as 7 horses insured with the company, but most have only 1 or 2. In 1902 there were 109 policy holders who insured 198 horses, but since then there has been a fairly steady decline, which is ascribed to greater strictness in taking in doubtful horses, none being accepted unless "serviceably sound," and to a feeling among the owners of the more valuable horses, especially those who own a number, that it pays them better to take the risk themselves than to pay the premiums required by the company.

There is no rule under which a new insurer can demand a share in the company, and a number of the policy holders hold no share and therefore have no voice in the management. The Articles of Association

fix the capital at 1,000 shares of £1 each, but in recent years there has been no increase in the number of shares issued, which stands at 647. As the shares have paid 6 per cent. for a number of years they are in demand and sell at a premium, one lot having recently changed hands at £1 1s. 6d. The directors refuse to allow shares to be sold to outsiders, so that there is a tendency to concentrate them in few hands, but in 1905 there were 81 shareholders, of whom 19 owned 1 share each and several 3 or 4. There are at present 7 directors, all living in the town, their occupations being coal merchant, butcher, grocer, baker, carter, cab owner and furniture dealer.

Results.—From the point of view of the shareholders the company has been successful. The original shareholders obtained their shares free of payment, in return for the savings they had accumulated by the previous good management of their co-operative insurance society. Their shares have paid them 6 per cent. per annum and sell at a premium. They are liable for any exceptional loss due to excessive mortality, but against this risk they have a reserve fund of £106—equal to more than two years' losses on claims—and the actual average death rate among the insured horses for the last 12 years has been only 2.3 per cent. per annum. The two disquieting features are the high costs of management and the falling off in the number of horses insured. Apart from the 7s. 6d. per horse paid for veterinary services, the costs of management have averaged, as follows, for the 12 years:—Audit fee, £2 2s.; salaries, £22 12s.; printing, postage, &c., £5 17s.; directors' fees, £18 5s. Total £48 16s. This is actually more than the amount paid on claims, which averaged only £43 18s. and is equivalent to an average of 5s. 9d. per annum per horse insured; whereas in the Bedworth Co-operative Insurance Society, which is run on co-operative lines, the cost of management averages 3s. 2d. per annum per horse insured (see *Journal* for April, 1913, p. 55), and in the registered co-operative cow insurance societies in England and Wales, the cost of management averages only 6d. per annum per animal insured.

If the company could reduce its costs of management it would have a still larger profit to show in its annual accounts, and although it could not increase the dividend paid to shareholders above 6 per cent., it would be in a position to pay a larger bonus to its policy holders and thus increase its usefulness to its neighbours on co-operative principles. A further step in the same direction might be made if the shareholders were to agree to reduce the capital of £647 to half that amount by taking payment from the company of half each share at 10s. per share and thus reducing the interest charge, which at present averages £38 16s. per annum, to half that amount. It might also require each policy holder to take out at least one share, and permit him to acquire up to five shares at £1 until the full number of 1,000 shares had been issued. This would broaden the basis of the company and lessen the inducement to sacrifice the interests of the insurers to those of the shareholders. But until the company gave equal votes to all the shareholders, irrespective of the number of shares held by each, it could not be considered to be truly co-operative.

To the insurer, say the man owning a horse worth £24 used for heavy carting work, on which he would receive from the company £16 in case of its death from disease or accident, the existence of this company must have been a great advantage. He pays altogether to the company 5½ per cent. per annum on the market value, i.e., £1 8s. per annum,

but on the average of the last 12 years he has received 11 per cent. on his premiums as bonuses, so that his net payment has averaged £1 5s. or 5½ per cent. on the market-value of his horse. In return for this payment he not only has his horse insured but is entitled to veterinary attendance and medicine free of charge. This latter privilege costs the company 7s. 6d. per horse, so the amount the insurer pays for insurance may be taken as 17s. 6d. per annum, equal to about 3½ per cent. on the market value of the horse, or that nearly 5½ per cent. on the amount payable in case of death. If he had insured his horse with a large live stock insurance company he would have paid for a horse of that class, not more than 10 years old, 8½ per cent. (some companies charge 10 per cent.), on the amount payable in case of death, i.e., £1 8s. for £16, as against the 17s. 6d. he has paid to the Newark Company. The chief advantage to a man of this class, however, is that, while he would have found it practically impossible to get a distant company to take for insurance a horse not already insured over 12 years of age, and would have found the rate charged on his horse as it grew old prohibitive, he can have his horse, if serviceably sound, insured with the local company for the first time up to 15 years of age, and once it has been accepted for insurance can keep it insured at the same rate of premium up to any age, and will get from the company two-thirds of its value and not less than £8, however small its value be, whenever it dies on his hands. This is mainly due to the comparatively small area covered by the company's operations, which makes close supervision and fair valuation possible and practically obviates all risk of fraud.

Bedworth Horse Insurance Society.—It is interesting to compare the Newark Company's experience with that of the Bedworth Horse Insurance Society, which is run on purely co-operative lines. At Bedworth a member insuring a horse used for heavy draught work worth £24 for £18 payable in case of death (the Bedworth Society pays three-fourths of the market value while the Newark Company pays only two-thirds) pays in insurance contribution £1 1s. 8d. per annum, equal to 6 per cent. on the amount payable in case of death, as compared with the 5½ per cent. an insurer pays at Newark. But the Bedworth member pays in addition to this insurance contribution only 4s. per annum for management expenses per horse insured so that his total annual payment for a £24 horse is £1 5s. 8d., in return for which he gets veterinary attendance and medicine free; while the Newark insurer pays altogether for a £24 horse £1 5s. per annum, including the cost of similar veterinary attendance; the Bedworth insurer however gets £18 on the death of his horse, while the Newark insurer gets only £16. The comparison would be much more favourable to Bedworth were it not that the average death rate among insured horses is 6½ per cent. there, while at Newark it is only 2.3 per cent. The reasons for this much heavier mortality at Bedworth seem to be (1) that the Bedworth horses are used for more wearing work, 98 out of 109 insured being employed in hauling coals and other heavy weights, while only 48 out of 109 are so employed at Newark; and (2) that the Bedworth horses are, on the whole, older, 48 out of 109 being over 12 years of age, while only 38 out of 109 are over that age at Newark. Now that the Bedworth Society has resolved not to admit any horse over 15 years of age to insurance for the first time, its death rate has already fallen and its reserve fund is mounting up satisfactorily; and there

seems reason to hope that the average death rate may soon be lowered so much that the society, having accumulated a substantial reserve fund, will be in a position to reduce the rate of premium charged to its old members. In one respect the Bedworth insurer is in a less favourable position than the Newark insurer who is not a shareholder. The latter is not liable to any levy, while the Bedworth member may be called upon to pay a levy to meet exceptional losses if the reserve fund becomes exhausted; but seeing that his society has already accumulated a reserve of £300, equal to three times its average annual losses, he is unlikely to be called upon to pay any levy.

If the Newark horse owners, instead of forming themselves into a limited liability company 14 years ago, had continued as a co-operative insurance society, giving to the insurers themselves all the benefit of any profits they might make, and paying no dividend to shareholders, and if they had, like the Bedworth Society, kept down the costs of management to 3s. 2d. per horse per annum, their average account would have stood as follows for the last 12 years.

Average receipts per annum :—

Premiums	£196 10
Entry fees	1 6
Sale of carcasses	2 3
Interest	21 12
Miscellaneous	0 8

Total receipts £221 19

Average expenditure per annum :—

Paid on claims	£43 18
Veterinary surgeon's fee	56 1
Management expenses	26 18

Total expenditure £126 17

Average surplus per annum £95 2

In that case, while retaining their reserve fund at the £600 they had already accumulated, they might have distributed the whole of this surplus in bonuses to the insuring members, or in other words have reduced their premium payments by an average of about 11s. per horse, so that the member insuring on co-operative principles a horse worth £24 (even one employed on heavy draught work) would have had his horse insured for £16 and attended to by a veterinary surgeon free of charge on a total payment of about 17s. a year instead of the £1 5s. he has actually paid, after allowing for the bonuses he has received. Such would have been the advantage to those insurers who are not shareholders of co-operative management, combined with the low death rate actually attained. Deducting the 7s. 6d. per horse charged for veterinary services the net amount paid by an owner for insurance proper would have been about 9s. 6d. per annum, or less than 3 per cent. on the £16 payable in case of the death of his horse, against the 8½ or 10 per cent., i.e., £1 8s. or £1 12s. he would have had to pay for a similar insurance to an ordinary live stock insurance company.

THE advantages which members of a farmer's co-operative society obtain by combined effort are emphasised when societies co-operate to arrange for the joint purchase of certain requirements. The Farmers' Central Trading Board provides a good example of this form of co-operation. For some years it had been the practice of the managers of the principal trading societies to meet together in order to discuss matters of general interest to their societies, and to arrange for joint purchases. The managers' meetings answered a most useful purpose, but in order that this work might be placed on a more definite footing, the Central Trading Board was created in September, 1912. On this Board the larger societies are entitled to direct representation, while the smaller societies, whose annual turnover does not exceed a certain sum, are entitled to join with other similar societies for the purpose of sending representatives. There are three main divisions of the Board—Northern, Southern and Welsh—which meet as occasion requires, while joint meetings of the whole Board are held in different parts of the country every two months. Already the Trading Board has been able to negotiate for large combined orders on behalf of the societies, and has secured very advantageous terms from manufacturers.

An account of *Farmers' Co-operative Societies* is given in Leaflet No. 97, which can be obtained gratis and post free on application to the Board of Agriculture and Fisheries.

OFFICIAL NOTICES AND CIRCULARS.

THE Rural Education Conference, which was constituted by the Board of Agriculture and Fisheries and the Board of Education in June, 1910, was appointed for a term of three years. This period having expired, the Conference has been re-constituted by the Board of Agriculture and Fisheries under the name of the Agricultural Education Conference.

The duty of the Conference will be to discuss, and to advise the Board upon, all questions connected with agricultural education which fall within the province of the Board of Agriculture and Fisheries, and specific questions will, from time to time, be referred by the Board to the Conference for consideration. In addition, any member may suggest for discussion questions other than those formally referred to the Conference.

The following is a list of the members of the Conference, showing the bodies by whom they have been nominated:—

The Earl of Shaftesbury, K.P., K.C.V.O. (Agricultural Organisation Society).

The Lord Barnard (Central Land Association).

The Lord Hastings (Advisory Council for the Eastern Counties).

Colonel the Hon. G. E. Hegeage (Advisory Council for the Midland Area).

The Right Hon. Henry Hobhouse (University of Bristol).

Sir Mark Collet, Bart. (Board of Agriculture and Fisheries).

Sir Henry F. Hibbert, M.P. (Board of Agriculture and Fisheries).
Mr. R. V. O. Hart-Synnot, D.S.O., B.Sc. (University College, Reading).

Mr. C. G. Argles (Land Agents' Society).

Mr. Graham Balfour (Advisory Council for Shropshire, Stafford and Warwick).

Mr. Charles Bathurst, M.P. (Board of Agriculture and Fisheries).

Mr. G. A. Bellwood (National Farmers' Union).

Mr. G. G. Butler (Armstrong College, Newcastle-upon-Tyne).

Mr. A. W. Chapman (County Councils Association).

Mr. F. J. Chittenden (Royal Horticultural Society).

Mr. D. T. Cowan (Association of Directors and Secretaries for Education).

Mr. David Davies, M.P. (Welsh National Agricultural Society).

Professor J. R. Ainsworth-Davis, M.A. (Advisory Council for the West of England).

Major J. W. Dent (University of Leeds).

Mr. M. J. R. Dunstan, M.A. (South-Eastern Agricultural College, Wye, Kent).

Mr. P. Hedworth Foulkes, B.Sc. (Harper-Adams Agricultural College, Newport, Salop).

Professor D. A. Gilchrist, M.Sc. (Agricultural Education Association).

Mr. William Goodwin, M.Sc., Ph.D. (Midland Agricultural and Dairy College, Kingston, Derby).

Mr. W. J. Grant (British Dairy Farmers' Association).

Mr. W. Hawk (Board of Agriculture and Fisheries).

Mr. W. P. Hiern, F.R.S. (Seale-Hayne College, Newton-Abbot).

Professor C. Bryner Jones, M.Sc. (University College, Aberystwyth).

Mr. Thomas Latham (Farmers' Club).

Mr. W. T. Lawrence (Board of Agriculture and Fisheries).

Mr. W. McCracken (Board of Agriculture and Fisheries).

Mr. K. J. J. Mackenzie, M.A. (University of Cambridge).

Mr. Ernest Mathews (Royal Agricultural Society of England).

Mr. F. H. A. Padwick (Advisory Council for South-East England).

Mr. G. H. Pattinson (Advisory Council for the Four Northern Counties).

Mr. J. H. Sabin (Surveyors' Institution).

Professor R. S. Seton, B.Sc. (Yorkshire Council for Agricultural Education).

Mr. A. F. Somerville (Bath and West and Southern Counties Society).

Professor William Somerville, M.A., D.Sc. (University of Oxford).

Mr. Leonard Sutton (Advisory Council for the Reading Area).

Mr. W. Meyler Thomas (Welsh Agricultural Council).

Mr. W. Tremlett (Advisory Council for Cornwall and Devon).

Mr. Christopher H. Turnor (Central Chamber of Agriculture).

Professor R. G. White, M.Sc. (University College, Bangor).

The Lord Barnard has been appointed Chairman of the Conference and Mr. H. L. French (Board of Agriculture and Fisheries, Whitehall Place, S.W.) will act as its Secretary.

COMPLAINTS having reached the Board of Agriculture and Fisheries that the arrangement under which notices were circulated throughout England and Wales, inviting farmers to make returns of the quantity of produce they have to sell at fair market price for the use of His Majesty's Forces, is not working quite satisfactorily, the Board are taking steps in consultation with the War Office, to constitute in each county, or group of counties, a Farm Produce County Committee.

The Committees will consist of leading farmers nominated by the Presidents of the Royal Agricultural Society of England, the Central and Associated Chambers of Agriculture, the Farmers' Club and the National Farmers' Union.

These Committees will invite farmers to submit samples and to quote prices for the various classes of farm produce which they wish to sell for the use of His Majesty's Forces, and it is hoped that they will be in a position to take up their duties in some districts by about 15th October.

THE Board of Agriculture and Fisheries have received the following communication from the Agricultural Consultative Committee:—

Extension of Area under Wheat.

With the arrival of the time for preparing the land for autumn and winter sowing, the Agricultural Consultative Committee desire again to impress upon farmers the great importance, in the national interest, that the acreage under wheat during the coming year should be largely increased.

The views of the Committee have already been expressed in the following extract from their notice of 18th August:—

"1. The acreage under wheat should be largely increased wherever practicable. In this direction it should not be forgotten that, on clean land, and by the aid of suitable artificial manure, good crops of wheat can be obtained in successive years. Attention is drawn to Section 26 of the Agricultural Holdings Act, 1908, which permits any system of cropping subject to the holding being protected from deterioration.

"2. There is much land of a certain class now under grass which would probably pay for breaking up. If this land is scheduled as arable in the farm agreement, the tenant has the option of ploughing it up. If it is scheduled as grass, the Agricultural Consultative Committee suggests co-operation between owner and occupier as to the advisability of breaking up certain fields in view of the national question of increasing home-grown food-stuffs."

The Committee of course do not suggest that good grazing land should be broken up, and they realise that the circumstances of each individual holding must be examined in considering the above recommendations; but they would point out that should it be found possible to increase the wheat acreage without detriment to the live-stock and general organisation of the particular holding, there seems every reason to suppose that it might prove to the financial advantage of the grower. The Agricultural Consultative Committee have been influenced in arriving at this opinion by the belief that the diminution in the area of wheat sown upon the Continent, and the consequent additional demand which must be made upon the world stock, cannot fail to result in a higher range of price than that which has obtained for many years past. Should this anticipation prove correct, farmers would probably

find it profitable to sow wheat on land other than that which would be drilled in the ordinary course, and the nation would benefit, equally with the grower, by an addition to the home-grown wheat crop.

The Committee have had under consideration the whole subject of increasing and safeguarding the home-grown wheat supply, and have reported to the Board upon the subject. The Government's decision was conveyed in the following official reply given to questions asked in the House of Commons on the 9th September:—

Mr. Charles Bathurst asked the Prime Minister whether, in the event of the Government deciding to provide, by legislation or otherwise, some financial inducement to farmers to retain upon their premises their stocks of wheat now being harvested, or sow this autumn a larger area than usual of their land with cereals, he will, without delay, make a public announcement to the above effect in order to avoid the premature marketing of this year's grain, and to encourage the early sowing of grain for next year's harvest, and the immediate preparation of the land for such purpose?

Mr. Charles Leach asked the Home Secretary what steps are being taken to secure a larger crop of grain during the War?

Mr. Hunt asked the Prime Minister whether, in view of the fact that on account of the War the wheat crop of the world must be short next year, he could give the farmers of the United Kingdom a guarantee that for all wheat suitable for making bread, reaped next year and sold in the United Kingdom after next year's harvest, the Government would, if necessary, make the price up to 35s. a quarter; and is he aware that the matter is urgent on account of the necessary preparation of the land?

Sir H. Verney: The Prime Minister has asked me to answer these questions. The retention of this year's wheat crop in stack until next summer would admittedly result in loss, through vermin and other causes, of a large percentage of the grain, besides depriving farmers of the use of the straw, and I am glad to be able to announce that the Government, after minute examination of the position, are satisfied that there is no necessity for them to take any action of the kind suggested in the first part of the question put by Mr. Bathurst. With regard to next year's cereal crop, the Government have carefully considered all the available information; it is a highly technical question, and, after consulting expert opinion, they have arrived at the conclusion that they would not be justified in holding out a financial inducement to farmers to increase their acreage of cereals. At the same time the Board adhere to the advice which they issued to farmers recently, with the concurrence of the Consultative Committee, that wheat appears likely to be a profitable crop next year.

THE Board of Agriculture and Fisheries consider it desirable to draw the attention of the public to the value of herring as food. In past years enormous quantities of herring,

The Value of Herring as Food.

amounting in the year 1913 to something more than eleven million cwt., have been landed in the United Kingdom by British fishing vessels. Probably nine-tenths of this quantity of fish has found its way to foreign markets, being exported mainly in the form of "pickled" herring, pickled in barrels in brine. The chief countries of export have been in the past Germany and Russia. The German market is closed, and the Russian market is extremely difficult to reach.

On the outbreak of war there were some 317,000 barrels of pickled herring, the product mainly of the Scottish fishery, ready for export. The greater part of this stock is still in the country. The English fishery is usually at its height in the months of September, October and November, and, in spite of inevitable restrictions of this fishery owing to the war, the Board are not without hope that considerable quantities may yet be landed. As a result of the closure of foreign markets the greater part of the herring landed in this country should be available for home consumption.

It has been stated that two salt herrings contain as much animal protein as need enter into the daily diet of an ordinary working man.

When it is realised that a barrel of herring can be purchased for prices varying from 25s. to 35s., according to size, quality, and the state of the market, and a half-barrel at not much more than half the price of a barrel, and that a barrel will contain some 800 to 850 herrings, it will be realised that pickled herring provide a very valuable form of food at a very low price, with the advantage that the food is in a state of preservation in which it can be stored for considerable periods. The wholesale price of one pickled herring would be about one half-penny. The retail price would necessarily be higher, but it is obvious that if the statement that "two salt herrings contain as much protein as need enter into the daily dietary of the average working man" can be relied upon, that amount of daily protein can be provided at a sum not largely in excess of one penny.

The Fishmongers' Company are prepared to provide on application recipes for the cooking of herring, including pickled herring. Broadly speaking it may be said that pickled herring are cooked by precisely the same methods as fresh herring, but need to be soaked in fresh water for several hours before cooking.

THE Board of Agriculture and Fisheries recommend any farmer who is experiencing difficulty in obtaining farm hands to apply to the Local Labour Exchange, the address of which can be obtained at any Post Office.

Farm Labour.

The Labour Exchanges are making special efforts to furnish farmers with the names of suitable men and women who have had previous experience in farm work, and all applicants will be interviewed and passed by a farmer of standing before they are put into communication with farmers who are in need of them.

In notifying their requirements, farmers should state fully the wages and other terms they are prepared to offer, and whether free board and lodging will be provided. They should also state clearly whether the work to be done is unskilled or requires special qualifications; whether it can be done by women, and, if so, whether suitable accommodation is available for them.

If a labourer is sent from a distance, his railway fare may be advanced through the Labour Exchange subject to an undertaking, either on his part or on the part of the farmer, to repay the amount so advanced. If desired, arrangements may be made with the labourer, subject to the consent of the farmer, whereby the latter will deduct the sums advanced from the wages and remit the same to the Labour Exchange.

Farmers are invited to support a movement which has been started for the purpose of assisting them to maintain an adequate supply of labour.

THE following prices have been reported to the Board by their Market Reporter as representing the prices current at Mark Lane on Wednesday, 23rd September, 1914:—

Prices of Feeding

Stuffs in

London.

Milling offals, ex mill, sacks excluded, per ton.—Bran, £4 10s. to £4 15s.; broad bran, £5 to £5 5s.; fine middlings, £7 15s. to £8; coarse middlings, £6 to £6 5s.; pollards, £5 to £5 5s.; rice bran, £4 15s. to £4 17s.; maize meal, £7 10s. to £8; barley meal, £8 10s. to £9.

Oil-cake, per ton.—English linseed cake, £8 15s. to £9; Indian linseed cake, £8 10s. to £8 15s.; cotton seed cake, London made from Egyptian seed, £5 8s. to £5 10s.; Indian cotton seed cake, £4 15s. to £5; Egyptian cotton seed cake, £5 10s. to £5 12s.; soya cake, £8 10s. to £9; linseed meal, £6 15s. to £7; dried brewers' grains, £5 to £5 5s.

It is understood that the King has given instructions that planting is to be undertaken at Sandringham on a scale that will afford a considerable amount of employment.

Planting Forest Trees

at Sandringham.

His Majesty has also given permission for an area on the Sandringham Estate being placed at the disposal of the Cambridge University School of Forestry, in order that it may be used for purposes of experiment and demonstration.

THE Board have received the following from the Agricultural Consultative Committee:—

Slaughter of Animals Act, 1914.

The Agricultural Consultative Committee wish to allay any apprehension which may have been caused among farmers by the passing of the Slaughter of Animals Act, 1914. This measure empowers the Board of Agriculture and Fisheries, for the purpose of maintaining a sufficient breeding stock, to regulate and restrict the slaughter, either generally or in any particular area, of animals used for human food. It is not, however, anticipated that it will ever prove necessary for the Board to make use of these powers, as the Committee feel confident that farmers throughout Great Britain will recognise the importance of keeping up the stock of farm animals, and of abstaining from slaughtering or selling for slaughter, stock which would in more ordinary circumstances be kept for breeding purposes.

On this subject the Committee feel that they may be permitted to reiterate the advice contained in their notice of the 18th August, viz.:—

1. The slaughter of immature or breeding stock of every description should be avoided. Where circumstances permit, the total head of live stock should be increased, particularly animals such as pigs, which multiply quickly.

Ewe lambs might with advantage be put to the ram towards the end of the year.

2. While there should be no diminution in the numbers of live stock kept, the strictest economy (subject to proper conditioning) and foresight with regard to feeding is advocated.

The cheapest efficient forms of food should be used, and no waste spaces capable of producing food for animals should be allowed. No recommendation is attempted as to the exact description of the foodstuffs to be grown or used, as this must depend upon the special circumstances of each case, of which generally the individual farmer will be the best judge; if in doubt, he can obtain advice gratis from the recognised Agricultural College in his "Province" or from the County Organiser.

THE Report of the Government Chemist upon the work of the Government Laboratory for the year ended 31st March, 1914, has been published [Cd. 7562, price 3d.], and contains, *inter alia*, an account of the work carried out during 1913-14 for the Board of Agriculture and Fisheries as regards imported dairy produce and margarine, sheep dips, feeding stuffs, soils, and various miscellaneous matters.

THE purpose of the Board's Special Leaflets was explained in the note in the *Journal* for September, 1914, p. 566, and a list of those issued was given. The following further Special Leaflets have since appeared:—

Issue of Special Leaflets.	Special Leaflet No. 7.	Hints on Growing the Wheat Crop of 1915.
	" " 8.	The Utilisation of Cereal Offals and Certain other Products for Feeding Purposes.
	" " 9.	Food Value of Acorns, Horse Chestnuts and Beech Mast.
	" " 10.	Pig Keeping for Cottagers and Small Holders.
	" " 12.	Notes on the Purchase and Preparation of Food for Poultry in Gardens and Allotments.

THE Annual Report of the Horticulture Branch of the Board for the year 1913-14 [Cd. 7605, price 4½d.] has recently been issued, and gives an account of the proceedings during the year under the Destructive Insects and Pests Acts, 1877 and 1907, and the Board of Agriculture Act, 1889. The principal pests dealt with are American Gooseberry Mildew, Wart Disease of Potatoes, Large Larch Sawfly and Small Ermine Moth. Cultural problems are referred to and the question of pollination of fruit trees is discussed. There is a chapter on diseases of bees.

AN endeavour is being made to urge agriculturists of all classes to augment the home supplies of poultry produce both by utilising existing stocks to the best advantage, and by judiciously increasing these stocks. There are likely to be many people to whom assistance and advice would be particularly helpful at the present time. In this connection poultry keepers, and those who may contemplate keeping poultry are reminded that, in counties where an Instructor in Poultry-keeping has been appointed, they should make application to the Agricultural Organiser, or the Secretary of the County Education Committee for the advice of the Instructor or for visits from him.

No outbreak of Foot-and-Mouth Disease has been confirmed in any part of Great Britain since the issue of last month's *Journal*. The last outbreak was confirmed at Stallingborough,

Foot-and-Mouth Disease.

near Grimsby, in the Lindsey Division of Lincolnshire, on the 6th September.

All the remaining restrictions which were imposed by the Board on the movement of animals on account of the outbreaks of disease in that locality have now been withdrawn as from the 12th October.

As mentioned in last month's *Journal*, no outbreak of Foot-and-Mouth Disease has been confirmed in Ireland since the 17th July last, and the special restrictions imposed by the Board as regards the removal of Irish animals from Landing Places were withdrawn, and the normal Regulations which permit the removal of Irish animals from Landing Places after 10 hours detention under veterinary supervision were restored, as from the 9th September.

MISCELLANEOUS NOTES.

THE Fourth Report [H.C. 441, price 8d.] of the Development Commissioners deals with the work accomplished between 1st April, 1913, and 31st March, 1914.

Fourth Report of the Development Commissioners.*

General.—The expenditure on agriculture and rural industries in the United Kingdom recommended during the year was £472,793 (practically all grants), as compared with £227,600 during 1912-13. Much of the large increase was, however, due to the fact that several large grants were recommended for capital expenditure on buildings.

Agricultural Research and Education.†—The scheme for college advisory work and for research which is supported from the Development Fund falls under two main heads: (1) the division of agricultural science into eleven principal branches and provision for systematic research into each at one or more institutions devoted to the subject; and (2) the division of the whole country into twelve areas, each centred round an agricultural college, assisted by a grant of approximately £1,000 a year to demonstrate the application of known scientific results to local conditions, and to provide technical advice for local agriculturists. The scheme includes two minor proposals, viz. (a) the award, each year for three years, of twelve research scholarships (tenable for three years and worth £150 per annum), of which the main object was to provide trained men for the research institutions, and (b) the provision of an annual sum (now fixed at £4,000 per annum for Great Britain) to assist special pieces of research work outside the scope of the research institutions. For the continuance of the whole scheme in England and Wales during 1913-14 and 1914-15 the Commissioners recommended the following grants on the application of the Board of Agriculture and Fisheries:—

* For the three previous reports see *Journal*, August, 1911, p. 369; December, 1912, p. 777; and October, 1913, p. 638.

† See also Leaflet 197.

Grants to Colleges and Institutions in aid of—	1913-14. £	1914-15. £
(a) Scientific Research and Experiments	20,000	27,100
(b) The extension of Advisory and Local Investigation Work ..	9,000	10,500
(c) Special Investigations and Researches not included above ..	3,000	3,400
Research Scholarships (including expenses of selection)	4,750	5,215
Expenses of Administration ..	800	750
	<u>£37,550</u>	<u>£46,965</u>

During 1913-14 nine institutions received grants in their capacity as provincial centres for local demonstration and experiment, and for the provision of technical advice to farmers. It is hoped that arrangements will be made with two more institutions to undertake this kind of work for their respective provinces.

The "grant for special investigations and researches" includes the estimated English share of a grant of £4,000 to be applied to the purpose throughout Great Britain. The original scheme of research scholarships was completed by the award in July, 1913, of the last twelve scholarships, making 36 in all; but the Commissioners have agreed to the award in July, 1917, of three "Major Science Scholarships" of the same value and period of tenure as the research scholarships, and to the continuance of minor science scholarships such as had been awarded in previous years, at a total cost not exceeding £100.

The Commissioners explain at some length the views on which they have acted with regard to the creation of permanent research institutes, and review the nature of the problems attacked at these institutes, their practical importance, and the methods which are being employed.

Apart from the maintenance expenses of research and other work carried on at universities, research institutes and agricultural colleges, in many cases considerable additions are necessary to buildings and equipment before that work can be properly discharged. Advances from the Development Fund for such purposes are made, as a rule, on the basis that only 50 per cent. of the expenditure necessary is met from the Development Fund, the other 50 per cent. being provided by the institution or locality concerned. During 1913-14 the Commissioners recommended the following grants for these purposes:—

- (a) £5,300 to the Board of Agriculture and Fisheries for the purchase of cottages, equipment, &c., for a research laboratory in plant pathology at the Royal Botanic Gardens, Kew.
- (b) £10,000 to the Midland Agricultural and Dairy College for new buildings and the purchase of a farm. (This is additional to any grant which the Board propose to make under the Farm Institute scheme.)
- (c) £10,325 to the University College, Reading, for the erection of buildings and the provision of equipment.
- (d) £500 (grant) and £3,500 (loan) to the South-Eastern Agricultural College, Wye, for new buildings and equipment. (The grant is additional to one of £2,000 recommended in November, 1912.)

Besides the above, the Commissioners have recommended, since the close of the year under report, a supplementary grant of £1,250 to Bristol University, in aid of the buildings required for a research institution in fruit-growing, a grant of £6,000 to the Rothamsted Experimental Station in aid of the erection of a new laboratory, and a supplementary grant of £1,825 to the Seale Hayne College in aid of the provision of additional College buildings.

Complementary to the scheme for research and technical advice is the farm institute scheme, particulars of which have appeared in this *Journal* from time to time. Briefly stated, the substance of the scheme approved is that local education authorities should be offered 75 per cent. of the capital cost, and a proportion varying from 50 to 75 per cent. of the annual cost of institutes and of the new work done there, on compliance with conditions settled in consultation by the Commissioners and the Board of Agriculture and Fisheries and approved by the Treasury. A grant of £80,000—the first instalment of a sum of £325,000 spread over the period to 31st March, 1916—was made to the Board for the purpose in February, 1912, but very little of this sum was actually spent up to 31st March, 1913. By November, 1913, over 40 English counties had expressed their desire to take advantage of the scheme. During the year the Commissioners recommended grants of £10,000 and £58,350 to meet expenditure in the financial years 1913-14 and 1914-15 respectively on this scheme. The Commissioners have agreed in the case of several institutes to the provision of fairly large farms.

Mention may be made under this heading of a grant up to £1,300 to the "Nursery and Market Garden Industries Development Society," a body committed to the study of the scientific problems connected with the growth of crops under glass; the grant in question has been made to meet half the cost of the buildings necessary, the other half being contributed by the growers represented on the Society and by other persons interested in market garden industries.

Veterinary Science.—The Commissioners have adopted three principles with regard to veterinary science:—(1) That the Government Departments concerned with the diseases of animals ought to be provided with proper laboratories and staff to enable them to carry on the research necessary for administration requirements; (2) that for more abstract research having no immediate reference to administrative work a University Professorship of Comparative Pathology should be founded; (3) that an annual sum should be set aside to encourage research work at veterinary colleges and institutions.

In January, 1914, the Commissioners recommended that a grant up to £28,650 should be made to the Board for the purchase of land and the erection and equipment of a new Veterinary Laboratory, the existing laboratory at Alperton Lodge being considered inadequate for the purpose (1) mentioned above. When the new building approaches completion the Commissioners are prepared to consider proposals for the expenditure of a sum not exceeding £3,000 per annum on research work there (£1,000 in addition to the grant of £2,000 now available for work at Alperton Lodge) so long as the financial position of the Development Fund permits.

A grant was recommended to the Board for the provision of research scholarships in veterinary science. For particulars of these see *Journal* for July, 1914, p. 358.

Cultivation of Sugar Beet.—An advance of £11,000 was recommended to the Sugar Beet Growers' Society for the purpose of organising and instructing farmers in the growth of sugar beet and its despatch to the Cantley factory. The conditions attached to the advance were intended to ensure that it should not influence the price of the sugar produced by the factory, or operate as a bounty to the Company owning it.

Bee-keeping.—In May, 1911, the Commissioners recommended a grant to the British Bee-Keepers' Association of a sum not exceeding £850 towards the cost of an experimental apiary, and in aid of the general organisation work of the Association. The whole of the grant was not spent at the close of the year 1912-13. In May, 1913, the grant of a sum not exceeding £150 was recommended in addition to the unexpended balance of the original grant, to continue the experimental apiary until 30th September, 1913.

Poultry Improvement.—The Board of Agriculture and Fisheries applied for grants in aid of a poultry-feeding demonstration for small-holders, and for experiments in poultry fattening. The Commissioners agreed to the payment from the Farm Institute grant of—

- (i.) Expenses (not exceeding £250) which may be incurred in the demonstration to be completed in October, 1913;
- (ii.) A similar sum for the continuance of the demonstration in another area subsequently to October, 1913;
- (iii.) A sum of £90 in aid of a proposal to carry the demonstration a stage further by undertaking the fattening and cramming of some of the chickens reared.

A grant of £225 was recommended to the Utility Poultry Club in aid of a 12 months' laying competition, to commence, if possible, on 1st October, 1913; and a further grant of £207 was recommended to the Club for the purpose of carrying out a combined ordinary and semi-intensive 12 months' laying competition to run from October, 1913, to September, 1914.

The scheme for a National Poultry Institute has temporarily failed.

Cultivation and Preparation of Flax.—The British Flax and Hemp Growers' Society was formed in consultation with the Commissioners, with the object of securing the cultivation and preparation for market of flax and hemp in Great Britain in order to ascertain whether these crops can be grown with profit to the growers. The Society elaborated a scheme which involved the cultivation of flax in selected districts, the establishment of experimental retteries, experiments on the growth of flax as a crop for seed independent of the fibre, and experiments in the breeding and selection of better strains of flax. The scheme contemplated the growth of about 170 acres in selected districts of England during 1913. An advance to the Society not exceeding £2,375 was recommended by the Commissioners.

Of the experimental area selected by the Society, that part (120 acres) situated in South Yorkshire was controlled by the University of Leeds working in close co-operation with the Society. A grant of £1,500 was made to the University of Leeds for this purpose; and with a view to an investigation into methods of retting, a grant of £2,400 was recommended to the University to meet the capital expenditure in establishing an experimental station at Selby, and a grant not exceeding £3,500 was recommended for working expenses during the year 1913-14.

Tobacco Cultivation.—The British Tobacco Growers' Society was formed in 1912 at the suggestion of the Development Commissioners, to

secure the growth of about 100 acres of tobacco each year for five years, and the rehandling, marketing and sale of the produce at a central station under the control of the Society. A grant of £7,500 was made in 1913-14 to provide for the cultivation of 60 acres, but the Society secured the growth of only 33 acres, 80 acres, however, being grown by private growers under the excise rebate system. Useful information has been obtained concerning the types of tobacco most suited to conditions in this country, and the soil and districts in which it would appear best to continue operations.

Horse and Live Stock Breeding.—Grants for light horse breeding purposes of £36,500 and £31,500 were made to the Board of Agriculture and Fisheries for 1913-14 and 1914-15 respectively. Reports on the administration by the Board of these grants have appeared in the *Journal* at various times.

As regards other live stock, the position at the beginning of 1913-14 was that, on the application of the Board, the Commissioners had recommended a grant of £30,000 to provide, up to 31st March, 1914, for assistance towards the improvement of heavy horses, the extension of milk recording, and the appointment of a live stock officer at each of 12 agricultural colleges in England and Wales. The Commissioners have since recommended the grant of such sum not exceeding £14,800, as might be required during 1913-14 for the bull and boar schemes. A grant of £41,750 has been recommended during the current year.

Cattle Testing Station.—An advance of £20,000 had already been recommended for the purchase of land and equipment for the Board's Cattle Testing Station at Pirbright; a further grant of £1,500 has now been recommended for the provision of live and dead stock, &c., necessary for the proper farming of the agricultural land at the Station. An account of the Board's Cattle Testing Station will be found on p. 616.

Co-operation.—A grant of £6,000 was made to the reconstituted Agricultural Organisation Society for 1913-14, in addition to a grant equal to the subscription income of the Society for the year, but not in any case exceeding £3,000.

Forestry.—The measures which can be taken by the State to promote forestry and afforestation fall into two main divisions—(1) provision for improved education, research and technical advice; (2) afforestation by the State itself, or the giving of pecuniary assistance by the State to other bodies desirous of afforesting land.

During the year provision was made for the continuance of the scheme of forestry research, technical advice, &c., by grants to the Board of £6,500 for 1913-14 and £8,100 for 1914-15. The portions of these sums allocated to advisory work (viz., £2,500 in both years) go to support an advisory officer at each of the following five centres—Oxford, Cambridge, Cirencester, Bangor and Newcastle.

With regard to forestry experiments, the Commissioners informed the Board that they were prepared to consider the establishment in suitable parts of the country of State experimental forests of about 5,000 acres each, and that they believe useful experiments on smaller plots could be carried out in association with the five institutions responsible for advisory work. Various steps were taken during the year to enable the Board to commence the work in regard to the minor experiments. The Commissioners have, however, always been of opinion that a forest demonstration area is one of the primary requirements of forestry in England and Wales, and grants have been made to

enable the Forest of Dean to be utilised for this purpose; a capital sum of £13,700 was granted for equipment and a sum of £1,700 towards the cost of maintenance for the year beginning 1st April, 1914. The equipment grant included provision for a forestry school, a forest garden, a woodmen's school, and for a museum, library and laboratory. The Commissioners hope that the Dean Forest will become a national centre, where students who would otherwise have to proceed to the Continent will be able to complete their practical training in forestry at home; where woodmen will be able to learn the manual operations necessary to their craft; and where many and important field experiments in sylviculture will be carried out and statistics relating to forestry compiled with a view to demonstrating to private forest owners improved methods of management.

A loan of £25,000 to the Liverpool City Corporation was recommended for the afforestation of a large part (not less than 4,000 acres, at the rate of 200 acres a year) of the water catchment area at Lake Vyrnwy; another 1,000 acres is to be planted from time to time in areas of not less than 50 acres in localities where experience has proved that planting may be valuable in future operations. The Commissioners hope that now that the first advance of this kind has been settled it will serve as a precedent for other great municipalities.

Reclamation and Drainage of Land.—The Commissioners express their regret and surprise that very few suitable schemes for the reclamation and drainage of land have been put forward by Local Authorities and bodies who might naturally be expected to take the initiative in such a matter. The main reasons are to be found in the facts that advances from the Development Fund cannot be made to private landowners, and that the state of the law in regard to public drainage and reclamation authorities is one either of insufficiency or of confusion. During the current year it is hoped to remove one of the main obstacles (*viz.*, the absence of a suitable executive authority) by the formation of an association for the reclamation of land which will be qualified to purchase and reclaim suitable areas. A provisional committee recently applied for a grant for preliminary expenses undertaken with a view to the reclamation of a particular area of about 1,100 acres, if it can be purchased on reasonable terms.

In 1912-13 a grant of £523 was made to the Board for the expenses of a preliminary enquiry into the existing arrangements for land drainage in East Anglia; a further grant of £1,025 has been made to continue the enquiries.

Arrangements have been made with the Duchy of Lancaster for an experiment on the reclamation of sandy heath land; a preliminary advance of £2,000 has been sanctioned for operations on about 200 acres of land owned by the Duchy near Brandon in Suffolk.

Particulars are being collected concerning the land available for reclamation in different parts of England and Wales, such as the nature of the soil, its present condition and the approximate value of the land.

Importation of Animals into the United States.—Order No. 209 of the Bureau of Animal Industry of the United States Department of Agriculture, which came into force on 1st July last contains revised regulations respecting the importation of horses, cattle, sheep, swine and other animals into the United States. So far as the United Kingdom is concerned, the only important amendments of the existing regulations* are as follows:—

All ruminants imported into the United States must now be accompanied by a certificate from the local authority of the district in which the animals have been located for the six months preceding the date of shipment stating that no tuberculosis has existed on the premises. The period during which the district of origin must be certified as free from other diseases contagious to cattle has been reduced from one year to six months.

In the case of swine, the period covered by the certificate as to freedom from contagious diseases has also been reduced to six months.

NOTE.—At the present time the importation of ruminants and swine into the United States from the United Kingdom is suspended, owing to the existence of foot-and-mouth disease in this country.

Importation of Plants and Seeds into Peru.—A supreme Decree, dated 13th June, 1914, provides that the importation of seeds, cuttings, plants and trees into Peru can only be effected through the Customs of Callao or through the Lima Post Office.

Export of Cattle and Forage to Jersey.—The importation of cattle and of hay and straw from Great Britain is now permitted into the Island of Jersey on production of the following documents at the port of landing:—

(a) A Certificate from the Board of Agriculture and Fisheries testifying that no case of foot-and-mouth disease or cattle-plague has occurred during the past two years on the farm or land from which cattle or forage is exported, or within a distance of five miles thereof; and

(b) A Declaration by the exporter, sworn before a Magistrate or Commissioner of Oaths, giving the exact place of origin of the cattle or forage.

Intending exporters should apply to the Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W., for forms of application for official export certificates.

THE Preliminary Statement of the Agricultural Returns for England and Wales, collected in June last, shows a decrease in the area under crops and grass of 15,470 acres. The arable **Agricultural Returns, 1914.** area declined by 60,000 acres, but there is an increase in the area of permanent grass of 44,600 acres. Wheat has increased by 106,000 acres, or by more than 6 per cent.; this amount being very largely substituted for barley and oats, which declined by 54,000 and 45,000 acres respectively. Most of the other crops (apart from clover and rotation grasses) show increases; notably beans by 26,000 acres, potatoes by nearly 20,000 acres, mangolds by 13,000 acres, and vetches

* See this *Journal* for Nov., 1911, p. 686, and June, 1913, p. 254.

by 23,000 acres. Clover and rotation grasses declined by 115,000 acres, and bare fallow also shows a diminution of 47,000 acres.

The live stock returns show a small decrease among horses, the decline of 16,000 among those used for agricultural purposes being more than made up by an increase in "other" horses on the farm. Cows show an increase of 220,000; other cattle of two years and above fell off by 198,000, but calves increased by 125,000; and the net result for all cattle is an augmentation of 161,000. Sheep show an increase of 130,000, entirely in the category of ewes kept for breeding, sheep above one year old having declined and the deficit having been made good by lambs. Pigs increased by 379,000, or 18 per cent., the increase in breeding sows being relatively greater than that of other pigs.

PRELIMINARY STATEMENT for 1914, compiled from the Returns collected on the 4th June; and comparison with 1913.

CROPS.

DISTRIBUTION.	1914.	1913.	INCREASE.		DECREASE.	
	Acres.	Acres.	Acres.	Per Cent.	Acres.	Per Cent.
TOTAL AREA (excluding WATER)	37,139,150	37,139,150	—	—	—	—
TOTAL ACREAGE under all CROPS and GRASS (a) ..	27,113,910	27,129,380	—	—	15,470	0.1
ARABLE LAND ..	10,998,180	11,058,230	—	—	60,050	0.5
PERMANENT GRASS (a) ..	11,328,410	11,001,460	326,950	3.0	—	—
TOTAL ..	16,115,790	16,071,150	44,580	0.3	—	—
Wheat ..	1,807,410	1,701,590	105,820	6.2	—	—
Barley ..	1,504,730	1,558,860	—	—	54,130	3.5
Oats ..	1,828,600	1,974,700	—	—	45,100	2.3
Rye ..	53,810	51,510	2,400	4.7	—	—
Beans ..	284,010	268,280	25,730	9.6	—	—
Peas ..	168,840	164,040	4,800	2.9	—	—
Buckwheat ..	3,120	3,090	—	—	360	15.2
Potatoes ..	461,580	442,030	19,550	4.4	—	—
Turnips and Swedes ..	1,045,090	1,053,390	—	—	8,300	0.8
Mangold ..	432,350	419,460	12,890	3.1	—	—
Cabbage and Kohl-Rabi ..	67,880	69,820	—	—	1,840	2.6
Rape ..	70,470	67,390	3,080	4.6	—	—
Vetches or Tares ..	123,740	100,940	22,800	22.6	—	—
Lucerne ..	53,850	57,280	—	—	3,630	6.3
Hops ..	38,860	35,680	980	2.7	—	—
Small Fruit ..	77,360	76,860	500	0.7	—	—
CLOVER and ROTA-TION GRASSES. ..	1,554,960	1,700,480	—	—	145,520	8.6
OTHER CROPS ..	828,300	795,350	32,950	3.9	—	—
BARE FALLOW ..	340,820	128,980	16,600	12.9	47,080	12.1
ORCHARDS (b) ..	243,110	243,610	—	—	500	0.2

(a) Excluding Mountain and Heath Land used for grazing (3,776,150 acres in 1914, as compared with 3,805,270 acres in 1913).

(b) Any Crop or Grass grown in Orchards is also returned under its proper heading.

LIVE STOCK.

CLASS.	1914.	1913.	INCREASE.		DECREASE.	
	No.	No.	No.	Per Cent.	No.	Per Cent.
Horses used for Agricultural purposes (including Mares for Breeding) ..	791,320	807,320	—	—	16,000	2.0
Unbroken Horses (including Stallions) ..	220,570	227,930	—	—	7,360	3.2
Other Horses ..	102,100	105,860	—	—	3,760	3.6
TOTAL OF HORSES ..	1,399,540	1,402,150	—	—	2,610	0.2
Cows and Heifers in Milk or in Calf ..	2,484,180	2,264,400	219,780	9.7	—	—
Other Cattle:—Two years and above ..	952,290	1,150,620	—	—	198,330	17.2
One year & under two ..	1,174,860	1,160,640	14,220	1.2	—	—
Under one year ..	1,288,420	1,141,280	125,140	11.0	—	—
TOTAL OF CATTLE ..	5,877,750	5,716,940	160,810	2.8	—	—
Ewes kept for Breeding ..	6,838,280	6,699,290	138,990	2.1	—	—
Other Sheep:—One year & above ..	3,152,000	3,420,610	—	—	268,610	7.9
Under one year ..	7,288,850	7,010,390	259,460	3.7	—	—
TOTAL OF SHEEP ..	17,280,130	17,130,290	129,840	0.8	—	—
Sows kept for Breeding ..	340,380	280,850	59,530	21.2	—	—
Other Pigs ..	2,141,030	1,821,250	319,780	17.6	—	—
TOTAL OF PIGS ..	2,481,410	2,102,100	379,310	18.0	—	—

THE Board have issued the following preliminary statement, dated 15th Sept., compiled from returns collected on the 4th June, 1914, showing the acreage under hops in each county of England in which hops were grown, with a comparative statement for the years 1913 and 1912:—

Acreage of Hops.

Counties, &c.	1914.	1913.	1912.
	Acres.	Acres.	Acres.
Kent ..	6,174	6,103	5,993
East ..	7,604	7,481	7,330
Mid ..	8,848	8,360	8,077
Weald ..	22,626	21,944	21,400
Total, Kent ..	1,580	1,556	1,516
Hants ..	5,507	5,439	5,236
Hereford ..	103	104	103
Salop ..	585	557	513
Surrey ..	3,036	2,889	2,845
Sussex ..	3,194	3,157	3,186
Worcester ..	30*	30*	30
Other Counties ..	38,661	35,676	34,829
Total ..			

* Gloucester and Stafford.

THE *Bulletin of Agricultural and Commercial Statistics* for September, 1914, contains estimates of the production of the cereal crops this year. The countries for which it is possible to give an approximate estimate of the production are as follows:—In *Europe*—Prussia, Hungary (proper), Belgium, Denmark, Spain, Great Britain and Ireland, Italy, Luxemburg, Netherlands, Russia in Europe (63 governments), Switzerland; in *America*—Canada, United States; in *Asia*—India, Japan; in *Africa*—Algeria (Department of Constantine only), Tunis.

Notes on Crop Prospects Abroad.

Wheat.—The total production in the above-mentioned countries, excluding Prussia, is estimated to amount to 325,413,000 qr., as compared with 350,567,000 qr. in the same countries last year, the decrease being equal to 7.2 per cent. The area under production was larger than in 1913 by 0.9 per cent.

Rye.—The estimated production in the above countries, with the exception of Great Britain, India, Japan, Algeria and Tunis, is placed at 173,457,000 qr., against 176,746,000 qr. in 1913, or a decrease of 1.9 per cent., while the area planted showed practically no change from last year.

Barley.—The production in the above countries, excluding Prussia and India, is estimated at 128,544,000 qr., or a decrease of 9.1 per cent. as compared with last year, when the production was 141,432,000 qr. The area under production showed a decrease of 0.3 per cent.

Oats.—For the above-mentioned countries, with the exception of Prussia, India and Japan, the estimated production is 285,048,000 qr., against 325,093,000 qr. in 1913, the decrease amounting to 12.3 per cent. The area planted was smaller than last year by 0.2 per cent.

United States.—The Department of Agriculture estimates the total production of the crops, from reports relating to the 1st October, as follows (in bushels, and final figures for 1913 in brackets):—Spring wheat, 217,000,000 (239,819,000); winter wheat, 675,000,000 (523,561,000); oats, 1,137,000,000 (1,121,768,000); barley, 197,000,000 (178,189,000); maize, 2,676,000,000 (2,446,988,000); linseed, 17,000,000 (17,853,000); and potatoes, 382,000,000 (331,525,000). (*Dornbusch*, 8th October.)

Canada.—A bulletin issued by the Census and Statistical Office at Ottawa, referring to the state of the crops at the end of August, states that the continued drought, especially in the north-west provinces, seriously affected the yields, which are lower than those of any year since 1910 and lower than the average of the six years ended 1913. In the three provinces of Manitoba, Saskatchewan and Alberta, 728,100 acres of wheat, 753,000 acres of oats, 102,000 acres of barley and 79,000 acres of flax are estimated to have failed to produce any grain. In the whole of Canada the yield of wheat is estimated at 159,660,000 bushels, against 231,717,000 bushels last year, and 204,712,000 bushels, the average of the four years 1910 to 1913; oats, 327,732,000 bushels against 404,669,000 and 351,246,000 respectively; barley, 37,014,000 bushels against 48,319,000 and 42,745,000; rye, 2,019,000 bushels against 2,300,000 and 2,189,000; and linseed, 9,042,000 bushels against 17,539,000 bushels and 14,497,000 bushels respectively.

Holland.—H.M. Consul-General at Rotterdam reports (September 12th) that wheat was harvested under satisfactory conditions, but some

damage was done by rain in the southern districts. About 10 per cent. of the crop suffered in Zeeland, but elsewhere the crop varies from good to very good. Oats are everywhere good or very good crops, but beans vary, and peas are a good crop except in a few districts. Clover-seed was damaged by rain in July and August; the crop varies, but is only fairly good on the whole. Eating potatoes mostly promise a good crop of excellent quality, there being no complaints of disease.

Siberia.—H.M. Commercial Attaché at Petrograd, in a report dated the 22nd August, states that the crop prospects in Siberia are generally good, and, with favourable weather conditions, promise a record harvest for that region. Many men and horses have, however, been withdrawn from the villages, and anxiety was felt as to the gathering of the crops.

Argentina.—The Minister of Agriculture has issued his estimates of the areas sown with wheat, linseed and oats as follows, last year's figures in brackets:—Wheat, 15,474,000 acres (16,235,000 acres); linseed, 4,260,000 acres (4,370,000 acres); and oats, 2,820,000 acres (3,085,000 acres). (*Broomhall's Corn Trade News*, 3rd October.)

Hops.—H.M. Consul at Portland, Oregon, in a report dated 16th September, stated that, in the Pacific States the crop was partly picked at that date, and it was estimated that Oregon would produce 120,000 to 135,000 bales, Washington 45,000 bales, and California 115,000 bales. Those hops which had already been picked in Oregon were of very good quality and free from mould, but during the four or five days preceding the date of the report there had been continual rain, and the remainder of the crop would probably be damaged. The crop in California was inferior. Only small lots were being sold and were fetching about 9d. per lb., but it was expected that if Great Britain bought as usual, the price would go up to at least 10d. per lb.

THE reports furnished by the Crop Reporters of the Board on agricultural conditions in England and Wales state that September everywhere proved a very fine month, except for about a week of rainy weather towards the middle. The corn harvest was therefore completed under favourable conditions, with the exception of a few of the latest districts.

The effect of the season on other crops has been very different between the east and west of England. In the east the weather has been too dry, and the rains in the middle of September were as a rule insufficient; as a consequence roots and seeds are very poor, the land is too hard to plough, pastures are dried up, and stock are not doing well. In the moister west, on the other hand, roots promise rather an over-average yield, seeds are strong and vigorous, pastures are full of grass, stock are thriving, and autumn cultivation is relatively well advanced.

Lifting of potatoes generally is in full swing, though in a good many districts it had only just commenced. On the whole prospects have rather fallen off during the month, although the crop is expected to be a full average. Some potato disease is mentioned from a good many districts, but it does not appear to be serious, although there is a good deal in some parts of Yorkshire. Prospects were for a yield about 1 per cent. above the ten years' average.

Roots have gone back considerably during the month, owing to the droughty conditions. In the north, Wales, and extreme south-west, improvement is noted among turnips during the month, but elsewhere they have deteriorated, especially in the eastern counties. Much the same may be said of mangolds, but they are better than turnips in most parts of the country, and only in the north is any material improvement recorded. At the end of the month the appearance of the fields indicated that turnips and swedes would yield about 93 per cent. and mangolds 96 per cent. of the average. Seeds are dried up and very patchy in the east, variable in the midlands, strong and very promising in the west; on balance they are not satisfactory. Pastures are in like case, burnt up in the east and the midlands, but carrying plenty of grass in the west. There have been some abundant second crops of hay in the north. Live stock are doing well on the western side; elsewhere they are, on the whole, standing still or going back, and in many places it has been necessary to give them supplementary food.

The fine weather generally allowed of excellent progress being made in cleaning the stubbles, and in many parts of the country autumn cultivation is well forward. The land is, however, frequently too hard to plough; this is the case almost everywhere in the eastern half of the country, where cultivation is in some cases backward.

ACCORDING to statements in the Board's Monthly Agricultural Report (1st October), the supply of agricultural labour in England and Wales continued, on the whole, sufficient, but not more than sufficient during September. The fine weather rendered the work expeditious, so that scarcity was less felt than might have been the case in a more trying season.

In all parts of the country, however, there are districts where labour was rather short. The following local summaries give further details regarding agricultural labour in the different districts:—

Northumberland, Durham, Cumberland, and Westmorland.—The supply was generally quite sufficient. In the few districts where recruiting has since affected the supply, harvesting operations were not affected.

Lancashire and Cheshire.—Except in one or two districts where it was rather scarce, the supply was sufficient, in some cases plentiful. Occasionally, however, there was a difficulty in obtaining skilled workers.

Yorkshire.—In the east and north, labour was somewhat scarce, a good many men having joined the Army, especially after harvest; in the west, there was generally a sufficiency.

Shropshire and Stafford.—Labour was very scarce in north and south-east Stafford, but was otherwise generally sufficient. Good stockmen were wanted in west Shropshire, potato lifters in south-east Stafford, and casual labourers in south Shropshire.

Derby, Nottingham, Leicester, and Rutland.—Labour was sufficient in some districts but in others a scarcity of both skilled and casual labour was reported. Horsemen and milkmen were difficult to obtain in south Notts.

Lincoln and Norfolk.—The supply was sufficient almost everywhere. In north-east Lincoln temporary labour was scarce during harvest, and in Holland wages are higher on account of scarcity.

Suffolk, Cambridge, and Huntingdon.—Labour, generally, was sufficient, except in south Cambridge and in the potato-growing districts of north-west Suffolk. The work being well forward was of assistance in diminishing the demand.

Bedford, Northampton, and Warwick.—There was a deficiency in the supply of labour in Bedfordshire, especially among young men; in Northamptonshire the supply was generally sufficient, although here again some shortage of young men was noted; skilled labour was scarce in parts of Warwickshire, but otherwise there was a sufficient supply.

Buckingham, Oxford, and Berkshire.—The supply of labour was generally sufficient for requirements, but there was a scarcity of skilled labour and of young horsemen in some districts. Casual labour for threshing, etc., was very scarce in north Oxfordshire.

Worcester, Gloucester, and Hereford.—Labour was mostly sufficient, but there were complaints of shortage in a few districts. Labour for potato digging and fruit picking was wanted in central Worcester.

Cornwall, Devon, and Somerset.—The supply of labour varied throughout the district. The weather was generally favourable for farm operations and enabled the harvest to be secured under good conditions. In north, east and central Cornwall, in north, north-east and central Devon, and in north Somerset the supply was sufficient. Elsewhere in the division the supply was not equal to the demand.

Dorset, Wiltshire, and Hampshire.—Nearly half the reports received alluded to scarcity as a result of recruiting. Labour was sufficient for harvest and the shortage at present is not serious, but some doubts are expressed as to the future.

Surrey, Kent, and Sussex.—Labour was generally sufficient, though rather short in districts on the Surrey and Sussex borders.

Essex, Hertford, and Middlesex.—Labour was generally sufficient, central and west Essex being the chief exceptions.

North Wales.—The supply was abundant in parts of Carnarvonshire, owing to many slate quarries having been closed; it was rather scarce in Denbigh, and sufficient in most other parts of the district.

Mid Wales.—The supply was generally sufficient for requirements, although some shortage was felt in a few districts.

South Wales.—There was a shortage of temporary labourers in west Carmarthen, and in south-west Monmouth large farmers were rather short-handed, but generally the supply was equal to the demand.

THE following statement shows that according to the information in the possession of the Board on October 1st, 1914, certain diseases of animals existed in the countries specified:—

Prevalence of Animal Diseases on the Continent.

Bulgaria (for the period August 21st—29th).

Foot-and-Mouth Disease, Glanders, Sheep-pox, Swine Fever, Tuberculosis.

Denmark (month of July).

Anthrax, Glanders and Farcy, Swine Erysipelas, Swine Fever.

Holland (month of August).

Anthrax, Foot-rot, Swine Erysipelas.

Italy (for the period September 7th—13th).

Anthrax, Blackleg, Foot-and-Mouth Disease (391 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Norway (month of August).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period August 14th—21st).

Anthrax, Foot-and-Mouth Disease (12,779 animals), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Sweden (month of August).

Anthrax, Blackleg.

Switzerland (for the period September 7th—13th).

Anthrax, Blackleg, Foot-and-Mouth Disease (293 "étales" entailing 3,950 animals, of which 215 "étales" were declared infected during the period), Glanders and Farcy, Swine Fever.

No further returns have been received in respect of the following countries:—Austria, Belgium, France, Germany, Hungary, Montenegro, Russia, Servia, Spain.

The Weather in England during September.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
<i>Week ending Sept. 5th:</i>	°F.	°F.	Inches.	Inches.		Hours.	Hours.
England, N.E. ...	61.2	+4.5	0.07	-0.57	1	5.3	+0.6
England, E. ...	62.5	+4.0	0.01	-0.53	1	7.5	+2.0
Midland Counties ...	62.9	+5.5	0.01	-0.63	1	5.4	+0.6
England, S.E. ...	63.6	+4.0	0.00	-0.66	0	9.1	+3.4
England, N.W. ...	61.6	+4.6	0.04	-0.85	1	6.1	+1.7
England, S.W. ...	63.3	+5.2	0.03	-0.86	1	7.2	+1.8
English Channel ...	64.5	+3.8	0.27	-0.39	2	6.9	+0.4
<i>Week ending Sept. 12th:</i>							
England, N.E. ...	59.1	+3.2	0.38	-0.22	4	5.3	+0.4
England, E. ...	61.7	+4.0	0.57	+0.07	4	5.8	+0.5
Midland Counties ...	59.8	+3.3	0.57	+0.06	4	4.9	+0.1
England, S.E. ...	62.2	+3.4	0.65	+0.08	4	6.3	+0.8
England, N.W. ...	59.7	+3.4	1.29	+0.59	5	4.8	+0.2
England, S.W. ...	61.0	+4.7	1.36	+0.65	5	4.4	-0.9
English Channel ...	62.8	+2.7	1.70	+1.14	6	4.5	-1.9
<i>Week ending Sept. 19th:</i>							
England, N.E. ...	53.6	-1.4	0.81	+0.35	4	5.5	+0.8
England, E. ...	55.7	-1.1	0.34	-0.05	4	5.6	+0.4
Midland Counties ...	54.4	-1.3	0.51	+0.11	5	5.6	+0.9
England, S.E. ...	56.9	-1.1	0.39	-0.05	4	5.4	0.0
England, N.W. ...	53.7	-2.0	1.70	+1.13	7	4.1	-0.6
England S.W. ...	55.7	-1.2	1.02	+0.45	6	4.1	-1.0
English, Channel ...	58.6	-1.0	1.45	+0.97	6	3.9	-2.6
<i>Week ending Sept. 26th:</i>							
England, N.E. ...	51.2	-2.7	0.02	-0.33	1	6.9	+2.5
England, E. ...	51.9	-3.7	0.14	-0.28	1	7.0	+2.1
Midland Counties ...	49.5	-4.9	0.01	-0.43	1	7.5	+3.2
England, S.E. ...	51.8	-5.0	0.02	-0.45	1	8.4	+3.4
England, N.W. ...	51.5	-3.1	0.02	-0.64	1	7.2	+3.0
England, S.W. ...	51.9	-4.0	0.00	-0.69	0	8.9	+4.3
English Channel ...	56.4	-2.4	0.01	-0.57	1	9.2	+3.2

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	SEPTEMBER.		NINE MONTHS ENDED SEPTEMBER.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	39	30	557	411
Animals attacked	48	33	612	453
Foot-and-Mouth Disease:—				
Outbreaks	8	—	22	—
Animals attacked	20	—	108	—
Glanders (including Farcy):—				
Outbreaks	8	6	82	121
Animals attacked	75	7	254	298
Parasitic Mange:—				
Outbreaks	†—	87	†1,547	1,999
Animals attacked	†—	144	†2,682	3,999
Sheep-Scab:—				
Outbreaks	2	5	155	134
Swine Fever:—				
Outbreaks	336	152	3,157	1,868
Swine Slaughtered as diseased or exposed to infection ...	2,129	1,875	31,068	24,987
Tuberculosis:—				
Number of Premises notified...	†—	537	†3,959	*—
Number of bovine animals notified as for slaughter ...	-†—	585	†4,223	*—

* The Tuberculosis Order came into operation on 1st May, 1913.

† The Parasitic Mange Order, 1911, and the Tuberculosis Order, 1914, were suspended as from 6th August, 1914.

IRELAND.

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

DISEASE.	SEPTEMBER.		NINE MONTHS ENDED SEPTEMBER.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Foot-and-Mouth Disease:—				
Outbreaks	—	—	76	—
Animals attacked	—	—	955	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	5	4	67	102
Sheep-Scab:—				
Outbreaks	17	20	407	394
Swine Fever:—				
Outbreaks	3	4	161	116
Swine Slaughtered as diseased or exposed to infection ...	23	46	837	721

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in September and August, 1914.(Compiled from Reports received from the Board's Market
Reporters.)

Description.	SEPTEMBER.		AUGUST.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—				
Cattle:—	per stone.*	per stone.*	per stone.*	per stone.*
Polled Scots	s. d.	s. d.	s. d.	s. d.
Herefords	9 3	8 9	9 5	9 1
Shorthorns	9 3	8 8	9 4	8 9
Devons	9 2	8 5	9 4	8 7
Welsh Runts	9 5	8 6	9 5	8 7
	9 1	8 7	9 4	8 6
Veal Calves	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
	8½	7½	9	8½
Sheep:—				
Downs	9½	8½	9½	9
Longwools	9	8	9½	8½
Cheviots	9½	8½	10	9
Blackfaced	9½	8½	9½	9
Welsh	—	8	8½	8½
Cross-breds	9½	8½	9½	8½
Pigs:—	per stone.*	per stone.*	per stone.*	per stone.*
Bacon Pigs	s. d.	s. d.	s. d.	s. d.
Porkers	7 10	7 5	7 9	7 3
	8 3	7 10	8 2	7 8
LEAN STOCK:—				
Milking Cows:—	per head.	per head.	per head.	per head.
Shorthorns—In Milk ...	£ s.	£ s.	£ s.	£ s.
—Calvers	23 4	19 7	23 5	19 3
Other Breeds—In Milk ...	21 14	18 18	21 9	18 13
—Calvers	20 9	18 1	20 15	17 8
	17 5	14 0	17 5	14 10
Calves for Rearing	2 10	1 19	2 13	2 1
Store Cattle:—				
Shorthorns—Yearlings ...	11 18	10 1	11 12	9 16
—Two-year-olds... ..	16 2	14 0	15 19	13 15
—Three-year-olds	19 9	16 12	17 10	—
Herefords—Two-year-olds...	16 3	14 6	16 19	15 0
Devons—	15 13	14 5	16 12	13 12
Welsh Runts—	15 8	13 15	15 0	12 18
Store Sheep:—				
Hoggs, Hoggets, Togs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	40 10	35 4	39 2	34 8
Store Pigs:—				
8 to 12 weeks old	21 8	16 2	21 7	16 1
12 to 16 weeks old	34 6	26 10	33 4	26 0

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in September, 1914.(Compiled from Reports received from the Board's Market
Reporters.)

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
BEEF:—		s. d.	s. d.	s. d.	s. d.	s. d.
English	1st	63 6	63 6	—	66 0	60 6
	2nd	59 0	61 6	—	62 6	58 6
Cow and Bull	1st	56 6	58 6	53 0	55 6	53 0
	2nd	51 0	53 6	46 6	51 0	47 6
Irish: Port Killed	1st	61 6	61 0	60 0	64 0	58 6
	2nd	58 6	59 0	56 6	59 6	55 0
Argentine Frozen—						
Hind Quarters	1st	64 0	65 0	64 0	65 6	64 6
Fore "	1st	54 0	54 6	53 6	52 0	53 6
Argentine Chilled—						
Hind Quarters	1st	65 6	64 6	64 0	68 0	64 6
Fore "	1st	55 0	56 0	53 6	55 6	54 6
Australian Frozen—						
Hind Quarters	1st	61 6	63 6	62 6	63 6	64 0
Fore "	1st	54 6	54 6	53 0	54 6	53 0
VEAL:—						
British	1st	71 0	66 0	77 6	61 0	74 6
	2nd	66 6	63 0	73 0	52 6	70 0
Foreign	1st	—	—	—	62 6	—
MUTTON:—						
Scotch	1st	—	—	79 6	80 6	78 6
	2nd	—	—	74 6	75 6	76 0
English	1st	77 6	83 6	—	74 0	74 6
	2nd	66 6	80 0	—	66 6	71 6
Irish: Port Killed	1st	72 0	—	72 0	66 6	71 6
	2nd	62 6	—	67 6	62 0	66 6
Argentine Frozen	1st	51 6	53 6	51 6	51 0	51 0
Australian "	1st	51 0	50 6	50 6	49 0	51 0
New Zealand "	1st	51 6	53 6	—	53 6	—
LAMB:—						
British	1st	79 0	82 0	78 6	84 0	82 6
	2nd	76 6	77 6	73 6	76 0	75 0
New Zealand	1st	65 0	64 6	63 0	65 0	63 6
Australian	1st	60 6	—	60 6	59 6	60 6
Argentine	1st	60 0	59 6	59 6	55 6	59 6
PORK:—						
British	1st	73 6	67 6	68 0	63 0	69 0
	2nd	67 6	65 6	63 0	58 0	64 6
Foreign	1st	—	—	—	57 6	—

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at
certain MARKETS in ENGLAND in September, 1914.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER:—	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
British... per 12 lb.	15 0	14 0	—	—	14 6	13 6
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
„ Factory ...	127 0	122 6	122 6	120 0	125 6	120 0
Danish... ..	114 0	108 6	113 0	107 0	114 0	105 0
French... ..	—	—	129 0	126 0	130 6	126 0
Russian... ..	125 0	119 0	—	—	121 6	114 0
Australian... ..	126 0	119 0	124 0	120 0	120 6	115 6
New Zealand... ..	—	—	—	—	123 0	116 6
Argentine... ..	—	—	—	—	130 0	124 0
CHEESE:—					118 6	116 0
British—						
Cheddar ...	81 6	73 6	80 0	76 0	83 0	76 0
Cheshire ...	—	—	120 lb.	120 lb.	120 lb.	120 lb.
Canadian ...	75 6	72 6	70 6	66 0	80 6	76 0
BACON:—			per cwt.	per cwt.	per cwt.	per cwt.
Irish (Green) ...	90 6	87 0	74 6	72 0	75 0	73 0
Canadian (Green sides)	84 0	82 6	83 0	79 6	84 0	80 6
HAMS:—						
York (Dried or Smoked) ...	130 0	122 0	—	—	130 0	120 0
Irish (Dried or Smoked)	—	—	—	—	113 6	104 0
American (Green) (long cut) ...	84 0	80 6	81 0	78 0	83 0	79 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British... ..	13 4	—	—	—	15 2	13 6
Irish	13 5	12 8	13 5	12 4	14 3	12 11
Danish... ..	13 7	12 7	12 8	11 10	14 2	12 5
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen... ..	73 0	66 0	53 6	48 6	75 0	66 0
Edward VII. ...	81 6	72 6	53 6	50 0	76 0	66 0
Up-to-Date ...	72 6	66 6	48 6	43 6	70 6	61 6
HAY:—						
Clover	—	—	95 0	73 6	96 6	88 6
Meadow	—	—	—	—	85 0	76 0

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 1912, 1913 and 1914.

Weeks ended (in 1914).	WHEAT.			BARLEY.			OATS.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Jan. 3 ...	s. d. 33 2	s. d. 30 5	s. d. 31 1	s. d. 33 3	s. d. 28 6	s. d. 26 2	s. d. 20 7	s. d. 19 10	s. d. 18 2
„ 10 ...	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
„ 17 ...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
„ 24 ...	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
„ 31 ...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb. 7 ...	34 0	31 0	31 0	33 2	28 10	26 7	21 4	20 1	18 9
„ 14 ...	34 4	30 9	31 0	32 10	29 1	26 7	21 7	20 2	18 11
„ 21 ...	34 6	30 11	31 0	32 8	28 8	26 7	21 9	20 7	18 11
„ 28 ...	34 1	31 0	31 0	32 0	28 6	26 2	21 6	20 4	18 11
Mar. 7 ...	34 1	31 3	31 5	31 7	28 5	26 2	21 8	20 0	18 9
„ 14 ...	34 0	31 1	31 6	31 2	27 11	26 0	21 8	20 2	18 7
„ 21 ...	34 1	31 1	31 5	31 10	28 6	25 8	21 9	19 11	18 6
„ 28 ...	34 4	31 3	31 4	30 3	27 6	25 7	21 8	19 7	18 8
Apr. 4 ...	34 10	31 4	31 6	30 9	27 0	25 6	21 11	19 2	18 5
„ 11 ...	35 4	31 3	31 5	30 2	27 8	26 8	22 1	19 2	18 4
„ 18 ...	36 7	31 6	31 7	29 11	26 11	25 4	22 4	18 10	18 4
„ 25 ...	37 10	31 8	31 9	30 4	26 7	26 6	22 9	19 3	18 5
May 2 ...	38 1	32 2	31 9	30 2	25 11	26 0	23 1	19 6	18 5
„ 9 ...	37 11	32 6	32 2	31 1	25 9	25 6	23 7	19 6	18 9
„ 16 ...	37 8	32 10	32 7	31 2	25 4	26 3	23 7	19 9	18 11
„ 23 ...	37 2	32 10	33 0	31 1	25 3	25 10	23 7	19 11	19 0
„ 30 ...	36 10	32 7	33 9	30 0	26 1	26 1	23 9	20 1	19 4
June 6 ...	36 11	32 10	34 0	29 11	26 2	25 11	24 0	19 8	19 4
„ 13 ...	37 0	32 8	34 1	30 8	24 7	24 11	23 10	20 2	19 8
„ 20 ...	37 5	32 8	34 1	30 8	23 10	25 10	24 0	19 8	19 9
„ 27 ...	37 10	32 8	34 3	30 2	24 3	25 4	23 11	19 1	20 0
July 4 ...	38 2	33 1	34 4	31 7	25 2	24 6	23 11	21 0	19 9
„ 11 ...	38 3	33 4	34 2	30 2	25 10	24 9	24 1	19 4	20 0
„ 18 ...	38 10	33 6	34 1	30 9	24 9	24 2	24 8	20 5	19 10
„ 25 ...	38 9	33 10	34 0	30 9	24 1	24 7	23 4	20 8	19 9
Aug. 1 ...	38 4	34 1	34 2	28 6	24 5	25 9	22 2	20 3	19 8
„ 8 ...	39 2	34 1	34 9	30 7	24 9	25 2	22 4	19 0	19 1
„ 15 ...	38 2	34 3	40 3	28 3	24 7	29 4	21 8	17 7	25 1
„ 22 ...	35 6	33 7	38 9	28 1	26 5	29 10	20 10	18 8	24 3
„ 29 ...	34 10	32 7	36 2	28 6	29 0	30 3	20 8	17 10	23 5
Sept. 5 ...	35 1	31 11	36 5	29 9	30 11	30 6	21 8	17 8	23 9
„ 12 ...	33 5	31 9	37 10	29 0	31 5	29 11	20 5	18 0	23 11
„ 19 ...	32 7	31 7	38 3	29 6	30 9	29 5	19 10	17 11	23 8
„ 26 ...	31 7	31 6	37 6	29 9	30 1	29 3	19 5	17 9	23 3
Oct. 3 ...	31 8	31 3	37 1	29 7	29 9	29 1	19 8	17 10	22 9
„ 10 ...	31 10	31 0	—	30 4	29 1	—	19 5	17 10	—
„ 17 ...	32 2	30 11	—	30 11	28 8	—	19 9	17 9	—
„ 24 ...	33 1	30 7	—	31 6	28 7	—	19 10	18 0	—
„ 31 ...	33 4	30 1	—	31 10	28 2	—	20 1	17 9	—
Nov. 7 ...	33 1	30 0	—	31 11	28 1	—	19 11	17 9	—
„ 14 ...	32 10	30 1	—	31 2	27 8	—	19 9	17 11	—
„ 21 ...	32 1	30 4	—	30 11	27 5	—	19 11	18 1	—
„ 28 ...	31 9	30 9	—	30 8	27 0	—	19 8	18 4	—
Dec. 5 ...	31 0	31 2	—	29 11	26 8	—	19 6	18 4	—
„ 12 ...	30 8	31 2	—	29 2	26 5	—	19 3	18 6	—
„ 19 ...	30 7	31 2	—	28 11	25 11	—	19 1	18 5	—
„ 26 ...	29 10	31 0	—	28 6	25 10	—	19 2	18 4	—

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.

**AVERAGE PRICES of British Wheat, Barley, and Oats at
certain Markets during the Month of September, 1913 and
1914.**

	WHEAT.		BARLEY.		OATS.	
	1913.	1914.	1913.	1914.	1913.	1914.
London... ..	s. d. 33 2	s. d. 39 2	s. d. 30 4	s. d. 30 0	s. d. 19 2	s. d. 25 0
Norwich... ..	31 10	37 3	29 4	29 4	17 1	23 10
Peterborough... ..	30 11	37 0	30 8	28 9	17 5	23 6
Lincoln... ..	31 5	37 5	31 10	29 3	18 4	23 3
Doncaster... ..	30 6	36 6	29 9	27 2	18 0	23 1
Salisbury... ..	30 9	37 6	28 0	29 7	17 5	23 8

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RECLAMATION OF WASTE LAND.

THE steadily upward trend in the prices of agricultural produce in recent years, partly consequent upon the failure of the production of the newer countries of the earth to keep pace with the growth of population, has brought the question of increasing the agricultural production in European countries prominently to the fore. Attempts are being made to solve the problem along two distinct lines.

It is sought in the first place to improve the methods of existing cultivators by various means; these attempts are finding expression in England in endeavours to put expert advice with regard to agricultural problems at the farmer's disposal, to increase intensive cultivation, to secure the widespread application of the principles of co-operation, to introduce new and more profitable crops and appliances, and generally to increase the efficiency of the farmer by investigation and research into all problems connected with the land, crops and live stock. There is, without doubt, plenty of room for this improvement, even in the most highly farmed countries. For example, in England the average yield of wheat is about 32 bushels per acre, though a good farmer expects 40; and the average yield of mangolds, a crop more dependent upon cultivation, is as low as 20 tons per acre when about twice as much would not be exceptional with good farming. A large proportion of the moderate land in England is retained under poor grass, whereas even as grass its production might be doubled by suitable manuring and careful management, while under the plough its production of food might easily be trebled or quadrupled.

In the second place it is sought to bring into cultivation land that has hitherto been left to run to waste because it was regarded as unprofitable to farm; and endeavours are being made to find methods whereby land may be made productive that has till now been used only for sport and the roughest of grazing. Even the most densely populated European countries contain great areas of uncultivated land. It is estimated that Germany alone possesses nearly ten million acres of such areas, and that country has taken the lead in trying to bring into use this undeveloped capital, and a Government department has been created to reclaim and settle the waste lands.

It might be asked why the second of these two methods should come into consideration at all when so much of the land that has already been reclaimed and upon which the first capital outlay of clearing, fencing, roadmaking, etc., has been accomplished, is not doing its duty. In this connection some notes from the Presidential address, by Mr. A. D. Hall, M.A., F.R.S., to the Agricultural Section of the British Association, at their recent meeting in Australia are of considerable interest. Mr. Hall points out that the educational agencies which will have to bring about better farming will only slowly become effective; further, that improved farming means more enterprise, more knowledge, often more capital, and the man who can bring these to the business is far rarer than the man who, given a piece of land even of the poorest quality, will get a living out of it by sheer hard work and doggedness. While, then, there should be no slackening in the efforts to improve the quality of the management of existing land, there is also a case for using every effort to increase the cultivable area; indeed, Mr. Hall thinks it is probable that for some time to come the second process will add most to both the agricultural production and the agricultural population.

After discussing the effects of liming and dry land farming in adding to the fertility and capability of the soil, Mr. Hall turns to the problem of land reclamation as it occurs in north-western Europe.

There are two main types of land that have hitherto been left waste, the peaty and the sandy areas. Of the peaty areas distinction must again be made between the low-lying moors bordering the lower courses of the great rivers (for example, in England near the mouth of the Trent), and the upland peat bogs, of which Ireland furnishes so many examples. The peaty areas have various features in common—an

excess of water, a deficiency of mineral salts, and, particularly in the upland bogs, a strongly acid reaction; but they possess great potential wealth in their richness in nitrogenous organic matter. It is in Germany and Holland that the methods of bringing into cultivation these moors have been most completely worked out; in Germany, for example, it is estimated that there are about five million acres of moorland, of which about 10 per cent. are now under cultivation. The reclamation process must begin by drainage, which may be carried out by open ditches, but is most satisfactorily effected by pipes, despite the greater cost. The water-table must be kept some 3 ft. below the surface. In districts which afford a market for peat, as, for example, on the Teufelsmoor near Bremen, the reclamation often begins by cutting out the peat, the lower layer of firm peat being won, dried, and sold for fuel. The upper spongy peat can be used for litter, but some part at least must be thrown back. Where the peat for burning is thus extracted the excavation is in places pushed further until the underlying sand is reached, and enough of this is dug to spread over the reclaimed area to a depth of 4 or 5 in., when it is mixed by cultivation with the spongy peat. Even when the peat is not removed, pits are often made in order to sand the land, so great an improvement does it effect in the character of the crops. Sanding, however, is not possible everywhere, and there are great areas under cultivation where the reclamation begins with drainage, followed by the cultivation of the immediate surface without either sanding or the removal of the fuel peat, such processes indeed being impossible over large areas, though they are carried out by the owners of small farms little by little. Special tools are required, certain forms of disc-ploughs and harrows giving the best results; heavy tools for large scale cultivation by steam or electricity must be furnished with broad roller-like wheels, and the horses employed must wear broad wooden shoes.

The next stage is the manuring, and it has only been the development of the artificial fertiliser industry during the last half-century that has rendered the cultivation of this type of land possible. On the alluvial moors, where the ground water has always been alkaline, the peat is rich in calcium, and no treatment with lime and marl is necessary (the English fens afford an example of this type of soil), but on the true peat-bogs (*Hochmoor*, of Germany), the manuring must begin with a good dressing of burnt lime, or, better, of marl or ground chalk. For meadows and pastures two tons per acre of lime,

or twice as much of carbonate of lime, should be applied; the amounts may be halved for arable land. This must be followed by about 5 to 8 cwt. per acre of basic slag and an equal amount of kainit; these dressings should be renewed in the second year, but may then be diminished in accordance with the cropping. Some phosphoric acid and potash salts must be continually supplied, however, and occasional dressings of lime or chalk must be given on the acid peaty areas. These latter also require nitrogenous manures in their earlier years, for the peat is slow to yield up the nitrogen it contains. The fertilisers should be nitrate of soda or nitrate of lime, never sulphate of ammonia. The whole success of the reclamation depends on the use of these manures, as the peat in a state of nature is almost devoid of both phosphoric acid and potash; on the acid peats, again, normal growth is only possible after a neutral reaction has been attained by the use of lime or marl. With this manuring it is found to be easy to establish a good meadow herbage in a very short space of time; it is not even necessary to get rid of the surface vegetation of *Erica* and other heath and bog plants. The manure is put on and the surface is worked continually with disc-harrows and rollers, but never deeply; a seed-mixture containing chiefly red, white, and alsike clovers, *Lotus uliginosus*, rye-grass, timothy, and cocksfoot, is sown in the spring and soon succeeds in choking the native vegetation.

It is impossible to say what is the cost of the reclamation of moorland in this fashion; the big expense is the drainage and the construction of roads, both of which are entirely determined by local conditions; but of the value of the process when accomplished there can be no doubt. A case has been quoted where a piece of moor bought for £75 was reclaimed and sold for £900; and, best test of all, one may see in places like the Teufelsmoor, near Bremen, families living in comfort on thirty to forty acres of what was once merely wild moor with no productive value.

Of even greater interest in England is the reclamation of heath-land, which has of late years been proceeding apace in Germany. In this category may be included all land which owes its infertility to the coarse grade and low water-retaining power of the particles of which the soil is composed, the soil being at the same time as a rule devoid of carbonate of lime, and covered in consequence with heather and similar calcifuge plants. In England there exist extensive tracts of uncultivated land of this character in close proximity to

considerable populations. The process of reclaiming such land for agriculture seems to have come to an abrupt conclusion somewhere about 1850, when the developing industries of the country began to offer so much greater returns for capital than agriculture. That land of the kind can be cultivated with success is evident from the mere fact that prosperous farms may everywhere be seen bordering the wastes, possessing soils that are essentially identical with those of the wastes. These were brought under cultivation when labour was cheaper, often without calculation of the cost because the work was done piecemeal at times when the men would otherwise have been idle. Were any strict account to be framed, the reclamation probably did not pay its way for many years, and it has only become possible again because of modern advances in science and machinery.

As examples of this type of land may be instanced the Bagshot Sands, on which, in north Surrey, in Berkshire and Hampshire, and in its southern development in the New Forest, lie so many thousands of acres of uncultivated heath. No systematic reclamation has taken place on this formation, but everywhere farms have been carved out, often by the industry of squatters, and within reach of London the vast supplies of town manure which used to be available have converted some of it into fertile land. The crystallisation of common rights into charters for public playgrounds, and its growing appreciation for residential purposes, will now always stand in the way of the utilisation of much of the Bagshot Sands for agriculture, but further afield there are many areas of similar character. The Lower Greensand is perhaps equally discounted by its residential value, but on the Tertiaries of Dorset, the Crag and Glacial Sands of Suffolk and Norfolk—the Brak, the Bunter Beds of the Midlands, lie many expanses of waste that are convertible into farming land, just as Lincoln Heath and much of the beautifully farmed land of Cheshire have been gained for agriculture within the past century. Equally possible is an attack upon the sandy areas, warrens or links, behind the sand-dunes on many parts of the English and especially the Welsh coasts; not all of them are wanted for golf, and many can be made suitable for market-gardening. In olden times the only way of dealing with such land was merely to clear it, burn the rubbish and start upon the ordinary routine of cultivation, but for a long time on such a system the crops will hardly pay their way from year to year, and the permanent deficiencies of the soil in lime and mineral salts

remain unrepaired. In Cheshire the enormous value of marl and bones in such a connection was early recognised; it has been the later discovery of the potash salts that renders reclamation a commercial proposition to-day.

The method that is now followed is to begin by clearing the land of shrubs, burning off the roughest of the vegetation, and turning over a shallow layer in the summer, leaving the heathery sod to the killing and disintegrating action of sun and frost until the following spring. The manure is then put on—lime or ground chalk or marl as before, basic slag and kainit, and the sod is worked down to a rough seed-bed on which lupins are sown, to be ploughed in when they reach their flowering stage. The growth of the lupins makes the land; they supply humus to bind the sand together and retain moisture, they draw nitrogen from the atmosphere, and with the phosphoric acid and potash form a complete manure for succeeding crops. Sometimes a second crop of lupins is ploughed in, but usually the land is put immediately to an ordinary rotation of rye, oats, potatoes, and clover. When the heath-land is divided among small tenants in an unreclaimed state, cropping often begins without the lupins, the necessary nitrogen being imported as nitrate of soda, but for years the land shows inferior results. The tenant, however, can rarely afford to lose the year the lupin crop involves, and so great is the demand for land in Germany that the State finds it preferable to let the tenant reclaim than to reclaim for him, and charge him as rent the cost of the more thorough process.

With regard to the finance of the operation, the bare heath costs from £5 to £7 an acre; the reclaiming down to the ploughing in of the lupin crop costs from £5 to £6 an acre; the reclaimed land after a few years' cultivation would sell at £20 to £30 an acre. Meantime the State has probably made a free grant for drainage, looking to get some interest back in increased taxation; the local authority has also made roads for which the increased rating due to a new agricultural community must be the only return. It is a long-sighted policy which will only find its full justification after many years when the loans have all been paid off and the State has gained a well-established addition to its agricultural land and its productive population.

In comparing English with German conditions there are certain differences to be taken into account. In the first place the work of reclamation will be dearer in England

because of the higher price of labour; further, the land will not be so valuable when won because the higher scale of prices for agricultural products enhances the price of land in Germany. Next, in view of the great industrial demand for men in England, it is doubtful if we have the men available who will bring to the land the skill and power of drudgery that was put into these German holdings of thirty to forty acres in their earlier years of low productivity. Moreover, in Germany these heaths are generally bordered by forests, in which the small-holder gets occupation for part of the year while his wife and children keep the farm going. For this, if for no other reason, afforestation and land reclamation and settlement should go on together.

Despite these drawbacks, Mr. Hall is of opinion that the reclamation of such heath-lands is a sound commercial venture in England, either for a landowner who is thinking of a future rather than of a present return on his capital, or for the State or other public body, wherever the waste land can be acquired for less than £5 an acre. The capitalised value of its present rental rarely approaches that figure, but the barrenest heath is apt to develop the potentialities of a gold-mine when purchase by the State comes in question. The map of England is so written over in detail with boundaries and rights and prescriptions that the path of the would-be reclamer, who must work on a large scale if he is to work cheaply, can only be slow and devious.

There are other possibilities of winning agricultural land, even in England, from the slob land and estuaries, and from the clays nowadays too heavy for cultivation; but the problems they present are rather those of engineering than of agricultural science. Mr. Hall emphasises again, in conclusion, that the reclamation of heath and peat-land—reclamation that in the past could only be imperfectly effected at a great and possibly unremunerative expenditure of human labour—has now become feasible through the applications of science—the knowledge of the functions of fertilisers, the industrial developments which have given us basic slag and potash salts, and the knowledge of the fertility that can be gained by the growth of leguminous plants. From beginning to end the process of reclamation of moor and heath, as seen in progress in north-western Europe, is stamped as the product of science and investigation.

FISH MEAL AND FISH MANURE.

THE value of fish offal for feeding and manurial purposes has not been sufficiently recognised in this country in the past, but an exceptionally good opportunity will in all probability be afforded to farmers during the coming winter of convincing themselves of its worth. Factories for the production of fish meal and fish manure (or guano) exist at many of our principal fishing ports, and as practically the whole* of the fish meal manufactured in the United Kingdom has in normal times been exported to Germany (where fish meal is principally used for feeding stock), it is more than likely that, with the closing of this market and the continuous supply of fish offal at the fishing ports during the winter, farmers will be able in the near future to purchase this feeding stuff at a price which will enable them to make good use of it.

The process of turning out fish meal involves little more than a further refinement of the prepared fish manure, and although the latter is extremely valuable it is considered in Germany to be wasted as such when it can be so readily converted into a valuable feeding stuff. The sudden closing of the German market for fish meal will, however, probably react also on the price of fish manure.

Quite apart, however, from any consideration as to the probability of reduced prices in the immediate future, farmers should not, in normal times, allow themselves to be dissuaded from experimenting with fish meal as a feeding stuff owing to the comparatively high prices which rule, seeing that small quantities only need be used in conjunction with other foods. The experiments referred to below suggest that the use of fish meal leads to increased profits in spite of a higher expenditure.

The raw material of the British factories consists, as a rule, of fish offals (heads, entrails, &c.), and fishmonger's offal.† The process of preparation of the food at the most up-to-date factories appears to be such that no doubt need be entertained of its purity. The fish offal goes through the processes of steaming, desiccation, &c., during the whole of which it is handled with the utmost care, and is ultimately

* Information in the possession of the Board shows that the annual production of fish meal in this country is well over 18,000 tons, and of fish manure over 26,000 tons.

† In the preparation of some high-grade meals, however, selected whole fish only are used.

reduced to clean, fine meal, which, if not precisely palatable to human beings, is at least inoffensive to the taste. Meal at one stage is passed over powerful magnets by which all the odd fragments of nails, iron, wire, &c., are extracted from it. It is also sifted to exclude other foreign bodies.

Fish Meal as a Foodstuff.

In considering the price of fish meal it must be remembered that the results claimed from it are achieved by the use of quantities of the meal which are, relatively to the total food consumed, very small. Indeed, there is a risk of meat and milk being tainted and of injury being caused to fowls through the feeding of *large quantities* of fish meal or fish meal which has *too high a content of fat (or oil)*.

Composition.—When purchasing fish meal, farmers should invariably require and obtain a complete analysis. English fish meal in general has a content of 55 to 65 per cent. of protein (which is highly digestible), 3 to 6 per cent. of fat, and 14 to 18 per cent. of phosphate of lime. Analyses given by several English firms may be quoted:—

(1)	Per cent.	(2)	Per cent.
Moisture	7.75	Moisture	18.13
Oil	2.20	Oil	4.28
Albuminoids	63.00	Albuminoids	56.46
Carbohydrates	0.53	Carbohydrates	0.12
Fibre	0.06	Fibre	0.23
Ash *	26.46	Ash †	20.78
* Phosphate of lime..	21.83	† Phosphate of lime..	16.61
(3)	Per cent.	(4)	Per cent.
Albuminoids	55	Albuminoids	55
Phosphate of lime....	14	Phosphate of lime....	17
Oil	5	Oil	3½ to 4

Feeding.—It is commonly accepted that high-grade fish meal should not contain more than about 3 per cent. of fat, but if only small quantities are included in the ration, there is probably no objection to using meal containing up to 4 or even 5 per cent. of fat.‡ In experiments at the Seale Hayne College fish meal containing 3.5 per cent. of oil and 55 per cent. of albuminoids was used, and pigs were fed in one case for four months at the rate of 1 lb. per head per day without apparently any deleterious effect on the taste of the bacon produced. In 1886 and 1887 Mr. John Speir fed cows for

‡ A good deal depends upon the condition of the oil; with colourless oil having practically no smell the limits given could probably be safely exceeded, but for all practical purposes it would be better to adhere to the stated figures.

several weeks on Norwegian herring meal, containing 20 per cent. of oil, in quantities rising to 7 lb. per head per day without the flavour of the milk being affected. In any case, if the risk of tainting exists it may be minimised by finishing off fattening animals on a ration from which fish meal is excluded; this could be done especially where the butcher has an objection to animals known to be fed on fish meal. A trial with any particular sample of meal would decide without much trouble whether it had any tainting effect on the milk or butter of cows.

The feeding value of fish meal depends upon its high content of digestible albuminoids (the albuminoids are about 90 per cent. digestible) which renders it especially suitable for combination with foods such as roots, potatoes, hay, straw and the starchy cereal grains and offals, which contain a low percentage of albuminoids.

Both the phosphate of lime and the salt (from 0.7 per cent. upwards) in fish meal are indispensable in the feeding of animals, but an excessive amount of salt is valueless and may cause illness, and the proportion of salt contained in fish meal should not, in ordinary circumstances, exceed 5 per cent.

Experiments in Germany and Norway have proved the value of fish meal as a food for horses, cattle, sheep, pigs and poultry, the meal being eaten eagerly by all these classes of stock, and, so long as the quantities fed were not too large, no harmful effects on the taste of the meat and milk seem to have resulted.

The only recent* English experiments that can be referred to are those carried out with pigs at the Seale Hayne College with meal of English manufacture. They seem to show that the addition of fish meal to other foods, in the proportion of some 14 to 29 per cent., will lead to a marked increase in the weight of the pigs so fed as compared with those fed on a diet containing no fish meal. The pigs used for the experiment were fed on foods arranged in four series, the first consisting of maize and gram or Indian peas; the second consisting of these two foods with an admixture of fish meal; the third consisting of maize with wheat, oats and barley, with an admixture of fish meal; and the fourth consisting of the same foods, omitting the fish meal. So far as the experiments go it appears that the substitution of fish meal for a certain proportion of the food gives increased profits, amounting to

* For the older experiments by Mr. John Speir with *Norwegian* fish meal see Transactions of the Highland and Agricultural Society of Scotland, 1888.

3s. 6d. or 42 per cent. per pig in the case of Series 2, and of 12s. 3d. or 94 per cent. per pig in the case of Series 3, in spite of the higher actual cost of feeding.

The following tables show the main details and results of the experiments :—

Period.	Series.	No. of Pigs.	Carcass Weight of Pigs.		Food.		
			*At Start.	At End.	Maize.	Fish Meal.	Other.
Jan. 11 to May 6, 1912 ..	1	4	lb. 320	lb. 677	lb. 1,383	lb. 0	lb. 691
.. .. .	2	4	320	760	1,073	461	540
Sept. 20, 1912 to Jan. 14, 1913 ..	3	8	491	1,607	4,582	728	560
.. .. .	4	8	503	1,350	5,198	0	672

Series.	Value of Food used.	Value of Pigs.			Profit.	
		At Start.	At End.		Total.	Per Pig.
1	£ s. d. 6 17 5	£ s. d. 8 8 0	£ s. d. 16 18 6	£ s. d. 1 13 1	£ s. d. 0 8 3	
2	8 4 6	8 8 6	19 0 0	2 7 0	0 11 9	
3	19 14 6	13 10 0	43 7 3	10 2 9	1 5 4	
4	17 6 8	13 16 11	36 8 5	5 4 10	0 13 1	

As a result of the experiments which have been carried out with fish meal it is suggested that the following quantities might be given daily to the different kinds of stock :—

- Cattle .. 2 lb. for every 1,000 lb. live weight.
 Pigs .. $\frac{1}{4}$ to $\frac{1}{2}$ lb., according to weight.
 Sheep .. $\frac{1}{10}$ to $\frac{1}{5}$ lb. for every 100 lb. live weight.
 Poultry .. Adult fowls should receive not more than 10 per cent. and chickens not more than 5 per cent. of their whole diet in this form. Fish meal with low percentages of oil and salt should be selected and the birds should be gradually accustomed to the food.

The above quantities should in no case be given at once; the fish meal should be introduced into the ration gradually. It is important that decomposition should not have set in in the fish meal fed to stock.

The dung from fish-meal-fed animals would have a high value in view of the large amount of nitrogen and phosphates

* The carcass weight of the pigs at the start was estimated as 70 per cent. of their live weight.

present in the food; it has been found that these phosphates are in a relatively highly soluble form and prove a quick-acting manure.

Fish Manure.

Origin.—Fish refuse and waste fish have long been used for manurial purposes. About fishing villages it has been the practice to use the heads and entrails of fish, together with worthless, damaged or decomposing fish and the shells of shell-fish for application to the land. East Kent farmers especially seem very partial to waste fish as a manure, and the loads of sprats and of "five fingers" (star-fish) occasionally obtainable are disposed of without difficulty. Its use in East Kent is not confined to hops—it has also been applied with great advantage to mangolds. The disadvantages attaching to the use of waste fish for manurial purposes are that a considerable proportion of the nitrogen present is lost as gaseous ammonia during putrefaction, and, further, that the material cannot be stored profitably for future use. At the large fishing centres, such as Hull, Grimsby, and Aberdeen, moreover, most of the waste fish cannot be utilised in this way, and as it soon becomes offensive, owing to its particularly penetrating and unpleasant odour, fish-manure factories have naturally sprung up.

Composition.—Fish manures vary in nature and composition according to the class of material from which they are made, their purity and the method of manufacture. Their manurial value depends upon their content of nitrogen and phosphates; if the manures contain much fish bone the content of phosphates will be high and of nitrogen low, while if the manures contain much fish flesh and little bone the nitrogen will be high and the phosphates low. Usually, also, fish manures contain small amounts of potash and lime, and in cases also a good deal of salt, which is of little manurial value. A proportion of the "fish manures" on the market in this country are, however, proprietary articles in which considerable amounts of potash and other substances have been added to the original fish manure.

The fish manures sold are usually finely ground and may be applied with any manure drill. Occasionally the fineness of grinding leaves much to be desired, pieces of hard bone up to $\frac{1}{4}$ in. in diameter being present. This coarsely-ground material must be less available, at any rate as regards the phosphates. It has been suggested that when large amounts

of oil are present (seldom the case, however) the manure will be rendered slower in action.

The variation in the content of nitrogen and phosphates will be evident from the particulars given in the table below, the analyses being those given by the manufacturers in each case. There is no doubt that the prices for some of these manures have been high in the past; in the table is given a rough indication of the value based on the content of manurial ingredients. It is to be remembered, however, that an allowance must be made for "mixing," and that the value of a manure also depends upon such questions as special suitability for the soil, crop, and general conditions for which it is intended, and on such points as condition and convenience for general use, in addition to which organic manures improve the physical character of the soil.

Nitrogen and Phosphate Contents of Fish Manures, and Approximate Values Based on Manurial Constituents.

	Analysis supplied by Manufacturer.	Approximate values based on Manurial Constituents.*		
		Per ton.		
		£	s.	d.
1	N. 8.34; Insol. Phos. 14.00	8	8	0
2	N. 4.17; Sol. Phos. 12.00; Insol. Phos. 5.00; Pot. 3.00	6	3	0
3	N. 1.25; Sol. Phos. 8.50; Insol. Phos. 1.00	2	2	0
4	N. 0.83; Sol. Phos. 15.00; Insol. Phos. 1.00	2	9	0
5	N. 1.64; Sol. Phos. 10.00; Insol. Phos. 2.00; Pot. 2.00	3	4	0
6	N. 2.00; Phos. 23.00; Pot. 4.00	4	11	0
7	N. 3.30; Phos. 23.00	4	13	0
8	N. 2.00; Phos. 34.00	4	0	0
9	N. 7.5; Phos. 9.00	7	0	0
10	N. 0.83; Phos. 25.00	2	12	0
11	N. 8.34; Phos. 16.50	8	12	0
12	N. 8.75; Sol. Phos. 8.00; Insol. Phos. 0.00	9	1	0
13	N. 8.34; Sol. Phos. 8.50	8	6	0
14	N. 8.34; Phos. 16.50	8	12	0
15	N. 3.75; Phos. 13.00	4	6	0
16	N. 4.17; Phos. 8.00	4	6	0
17	N. 11.26; Phos. 12.50	10	18	0
18	N. 8.75; Sol. Phos. 18.00	9	14	0
19	N. 5.41; Sol. Phos. 7.50	5	12	0

Action.—The action of the nitrogen and the phosphates in fish manure is gradual and safe, these substances continuing to become available to the plant throughout the whole of the growing season. This is due in the case of the nitrogen to the fact that, while some of the compounds are soluble

* Roughly, prices in June 1914. See Leaflet No. 72.

in water and rapidly decomposed by bacteria, the main constituents are proteins and gelatinoids which resist attack to a greater or less degree. Fish manures are, however, more rapid in action than bone meals, on account of the greater quantity of nitrogenous organic matter which they contain; otherwise their action is very similar to that of meat guanols and bone meals.

Application.—Fish manure should be applied early in the year, when the land is first worked, and it should be worked into the land as soon as sown, otherwise rooks and other birds will eat it as long as they are allowed to do so. It is injurious to germinating seeds or the tender rootlets of growing plants until it has been in the soil for a short time and the first active fermentation is over (Hall).

Farmers should not have this manure delivered long in advance of the time when it will be used, since it has an unpleasant smell, becomes lumpy, and, though well-made samples do not contain much more than 20 per cent. of moisture, a high moisture content may result in heating and fermentation in storage and the loss of some of the nitrogen.

ASHES OF HEDGE-CLIPPINGS AND TRIMMINGS AS A SOURCE OF POTASH.

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IN view of the fact that the main source of potash manures is at present cut off, it has become necessary to find new supplies, and a suggestion was recently made in a notice from the Board* that bonfire ashes would prove very suitable for the purpose. A series of experiments has been made at Rothamsted to ascertain what amounts of potash can be collected in this way under ordinary farm conditions.

Just after harvest, and during the ensuing winter, a certain amount of hedging and ditching is carried out on most farms. The material removed consists largely of grass, weeds, dead wood and green wood; it is very bulky and must be burnt promptly in order to get rid of it. The ash of this material was analysed in the laboratory by Mr. Davis, and proved to

* See *Journal*, September, 1914, p. 562.

be nearly as rich in potash as kainit, as shown in the following analyses :—

Hedge cleaning from	Agdell Field.	Barnfield.	Foster's Field.		Mean of three Fields.
Percentage of potash (K ₂ O) in Ash ..	13.0	10.4	10.7	9.6	10.9

Kainit contains 12.5 per cent. of potash (K₂O).

At threshing time also, a large quantity of material accumulates which cannot safely be trodden into the dung because it contains weed seeds, and is either put on to pastures or burnt. A large heap of this was burnt, and the ash was found to contain 11 per cent. of potash.

Thus some of the normal processes of farm routine give rise to ash, rich in potash, which would at normal times be worth about 40s. a ton and is now worth considerably more. There can be no question that it is worth the trouble of collecting, and that its collection should become a part of the ordinary work of the farm.

One very important matter needs attention, otherwise the material loses enormously in value. The particular combination of potash present in the ash is the carbonate, the most soluble of all potassium compounds and the one that keeps least well in a damp atmosphere.

Some of the heaps from Foster's field were left out all night and a certain amount of rain fell. The rain was not particularly heavy—.09 inch—and would not at first have been expected to do a great deal of harm; but it brought the potash down to one-half the original amount :—

	Per cent. of Potash.		
	a.	b.	Mean of a and b.
Ash collected dry ..	10.7	9.6	10.1
Collected after rainy night ..	5.7	4.4	5.0

These figures show that bonfire ashes, to be of any practical use, must be collected at once and not be exposed to rain. There may be some difficulty about this. If a spell of dry weather could be counted on, the hedge trimmings could be burnt at convenient intervals, and the ashes collected in a

cart as soon as sufficient had accumulated. This course, however, is not open to the farmer; he cannot leave the heaps of unburnt material too long, or they get in the way of the plough, nor can he spare a horse to cart the material to be burned in some central place. The only feasible plan is to burn the rubbish on the spot and ensure that the ashes are collected and carried in before rain comes. The ashes keep hot for some time and cannot be collected directly the fire has died down, but a shelter may be readily improvised to protect the heap overnight if necessary. When cold the ashes may be collected in a sack, a bucket, a barrow or cart, and should be kept in a dry place under cover. In this way the cost of collection is comparatively small, while the amount obtainable is fairly considerable. The following weights were obtained from measured lengths of hedge, one side only being taken :—

Mainly Grass from the Hedge Bottoms.									
Length of hedge, yards	..	..	200	200	43	47			
Weight of trimmings, lb.	..	..	230	192	101	119			
Weight of ash, lb.	..	..	9	8	3	2.4			
Lb. of ash per 100 yds. of hedge	..	..	4.5	4	7	5			

Mainly Wood from Hedge Trimmings.									
Length of hedge, yards	..	36	33	43	37	29	79	86	35
Weight of trimmings, lb.	..	183	293	388	105	111	196	214	311
Weight of ash, lb.	..	4.5*	6*	11*	3	2	7.7	9.7	9.8
Lb. of ash per 100 yds. of hedge	..	12.5	18	26	8	7	10	11	28

The cleaning out of the hedge bottoms yielded therefore about 5 lb. of ash, while the trimmings gave about 10 to 20 lb. (average 15 lb.) of ash, per 100 yards of hedge. A 20-acre field with 1,300 yards of hedge would, therefore, on this basis yield ash equivalent to more than $\frac{1}{2}$ cwt. of kainit from the hedge bottoms, and equivalent to nearly 2 cwt. of kainit from the total trimmings.

The further question arises: is it worth while turning a man on to cut and trim hedges simply for the sake of the cuttings? To obtain information on this point account was kept of the time required to trim measured lengths of hedge, burn the rubbish and collect the ash, a man being employed who was of the type that would naturally be used for this kind of work. The results are as follows :—

Length of hedge, yards	Mainly Grass,					More Wood than Grass.				
	200	200	43	47		79	86	35	36	33
Weight of ash lb.	9	8	3	2½		7½	9½	10	4½	6
Time taken, hours	19	17	2½	2½		4	5	6	3	3
Cost of ash per lb.†	8½d.	8½d.	3d.	5d.		2d.	2d.	2½d.	2½d.	1½d.

* These samples were wet.

† Charging the whole cost to the ash.

In another case 150 rods of hedge were trimmed for 12s. 11d. —i.e., 1d. per rod—and the ash cost 1d. per lb.; even this, however, is high and is equivalent to kainit at £9 10s. per ton.

Obviously, the potash would prove very expensive if it were charged with the whole cost of the process. The cost, however, is less per lb. of ash where the trimming and burning have to be done in any case, and where part or all of the cost is borne by the estate or the nominal establishment account; indeed, the value of the ash might reasonably be a factor in determining whether or not a doubtful piece of work should be done.

A further experiment was made to discover what weight of ash was obtained by burning the waste cavings, &c., obtained during threshing. The produce of 13 acres gave 678 lb. of ash, approximately 52 lb. per acre. It contained 11.2 per cent. of potash (K_2O), or was almost as rich in potash as kainit, and far too good to waste. In ordinary practice the amount of ash per acre might easily be less, as more of the cavings could be used for feeding purposes, but a certain quantity is always obtainable and should be carefully saved.

As already stated, the ash should be collected at once and not exposed to rain. It should be put through a sieve to remove stones, and then forms a very light powder which easily blows about but readily mixes with superphosphate without heat, smell or caking. The mixture should be applied straight away, the ashes not having the keeping properties of kainit or sulphate of potash.

PALMNUT KERNEL CAKE.

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It was feared by many, farmers and others, that the outbreak of war would cause a considerable rise in the prices of certain feeding cakes and meals which are imported from abroad. It appears, however, that the natural tendency of prices to rise from this cause has been more than counterbalanced, in some cases at least, by the loss of the German market. Notably, this has been the case in regard to palmnut kernel cake, and as most of the raw material—the palmnut kernels—comes from British Colonies in Africa the subject is deserving of the attention of traders and farmers alike.

Of the enormous quantities of palmnut kernels shipped annually from West Africa by far the greater part has hitherto

gone to Germany. Indeed, the producing colonies have been practically dependent on that country for the purchase of one of their staple commodities. For example, last year Germany imported 232,125 tons of palmmut kernels, and of that quantity 202,839 tons, i.e., over 87 per cent. of the whole, came from British Colonies in Africa.

That all these kernels were not required by Germany for the production of oil for home consumption is shown by the fact that in the same year she exported 28,489 tons of oil, which is equivalent to about 64,000 tons of kernels.

The position in regard to palmmut kernel cake is very different. Germany not only consumes all the cake she manufactures but also imports thousands of tons annually from this and other countries. So far as Germany is concerned, the cake has become the principal and the oil the by-product. The result was that the price of palmmut kernel cake had risen to such an extent in this country that our farmers found it unprofitable to buy, and before the outbreak of war it had become almost unobtainable.

This state of affairs, however, is now completely altered. The German market for the cake is cut off, the price has fallen, and there is thus an opportunity for farmers at home to obtain this cake in some quantity. The crushers, however, complain that farmers show little inclination to profit by the position. In the past, palmmut kernel cakes achieved a rather unenviable reputation; and farmers are unfamiliar with the properties and composition of the more modern product, and do not know exactly how to use it to advantage.

The palm fruit, from the palm *Elaeis guineensis*, is about the size of a chestnut. The actual nut or stone is, however, much thicker in the shell and is very hard. It is covered with an outer coat or pericarp consisting of fibrous, oily material, and it is from this pericarp that the palm oil, properly so called, is expressed. To obtain this oil, the natives of the country of origin pound the fruit in wooden mortars, generally after a process of fermentation; the pulp is then boiled in small kettles and the oil is squeezed out by hand. This crude method is not only wasteful, but the oil produced is of low quality and is usually rancid. After the palm oil has been thus removed the nuts or stones are cracked, as one would crack a walnut, and the kernels are separated. It is from these kernels that the palmmut kernel cake is prepared by crushing out the oil.

At one time palm oil was made by crushing the fruit as a whole, but the results were considered unsatisfactory, and

the method is not now employed to any extent. The oil left in the cake produced in this way rapidly turned rancid and the cake was refused by cattle. It is probably owing in large measure to this fact that palmmut kernel cake is still regarded by many farmers as a somewhat unsavoury feed.

At the present day the kernels are imported into this country in a perfectly fresh condition, and before they are crushed they are subjected to a process of cooking, by which the ferment that causes the oil to turn rancid is rendered inactive. If palmmut kernel cake is stored in a suitable, dry place there is little danger of fermentation taking place.

In the modern processes the crushing is heavy, and the amount of oil left in the cakes is much smaller than formerly. This may at first sight be regarded as a serious defect in a feeding cake, but—price apart—it is not so. On the contrary, the low percentage of oil appears to reduce the laxative effects which are said to have been observed, but which may have been due to rancidity. Further, as a necessary consequence of the reduction in the percentage of oil, the percentages of all the other ingredients are correspondingly increased. The modern palmmut kernel cakes differ from those formerly produced in another respect, which, in the writer's opinion, is of much greater importance—they contain only about one-half the amount of woody fibre that was commonly present in the cakes produced by the older methods.

These facts are strikingly illustrated by an analysis recently submitted by one of the largest producers in England, and which is compared with some earlier analyses in the tabular statement below:—

Analyses of Palmmut Kernel Cakes.

	Crowther. (1908).	Kellner. (1905).	Smetham. (1909).	Recent. (1914).
Albuminoids	17.0	17.7	15.89	18.5
Oil	10.0	8.6	9.14	5.5
Carbohydrates	36.0	36.2	41.66	50.0
Crude fibre	22.0	23.8	19.74	10.0
Moisture	10.0	9.7	9.73	12.2
Ash	5.0	4.0	3.84	4.0
	100.0	100.0	100.00	100.2

The writer is unable to guarantee the accuracy of the recent analysis, and he would be the last to suggest that a purchaser should accept the word of the seller in regard to the composition of this or any other cake. The seller is bound, by

Regulations under the Fertilisers and Feeding Stuffs Act, to guarantee, within reasonable limits, the percentages of oil and albuminoids. He is not bound to give any guarantee respecting the percentage of woody fibre, but he is at liberty to do so, and farmers would be well advised to ask for such a guarantee. It is not more unreasonable to do so than to ask the manure merchant for a guarantee as to the amount of oil in fish manures; for, just as the oil depreciates the value of the fertilising ingredients of the manure, so the presence of a large proportion of crude fibre depreciates the nutritive value of the ingredients of the cake.

In Kellner's analysis the crude fibre amounts to over one-fourth of the dry matter of the cake, and one would naturally expect that this would tend to depress the digestibility of the nutrients and so diminish their value. Kellner, indeed, suggests that such is not the case, but this suggestion amounts to a refutation of his main thesis and should be accepted with reserve. Since manufacturers now profess to be able to produce palmnut kernel cakes containing not more than 10 per cent. of fibre, they should be asked to give a guarantee of that or some similar maximum amount (say 12 per cent.).

Manufacturers who are now trying to push the sale of palmnut kernel cake in this country should realise that they still have to reassure farmers regarding its keeping qualities. Probably the readiest means to this end would be to undertake to refund the price paid for any portion of a consignment that goes bad within a given time—say three months. It may possibly be found that such an undertaking is actually implied by the guarantee that the substance is suitable for use as cattle food, provided it is kept in a place suitable for storing oil cakes. Co-operative buyers who are in a strong financial position might consider this point.

Is there, then, any reason—apart from such considerations as the benefit to the Colonies and promotion of British industries—why farmers should not give a trial to palmnut kernel cake? So far as the writer is aware, the cake possesses no special or peculiar properties. The question is purely one of economics. At the present time these cakes are quoted at £5 1s. 3d. per ton f.o.r. at Liverpool. The analysis submitted along with this quotation (and given above) shows that the price is about 11d. per unit. The price of decorticated cotton cake corresponds to about 1s. per unit. To whatever extent the former can be substituted for the latter there would, therefore, be a saving of about 1d. per unit; but it should be kept in view that this means a difference of 9s. per ton in favour of

palmnut kernel cakes, *i.e.*, 9s. less for the same amount of nutritive matter. The price quoted in London during September and October has been £6 5s. to £6 10s. per ton.

It has been shown above that palmnut kernel cakes vary considerably in composition, especially as regards oil and crude fibre. It is more than usually important, therefore, for farmers to have these cakes analysed and to procure advice from the agricultural colleges in their provinces or other similar source, as to the price. As matters now stand the writer considers that, subject to an undertaking as to keeping, and a guarantee of not more than 12 per cent. of crude fibre, a farmer who buys palmnut kernel cake at 11d. per unit makes a good bargain.

Palmnut kernel cakes may be used for various purposes but they are employed most extensively for feeding milk cows. There appears to be no certain information regarding the effect of these cakes on the quality of butter, but it seems probable that, if anything, they would tend to harden it. The experience of foreign stock-feeders, however, would appear to indicate that palmnut kernel cake would make a very good substitute for linseed cake in feeding dairy cattle. Cows may receive up to 5 lb. per head per day.

Palmnut kernel oil, which is largely used for human food, is very suitable for certain classes of stock, though there is not sufficient information available to enable a definite comparison to be made between palmnut kernel and linseed oils.

CONTINUOUS CROPPING.*

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Landowners and agricultural economists favour the idea of a revival in tillage, and are endeavouring to bring it about by various legislative and educational efforts. The practical farmer, however, especially in districts where the decrease in arable land is most marked, holds strongly to the view that the cultivation of land is no longer sufficiently profitable. As a practical agriculturist the writer agrees with the latter view, in so far as the argument is concerned with the cultivation of land as at present carried out.

* This article is based on experiments conducted in Ireland. The suggestions contained herein are intended primarily to apply to Irish conditions and must not be read as proposing drastic changes in the farming methods practised elsewhere. It is possible, however, that some of the suggestions may be found applicable locally in this country.

Most of our arable land is cultivated on the Norfolk rotation or some modification of it, and this results in the arable land being practically uncropped for as long a period during the rotation as it is cropped. For example, the land in Ireland is almost everywhere idle throughout the winter after corn crops, and after roots, that is to say, the average farmer is content to obtain one crop per annum from his land. Whilst such a system of partial cropping might have been profitable prior to the days of foreign agricultural competition, it is no longer so.

As to the climatic difficulties, practically all farm crops in Ireland are sown, and the land more or less prepared, in the period between March 1st and mid-May. This results in the maximum amount of tillage labour being performed at a time of the year when, through excessive rainfall, the land is usually in the most unsuitable condition for tillage operations. Very light soils must be excepted from this dictum. Unfortunately no official statistics relating to the matter are available. Practical farmers, however, will recognise the fact that, in late years, for one day on which tillage operations are possible at the period of the year mentioned there are often several days on which they are impracticable. An example of this may be given. In the present year, on a farm situated in a district where the annual rainfall is less than 30 inches, and on which the soil is a medium loam, there were, owing to the wet condition of the soil, only three working days between March 1st and April 2nd on which the land could be tilled. Again, during the years 1912 and 1913, an inquiry conducted with the assistance of several farmers having land of various textures in Co. Limerick showed that from March 1st to May 15th, Sundays excluded, out of every ten days there were only four on which the land could be tilled. The question as to how far such tillage conditions prevail in the United Kingdom as a whole, might well form the basis of an inquiry by one of the many bodies at present engaged in agricultural research.

Even when climatic conditions in spring are more favourable for tillage operations, the present system of cropping results in too great a pressure of work both in spring and autumn. In other words, there is not that even distribution of horse and manual labour throughout the seasons which is necessary for the most profitable farming. Owing to unfavourable climatic conditions and uneven distribution of labour, there are too many of what might be termed "ineffective" or "half idle" days on which both men and horses are not engaged

on profitable work, though they may not be actually idle. Further, agricultural labour becomes scarcer every year, wages are increasing, and it is often stated that the efficiency of the rural labourer has decreased. These facts point to the necessity for a less expensive and at the same time a more intensive system of cropping—the reduction to a minimum of costly hand labour and a further substitution of horse and machine labour.

A New System of Tillage.—Is such a system possible? In regard to Ireland the reply may be decidedly in the affirmative, and the writer proposes to describe a system which is being carried out on three farms in Ireland. How much of this system is suitable for British conditions is for the British farmer to determine.

The system of cropping referred to has become known in Ireland as Continuous Cropping, indicating that throughout the rotation the land is practically never left uncropped. The more intensive cropping has doubled the stock-carrying capacity of the land, compared with that of the land when in grass, and the labour bill for tillage operations is not one-fourth as much as it would be, if the same area of land were cultivated on the ordinary system. The main idea of the system is to produce soiling and fodder crops for consumption on the holding. Pasture is also to a large extent replaced by summer soiling crops.

Vetches or Tares.—A tare crop (vetches mixed with cereals) forms one of the most useful of summer soiling crops. One acre properly grown and managed will yield quite as much green food as three acres of similar land in pasture. The crop may be introduced into the rotation under varying conditions. It can be sown on lea land, on corn stubbles, or on potato or root land. There are two varieties of vetches—the winter and the spring. The taking of a tare crop on lea or stubble land or after roots is carried out in the same way as in the case of an ordinary grain crop.

The mixture of vetches and cereals should be varied according to circumstances. If it is intended to sow tares in autumn for a single crop to be cut green in spring, a suitable mixture is about 8 stones of winter vetch, $3\frac{1}{2}$ stones of winter wheat, and 3 stones of giant Essex rye per statute acre. When the autumn-sown tare crop is first to be grazed and afterwards cut for soiling, a more suitable mixture would be 6 to 8 stones of winter vetch, 4 to 5 stones of winter oats, and 4 to 5 stones of winter barley or wheat per statute acre. The tendency to

"braird" of both vetches and grain varies with soil and district, and the proportions and quantities of seed quoted must be regarded as approximate.

If the land on which the tares are to be sown is poor it should of course be manured, with either farmyard manure or artificials. If the former, about 20 to 30 tons per statute acre may be applied and ploughed in. If artificials, a complete mixture should be used, *e.g.*—

3 cwt. Superphosphate	} per statute acre.
3 cwt. Kainit	
1 cwt. Sulphate of Ammonia	

This mixture should be broadcasted and worked into the land under the last stroke of the harrow at seeding time. On peaty land or heavy clay land short of lime an equal weight of a good grade basic slag should be substituted for the superphosphate. Where basic slag is used it should not be mixed with the sulphate of ammonia, but be sown alone; the kainit and sulphate of ammonia may, however, be mixed before sowing. On light soils the sulphate of ammonia should be replaced by a top dressing of 1 cwt. of nitrate of soda about the middle of March. It would also be an advantage on light land to replace bone meal with either slag or superphosphate for the autumn sowing.

It is very desirable to arrange for a continuous supply of vetches for soiling throughout the summer and autumn, and in order to accomplish this some authorities recommend the sowing of tares at different periods of the year—an autumn sowing of winter vetches, a very early spring sowing, a late spring sowing and a summer sowing of spring vetches. In practice, however, this system of successional sowings is, for climatic reasons, not always possible, while the spring and often the summer sowings must of necessity be put down on land which has been left idle throughout the winter. It is also very difficult to include successional sowings in a rotation. The writer has found it much better to sow in the autumn all the tares required for summer soiling, and arrange for a continuous supply of green soiling throughout the spring, summer and autumn by what may be termed "sectional grazing."

The advantages of "sectional grazing" are not at once apparent, and may be briefly described. All the vetches required for summer soiling are sown in the previous autumn, generally in September or October, on either lea land or stubble, on which at that time of the year tillage operations are very

easy. About the first week of May the "break" is divided into two sections by means of a quickly-erected movable fence (the Canadian wire fencing is admirable for the purpose) one section being one-fourth of the break, and the other three-fourths. The smaller section is left ungrazed and is kept for soiling in May and June. When the crop on the larger section is about 9 in. high cattle or sheep (preferably the latter) are allowed to graze it. After the entire section has been grazed for about a fortnight the fence is moved on, cutting off another quarter from the grazing stock, and a similar course is adopted a fortnight later, while finally, after a further two weeks the animals are turned off the remaining quarter. As will be readily seen, the object of this "sectional grazing" is to arrange for the *second growth* of the tares to come in for use at different times through the summer and autumn. The system of sectional grazing may be illustrated by assuming a break of 8 acres of autumn-sown tares, divided into four plots each containing two acres, when the following diagram will make the system clear, the dotted line indicating the position of the movable fence at different dates.

Plot 1.—Left Ungrazed. Soiled May and June.
Plot 2.—Grazed May 1st.—May 15th. Soiled July.
Plot 3.—Grazed May 1st.—May 31st. Soiled August.
Plot 4.—Grazed May 1st.—June 15th. Soiled September.

Successional Cropping.—In order that Plots 1 and 2 shall not be without a crop during July and August, respectively, the writer always sows on this part of the field about March 15th, or as soon as soil conditions permit after that date, from 30 to 40 lb. of Italian rye-grass seed per acre. The resulting crop will, if properly manured, give still further soiling or grazing during the latter part of August and in September.

A better system than that of sowing rye-grass, providing it can be made to fit in with the subsequent rotation, is to utilise giant rape and other winter green crops, as shown in the following diagram :—

Plot 1 ..	1a. Soiled May, sown in June with Giant Rape, consumed in September and again in March.
	1b. Soiled June, sown in July with Giant Rape, consumed in October and November.
Plot 2 ..	2a. Soiled early July, sown with Hardy Greens in late July, consumed in January.
	2b. Soiled late July, sown with Hardy Greens in early August, consumed in February.
Plot 3 ..	3a. Soiled early August, sown in late August with Giant Rape and Giant Essex Rye, consumed in March.
	3b. Soiled late August, sown in early September with Giant Rape and Giant Essex Rye, consumed in early April.
Plot 4 ..	4a. Soiled early September, sown in late September with Giant Essex Rye, consumed in late April.
	4b. Soiled late September, sown in early October with Giant Essex Rye, consumed in late May.

Half of Plot 1 (1a), which is cleared in the month of May, may be sown in June with giant rape, for cutting in September and again in the following March, while the other half (1b) cleared in June may be sown in early July with giant rape to provide green food in October and November. Similar procedure follows in the case of the other three plots, as is shown in the diagram. By this means a continuous supply of luscious and cheaply-grown green food will be available for use throughout the winter.

Details regarding the cultivation and sowing of the various crops will be given later.

Labour Economies.—In connection with summer soiling it may be of interest to describe the system of utilising the crops, with the object of economising labour. About one acre of Plot 1 is cut green and fed to the stock either in the house or on the pasture. Directly this acre is cleared a movable fence is erected separating the growing crop from the part which has been cut, and every morning the stockman cuts two or three swathes of the growing crop with a one-horse mowing machine. The horse is then hitched to an ordinary

slide rake and the swathes are gathered into heaps, which, when conveniently near the fence, are thrown over to the cattle which stand on the cleared part whilst being soiled. As the distance from the growing crop to the fence increases the heaps are carted to the cattle on an ordinary hay bogie which is fitted with "creel" sides. There is great economy in this system of soiling. The carting of the green fodder is reduced to a minimum, but a still greater saving is effected by avoiding the necessity of carting out manure from the houses as would have to be done were the cattle fed indoors. In order to distribute the manure properly, the soiling heaps should be spread over the area as evenly as possible.

Value of Vetch Hay for Milk and Beef Production.—The feeding value of green tares for soiling has long been understood, but perhaps few agriculturists realise what splendid fodder for all kinds of farm stock may be obtained by converting tares into hay. The writer has successfully brought cattle from poor store to prime fat condition by the use of vetch hay along with giant rape and hardy greens, which usually follow tares, and this without the use of one pennyworth of cake, meal or grain. In an experiment conducted during the past winter at Sir Horace Plunkett's farm in County Dublin it was found that for winter milk production a daily ration consisting of

- 14 lb. Oat and Vetch Hay,
- 14 lb. Meadow Hay,
- 70 to 84 lb. Giant Rape or Hardy Greens,

proved quite as useful as

- 21 lb. Meadow Hay,
- 56 lb. Roots,
- 3 lb. Maize Meal,
- 3 lb. Decorticated Cotton Cake.

On the former ration the cost of the food necessary to produce one gallon of milk came to a little more than 2½d., whilst with the second ration the cost reached a little more than 4½d.—roots being charged at 10s. per ton, winter greens at 3s., maize meal at £6 10s., decorticated cotton cake at £9, and meadow hay and vetch hay at £2.

The cultivation, manuring and time of sowing of a crop of tares for hay may be the same as when the crop is used for soiling purposes. The proportion of seed, however, should be different, as it is very desirable to grow the crop without any danger of its lodging, and so that it can be more easily "saved" than would be the case with a crop from the seed recommended for soiling purposes. A useful mixture for a

vetch hay crop intended to provide fodder for cattle or sheep, would be 5 stones of winter vetches, 6 to 7 stones of winter oats, and 6 to 7 stones of winter wheat or winter barley, per statute acre.

The seeding of vetch hay intended for horses should consist of 8 to 10 stones of winter oats, 4 stones of winter vetches, and 4 to 5 stones of winter beardless barley, per statute acre.

From seeds sown in September or October a crop should be fit to cut by about the middle of the following June. A certain amount of judgment is needed in deciding when to cut the crop. If cut too young the vetch "wilts" and falls into dust; if allowed to grow too long the crop becomes fibrous and stock refuse it. The right time to cut is when the small seeds in the pods at the base of the plant are about half formed.

The method of cutting and saving the crop is precisely the same as in the case of "seeds hay," except that it is desirable to sweat the crop in the stack a little more. As the crop is cut at the time of the year when the minimum of rainfall and the maximum of sunshine are expected no great difficulty is usually experienced in making the crop into hay. In wet seasons, however, it may be desirable to make the crop into silage, either on the ordinary system, or, preferably, on the American Stave Silo system.

Subsequent Cropping.—The type of crops which have been recommended as suitable for sowing after vetches for soiling may also be put down after vetch hay. In practice the writer usually divides the vetch hay break into three divisions A, B, and C. Division A is sown with giant rape in the latter end of June, division B with hardy green turnips broadcasted in early July, and division C with a mixture of giant Essex rye and giant rape in late July. The first crop (A) gives excellent feeding from September to mid-December, the hardy turnips are used from mid-December to the end of February, and the giant rape and rye are consumed during the months of March and April, thus providing a continuous supply of green fodder throughout the winter. The giant rape used in September and October yields a second crop for consumption in the following March, when it is usually grazed off by sheep and lambs, and answers this purpose admirably.

Substitute for Roots.—These winter soiling crops, which may be referred to generally as winter greens, form an admirable substitute for roots. Root growing as carried out under the present system is held to be far from profitable. The crop is usually sown on a lea oat stubble which is left uncropped from the time the corn is carted in August and September until

the roots are sown in the late April or early May of the following year. In addition, the bulk of the cultivation for a root crop is carried out in early spring, when, as already indicated, climatic conditions make the cultivation of all except the lightest soils very difficult. Finally, the root crop requires an enormous amount of labour, especially hand labour, which is very costly. For roots the land is ploughed in autumn, cross-ploughed in spring, cultivated and worked down to a fine seed bed. At this stage, especially on the heavier classes of land, a downpour of rain may not only stop tillage operations but may result in a large amount of the cultivation having to be repeated. The subsequent manuring, splitting of drills, and sowing of seed, thinning, hand and horse-hoeing, harvesting and clamping, with subsequent pulping, slicing and feeding of the crop need no description. An estimate may be made on paper to show a profit from root growing, but in practice it is almost impossible to grow the crop except at a loss. On the other hand an acre of winter greens sown as suggested will yield as much nutriment per acre as an acre of roots sown under the ordinary system, while costing no more than one-fifth as much for horse and manual labour as the latter. This is a point of the greatest importance. The cultivation of winter greens is undertaken at a time of year when the days are longer than they are in early spring, and when instead of being a hindrance to tillage operations rainfall is usually a help. Again, the winter greens form the second crop in the year, and can be so blended with the preceding crop of vetch hay as to form a properly balanced ration for all kinds of bovine stock. This is impossible with the ordinary crops of the farm (except where beans are grown) without the addition of high-priced cakes and meal.

The Cultivation of Winter Greens.—The actual cultivation of winter greens is very simple. The practice is to cut the preceding crop of vetch hay in sections, saving and carting that on one section and tilling the land before cutting the second section. The object is to make the period between the clearing off of one crop and the cultivation for the next as short as possible. This is done in order to conserve the moisture, and so reduce the labour of cultivating the land, and hasten the germination of the winter green seeds.

After the vetch hay is harvested a three-horse disc harrow is run over the land twice; then follows a three-horse cultivator; and, finally, two more runs of the disc harrow are given, in this case the land being cross-disced. Beyond levelling the land with a chain harrow no further cultivation is needed.

In the case of giant rape or hardy green turnips the seed is then broadcasted and covered by simply rolling. The amount of seed required for giant rape is about 5 or 6 lb., and for hardy green turnips about 4 or 5 lb., per acre. Without the use of a small seed fiddle it is extremely difficult to broadcast evenly such a small quantity of seed as the above. Thin seeding is of special importance, as *if the crops are sown too thickly a weak, spindly growth results and the crop is unable to withstand even a mild frost.* It is therefore wise to err on the thin side when sowing, and since the crop will be over-ground about a week after sowing, it is quite a simple matter to scatter a little more seed if the first sowing does not appear to be thick enough.

Hardy green turnips are a special variety of hybrid turnip which have been produced for late sowing and to withstand frost. They will grow at a very low temperature. When broadcasted the crop grows up like giant rape, the foliage, for which the crop is chiefly grown, often attaining a height of 5 ft., while, in addition, the plant grows a small bulb, rather bigger than a large potato. The crop may be mown like giant rape, or it may be pulled, when both the forage and the bulb are fed to stock. If, when the crop is mown, care is taken to leave a small portion of the stem above the bulb the crop will grow a second time; thus, hardy greens sown in June would be fit to cut in September and would then yield a second crop by the following February or March. The crop is more suitable than giant rape for the lighter and poorer soils.

Rye and Rape Mixed.—The preparation for this crop is the same as that given above. The proportion of seed to sow is about 9 stones of giant Essex rye and $2\frac{1}{2}$ to 3 lb. of rape, the two being sown separately, the rye either drilled or broadcasted and covered with the harrow, and then the rape, which is simply covered by rolling. In no circumstances is it advisable to mix the rye and rape before sowing, as such a method makes it impossible to get an even distribution of the seed, while the covering necessary for the rye would be altogether too much for the rape. As already indicated, the order of sowing the various winter greens is as follows :—

First section sown with Giant Rape in late June.

Second section sown with Hardy Green Turnips broadcasted in early July.

Third section sown with mixed Giant Essex Rye and Giant Rape in late July.

It is often an advantage, especially on peaty soil, where rape grows very rapidly, to allow an interval of about a week or ten days between the sowing of the rye and the rape seed, in order to minimise the possibility of the rape smothering out the rye.

Giant Essex Rye Alone.—It is sometimes advisable to make four sections of the vetch hay stubble, and sow also a strip of giant Essex rye alone, the preparation being as given above (p. 709). The quantity of seed should be about 16 to 18 stones per statute acre. This crop may be sown any time in July or August, but if sown before the end of August it is generally advisable either to cut or to graze the crop in October and allow the second growth to come in for the following April. When sown early rye will grow too rank to stand over the winter if the grazing or cutting is omitted.

If in spring the rye is grazed or mown before the ear appears in the stalk, and the land is then well bush-harrowed and rolled the rye will grow again and ripen into a grain crop. For this purpose the St. John's Day Rye, owing to its greater tillering capacity, is more suitable than any other variety, but unfortunately it has been difficult to obtain this variety of seed in recent years.

Manuring of Winter Greens.—Either the winter greens, or the tare crop which precedes it, must receive a liberal dressing of farmyard manure. It has been found better to give the farmyard manure to the tare crop, as if dung is applied to the vetch stubble quick cultivation with the implements previously mentioned is not possible unless the manure is well rotted, and the manure must be ploughed in. When a liberal dressing of dung has been given to the tare crop, artificials will suffice for the winter greens. A suitable dressing would be

4 to 6 cwt. Superphosphate,
1 to $1\frac{1}{2}$ cwt. Nitrate of Soda,
1 to $1\frac{1}{2}$ cwt. Sulphate of Ammonia,
per statute acre.

On light soils bone meal may be substituted for the superphosphate, and on peaty soils or heavy land, especially where there is a deficiency of lime, an equal weight of basic slag may be used instead of superphosphate.

The cost of the cultivation described above for winter greens is very low. With a three-horse disc and cultivator one man has no difficulty in doing all the necessary cultivation of one and a half statute acres in a day, or, charging horse and manual labour at 3s. each per day the cost of cultivation

is only 8s. per acre. The sowing and broadcasting of the manure and seed on one and a-half statute acres of land could also be done by one man in a day, while rolling will cost about 1s. Thus the whole cost of cultivating and sowing is only 12s. per acre.

A point of great importance is that the growing of winter greens does away entirely with the necessity for weeding the land. Weeds of every description are completely smothered out by the vigorous growth of the crops.

The growing of winter greens has a marked effect in preparing the soil for any succeeding spring-sown crop, and this is one of the most valuable features of the system of Continuous Cropping.

MARKETING OF EGGS.

EDWARD BROWN.

ALTHOUGH their proximity to consuming centres places British producers of eggs in a much more favourable position than their continental competitors, unsatisfactory methods of marketing have prevented them from reaping the full benefit of the advantage. The complaints of retailers that home supplies of eggs are less reliable than, and often inferior to, the better grades of the imported produce are unfortunately too often justified. It is true that during recent years there has been a marked improvement in the methods of marketing. The establishment of egg-collecting depots has demonstrated the benefit of marketing on co-operative lines, and the work of itinerant poultry instructors has led many poultry-keepers to adopt better methods. It is probable, however, that by far the greater number of eggs produced in this country still reach the consumer lacking in one or more of the qualities which indicate a first-grade egg. This state of things contrasts unfavourably with the steps taken by foreign shippers to improve the quality of the eggs placed on the British market, and is the more unfortunate because the introduction of a more efficient organisation for marketing would enable the British producer to take full advantage of his position. No foreign eggs can be marketed in this country under four days, and the number imported so quickly is very small indeed; hence it appears probable that the demand for eggs fresher than this is practically unlimited and restricted to native supplies.

The Egg Standard.

The consumer unconsciously plays an important part in fixing the standard for the first-grade egg. Popular prejudice may not always be supported by scientific fact, but, as the consumer is ultimately responsible for the demand, the producer will find it to his advantage to study public requirements carefully and endeavour to meet them as far as lies in his power.

Age of the Egg.—The interval between the time the eggs are laid and the time they reach the consumer should not be more than three to five days, according to the season of the year. If older than this they must face competition with foreign supplies, and have lost a measure of their new-laid quality. With things as they are at present, delay in marketing is traceable to the dealer or retailer as well as the producer. Unless the poultry-keeper delivers his eggs to private customers he loses control of them after they have passed out of his hands, but he can at least ensure that he is responsible for no part of the delay.

External Qualities.—The egg should be not less than 2 oz. in weight; smaller eggs may be equal in nutritive value to those of larger size, but the consumer has an undoubted preference for the latter. In shape it is desirable that the eggs should be neither too long and narrow nor too wide and short; provided, however, the shell is even and not abnormal this does not greatly matter. The shell should be strong and devoid of any roughness. A thick shell may mean that the proportion of edible matter to total weight is less than when the shell is thin, but this is more than compensated for by the fact that there is less evaporation and the transport qualities are greater. Roughness of the shell is undesirable as in autumn and winter it generally denotes preservation by lime water. The bright, shiny coating of the egg known as "bloom" should still be present.

While it may be true that there is no appreciably greater value in eggs with tinted shells the consumer usually prefers them to those having white shells, and the producer should therefore include at least a proportion of tinted eggs. The production of tinted eggs is dealt with in Leaflet 129 (*Winter Egg Production*).

Internal Qualities.—While it is important that eggs should present an attractive external appearance, their actual food value can only be determined by an examination of the contents. Examination should show a small air space at the

broader end of the egg. When an egg is new-laid the air space is scarcely perceptible, but it increases in size every day. The contents should be clear and free from spots representing moulds, or dark areas showing development of the germ or bacterial colonies in the white.

When broken the white and yolk ligaments should be strong and firm and the yolk round. A flat yolk indicates age or a "stale" egg. The best yolks are reddish-yellow in colour, and not pure yellow. If boiled before it is more than three to five days old the white does not thicken to the extent that it will later, but remains milky and flaky.

Finally, it may be said that infertile eggs are to be preferred to those which have been fertilised.

Measures for Improvement.

When the poultry-keeper fully realises the qualities which characterise a first-grade egg he should not find it difficult to make his produce conform to the standard. The general management of poultry for egg production is dealt with in Leaflet 114 (*Feeding of Poultry*), and Leaflet 129 (*Winter Egg Production*), but, from the point of view of marketing, the following points may be emphasised.

Breeding.—To ensure a regular supply of eggs throughout the year it is desirable to keep two breeds, one a non-sitting breed, and one a general purpose breed. The general purpose breed will provide the necessary proportion of tinted eggs. Many strains of poultry at the present time are inclined to lay rather small eggs. To remedy this care should be taken to breed only from hens laying eggs of the requisite size, and to select eggs for hatching that are of the desired weight.

Nests and Cleanliness.—Nests should be sufficient in number, roomy, dry and clean. They should be removable to facilitate cleaning, and the nesting material should be renewed frequently, especially if it becomes wet or soiled. If, in spite of every precaution, dirt has collected on the egg, it should at once be removed by means of a dry cloth. Should that not be sufficient a slightly dampened, but not wet, cloth may be used. It is desirable to lime-wash the nests frequently, to rid them of parasites.

Collecting and Storing the Eggs.—The eggs should be collected at least once daily; in warm, moist weather twice daily is preferable. They should not be kept in a hot room or exposed to the sun's rays. The store-room should be cool and dry, and free from objectionable odours. A dairy

is excellent for the purpose, but failing that, a larder or well-ventilated cellar would be suitable. It should be remembered that few food products are more susceptible than eggs to taint by strong-smelling substances, and to rapid deterioration when improperly stored.

All abnormal eggs, double-yoked, large, small, dirty and cracked eggs should be utilised for home consumption.

If it can be avoided fertile eggs should not be marketed. In warm, moist weather they may undergo partial incubation, and, in any case, form the great mass of bad and deteriorated eggs. The male birds should be removed directly after the close of the breeding season.

The practice of holding back eggs in the hope of obtaining a higher price cannot be too strongly condemned, and is against the interests of the producer in every way. Eggs should be marketed at least once a week; if the highest class trade is to be secured they must be marketed three times a week in spring and summer, and twice a week in winter.

Packing.

Sectional egg boxes, which are returnable, are generally used in this country by all classes of dealers and co-operative societies. They vary in detail, but for practical purposes are similar in principle. The return of cases involves a large amount of trouble, annoyance and loss, and retailers generally prefer non-returnable boxes. The question is chiefly one of cost. A sectional non-returnable box holding three long hundreds could not be made, even in quantities, for much below 2s. On the other hand a strong returnable case holding the same number may be purchased for 6s. and with small repairs and renewals of fittings could be used for a hundred journeys. Even adding the cost of returning, the saving to the sender is considerable. The principal advantage of non-returnable cases is that the fittings are new and will, therefore, be perfectly clean, while this is not always the case with those which have been frequently used; as eggs are so susceptible to external influence and are easily tainted, this is an important point. If they are encased for some hours or days in boxes with the fittings damp and dirty the eggs will soon deteriorate. The fresher and better the egg the more easily is it affected in this way. It is advisable to renew the cardboard fittings and dividing sheets from time to time.

During hot weather persons who are conveying eggs to the market or railway station should see that the boxes are not

exposed to the full glare of the sun. Vans in which they are carried should be well ventilated.

Treatment of Eggs in the Markets and by Retailers.

Many of the old market buildings in country towns, where eggs and butter were brought for sale, were cool and therefore well suited for perishable products such as eggs. Some of these still remain, but it frequently happens that eggs are now sold in the open market quite irrespective of the weather. Not only is this so but the eggs are also packed under the same conditions. Exposure to bright sunshine or rain during packing must lead to deterioration, and were it not that the journey is frequently a short one, the damage would be considerable. The more careful local traders recognise this, and, whenever possible, pack under cover in a cool place. In all local markets suitable rooms should be provided for packing eggs.

The retailer also often fails to realise the perishable nature of the eggs which he offers for sale. It is true that the eggs do not as a rule remain very long in his possession, but, while they are, they may undergo rapid deterioration by being placed in hot shop windows exposed to the sunlight during the day and to radiation from gas jets at night. The eggs should be kept in a cool place removed from any strong-smelling goods. Special care should be taken to store eggs in suitable places over night and during week-ends.

Testing and Grading.

Grading.—The greatest obstacle in the way of improvement in the marketing of eggs in this country is the present practice of selling on a basis of quantity rather than quality. It is quite a common occurrence for eggs delivered as new-laid country eggs to include a large proportion of second-grade and even stale eggs. With a system of grading this would not be possible. On the Continent and in Ireland eggs are graded into three sizes (firsts, seconds and thirds), and the inferior and small eggs are retained for sale locally. Such a system, efficiently carried out, has numerous advantages, of which the following may be mentioned. Poultry-keepers whose aim is to produce only eggs of the best quality would obtain an increased price, and retailers could make their purchases with the knowledge that the eggs are what they are stated to be. Uniformity in size means that supplies of graded eggs will present an attractive appearance, and also that there is less risk of breakages in packing. With the prospect of obtaining increased prices there would be a

tendency in the direction of a general improvement in the quality of the eggs produced.

Testing.—A system of grading can only be successfully carried out with the assistance of accurate testing. Inefficient testing will lead to confusion and largely defeat its own ends. Facility in testing can only be acquired by practice, and for this reason it is desirable that the operator should devote the greater part of his time to the work. Testing is therefore best undertaken when there are large quantities of eggs to be dealt with, as, for example, at a co-operative egg depot and in the local market. The test might take place where the eggs are purchased from the producers, who could then be paid on the basis of quality, and not on the present system of all-round prices. No greater stimulus could be given to the production of first-class eggs. Testing and grading are already leading features of the improvements in handling introduced by co-operative societies, and are also being adopted by better class local traders, and accommodation should be provided for the purpose at all local markets. If this were done retailers could then purchase with confidence from local collectors, who, by giving enhanced prices to reliable producers, would in their turn compel other poultry-keepers to aim at the same standard.

It is impossible to emphasise too much the necessity for the grading and testing to be carried out in such a way that the guarantee of quality can be accepted without hesitation. The importance of this is well recognised in some Continental countries and in British Colonies where proposals are being made for a control system by which an official grader and tester would be employed.

In any general improvement in the conditions under which eggs are marketed much might be done by an extension of co-operative principles (see Leaflet III, *Co-operative Egg and Poultry Societies*). Co-operative societies can introduce efficient methods of grading; they can serve much wider markets than the individual poultry-keeper, and they can maintain steadier prices when eggs are plentiful. Co-operative marketing, however, is still the exception rather than the rule in this country, and the incentive to produce the better class eggs is often lacking. Every effort should therefore be made to improve the existing machinery, both by the adoption of more systematic and expeditious methods of forwarding from producing to consuming centres, and by the introduction of an efficient system of testing and grading.

THE systematic provision of agricultural instruction suited to the needs of the wives and daughters of peasant proprietors and agricultural labourers is a question which has only come well to the fore quite recently in Holland. Earlier attempts in this direction were made, however, in the provision of dairying instruction in districts where this branch of agriculture was left almost entirely to women. Thus, instruction in butter and cheese-making was provided for girls as well as men students at the dairying schools of Bolsward and Oudshoorn. This instruction had to be given up, however, after a few years owing to lack of students. Somewhat similar attempts were made by the Agricultural Union of the Provinces of Geldern and Overijssel, which instituted courses in dairying for women conducted by a peripatetic instructor. In South Holland the Dairy Council of the Dutch Agricultural Society provided courses in cheese-making. These forms of special instruction lost much of their utility owing to the improvement of mechanical dairying processes.

It was not until 1908 that a number of agricultural societies began to consider seriously the organisation of a thorough technical education for the female agricultural population; the immediate incentive seems to have been the successful results which had been attained in this direction in Belgium at that date. Previous to 1908, commissions had been appointed by agricultural bodies to investigate the subject, and the Department of Agriculture deputed two women to study the organisation of domestic economy courses in Belgium, Germany and Denmark.

It must be mentioned that domestic economy schools in towns had been attended by young women from rural districts, but the number of such attendances was small, owing, no doubt, to the cost of attending throughout a whole course and to the fear of the parents that such a measure helped the influx into the towns.

Agricultural societies sought, therefore, to give the instruction as far as possible in villages. The courses were designed not only to produce good housewives and mothers, but also good peasant women. Such instruction is at present supported financially by the Ministry of Agriculture. The

* *Intervention du Gouvernement en Faveur de l'Agriculture dans les Pays Bas*, 1913 (Netherlands Ministry of Agriculture), and *Mitteilungen der Fachberichterstatler* No. 13, 1914 (Austrian Ministry of Agriculture).

courses are unambitious in character but of sufficient length; as a rule there are two hours of instruction per week, and in drawing up the curriculum due attention is given to the type of agriculture of the district. As a rule would-be students must have completed their sixteenth year. Wherever this kind of instruction has been introduced it has met with a most friendly reception from the agricultural population, and a good future is predicted for it. The courses are, as a rule, conducted by an instructress in domestic economy and by a teacher of agriculture possessing a diploma, and also, where the character of the district requires it, by a practical gardener.

In view of the diversity of agricultural conditions in different parts of the Netherlands, the occupations of the female agricultural population and their social position change rapidly from district to district, and due regard must be paid to this in the organisation of instruction. At the outset, therefore, preliminary trials of different systems were made in order to discover the most suitable of these. Thus, courses were held in which the instruction was given twice weekly during two summer terms, in others during several winter months in consecutive years. In North Holland trials were made of a four-year course, to which girls under sixteen were admitted. Finally, the Agricultural Union of Geldern introduced peripatetic schools in which courses lasting eight weeks were held.

The courses for the wives of agricultural labourers occupy a special position; they consist of a number of "conferences" at which information on the most important subjects of domestic economy is given in an easily comprehensible form.

Courses in the Different Provinces.—The first of these agricultural domestic economy courses was held at Groenlo and was due to private effort. This was closely followed in 1909 by a domestic economy course of two summers in the State Agricultural Winter School at Veendam. In 1910 several summer courses were established in Groningen, Geldern and Zeeland, those in this last province relating more particularly to dairying.

A commission of the Agricultural Society for North Holland, appointed to study the question of agricultural instruction for women, drew up three different schemes of courses. The scheme based on *Course A* was put into practice in 1911, and lasts five years. The instruction is given thrice weekly in the first two years and twice weekly in the remaining three years. This course is held at the domestic economy school at

Alkmaar. *Course B* is of four years duration, and is suggested as suitable for girls who for pecuniary reasons may not be able to avail themselves of *Course A*. At present there is one example of this type; but other such courses are to be instituted in different parts of the country. *Course C* is similar to the winter courses in agriculture and horticulture, and comprises two years of study. There are at present two such courses in existence. *Course B* is still in the experimental stage, while *Courses A* and *C* can be regarded as definitely established.

In Lierop, in North Brabant, an agricultural domestic school was founded by the Society for the Education of Peasant Girls. It has its own buildings with boarding arrangements and possesses a domestic establishment for the purpose of practical instruction. With the exception of the sections for agriculture and horticulture, instruction is given by "sisters," and is principally of a practical character. The school is very similar to the domestic economy schools of Germany.

As a result of propagandist work on the part of the Government and the different agricultural societies, courses in agricultural domestic economy have also been instituted in Friesland, Overijssel, and South Holland. The number of these courses has largely increased since 1910. In the year 1911-12 short courses were instituted for the first time for women and girl labourers (above 18 years). In some districts these courses were extraordinarily successful, as was evidenced by the large number of female students attracted.

In 1912 there were 53 courses for women and girls, some relating only to dairying and animal nutrition, others including also domestic economy and hygiene in their curriculum. The number of female students was about 1,100, the majority being between the ages of 16 and 18. The number of domestic economy instructors is at present 209.

The present organisation of all these classes is only experimental, and must not be regarded as definitely fixed. Attempts are being made to work out a common curriculum by which the uniformity of the instruction and the consequent normal development of the Dutch domestic economy teaching shall be ensured.

Instructors.—As regards instructors, the teaching in agriculture and horticulture is given by instructors with diplomas. The domestic economy courses in the narrower sense are carried on naturally by women, while the courses in hygiene, nursing and first aid are in most cases conducted by doctors. Owing

to the rapid development of the courses difficulty was experienced as to the supply of teachers; it was resolved from the beginning to employ only women for the course in domestic economy, and further only those thoroughly familiar with the life on the peasant farms. It was, therefore, found of advantage to train peasant girls to be teachers, and a special school was founded for this purpose in 1913 at Rollecate, in a thoroughly rural district. The practical character of the Dutch is manifested in this measure, as the peasant women pay no one more attention than these women teachers taken from their midst, and familiar with their conditions. The school can accommodate eight to ten students. A vegetable garden is attached to the school, and the owner of the holding of Rollecate has put his farm entirely at the service of the school. The length of the course is 1½ years. Would-be students must possess the diploma of a domestic economy school or a certificate issued by a competent authority showing that they possess the necessary preliminary knowledge. Preference is given to young women who are at least 20 years of age, and who have been brought up in the country. The curriculum includes cooking, domestic work, washing, rational feeding, a knowledge of foods and kitchen utensils, laundry work, physics, chemistry, botany, zoology, gardening, hygiene, and theoretical and practical pedagogy. Care is taken that these subjects shall be taught in their application to rural conditions. The fee for the whole course is £6 5s., exclusive of the cost of food, the students and teachers boarding themselves in common.

Control and State Aid.—The domestic economy courses in Holland are under the direction of the inspector of agricultural education, and are controlled by the State agricultural and horticultural professors within whose districts the courses are held. No question relating to instruction and staff can be decided without the assent of these professors, who are aided in their control by the professors of the agricultural and horticultural winter schools, since the number of courses has increased to such an extent that it is impossible for the former professors to inspect all courses regularly.

There is a yearly gathering of those who conduct the courses, under the presidency of the inspector; matters relating to the courses are thoroughly discussed, and teachers are kept *au courant* with progress in agriculture and horticulture. Holiday courses of a few days in length are held from time to time with the same object. The local control of courses

in agriculture and horticulture is exercised by special control commissions, appointed by the societies by whom the courses are instituted.

Subsidies have been given by the Government in aid of this class of education in two different ways; the Agricultural Society of North Holland and the Lierop Society for the Education of Peasant Girls receive an annual grant; in the case of all other courses grants of varying amount are made towards the salaries of the instructors, cost of teaching, material, &c. In 1912 the State expended about £16,000 in subsidies to the agricultural domestic economy courses. The provincial authorities and agricultural societies contributed in addition about £400. In most districts in which courses are held the district authority places the school, with heating and lighting, at the disposal of those taking the course.

It is insisted by the peasants that these courses shall be designed to improve the family life on their holdings and not convert their daughters into "town" girls.

Although the curricula cannot yet be regarded as definitely settled, preference is already given to two-year courses in which instruction is given twice weekly. No great hopes are based on the peripatetic work, as the longer the teachers remain in continuous contact with the population, especially the mothers, the greater is the confidence placed in them. There is also the opportunity on the part of students in the latter case of going to the teacher for advice when difficulties arise in the practical application of matters learnt during the course, so that the non-peripatetic teacher in course of time becomes a standing adviser.

Now that a beginning has been made, Dutch circles interested in the movement desire to have the instruction made compulsory, as they see in it the most effective means of combating poverty and drunkenness and of raising the general standard of health.

In view of the probability of high prices for wheat continuing after the harvest of 1915, many farmers have already decided to increase their wheat sowings in the coming season, and others are considering the methods by which they may be able to do so with the least disturbance to their existing system of farming.

Hints on Growing the Wheat Crop of 1915.

The following notes refer to possible changes in the place of wheat in the rotation, and to the manuring of the crop.

when taken out of its ordinary course. The suggestions have been so arranged that they apply to the more common rotations practised in different parts of the country.

When endeavouring to increase the area under wheat, farmers will, no doubt, not forget other crops which need special consideration under present conditions. It would be undesirable to reduce the area under oats, especially in the North, for this grain may be of even more value to a nation at war than wheat. It should also be remembered that the United Kingdom is practically dependent on its own resources for its supply of potatoes, and that potatoes will produce twice as much human food per acre as wheat, where each crop is grown under conditions which suit it well.

Those farmers who usually dung land for wheat, and buy artificials for potatoes and root crops, will be well advised to use artificial manures for wheat this season. Farmyard manure (especially liquid manure which is rich in potash) will be particularly valuable next year for growing potatoes, and also swedes and turnips, since artificial potash manures may not be obtainable.

Manures available.—Reference can only be made here to the most common artificial manures—nitrate of soda, sulphate of ammonia, superphosphate and basic slag. There are, however, other suitable artificial manures, and there is no reason to suppose that there will be any difficulty in securing sufficient supplies of one or other of the nitrogenous and phosphatic manures at reasonable prices. Indeed, manures which in ordinary circumstances would go to the Continent, may come into our markets. Thus, guano, of which a large quantity is used by sugar-beet growers, is likely to come to this country. The nitrogenous sorts would be very suitable for manuring corn crops, while both the nitrogenous and phosphatic guanos would be useful for green crops.

It is only under very special conditions that potash would be essential to the success of a crop of wheat. Farmers who do not know that it is necessary, will be well advised to make no attempt to buy artificial potash manures for wheat; in the few cases in which experience may have shown potash to be necessary for wheat, a light dressing of dung should be given, but, as already stated, dung should usually be reserved for other crops.

Varieties of Wheat.—Farmers who already grow wheat know what kinds suit their soils. Those who have not been in the habit of growing wheat should inquire locally as to the

kinds that succeed best. Those who wish for information as to the value of the newer sorts which have recently come into cultivation should apply to the Provincial Agricultural College.

Autumn Wheat.—The case of wheat grown in four-, five-, and six-course rotations may be considered.

1. *Four-course Rotation* [Roots—spring corn (barley)—clover and grass seeds—autumn or spring corn (wheat or oats)].—Farmers who work their land on the four-course rotation, and can clear the root crops off a part of the land before the beginning of November, might replace some of the barley crop by wheat on any loam or strong loam soils suitable for wheat growing.

There will not be time to feed off any considerable area of the roots on the land before sowing wheat, and if the roots have been grown either with dung only, or with artificial manures only, the wheat crop should get a dressing of $\frac{3}{4}$ cwt. of sulphate of ammonia and 3 cwt. of superphosphate at seeding time. If the root crop has had 3 to 5 cwt. of superphosphate or an equivalent in basic slag in addition to dung, wheat ought not to require any superphosphate or basic slag in the autumn. Similarly, if 1 to 2 cwt. of sulphate of ammonia, or an equivalent, was given to roots, no nitrogenous manure should be required, as the season has been dry, the root crop is small and much of the manure remains in the soil. If no artificial manures are given in autumn, then, where the whole root crop has been carted off, 1 cwt. per acre of nitrate of soda will probably be required in spring, especially if the weather is wet and the season backward.

2. *Five-course Rotation* [Roots—wheat—barley—seeds—oats or wheat].—In some districts where barley would lodge if taken after roots, the normal practice is to grow barley after wheat. In such cases, especially where the land is strong, wheat might with advantage follow wheat this year; but if this plan is adopted the crop is likely to be unsatisfactory unless it is properly manured. A suitable dressing would be $1\frac{1}{2}$ cwt. of sulphate of ammonia and $2\frac{1}{2}$ to $3\frac{1}{2}$ cwt. of superphosphate per acre at seeding time; or half the sulphate might be applied in spring.

3. *Five-course Rotation* [Roots—barley—seeds for hay—seeds grazed—oats or wheat].—Since wheat should not be substituted for oats, and since it would be undesirable to reduce the green crop break to less than one-fifth of the arable

land, the area under wheat in this case could only be increased by substituting wheat for part of the barley crop, as in the four-course rotation, or by breaking up part of the land usually reserved for second year's grass.

Farmers should not attempt the latter course unless they have a full supply of labour at command, or an equivalent in power and other machinery, for not only would it mean more work next season, but, in order to avoid permanently dislocating the rotation, it would be necessary to take two corn crops in succession, and there would be much more cleaning to do in 1917 when the land is being prepared for roots. If, however, farmers are satisfied that they can till the extra land and keep it clean, and if they can arrange to graze fewer stock than usual next summer, it would be both practicable and desirable to increase the area under wheat next season, for, if the second corn crop were suitably manured, it could be done without injuring the land. If the cross crop were wheat, then it should be treated as indicated for wheat after wheat in Rotation 2 above. If, however, oats follow wheat in 1916, the manure should be given in spring. The following dressing would be suitable: 1 to $1\frac{1}{4}$ cwt. of nitrate of soda (or $\frac{3}{4}$ to 1 cwt. of sulphate of ammonia) with 3 cwt. of superphosphate.

4. *Five-course converted into Six-course Rotation.*—Sometimes five-course have been converted into six-course rotations by leaving down grass for a third year. In such cases the area under corn may be increased by the methods suggested above in the case of Rotation 3.

5. *Six-course Rotation* [Roots—barley—seeds—wheat—roots, potatoes or beans—wheat or oats].—In a rotation of this kind wheat might be increased by substituting it in part for barley, as in Rotation 1, and in part for mangolds or other root crop. Wheat should not be substituted for potatoes under existing conditions, however, for the reasons already given.

When wheat follows the first root crop in this rotation it should have the same manurial treatment as suggested in the case of Rotation 1, and when it replaces part of the fallow crop in the fifth course of the rotation it should be manured as recommended in Rotation 2.

6. *Breaking up Old Grass.*—Where arrangements can be made for breaking up old grass land which is farmed in conjunction with land worked on any of the foregoing rotations,

some of the grass might go directly under wheat; but where there is a strong sod, the land would usually pay better under such spring crops as oats or potatoes. Wheat might in this case be sown in autumn on all the land usually put under oats; it might also, of course, occupy part of the break usually reserved for barley.

All second-rate and inferior grass land ploughed up for corn growing should be dressed with $2\frac{1}{2}$ to 4 cwt. of superphosphate or basic slag per acre when the seed is sown, and in most cases a nitrogenous manure in spring would be an advantage. It is unlikely that farmers will plough up good grass land, but if such land is ploughed and put under corn manuring will seldom be called for. In some districts, however, corn crops might be benefited by 2 to 3 cwt. per acre of superphosphate even if grown after good grass.

Spring Wheat.—Spring-sown wheat is not, as a rule, a satisfactory crop in the north, but throughout the greater part of England very good crops of spring wheat may be secured, so that farmers who do not increase their wheat sowings in autumn may still grow larger quantities of wheat than usual if they can decide on their course of cropping before February 1st.

There are two cases in which farmers who have not increased their autumn sowings should not hesitate to sow spring wheat, viz.: (1) after roots on strong land which usually grows second-rate barley or oats, and (2) on land on which the oat crop has recently suffered severely from eel-worm ("tulip root") or frit fly. These two cases may often occur on the same farm, for on land not naturally well adapted for barley, the oat crop has often been grown too frequently in recent years. With better wheat prices there is now an opportunity of getting "oat-sick" land into a sound condition.

Spring wheat which follows roots fed off by sheep should not, as a rule, require any manures. On land known to be poor in phosphates, however, a dressing of $2\frac{1}{2}$ to 3 cwt. per acre of superphosphate before sowing will push on the young plant and help the crop to mature well.

Spring wheat taken after grass on raw, strong land on which oats have been suffering from "tulip root" would probably benefit by 1 cwt. per acre of sulphate of ammonia towards the end of March, or $1\frac{1}{2}$ cwt. of nitrate of soda a fortnight later.

How to obtain Advice.—Farmers wishing for further advice on manuring, or other points connected with wheat growing,

should consult the County Organiser for Agricultural Education. In cases where the county does not employ an agricultural staff, direct application should be made to the Provincial Agricultural College.

ALLOTMENT holders and occupiers of small gardens seldom grow sufficient vegetables to last all the winter, and in many cases do not think it necessary to make arrangements for storing their crops. The produce, however, of even a small garden, if it is suitably stored, can be made to last much longer, while the allotment or garden can be more profitably cultivated if each crop is lifted at the proper time, and the land is at once dug over in preparation for the next crop. Constant digging, hoeing and turning over the soil tends also to keep down insect and fungus pests, and to secure a better yield for each successive crop.

Harvesting the Crop.

Nearly all vegetable crops should be harvested as soon as they are ripe, as delay favours the development of disease. In most cases the proper time is obvious from the appearance of the plant. Thus *potatoes* should be lifted when the haulm begins to die; *artichokes* when the leaves begin to wither; *onions* when the bulbs are sufficiently large, the leaf-tips turn brown, and the leaves appear "slack" (the necks should be bent over to the soil a few days before the onions are lifted, and the skins should be allowed to die in order to make the bulbs round); *cauliflowers* should be cut before the "flower" loses its white curdy appearance; *carrots* should be lifted before the autumn frosts begin and when the older leaves show signs of withering; *broccoli* in the Midlands and the north of England (it is unnecessary in the south of England) should be laid over facing north on the approach of winter, to prevent damage to the colour of the "flower," and to enable the crop to resist a hard winter so that they may be cut in good condition in early spring; *celery* is ready for lifting as soon as the earthed-up stems are sufficiently blanched; and *parsnips* may be left in the ground and be raised when required, even after the tops have died down.

Methods of Storage.

Potatoes.—It is not advisable to attempt to store early potatoes for any length of time. After being lifted they should be kept in sacks or covered boxes and be utilised as required. Diseased potatoes should at once be picked out and burnt, and should on no account be left on the ground or be thrown on the manure heap. Further, they should not be fed to pigs or other animals, unless they have first been well boiled.

The sound potatoes should be sorted into three grades—the ware (cooking size), “seed” (small size) and chats (very small size). The last are generally given to pigs or poultry.

All potatoes of “seed” size which it is proposed should be kept for planting should be “boxed.” Many growers do not box their late varieties owing to considerations of space, but small growers will find it will pay them to box all varieties before planting. Boxing consists in placing the potatoes in layers not exceeding two potatoes in depth in boxes or on shelves in a cool place where they will not be exposed to the frost, but will be exposed to light and air through the winter. Potatoes so treated turn somewhat green in the light, and the two or three short shoots which they put forth in the spring lead to a much better crop in the following season than may be expected from several weak shoots which usually result if seed potatoes are selected from pits in the spring and immediately planted.

If grown in sufficient quantity late potatoes may be stored in the open in a pit, pie, or clamp. This is formed by piling the potatoes in a solid triangular heap, or against a wall, and covering them over with straw and soil. They will usually keep well till the spring if the following precautions are observed:—

(1.) The clamp should be on a well drained site, and the potatoes should be piled on the ground, a shallow trench being dug round the clamp to supply soil to cover the potatoes, and to drain off the water after heavy rainfall.

(2.) The site should be as little as possible exposed to the sun, as it is essential that there should be no rise of temperature in the clamp. Potatoes may suitably be clamped against a north wall.

(3.) The potatoes should first be covered with straw to a depth of about six inches and then with about three inches of soil. The top of the ridge may safely be left covered

only with straw for a time, but must be covered with soil before frosty weather sets in, when a ventilating hole should be left at the top of the ridge. Into this hole should be inserted a piece of tile piping, which in rainy weather may be closed with a bunch of hay or covered with a tile, but in fine weather, especially just after the clamp has been made, should be left open to allow the heated air to escape. If this is not done the potatoes may decay. About a month after the clamp has been formed, but before severe frost sets in, the covering of earth should be increased to six inches or more in very cold districts. If frost reaches stored potatoes they will often decay as soon as a thaw sets in.

If the quantity grown is not sufficient to necessitate the making of a clamp, the potatoes may be stored in sacks or in boxes in a cool cellar or shed, but they should not be allowed to get too hot or be exposed to frost.

Artichokes may be stored in the same way as potatoes.

Beet may be lifted in October or November, or the tops should be twisted off with the hand, and not cut with a knife, lest “bleeding” should follow. The best place to store beet is a shed where they will be protected from frost. They should be stacked in layers, with half an inch of clean sand, dry soil, or sifted ashes between each layer of beet.

Carrots should be lifted in October, or during November, and the stems cut off close to the crown. They may then be stored in the same way as beet.

Parsnips.—The usual practice is to leave parsnips in the ground, even after the tops have died down, and only lift them as required. It is better, however, to lift them before the winter is over and store them in the same way as beet, if only for the reason that the ground may be dug over before the spring.

Beet, Carrots and Parsnips may also be pitted in the same way as potatoes if the storage accommodation is small and the quantity grown is large.

Cauliflower and Celery.—If it is desired to lift and store these vegetables on account of severe weather, or to cultivate the soil in preparation for the next crop, they may be lifted with as much soil as will cling to their roots, and be stacked upright in a cool shed to which light is admitted. The plants should be packed close together and the exposed side should be banked up with soil. In this way they will keep as long as in the open ground. The proper time to lift is about the

end of October or during November for cauliflowers, and the middle of November for celery.

Onions should be lifted as soon as possible after ripening begins. They should first of all be dried on the surface of the ground, being turned occasionally till dry throughout. They may then be tied in straps or left on the floor of a dry shed. If tied in straps they can be hung from the roof or a beam.

Brussels Sprouts do not require storing, as they will stand the severest weather likely to be experienced in England.

At the present time, owing to the outbreak of war, a number of feeding stuffs which are commonly used for pig feeding are scarce and dear, while others are relatively plentiful and cheap. Notes on Pig Feeding. Farmers, therefore, may well consider carefully how they can reduce the cost of rations in the piggery. The Board think it may be useful to suggest some rations, which are therefore given below. In each case Ration 1 represents a ration in general use, while the others are alternative rations intended to show how, by using other feeding stuffs, the food bill may be reduced. The cost is based on the prices ruling in London in October.

Rations for Fattening Pigs.

For pigs of 40 lb. live weight.

Ration 1.		Ration 2.		Ration 3.	
1 lb. Middlings	} 1½d.	½ lb. Middlings	} 1d.	1 lb. Sharps	} 1d.
½ „ Barley Meal		½ „ Gluten Meal		½ „ Middlings	
		½ „ Rice Meal		½ „ Fish Meal	

For pigs of 80 lb. live weight.

Ration 1.		Ration 2.		Ration 3.	
1½ lb. Sharps	} 2½d.	1 lb. Sharps	} 1½d.	1½ lb. Sharps	} 1½d.
1½ „ Barley Meal		„ Bran		1½ „ Middlings	
		„ Gluten Meal		1½ „ Fish Meal	
		„ Rice Meal			

For pigs of 140 lb. live weight.

Ration 1.		Ration 2.		Ration 3.	
2 lb. Sharps	} 3½d.	1½ lb. Sharps	} 2½d.	1½ lb. Sharps	} 2½d.
2 „ Barley Meal		„ Bran		1½ „ Middlings	
1 „ Maize Meal		„ Gluten Meal		1½ „ Rice Meal	
		1½ „ Rice Meal		1 „ Fish Meal	

For pigs of 180 lb. live weight.

Ration 1.		Ration 2.	
2½ lb. Sharps	} 4½d.	2 lb. Sharps	} 3½d.
2½ „ Barley Meal		1 „ Bran	
1 „ Maize Meal		1 „ Gluten Meal	
		2 „ Rice Meal	

Rations for Sows.

For sows suckling their young the following rations are recommended:—

Ration 1.		Ration 2.		Ration 3.	
4 lb. Sharps	} 6d.	4 lb. Sharps	} 5½d.	4 lb. Sharps	} 5½d.
4 „ Middlings		3 „ Middlings		2 „ Bran	
2 „ Bran		2 „ Bran		4 „ Rice Meal	
		½ „ Fish Meal			

The total quantities shown in the foregoing rations suppose that only such foods are fed, with water; they may, however, be varied somewhat according to the appetite of the animal and the amount of vegetable food and dairy by-products available. A supply of vegetable food is very advantageous. Young store pigs may be allowed to run out occasionally in suitable weather, when they will pick up the greater proportion of the green food required, but as fattening progresses the amount of exercise must be curtailed and recourse must be had to green forage, such as clover, vetches, lucerne, and rape, and to potatoes, turnips, and mangolds. The three last-mentioned should be boiled before being fed. The results of numerous experiments show that about 4 lb. of potatoes or 8 lb. of turnips or mangolds may replace about 1 lb. of cereal meals in a mixed ration. Lucerne, clover, and rape, lb. for lb., are even more valuable than potatoes when fed in conjunction with cereal meals or offals. Similarly, skim milk or buttermilk is a most useful addition to a meal ration, particularly for young pigs. It is calculated that 1 gal. of skim milk is equal to 1½ lb. of cereal meals. When procurable at about 1d. to 1½d. a gallon skim milk or buttermilk can generally be profitably fed in quantities up to 1 gal. per head daily. When any of these green crops or dairy products are available they should be used in the manner indicated to replace in part the meals shown in the rations above.

The use of acorns may often reduce the food bill. An account of the Food Value of Acorns, Horse Chestnuts and Beech Mast is given in Special Leaflet No. 9.

THE Board's Leaflet No. 239 on the Pear Leaf Blister Mite has been revised, and the following methods of dealing with this pest replace those previously given.

Pear Leaf Blister Mite.

A winter wash either of lime-sulphur or paraffin emulsion is usually recommended for blister mite, both in this country and in America.

In adopting any of the following suggestions the grower must take into account local conditions and the intensity of the attack. In mild cases a single application of a winter wash may be sufficient, but where the attack has become serious it is wiser to make two applications as suggested below.

(1) *Lime-Sulphur Washes*.—A lime-sulphur wash at winter strength may be applied after the leaves have fallen in the autumn (November approximately) and again when the buds begin to swell in spring (February approximately). Owing to the variations in strength found in most home-made lime-sulphur washes it is generally better to buy the concentrated wash from a reliable manufacturer who will provide the necessary instructions as to dilution.

In experiments at Wye, Theobald found that a lime-sulphur-caustic-soda wash applied in November and February was more effective than either lime-sulphur alone or paraffin emulsion. His formula for such a wash, in addition to lime-sulphur, contains 1 lb. of caustic soda and 1 lb. of soft soap to each 10 gallons of water.

(2) *Paraffin Emulsions*.—Paraffin emulsion may also be used at the periods recommended in the case of lime-sulphur. In Bulletin 283 of the New York Experiment Station one part of standard paraffin emulsion in five parts of water is suggested. In this country one part of standard emulsion in ten parts of water is the strength usually recommended for a winter wash. The standard emulsion referred to in the above Bulletin appears to be composed as follows:—

Paraffin	..	..	..	..	2 gallons.
Water	..	..	..	..	1 gallon.
Soft Soap	..	..	..	..	$\frac{1}{2}$ lb.

The soap should be dissolved in boiling water and while still hot the paraffin should be added, the whole being thoroughly churned.

A dilute emulsion is stated to be of service when applied to the foliage in early summer. Such a wash might be obtained by diluting one part of the standard emulsion described above with 25-30 parts of water.

(3) Where an attack is noticed before the mites have spread, or where only a few small trees are affected, the blistered leaves may be collected and burnt.

THE Board have recently received inquiries as to the value of road sweepings as manure. The manurial value of road sweepings is naturally very variable. If they are obtained from the well-paved streets of towns and are swept up by hand they may, in some measure, approach stable manure in value. Even with town sweepings, however, there is a possibility of the inclusion of much other waste material, which may augment or decrease the manurial value of the whole.

In sweepings collected from country roads there may be a large proportion of sand and other material of no direct manurial value. On the main thoroughfares the value of sweepings has been adversely affected by the introduction of motor vehicles. This deterioration need not, however, be very great, as the amount of oil and other substances in the sweepings is generally insufficient to make any appreciable difference.

The smaller proportion of urine in road sweepings makes them less valuable than stable manure, as the nitrogen is not so readily available. An analysis of a sample of road scrapings carried out by the Consulting Chemist to the Royal Agricultural Society of England gives the following constituents, which are compared with those of fresh horse manure with straw:—

	Road Sweepings.	Fresh Horse Manure
	Per cent.	with Straw.†
	Per cent.	Per cent.
Moisture	13.40	71.3
Organic Matter	3.61*	25.4*
Oxide of Iron and Alumina	4.13	—
Lime	.50	0.21
Phosphoric Acid	.20	0.28
Potash	—	0.53
Sand	77.33	—
*Containing Nitrogen ..	.086	0.58
Equal to Ammonia ..	.104	0.70

† From McConnell's *Agricultural Notebook*.

It is concluded that the scrapings are little if at all richer than ordinary soil, as far as manurial value is concerned.

Generally speaking, therefore, while road sweepings may be of advantage in improving the mechanical condition of stiff, badly-aerated soils, or in giving more cohesion to very light soils, it is questionable whether their fertilising value, particularly in the case of scrapings from country roads, is sufficient to give them much monetary worth.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Green Manuring (*Mitt. der deut. Landw. Gesell.*, 24th June, 1911, and 11th July, 1914). These experiments were commenced some years ago on two kinds of soil—a loess loam and a sandy soil.

On the loam the rotation is barley, potatoes, wheat and sugar beet. Green manure crops are taken between the barley and the potatoes and between the wheat and sugar beet. After the barley a mixture of peas, beans and vetches is grown as a stubble crop on some plots, while yellow clover is sown in the barley on other plots. In the case of wheat, both yellow and white clover are sown in the crop. All four crops of the rotation are grown every year on different plots.

On the sandy soil the rotation is rye, potatoes, both crops being grown each year. Serradella and yellow (or a mixture of yellow and white) clover are sown in the rye, while yellow lupins, blue lupins and a mixture of peas and beans are also taken as stubble crops.

The quantities of dry matter and nitrogen produced by the different green manure crops were ascertained. The green manure crops in 1911 were a complete failure, but the following table shows the average amount of dry matter and nitrogen produced in the four years 1909, 1910, 1912 and 1913 (in lb. per acre):—

		Dry Matter.	Nitrogen.
		lb. per acre.	
Loam Soil.			
After barley—			
Yellow clover (three years)	.. ..	3,233	114
Peas, beans, vetches	.. ..	3,088	100
After wheat—			
Yellow clover (three years)	.. ..	2,571	94
White clover (three years)	.. ..	2,235	78
Sandy Soil.			
After rye—			
Serradella (one year only)	.. ..	3,555	89
Yellow and white clover	.. ..	3,426	107
Peas, beans ..	.. ..	3,031	85
Yellow lupins ..	.. ..	3,882	109
Blue lupins (two years)	.. ..	3,306	80

The increased yields over the plots receiving no green manure were as follows (lb. per acre) for the first crop after the green manuring:—

		Potatoes.	Sugar Beet.
		(1 year.)	(Av. of 2 years.)
Loam Soil.			
Yellow clover	.. ..	5,256	5,568
" " + dung	.. ..	5,800	7,500
Peas, beans, vetches	.. ..	3,885	—
White clover	.. ..	—	5,175

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

		Sandy Soil.
		Potatoes.
		(Av. of 2 years.)
Serradella	.. ..	5,291
Yellow and white clover	.. ..	7,094
Peas, beans	.. ..	3,007
Yellow lupins	.. ..	5,497
Blue lupins (one year)	.. ..	3,034

The inutility on a loam soil of manuring potatoes with nitrate of soda after green manuring was demonstrated, the addition of this artificial to the potatoes depressing the yield on all the green manured plots.

The effect of the green manuring on the second following crop was ascertained. In the case of wheat following potatoes on the loam soil the effect was very appreciable, the increases (average of two years) being 461 lb. of grain per acre from the mixture of peas, beans and vetches, 450 lb. from yellow clover and 503 lb. from yellow clover and dung. The residual effect of the dung was thus small. In the case of barley after sugar beet on the loam the residual effect of green manuring was not so remarkable owing to low yields generally. On the sandy soil the second crop after the green manuring was rye; the increased yields of grain were about 162 lb. per acre in 1911 and 233 lb. in 1912 for all the green manures, there being little to choose between the effect of each kind of green manure.

The Effects of Caustic Lime on Certain Soils (*Jour. Agric. Sci.*, Vol. VI., Part 3; H. B. Hutchinson and K. MacLennan).—Investigations carried out on five soils of widely different types showed that the amount of caustic lime necessary to induce specific changes in the flora and fauna of the soil depends very largely on the character of the soil. The amounts of caustic lime necessary to effect reactions in each of the five soils tested were:—On light, sandy soil, poor in organic matter and in carbonate, 0.2 to 0.3 per cent.; on stiff clay loam, poor in organic matter but rich in carbonate, 0.3 to 0.4 per cent.; on an open sandy loam of an acid nature, 0.5 to 1.0 per cent.; on a rich well-dunged garden soil, 0.5 to 1.0 per cent.; while a light, sandy, organic soil, deficient in carbonate, failed to react even to applications of 1.0 per cent. of caustic lime.

Each of these soils, as well as many others examined, appears to absorb directly a definite amount of caustic lime, and, until these requirements are satisfied, the partial sterilisation does not set in. When this point has been reached there occurs an initial decrease in the numbers of bacteria followed by large increases, the larger forms of soil protozoa are killed, and an inhibition of nitrate production is caused. Lower doses than those required for partial sterilisation induce a temporary suspension of nitrification and a consequent accumulation of ammonia.

Caustic lime chemically breaks down some of the organic matter of the soil, as shown by the ammonia formed during periods when soil bacteria are quiescent; when, however, bacterial growth commences, there is a large increase in the rate of ammonia production.

The return in nitrogen, as ammonia and nitrate for each increment of lime applied, varies with the character and reaction of the soil and its carbonate content. On the average, and within a period of about 250 days, it amounted to approximately 1.0 per cent. by weight of the

caustic lime applied. Chalk gave less return, apparently because of its relative inaction on soil organic matter.

FIELD CROPS.

Manuring of Meadow Hay (*Yorks. Council for Agric. Educn., Guide to Expts. at Manor Farm, Garforth, 1914*).—Experiments have been carried out on $\frac{1}{10}$ acre plots since 1899 to ascertain the effect on meadow hay of various combinations of manures, whether applied each year or alternated with dung in some cases. The amount of each manure applied has remained constant throughout the period 1899–1912, for which the results are now published, the rates per acre being as follows:—Dung, 10 tons; nitrate of soda, $1\frac{1}{2}$ cwt.; superphosphate, 2 cwt.; kainit, 3 cwt.; sulphate of ammonia, 130 lb. The following conclusions as to the results of the treatment have been reached:—

Effect of Manures on Character of Herbage.—The percentages of the various species of plants were determined from a botanical analysis of the plots made in 1909.

The unmanured plot consisted chiefly of bent and sorrel; the percentage of inferior grasses was 59.1 and of weeds 18.3.

Dung applied every year encouraged the good grasses, especially foxtail and cocksfoot, and strongly repressed bent. It has, however, strongly encouraged the growth of soft brome and doubled the proportion of weeds, hogweed and beaked parsley in particular. Good grasses constituted 43.3 per cent. of the plants on this plot, inferior grasses 14.3 per cent. and weeds 36.8 per cent.

The application of dung in alternate years greatly increased the proportion of good grasses (60.2 per cent.), particularly golden oat grass, and strongly repressed bent. On the other hand it encouraged the growth of weeds (28.9 per cent.), especially sorrel.

Dung and complete artificials, applied alternately, encouraged foxtail, cocksfoot, golden oat grass and tall oat grass and almost eliminated bent; but weeds, particularly hogweed and beaked parsley, were encouraged and formed 29.5 per cent. of the total growth.

A complete mixture of artificials applied every year produced the highest percentage of good grasses (69.6) and the lowest percentage of weeds (10.8); cocksfoot and golden oat grass were strongly encouraged while bent and sorrel were reduced.

Nitrate of soda and superphosphate applied annually encouraged cocksfoot, golden oat grass and tall oat grass. The growth of bent was greatly checked while sorrel was slightly encouraged.

Nitrate of soda alone each year encouraged cocksfoot and tall oat grass at the expense of bent. The percentage of inferior grasses was 26.7 and of weeds 19.2.

Sulphate of ammonia alone encouraged cocksfoot at the expense of foxtail and golden oat grass. The percentage of inferior grasses on this plot was very high, viz., 62.9.

Profitable Amount of Manure.—With the object of determining the most suitable proportions in which nitrate of soda, superphosphate and kainit should be applied, when used as a substitute for dung, plots of meadow hay $\frac{1}{10}$ th acre in extent have been treated continuously at Garforth for 15 years.

The most profitable mixture proved to be 2 cwt. nitrate of soda, 2 cwt. superphosphate, and 3 cwt. kainit per acre, which produced a

crop of 42½ cwt. The effect both of reducing the amount of nitrate of soda and the amount of kainit in this mixture was to lessen the yield. Doubling the amount of superphosphate did not increase the yield in proportion to the additional expense, while doubling the amount of kainit caused a decrease in the yield in this experiment. Nitrate of soda and kainit gave a higher yield than either nitrate of soda and superphosphate or superphosphate and kainit.

The Tillerage of Wheat (*New Zealand Journal of Agriculture, July 20th, 1914*).—Five varieties of seed wheat were treated with a solution of nitrate of ammonia, and three with a solution of sulphate of ammonia, the solution in each case being of about 3 per cent. strength. Plots were sown with treated and untreated seed and the average number of stems per wheat plant ascertained. The average increase in the number of stems per plant resulting from the treatment was 20.6 per cent. in the case of the varieties treated with nitrate of ammonia and 12.8 per cent. in those treated with sulphate of ammonia. In the first instance the average number of stems per plant was increased from 7.28 to 8.78, and in the latter from 7.8 to 8.8, as a result of treatment. Owing to the ravages of birds it was impossible to discover the effect of the greater number of stalks on the yield of grain.

Varieties of Oats (*Lancs. C. C. Educ. Committee Agric. Dept., Farmers' Bull., No. 26*).—Trials have been made with varieties of oats since 1909, and since 1911 the same varieties have been tested each year. The results for the three years 1911–1913 are as follows:—

The rates of seeding per acre in bushels were: Wide Awake, 4.74; Banner and Goldfinder, 5.00; Victory, 5.78; Propsteier, 6.44; Abundance, 7.00. The average annual yields of good grain for the three years in bushels per acre were: Wide Awake, 68½; Victory, 58½; Propsteier, 54½; Banner, 51½; Goldfinder, 51½; Abundance, 39. In 1913, two further varieties were tested, namely Yelder and a mixture of Banner and Sandy. These yielded 65½ and 52 bushels of good grain, respectively.

It was found that the varieties which braided early were also the first to ripen. Oats of the grain-producing type (Wide Awake and Banner) gave the highest percentage of meal. The mixing of the two varieties, Banner and Sandy, did not result in an increased yield of grain as compared with Banner grown alone. Where a high value is placed on the feeding value of the straw, the Sandy oat is to be recommended. The two Swedish varieties, Propsteier and Victory, gave distinctly better results than the standard types usually grown in Lancashire.

Varieties of Wheat (*Univ. of Leeds and the Yorks. Council for Agric. Educ., Report No. 93*).—Eight varieties of wheat were tested in each of the three years 1912, 1913, and 1914, at Garforth. In all three years the soil was a medium loam, although the fields selected for the experiments were changed. The previous crop in each year was "seeds"—rye-grass and clover—following a cereal crop after either roots or potatoes.

The following were the average yields of grain and straw over the three years:—Garton's Victor, 49 bush. (of 63 lb.) grain, 33½ cwt. straw; Little Joss, 47 bush. grain, 36 cwt. straw; Webb's Standard Red, 44½ bush. grain, 34½ cwt. straw; Squarehead's Master, 44½ bush. grain, 36½ cwt. straw; Squarehead II. (Svalöf), 44 bush. grain, 36½ cwt. straw; Browick Grey Chaff, 44 bush. grain, 35½ cwt. straw; Sun

(Svalöf), 43½ bush. grain, 32½ cwt. straw; Carter's White Standup, 43½ bush. grain, 32½ cwt. straw.

Squarehead II. is a red-grained, white-chaffed wheat introduced from Svalöf, in Sweden. The straw is very strong, while the grain is large and rather coarse. Seed of this variety grown at Garforth, direct from Sweden, has always produced a thin plant. Seed grown for the second time on the farm gives a much thicker plant. The weight per bushel of the grain has always been low at Garforth. This variety is recommended for the stronger and better soils.

Sun is a red-grained, white-chaffed wheat introduced from Svalöf. At Garforth the grain has always been of excellent quality, but the yield of straw has not been high.

LIVE STOCK AND FEEDING STUFFS.

Factors Controlling Fertility in Animals (*Jour. Agric. Sci., Vol. VI., Part 3; J. Hammond, M.A.*).—An investigation was held to throw further light on certain of the factors which limit the fertility of domestic animals. The animals examined were rabbits, pigs and a bitch.

It was found that various circumstances, the chief being the age of the animal, control the number of ova shed at each heat period. The data obtained showed that the low fertility of young as compared with adult sows is due to the fact that not so many ova are shed at each period.

Counts were made of the number of corpora lutea present in the ovaries and the number of foetuses present in the uteri of pregnant rabbits and pigs, and the results showed that many more ova are shed at the heat period than young are produced at birth. Some ova possibly may be lost, but many ova, after being fertilised, atrophy or wither at some period of their development and undergo absorption in the uterus.

While the occurrence of atrophic foetuses only causes reduced fertility in animals which have many young at birth, their occurrence in the case of animals producing only one young would give rise to sterility, so that the problem of the cause of the atrophy becomes an important one.

It appears that the atrophy is not bacterial in origin, since frequently healthy and atrophic foetuses lie side by side in the uterus. Moreover, no bacteria could be found either in the foetus or foetal membranes.

A number of foetal rabbits and pigs were weighed and the results showed that competitive nutrition in the uterus has little effect in determining the size of the foetus, while evidence was given to show that nutrition cannot be the cause of atrophy. It seems possible that the atrophy is due to innate lack of vitality in the foetus.

No conclusion has yet been arrived at as to the cause of the atrophy, and the various possibilities are still under investigation.

Feeding Statistics and Starch Equivalents (*British Association, 1914, Agricultural Section, and Journ. Agric. Sci., Vol. VI., Part 2; T. B. Wood, M.A., and G. Udny Yule, M.A.*).—The authors have made a statistical study of the results of about 400 feeding trials collected and tabulated for the Highland and Agricultural Society. The trials were all carried out with oxen or sheep in Great Britain before the year 1907. Some of them go back to the year 1839. Examination of the results has yielded the following conclusions:—

When the diet of oxen or sheep is increased above maintenance requirements the law of diminishing return asserts itself, and successive increases in the diet do not produce proportional increases in live weight.

As the diet is increased above maintenance requirements a smaller proportion of each successive increase is converted into live weight, and consequently a larger proportion is lost as heat.

When oxen or sheep in store condition are given a diet which supplies considerably more food than is required for maintenance the proportion of the excess of food above maintenance requirements which is converted into live weight continuously falls as fattening proceeds.

From the above conclusions it follows that there is not a direct proportionality between the amount of food above maintenance requirements and the live weight increase produced; whereas the figures from which Kellner's starch equivalents were calculated do show a direct proportionality between the amount of starch equivalent above maintenance requirements and the live weight increase produced. This discrepancy is explained by the fact that Kellner's results were obtained by feeding animals in store condition for short periods during which they never approached what the butcher calls ripeness, whilst in the British trials the animals were fed for several months until they were ripe for the butcher.

It is by no means rare to find individual oxen which on an average fattening ration of 8.5 lb. of starch equivalent above maintenance requirements make daily live weight increases as large as 3 lb. or as small as 1 lb. The former should give out 17,000 calories per day, the latter 22,000 calories per day, a difference of about 25 per cent. It should be possible to detect differences of this order by measurements of skin temperature.

Coconut Meal and Gluten Feed (*Massachusetts Agric. Expt. Sta., Bull. 155*).—The coconut meal used in animal feeding consists of the dried and ground flesh of the coconut from which the oil has been extracted. The particular sample used in this experiment had the following composition (per cent.):—Water 9.00, protein 19.35, carbohydrates 48.00, fat 9.12, fibre 8.64, and ash 5.89, so that it contained rather less protein and fibre and more carbohydrates than the average of German samples. The food chosen for comparison was gluten feed, and this contained less ash and fat, rather more protein and decidedly more carbohydrates than the coconut meal.

Digestibility experiments with sheep showed the following amounts to be digestible (in lb., out of 2,000 lb.—coconut meal is given first):—Protein 347.6, 397.2; carbohydrates 829.0, 949.6; fat 187.4, 46.6; fibre 40.4, 118.6; ash 75.4, 66.5; and total digestible matter 1479.8, 1578.5. If the fat is converted into its starch equivalent the coconut meal would seem to furnish 1,705 lb. and the gluten feed 1,634 lb. of digestible matter per 2,000 lb. fed.

Ten cows were selected and the comparative value of the two foods for milk production was ascertained. The basal ration consisted of hay and bran, five cows being fed on coconut meal and five on gluten feed, these two foods afterwards being changed over; both foods were fed at the rate of 3.68 lb. per head per day. Substantially the same amounts of milk were obtained from the coconut meal as from the gluten feed, but slightly more butter fat was secured from the former.

It is believed that coconut meal is fully equal to gluten feed in nutritive value, although it is doubtful if it exceeds it. German observers consider it particularly desirable for dairy animals in amounts of from 3 to 4 lb. per head daily, and it has been shown to increase somewhat the fat content of the milk. Fed in excess of 4 lb. it is held to make too hard a butter.

Cattle Feeding (*Pennsylvania State Coll. Agric. Expt. Sta., Bull. No. 124*).—The object of this experiment was to test the relative feeding values of maize silage and of mixed hay for cattle, and the advisability of feeding cattle chiefly on roughage during the earlier part of the feeding period and of adding grain during the later part. Twenty-four bullocks were divided into two lots, equal in weight, and of the same quality and breed. The animals in Lot I received as much maize silage as they would consume during the first two months and each had 3 lb. of cottonseed meal per 1,000 lb. live weight daily. At the end of 56 days they received in addition as much maize as they would eat. The animals in Lot II. received daily 20 lb. of maize silage each and all the mixed hay they would consume, as well as 3 lb. of cottonseed meal each per 1,000 lb. live weight. After 56 days they were fed in addition with as much maize as they would eat.

At the end of the test which lasted 20 weeks, it was found that the bullocks in Lot I. had made a total gain in weight of 3,280 lb. against 3,135 lb. in Lot II., or an average daily gain per animal of 1.944 lb. compared with 1.803 lb. The cost of feeding per 100 lb. of gain was in the case of Lot I. £1 14s. 7d., and in the case of Lot II. £1 19s. 4d. The profit per bullock, obtained by deducting the initial value and the cost of food from the selling value was, in the case of Lot I. £2 18s. 9d. and Lot II. £2 6s. 9d.

The conclusions reached are that maize silage at 16s. 4d. per ton is relatively more economical and more effective for feeding bullocks than a combination of silage and mixed hay when hay is valued at £2 16s. per ton. Maize silage was found to be more palatable than maize in the ear, and for this reason it is necessary when fattening cattle to limit the amount of silage given in order to insure the greatest gain in flesh during the finishing period. The experiment bears out the results of previous experiments, which have indicated that when cattle of about 900 lb. weight are put on roughage during the early part of the feeding period they will make economical gains even though the actual daily gains may be smaller.

Fattening Capacity and Skin Temperature (*British Association, 1914, Agricultural Section and Jour. Agric. Sci., Vol. VI., Part 2; T. B. Wood, M.A., and A. V. Hill, M.A.*).—It appears from this experiment that animals with a higher fattening capacity have cooler skins than those with a lower fattening capacity. The experimenters measured the skin temperatures of 18 oxen which had been on a fattening diet for 10 weeks at the Norfolk Agricultural Station. It was found that the average skin temperature of 8 animals which had during the last three weeks made average daily increases in live weight of 2.7 lb. per head was approximately less by 3° C. than that of 5 animals which had during the same period increased by only .7 lb. per head per day.

WEEDS AND PLANT PESTS.

Soda and Potash for American Gooseberry Mildew (*Zeit. für Pflanzenkrankh., XXIII., 6*). The damage done by American gooseberry mildew in Russia led to experiments being undertaken by the Phytopathological Institute of the Russian Ministry of Agriculture. Owing to the lack of proper precautions on the peasant holdings to prevent the spread of the mildew, the fungicides to be used must be more than usually effective. The fungicides ordinarily in use (including Bordeaux mixture

and sulphur preparations) did not answer the purpose, but good results were obtained from a patent preparation which on analysis was found to contain arsenic and either soda or potash. This led to tests being carried out with soda and potash alone, and both were found effective even when diluted to the strength 0.14 oz. in 3 gal. of water. The foliage did not suffer when sprayed with a solution of up to eleven times this strength. The drawback to the use of the solution was that it was easily washed off the leaves by rain and the addition of syrup only partially remedied this fault.

A solution of 0.5 per cent. soda alone or mixed with a 0.25 per cent. potash solution, or a solution of 0.25 per cent. potash alone is recommended, with the addition of an adhesive such as syrup. The procedure advised is to collect and burn all fallen leaves and diseased shoots in autumn or early spring, and immediately afterwards and before the buds appear to spray the bushes and the ground below with a 1 to 3 per cent. solution of sulphate of iron and afterwards to spray the bushes every ten days with the soda or potash solution until the bushes are in leaf.

Sulphuric Acid for the Destruction of Weeds (*Prog. Agr. et Vit., various issues, summarised in Expt. Sta. Rec., April, 1914*). After trials of sulphate of copper, sulphate of iron, and sulphuric acid in varying strengths, the author concludes that sulphuric acid in 6, 8 or 10 per cent. solutions (the degree of strength depending upon local conditions) is the most satisfactory spray to use. The solution was applied at the rate of 107 gal. per acre and killed most of the annual weeds, but it did not perceptibly retard the growth of wheat although the lower leaves were killed. This solution had the advantage of being effective in 3 or 4 hours, while the other solutions required 3 or 4 days. The sulphuric acid solution also had a fertilising effect on the soil.

The Preparation of Lime Sulphur Solution (*Agricultural Gazette of New South Wales, July, 1914*).—The following recommendations are made with regard to the preparation of lime-sulphur solutions as a result of an enquiry conducted by the Chemist's Branch of the New South Wales Department of Agriculture.

The proportions of lime, sulphur and water which are stated to give the best results are 50 parts pure lime, 100 parts pure sulphur and 500 parts of water, all by weight. For practical purposes, therefore, 53 lb. freshly-burnt quicklime, 100 lb. flowers of sulphur and 50 gal. of water should be taken in order to make 50 gal. of spraying fluid.

Boiling should be carried out in an iron receptacle and, to prevent boiling over, the mixture should not exceed in volume three-fourths of the boiler capacity. The lime and sulphur having been weighed out and placed in the boiler, half the total amount of water to be used is added. This mixture is now thoroughly stirred, and mixed well together with a wood stirrer. When the first portion of the water is poured on the mixed lime and sulphur there will be a rise of temperature due to the lime slaking and "spurting" may take place; but when the remainder of the water (*i.e.*, half the total water to be used) is added later, the temperature of the mixture will be considerably reduced and no spurting need be feared. Care should, however, be taken to prevent any splashes from reaching the face.

When the mixing has been thoroughly done the second half of the total amount of water required is added. The mixture is now to be

boiled for one hour (reckoned from the time it is raised to the boiling point); it must be kept boiling briskly. The frothing will be at its maximum about 15 minutes after boiling commences, and the stirrer must be freely used to break the bubbles. A considerable amount of water will be evaporated, and this should be replaced from time to time by the addition of more hot water.

The concentrated spray prepared as above must be diluted before use, and should be used shortly after making.

FORESTRY.

Preservative Treatment of Timber for Estate Purposes (*Quar. Jour. For.*, July, 1914, J. F. Annand, M.Sc.).—The experiments were undertaken mainly to ascertain whether the creosote treatment for preserving timber could with advantage be modified or cheapened.

Different lots of timber were treated with pure creosote, with creosote saponified by the addition of a very small proportion of caustic soda, and with naphthalene. Although the experiments are not nearly complete, it has been found, so far, that the addition of a small quantity ($\frac{1}{4}$ per cent. or less) of caustic soda to pure creosote improves penetration in the case of timbers which take the preservative with difficulty, and that the saponification of the creosote makes it possible to dilute the preservative by the addition of water, thus cheapening the creosoting process. For the treatment of estate timber by the simple open tank method, saponified diluted creosote would seem to be a cheap and effective substitute for the Rüping process used by professional creosoters. Good results were obtained when average creosote was diluted to half its full strength, but diluted to a greater extent than this the penetration was found to become less complete, especially in the case of green or only partially seasoned timber.

The advantages of using naphthalene as a preservative are that green timber can be treated as effectively as air-dried timber, and that the discoloration of the timber is less than with creosote. It is also an excellent preservative, but large quantities are taken up by most timbers, and at present prices the process is not, on the average, less costly than creosoting.

POULTRY.

Cotton Seed Meal and Beef Scrap as Foods for Chickens (*Rhode Is. State Coll., Agric. Expt. Sta., Bull.* 156).—Eight experiments were carried out to compare cotton seed meal and beef scrap as protein foods for chickens. These two foods were fed in most cases in such quantities that their nitrogen content was the same. The basal rations fed were so deficient in protein that a considerable amount could be added in the foods under trial without supplying enough for the maximum growth of the chickens. Under such conditions the amount of protein would be the main factor influencing growth. Further, the non-protein constituents of the foods were usually in such liberal amounts that the protein was probably mainly efficient as a source of nitrogen rather than of energy.

It was shown that for the growth of young chickens it is more important, within reasonable limits, for the amount of protein to be sufficient than for it to be associated with a definite proportion of carbohydrates and fat (*i.e.*, than for there to be a definite nutritive ratio).

In certain of the experiments the chickens were cooked after preparation in the usual way, and the amount of water, ash, protein and fat determined not only in the bones, but also in the meat and soup. Between the ages of about four to fifteen weeks, the chickens retained in the cooked portion about 18 per cent. of the nitrogen consumed in the rations of medium protein content, in which case there was no unnecessary waste of nitrogen.

There was, if anything, a larger gain in live weight per gramme of nitrogen fed in the case of beef scrap than in that of cotton seed meal.

If the constituents of bone are supplied there appears to be no reason why cotton seed meal may not be used to furnish a considerable portion of the protein required by chickens, especially if a moderate growth is satisfactory to the feeder. If the most rapid growth is desired, regardless of the amount of feed consumed, beef scrap, it is stated, will be found more satisfactory since in these experiments the chickens consumed more of the beef scrap ration when allowed to have all they would eat, and made a more rapid growth in consequence.

No toxic effect was found to result from the feeding of cotton seed meal.

Utility Poultry Club's Twelve Months Laying Competition (*Harper Adams Agricultural College*).—The report for the final month of the 1913-14 Competition, which was concluded on October 24th, has been issued, but the results are subject to final revision. The Competition consisted of 50 pens of pure-bred birds, and each pen comprised six pullets hatched in the spring of 1913. The following table gives the particulars for the leading pens for the whole 52 weeks:—

Order.	Pen No.	Breed.	Eggs laid during year.	
			No.	Value.
				£ s. d.
1	6	W. Wyandottes	1,339	7 6 7 $\frac{1}{2}$
2	38	W. Leghorns	1,393	7 6 4 $\frac{1}{2}$
3	2	W. Wyandottes	1,364	7 0 10 $\frac{1}{2}$
4	18	"	1,236	6 19 4 $\frac{1}{2}$
5	41	W. Leghorns	1,330	6 16 11
6	24	W. Wyandottes	1,332	6 14 5 $\frac{1}{2}$
7	35	W. Leghorns	1,304	6 14 3
8	5	W. Wyandottes	1,300	6 12 9
9	39	W. Leghorns	1,284	6 12 5 $\frac{1}{2}$
10	42	"	1,304	6 7 1 $\frac{1}{2}$
11	15	W. Wyandottes	1,186	6 5 11 $\frac{1}{2}$
12	46	W. Leghorns	1,161	6 5 4 $\frac{1}{2}$

Pen No. 18 (White Wyandottes) held the premier position for eight months but had the misfortune during the eighth month to lose a bird by death and to have a second badly affected by roup. It is hoped that the new arrangement, which has been adopted for the 1914-15 Competition, of sending a seventh or "reserve" bird at the commencement of the Competition, may help to avoid a repetition of this, and so save time which must necessarily be lost when a bird has to be sent from a long distance to take the place of one dying during the progress of the Competition. In the case of Pen No. 24 no fewer than four birds died, and one was returned to the owner.

NOTES ON AGRICULTURAL CO-OPERATION.

HITHERTO the agricultural co-operative credit movement, which has conferred such great benefits upon the agricultural population of many other countries, has made very little progress in England and Wales. At the end of the year 1912 there were in this country only 46 agricultural credit societies, with 863 members, and during the year the total number of loans granted by them to their members was 182, amounting in all to £1,895. Such progress as has been made is due mainly to the exertions of the Agricultural Organisation Society and its predecessors, who drew up a set of model rules on the Raiffeisen principle of the unlimited liability of each and all of the members for the debts of the society; and all the existing agricultural credit societies are based upon this principle. They are registered under the Friendly Societies' Act, and confine their operations to the granting of loans to small agriculturists for such purposes as the Committee of the society think likely to be profitable to the member borrowing the money. Such a society has no share capital, and the rules lay down that no part of its funds shall be divided by way of profit, bonus, dividend, or otherwise among the members, the main object of the society being to enable its members to obtain small loans for profitable agricultural purposes at as low a rate of interest as possible. So far as they go, these small societies have been very beneficial to their members, and have, on the whole, been well and economically managed, the expenses of management amounting on the average to a little over £1 per society per annum.

The loans are taken generally for such purposes as the purchase of sheep, pigs, cattle, horses, carts, implements, feeding-stuffs or manure, or the employment of extra labour on the borrower's holding, and are, as a rule, made repayable about the time when the borrower may expect to reap the return of his expenditure, so that the date fixed for repayment is usually from six to twelve months after the date of the loan. By means of these societies a number of small farmers and labourers have obtained the small loans needed for their agricultural operations at a lower rate of interest than they would have had to pay elsewhere, and some of them have been able to secure loans who could not otherwise have borrowed at all. Instances may be cited of men who were enabled by loans from their societies to buy and feed sheep, pigs or cattle, to hold over stock or produce for better prices, to procure seed, plants or manure, to work their land to better advantage, or to add to the area of their holdings; and of some, who by means of a succession of such loans, have risen from the position of labourers to that of substantial smallholders.

The slow progress of the movement in this country may be ascribed to several causes. It is no doubt partly due to the comparatively small number we have here of homogeneous communities of small farmers; partly to the fact that England and Wales are exceptionally well supplied with banks which are willing to make advances to individual borrowers at a fair rate of interest, provided that the security for the loan is satisfactory; partly to the reluctance of the English

smallholder to combine with his neighbours and apply to them for pecuniary assistance, even in the form of a loan repayable with interest, and to make to them the disclosure of his private affairs which a lender may reasonably require before making an advance. Some societies have also found a difficulty in obtaining the funds necessary for their operations on the basis of their joint security, owing to the unfamiliarity of possible lenders with the co-operative principle as applied to credit.

In order to reduce this difficulty the Board of Agriculture and Fisheries approached a number of the leading joint stock banks, and, after considerable discussion, were successful in enlisting their sympathy and obtaining the consent of twenty-two banks to an announcement that they were ready to assist registered co-operative credit societies, consisting mainly of smallholders and allotment-holders, to the following extent. They were prepared to allow the manager of a country branch to assist in the formation of such a society, to give advice to its members on matters of book-keeping, to take part when requested in the audit of the annual return without remuneration, and in special cases to accept the post of unpaid treasurer. The banks agreed to give favourable consideration to applications from such societies for advances, of course requiring in each case to be satisfied as to the security for the loan; and in general practice to allow the loan to stand for twelve months, subject to reconsideration at the end of that period. They also agreed that when a bank is satisfied that the joint liability of the members of a society under its rules constitutes an adequate security for a loan, the bank would require no further guarantee for its repayment; and that the rate of interest to be charged on approved advances would be a favourable fixed rate, subject to a year's notice of alteration.

These valuable concessions by the banks have been made in favour of co-operative credit societies formed under the model rules issued by the Agricultural Organisation Society, which make all the members of a society liable without limit for the debts of the society. They have already been taken advantage of by a few societies, and there is reason to expect that, should a community of smallholders found a society on this basis, and appoint a trustworthy committee, they will have no great difficulty in obtaining a small advance from one of these banks at a fair rate of interest; and should their business be conducted on sound lines, and more especially, should they be able to show the bank that the loans they make to their members are used for profitable agricultural purposes and punctually repaid, they may hope to obtain from the bank a gradually increasing advance to enable them to extend their operations.

Perhaps the principal reason, however, why so small a number of co-operative credit societies have been formed in this country is that there is here a strong objection among all classes to incur an unlimited liability, an objection which cannot be got over by pointing to the fact that, according to the experience of thousands of successful societies of the kind in other countries, it is perfectly safe for a community of smallholders, covering an area sufficiently limited to enable them to judge of each others' character and trustworthiness, to work a society of this sort on the basis of unlimited liability. In order to meet this objection, it seemed desirable to draw up a set of model rules for a credit society, based upon the more familiar principle of liability limited by shares. This system is in accord with the opinion

expressed by Mr. H. W. Wolff, a leading authority on agricultural credit, in the preface to his *Co-operative Credit Bank Handbook*, where he says "A quite unwarrantable impression appears to have got abroad to the effect that co-operative banks with shares and limited liability are applicable to towns, and that for rural purposes, and the service of agriculture, only the peculiar system can come into account which dispenses with shares and makes liability unlimited. There could not be a greater mistake, and were the impression to become general, serious prejudice would be done to agriculture." He goes on to say that in this country, of all others, banks with shares and limited liability appear indispensable, if banking work for the benefit of agriculture is to be done on a large scale.

The Friendly Societies Act, under which the existing model rules framed by the Agricultural Organisation Society have been drawn up, is not applicable to a form of society based upon liability limited by shares. The new model rules have, therefore, been framed under the Industrial and Provident Societies Act, which regulates the numerous highly-successful co-operative distributive societies with which this country is covered.

It is unusual to find in a rural parish a community of smallholders sufficiently numerous to form of themselves a credit society having the restricted area which is necessary for its proper working. It seems advisable, therefore, while retaining the important principle of neighbourhood, and consequent knowledge by the members of each other's character, to extend the operations of a society to all classes residing within an ordinary country parish, by leaving all free to take part in the working of the society, whether they are directly engaged in agricultural work or not. At the same time, it is important to keep in mind that the object of the society is not to enable shareholders to obtain a large dividend on their shares, but is to provide small loans to small men of good character at as low a rate of interest as can be worked down to without incurring loss to the society. For a similar reason, it seems advisable not to confine loans to purposes which can strictly be called agricultural, but to make it possible for a society to advance money to a member for any profitable purpose connected with the life of a rural parish, although it may be only indirectly connected with agriculture.

Form of Rules.—It has been thought best to draw up a set of general rules which can be adopted by any credit society as its own, while leaving it free, by passing a special rule, to suit any of the general rules to its individual circumstances. This plan has several advantages. It tends towards uniformity in details, and thus will save the time of committees and of all who have to deal with these societies. It conduces to economy, as any society adopting as a basis for its own rules these general rules, which have been accepted by the Chief Registrar of Friendly Societies, will have to pay a registration fee of only £1 instead of the £5 which would be charged for registration if it drew up an entirely fresh set of rules of its own. Any such society will also be able to obtain any number of copies of the general rules it may require at a cost of 1d. each, and will have to print only the few special rules which it may desire to prefix to them. But the main advantage of the form adopted is that in the general rules an inexperienced rural community has placed at its disposal a system of working which has been drawn up after careful consideration of the criticism of many

competent authorities on the subject, and may safely commence operations under the general rules as they stand. At the same time, the facility of passing special rules leaves it open to any society, as its experience grows, to alter any of the general rules to suit its own particular needs. The only special rules that must be drawn up by a society which adopts these general rules are—one, giving the society its name and stating where its registered office is to be, and a second, defining the area of the society's operations. For the proper working of a co-operative society of this kind it is essential that the members should know each other, and that the committee, in whose hands lie the granting of loans and the management of the society, should have a personal knowledge of the men to whom the society's money is to be lent. It is, therefore, advisable that the operations of a society should be confined to the residents, owners, and occupiers of a single parish, or of two or three adjoining parishes, or some similarly restricted area.

Object.—It is possible for a society to be formed under the Act which will not only lend money to its members, but also provide them with their agricultural requirements or sell their produce on a co-operative basis. But to combine those different operations is a more complicated and more difficult matter than when they are dealt with separately, and trading is apt to involve a greater risk than purely banking business. It is therefore advisable for an inexperienced society to confine itself, at all events in the first instance, to borrowing and lending only. Later on, when it has gained experience, it may, if it finds it advisable, add trading to its operations by passing special rules. Meanwhile these rules have been drawn up for a society whose sole object it is, by combining the credit of its members and so obtaining the necessary funds, to make loans to them for profitable purposes at as low a rate of interest as it finds possible, with due regard to its own stability.

Membership.—It is essential that no one should be allowed to join as a member until the committee have satisfied themselves that his personal character is such as to make him a strength and not a weakness to the society, whose success and credit will depend on the general trustworthiness of its members.

In order to limit the liability of members the rules provide that in no case can a member be required to contribute towards the losses of the society more than the unpaid amount of the shares which he has applied for or purchased, and that his liability to contribute shall cease a year after he ceases to hold a share, unless proceedings are previously commenced for winding up the society. It is necessary to provide that a member's liability shall continue for a year after he ceases to be a member, as otherwise the society would probably find it difficult to get anyone to lend it money; for without this provision a creditor would be under the apprehension that the substantial members of the society might suddenly get rid of their shares and withdraw from membership, and leave the society without sufficient means to meet its debts.

Shares.—Under the Industrial and Provident Societies Act it is necessary for a society to have shares with limited liability. From the point of view of the small man, who wishes to become a member, it is desirable that the value of the share which he must take up should be kept as low as possible; but on the other hand it is to be remembered that unless the liability of the members under their shares is substantial, the society is unlikely to obtain the necessary capital, as people will

only lend the society their money if there is a practical certainty of its being repaid. In the general rules it is provided that the shares should be of a value limited to £1 each, and that each member must hold at least one share. It is also arranged that on every share 5s. shall be paid up within the first year after the allotment of the share, the remaining 15s. being left as an unpaid liability on each share, with a proviso that no call shall be made on this liability unless a general meeting shall decide that such a call is necessary to make the assets of the society sufficient to cover its liabilities. Thus it will be possible for anyone to become a full member, entitled to all the privileges of the society, on payment of the entrance fee and of 5s., of which 1s. is payable on allotment and the rest is payable by quarterly instalments of 1s.; and if he takes up only one share, he will feel secure that in no case can he be required to pay more than 15s. (besides the 5s. he has already paid) towards the debts of the society, and that he will be subject to a call on this unpaid liability only if the state of the society's finances urgently requires it, and not merely to enable the society to extend its business. There is thus a definite limit placed on the risk he undertakes by becoming a member, and at the same time he has a pecuniary interest in watching the management of the society, and if necessary can exercise his vote, which is equal to that of any other member without regard to the number of shares held by each, in such a way as to keep the society on sound lines.

Naturally a society which places a limit of £1 on the liability of each share cannot expect to be able to borrow any large amount of capital, unless some of the members take up a considerable number of shares, and in some parts of the country a community may find that it requires a larger credit than this for its operations and that its members are willing to undertake a greater liability than £1 per share. In such a case the society can, by passing a special rule, alter the value of the share in the general rule from £1 to £2 or £5 or such other figure as it may find suitable to its needs. If this be done, it would be advisable to increase the amount to be paid up per share. Should any society prefer to make the instalments of the share capital payable weekly or monthly instead of quarterly, this also can be done by special rule.

The Act requires that when a society carries on banking business the shares shall not be withdrawable, so that no member can at any time claim repayment, as a matter of right, by the society of any share capital paid by him; but he can always sell his share to any other member, or to any person whose application to become a member has been approved by the committee, on such terms as may be agreed upon, and if he leaves the parish or dies, the committee will have the power to repay to him or to his heirs the money he has paid up on his share.

Borrowing by the Society.—In order to have sufficient funds to lend to its members it will be necessary for the society to borrow, and naturally no one will be willing to trust it with his money unless he has reasonable grounds for expecting that his loan will be repaid. The society must therefore offer some security. That security will consist partly of the paid-up share capital, partly of the liability of the members represented by the unpaid share capital, and still more, as time goes on, of the Reserve which the society ought to accumulate from the profits of its working, and of the confidence given to creditors by proofs

of the careful management of its affairs. In order to avoid extravagant borrowing by the committee, it is essential to lay down limits to its powers. This is done in a general rule, which requires the committee to obtain the authority of a summoned general meeting before it agrees to pay a higher rate of interest than 5 per cent. per annum on any sum borrowed, and before it increases the total indebtedness of the society beyond the amount of the share capital, paid and unpaid, and the reserve fund for the time being. If each member took up only one share, this provision would prevent the society at first from borrowing any large amount of capital, but it is hoped that in most parishes a number of members will be willing to help the society by subscribing for a considerable number of shares, and thus increasing its borrowing power. If, after starting operations, the society finds that it requires, for the purpose of making loans to its members, to borrow a larger amount than is allowed by this rule, it will always be possible for a summoned general meeting, without passing a special rule, to give the committee authority to increase the amount of borrowings to as many times the amount of the share capital and reserve fund as the members think safe, with due regard to the credit of the society.

When a loan is made for agricultural purposes, it is usually some months before the borrower can reap the full advantage of the operation on which he has spent the money, and can be in a position to repay the loan from the proceeds of that operation. Such loans to members are therefore generally made repayable only after the expiry of some months. There is a risk that while most of the society's funds are out on loans of this character, depositors might suddenly require repayment of their deposits, which it would be difficult for the society to make at once. It is therefore arranged that, when a society first starts working, it should accept deposits only on condition that they cannot be withdrawn on less than three months' notice. This is intended to give a society time to arrange for the provision of the necessary funds; but, of course, if the funds were available, the society would ordinarily repay the deposits at once; and if a society finds that the condition of three months' notice acts as a discouragement to depositors, and that it can safely shorten the period of notice, it can at any time do so by summoning a general meeting and without passing a special rule.

Loans to Members.—It is essential that loans should be made only to members of the society, and only for such purposes as are, in the opinion of the committee, likely to be profitable to the member. If the loans were made for other purposes, there would be a greater risk of their not being recovered. For the success of such a society in an ordinary rural parish, it is desirable that loans should be available to all classes of the community, and for any profitable purpose connected with rural life; for instance, to help a thrifty, industrious agricultural labourer or artisan to improve his position by renting or equipping an allotment or small-holding; by providing himself with tools, implements, seed, manure, feeding-stuffs or stock; or by increasing the efficiency of his labour. The society might also be useful to allotment holders or smallholders by enabling them to rent, equip, or add to a holding, to purchase on cash terms seed, manure, stock, feeding-stuffs or implements, to employ labour, or to hold over their saleable produce or live stock for a better or more seasonable market.

The main object of these societies is to advance money to members on the security of personal character, but as accidents may happen

to any member, however conscientious, industrious, and thrifty he may be, it is necessary in the interests of the society that some further security for the repayment of the loan than the member's own signature should be obtained. In ordinary cases it is advisable that the committee should require two sureties, approved by them, to make themselves responsible for the repayment of the loan should the borrower for any reason fail to repay it on the due date, and also for the expenditure of the loan on the purpose for which it is granted. Provision is, however, made for the acceptance by the committee of security, to be approved by them, in some other form than that of the personal guarantee of two sureties.

In order to prevent the locking up of the society's capital in a few hands, it is provided in the general rules that no member should be lent more than £50 in all, or should be given a loan for a longer period than two years; but it will be open to a general meeting, after experience has been gained, to relax these restrictions without making an alteration in the rules.

It would not be fair to those members who borrow only small sums from the society to allow other members to borrow large sums without taking a larger share in the joint liability for the debts of the society, which is one of the chief means of enabling the society itself to obtain credit. It is, therefore, provided that any member who wishes to borrow more than £5 from the society should be required to take up more shares than one, at the rate of one share for every £5 he borrows. For instance, if the nominal value of each share is £1, a member holding one share, and liable to be called upon to pay not more than £1 altogether towards the debts of the society, should it incur serious losses, will be able to borrow from the society up to £5; if a member wishes to borrow £25 from the society, he will have first to subscribe for five shares altogether, and thus make himself liable to pay, in case of need, up to a limit of £5 towards the debts of the society.

If a society felt itself in a position to work on a higher scale, and chose to pass a special rule making the value of a share £5 instead of the £1 suggested in the general rules, it might, at the same time, pass a special proviso to the effect that it would not make any loan to a member which will raise his total indebtedness to the society above £100, or to a sum exceeding £20 for each share held by him, or enter any other figure which it may consider suitable to its purpose.

While the chief object of the society is to make loans for profitable purposes to small men, who might have difficulty in borrowing elsewhere, its second object is to make those loans at as low a rate of interest as possible. In this country the ordinary rate of interest charged on loans made to farmers on good security is 5 per cent. per annum, and several existing credit societies, which have built up a reserve fund, manage to make loans to members at this rate. One society is now in the position of being able to lend money to its members at 4 per cent. per annum. It would however ordinarily be unsafe for a new society to expect to be able to make loans at 5 per cent., and out of the income received at that rate from its members to pay the interest on the capital borrowed by the society, as well as its management expenses. It is therefore provided in the general rules that a society should begin by charging 6½ per cent. per annum on loans made to its members, this rate being adopted instead of 6 per cent., because it can be easily calculated at 1½d. per £ per month. When a society has built up a

reserve fund, it may hope to be in a position to reduce the rate charged on loans to members to 5 per cent., or even less.

It would be dangerous for a society at first to lock up its capital by making long-term loans to members, and to do so would be likely to result in the absorption of an undue proportion of the available capital by a few of the members to the injury of others who might want short-term loans. It is, therefore, provided in the general rules that, unless with the authority of a summoned general meeting, no loan shall be made for a longer period than two years, and that if any loan is made for a longer period than one year, at least half the loan must be repaid during the first year, so that the money may be available for loans to other members. If after some years' experience the society finds that it has sufficient command of capital to make loans for longer periods, it will be able to do so by a resolution of a summoned general meeting without altering its rules.

A loan should only be made for a purpose which is likely to enable the borrower to obtain after a certain time a return which will make it possible for him to repay the loan from that return, with interest, and with some profit to himself; and the date for the repayment of the loan should be fixed, with regard to the time at which that return is likely to come in. For instance, if a man borrows money to buy pigs and fatten them, the date for repayment should be fixed about the time at which he is likely to sell the pigs; or if he borrows money to plant strawberries, the date for repayment should be about the time at which he will receive payment for his crop. In some cases it may suit the convenience of the borrower better to fix instalments for repayment; for instance, if the money is borrowed to buy a cow from which the income will be received gradually by the sale of its milk, the repayment of the loan might be arranged by instalments to be paid every quarter, or every half-year; in other cases again, it may suit the borrower better to repay the loan by weekly or monthly instalments.

As the main object of the society is to provide small loans for small men, preference should be given to small loans over large ones, and to prevent a monopoly of the benefits of the society among a few members, a member who has not recently received a loan should be given preference over a member who has recently borrowed from the society.

In order to secure the society against loss it is important that the committee should freely discuss among themselves the character of the applicant and his sureties, the object for which the loan is desired, and the probability of its being repaid. In most cases their own knowledge will be sufficient to enable them to come to a decision, but they may sometimes find it necessary to question the applicant on the subject. Members may be deterred from applying for a loan by a natural reluctance to disclose their affairs to their neighbours. It is therefore essential that all proceedings with regard to loans at committee meetings should be kept secret, and that this rule should be strictly enforced. It is also laid down that no person, unless he be an officer of the society, or be specially authorised by a resolution of a general meeting, shall have the right to inspect the loan or deposit account of any other member without his written consent.

It is most important that punctual repayment of loans should be strictly insisted on by the committee, and when a borrower fails to pay

on the due date, the committee should at once take steps to enforce payment from him, or, if necessary, from his sureties. The committee might also arrange that the Secretary shall send notice to the borrower and his sureties a fortnight before the date of repayment calling their attention to the fact that repayment will soon be due.

In special cases, but only for very good reasons approved by the committee, as for instance, illness of the borrower, or serious failure of his crops, it may be necessary to grant an extension of the date fixed for repayment, and in all such cases the consent of the sureties should be obtained to the extension, or if they decline to continue their responsibility, new sureties should be required.

Application of Profits.—As the society will have the use of the paid-up share capital, which it can lend to members at 6½ per cent., it ought soon to be able to pay some dividend on that share capital, but the rate of dividend should be limited, as otherwise the interest of the shareholders would conflict with that of the borrowers, and the society might be tempted to raise the rate of dividend on shares, instead of adding to the reserve fund and ultimately reducing the rate of interest charged to borrowing members, which is its second main object. It is therefore provided that the rate of dividend shall be limited to 5 per cent. per annum on the paid-up share capital, and that all that remains of the profits of any year, after paying the dividend, shall go to the reserve fund. A good reserve fund increases the credit of the society, gives security to the members against having to pay calls on their unpaid share capital in order to meet exceptional losses, and brings in an income in interest which can be utilised to meet management expenses and increase the profits of future years.

Conclusion.—A credit society of the type suggested in these rules is, like many forms of co-operation, open to the charge of being an attempt to combine business with philanthropy. The society is expected to deal on strictly business principles, as regards money borrowed by it from depositors or other creditors, or lent by it to its members. But it is hoped that in many parishes men will be found willing to give their time and thought to the affairs of the society as members of the committee, and possibly as secretary or treasurer, without remuneration. It may also be hoped that, at all events in some parishes, a number of the better-to-do residents, who do not themselves expect ever to borrow from the society, will join it and subscribe for a number of shares, not from any expectation of a large dividend, but merely in order that they may help their deserving neighbours by investing a comparatively small sum in the society and adding to its credit by becoming shareholders, while strictly limiting their own liability.

There is in most parts of this country a considerable amount of capital seeking for investment and content with a low rate of interest, provided that the security is good; and the residents of almost any parish may reasonably expect that, if they combine their credit by forming a society of this character and prove by continued good management that it can safely be trusted to repay its debts, they will soon find that banks and other bodies and persons having money to lend will be glad to advance them the capital required and to see it fructify in their own neighbourhood, at a lower rate of interest than they would expect if their capital were sent away for investment abroad,—thus enabling

the society to fulfil its object of making small loans to its poorer members at a fair rate of interest for profitable purposes connected with the rural life of the parish.

THE Board have recently issued sets of Model Rules suitable for agricultural co-operative societies of the following kinds:—

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| <p>Model Rules for
Co-operative Credit
and Insurance
Societies.</p> | <p>1. For Rural Credit Societies with shares and limited liability, to be registered under the Industrial and Provident Societies Act.
2. For Unregistered Pig Insurance Societies,
3. For Pig Insurance Societies to be registered under the Friendly Societies Act.
4. For Unregistered Cow Insurance Societies.
5. For Cow Insurance Societies to be registered under the Friendly Societies Act.</p> |
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Copies of these Rules may be obtained from Messrs. Wyman and Sons, Ltd., 29, Breems Buildings, Fetter Lane, London, E.C., at the price of one penny each.

Pamphlets explaining the Rules and summarising the experience of many such Societies in England and Wales may be obtained free of charge on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

It is hoped that these pamphlets will prove useful, not only to agricultural communities who may contemplate the formation of new Societies, but also to Societies and Clubs which are already in existence, and which may wish to obtain from the experience of others suggestions for the improvement of their own methods of working.

A BILL relating to small holdings was presented to the Danish Folketing on 26th January, 1914, by the Minister of Agriculture, and was passed into law on 13th June, 1914.

Danish Small Holdings Law of 1914.

This law, which modifies the laws in force since 1899, aims at facilitating the acquisition of small holdings by farm labourers and persons of similar status in country districts (rural artisans, fishermen, small cultivators, &c.).

To obtain State aid the applicant must satisfy certain conditions; as a rule he must be between the ages of 21 and 50; he must show that he is industrious, sober, and thrifty; that he possesses the natural aptitude necessary for the proper cultivation of the small holding; and, while he must show that he has insufficient means to purchase the holding without financial help, he must possess the necessary capital (see below) to enable him, with the aid of the State loan, to become owner of the holding in question. Preference is given to applicants who have saved the necessary sum out of their wages.

The holding selected must not be below 2½ acres in area; no maximum area is specified, but the holding must not be more than £444 in value (in exceptional cases in districts where the price of land is particularly high, £555).

State aid is given in the form of a loan equal in amount to nine-tenths of the value of the holding. This loan is granted to applicants having the necessary qualifications, on the recommendation of commissions specially formed for this purpose in different parts of Denmark.

The loan, which bears interest at 4 per cent. per annum, is a mortgage on the holding, buildings, cattle, &c. The amortisation (1 per cent.) does not commence until 5 years have elapsed from the time the loan was granted. The owner of a small holding can obtain a supplementary loan for enlarging his holding on certain conditions.

The sum of £278,000 is placed at the disposal of the Danish Treasury for the provision of the above-mentioned loan during the three years in which the law is to remain in force.

A person acquiring a holding under this law must cultivate it as an ordinary farm. He can sell it if he wishes, but only on condition that the new owner, if he does not satisfy the conditions laid down, pays to the State the amount of the loan. This latter regulation may be waived if the new owner is the son or son-in-law, or one of their children. In the event of the decease of the owner his widow is always granted the rights held by the husband.

OFFICIAL NOTICES AND CIRCULARS.

1. THE Board of Agriculture and Fisheries are taking steps, in consultation with the War Office, with the object of facilitating the purchase by the military authorities of farm produce, such as forage and vegetables, direct from the farmer.

2. With this object in view the Board have appointed an Organising Committee consisting of the following :—
Mr. H. Trustram Eve, Secretary to the Farmers' Club (*Chairman*) ;
Mr. E. J. Cheney, Assistant Secretary, Board of Agriculture and Fisheries ;

Mr. A. H. H. Matthews, Secretary to the Central and Associated Chambers of Agriculture ;

Mr. T. McRow, Secretary to the Royal Agricultural Society of England ;

Colonel H. Godfrey Morgan, C.B., D.S.O., Assistant Director of Supplies, Central Force ;

Mr. H. W. Palmer, Secretary to the National Farmers' Union ;

Mr. Clement Smith, Member of the Agricultural Organisation Society and of the Farmers' Central Trading Board ;

Mr. R. J. Thompson, Board of Agriculture and Fisheries.

Secretary : Mr. A. Dunbar, 16, Bedford Square, London, W.C.

3. There will be set up for each county or, in certain cases, for groups of counties, a farm produce county committee consisting of eight tenant farmers of recognised standing who will be nominated jointly by the Presidents of the Royal Agricultural Society of England, the Chairman of the Farmers' Club, the Chairman of the Central and Associated Chambers of Agriculture, and the President of the National Farmers' Union.

4. A County Committee will elect their own Chairman, and may co-opt not more than four other persons as the nominated members may decide.

5. A County Committee may appoint, as may be considered necessary, a sub-committee of not more than three farmer members for each of the districts served by the minor market towns of the county. The chairman of each sub-committee must be a member of the County Committee.

6. A County Committee will meet on a fixed day in each week, when they will discuss and settle the prices for the ensuing seven days at which farmers and others in the county might be reasonably expected to dispose of their farm produce for the use of His Majesty's Forces. A County Committee will also invite farmers to submit samples and to quote prices for the various classes of produce which the military authorities may desire to purchase in the district.

7. A Purchasing Officer of the Army will attend, whenever possible, the meetings of the County Committee and of the sub-committees, and will intimate beforehand, as far as practicable, the classes and quantities of produce he desires to purchase. The County Committee will invite farmers to attend the meetings in order that they may submit their offers for the consideration of the Purchasing Officer.

8. The War Office have undertaken to purchase, as far as practicable, through the County Committees, but necessarily reserve the right to refuse offers which the Committee may obtain, in cases where the Purchasing Officer can make better arrangements elsewhere.

9. The County Committee have discretionary power to make arrangements with any agricultural co-operative association or other body of organised farmers, for the purpose of assisting them in any but their advisory work.

NOTE.—The Board are informed that some farmers who have already forwarded offers of produce direct to the Board are holding the quantities offered in anticipation of a demand being received from the War Office. The Military Authorities may not, however, be able to take advantage of these offers, and farmers should not retain their produce if they have a favourable opportunity of disposing of it elsewhere, and do not desire to submit offers to the Farm Produce County Committees referred to in the above notice.

THE attention of farmers is particularly directed at the present time to a pamphlet issued by the Board describing the types of horses suitable for army remounts. The information

Types of Horses	given in the pamphlet was revised in April
Suitable for Army	last and may therefore be considered as
Remounts.	affording a fairly accurate indication of the
	different classes of horses at present needed

for the Army. Photographs of the different types of animals are accompanied by information as to the conditions applicable to horses intended for army remounts, and the prices which they fetch in normal times.

The pamphlet (Miscellaneous Publications, No. 10) may be obtained gratis and post free from the Office of the Board, Whitehall Place, London, S.W. Letters so addressed need not be stamped.

THE purpose of the Board's Special Leaflets was explained in the note in the *Journal* for September, 1914, p. 566, and a list of those issued was given at the time and again in

Issue of	the <i>Journal</i> for October, 1914, p. 658. The
Special Leaflets.	following further Special Leaflets have since
	been prepared :—

Special Leaflet No.	13.—Marketing of Eggs.
"	" 14.—Poultry Colonies on Farms.
"	" 15.—Harvesting and Storing of Garden Vegetables.
"	" 16.—Notes on Pig Feeding.

LONDON.

THE following prices have been reported to the Board by their Market Reporter as representing the prices current at Mark Lane on the dates shown :—

	5th October.	12th October.	19th October.	26th October.
<i>Millers' Offals, &c., ex mill, sacks excluded.</i>	Per ton.	Per ton.	Per ton.	Per ton.
Bran	92s. to 100s.	95s. to 100s.	100s.	About 105s.
Broad bran ..	110s.* to 112s.*	105s. to 110s.	110s.	120s.
Rice bran ..	97s. 6d. to 98s. 9d.	96s. to 98s.	92s. 6d.	97s. 6d.
Fine middlings ..	£8 2s. 6d.*	£7 to £9.	£7 5s. to £9.	£7 10s. to £8 10s.
Coarse middlings ..	£5 15s. to £6.	£6.	£6.	£6 to £6 10s.
Pollards	£5 4s. to £5 6s.	£5 2s. 6d.	£5 2s. 6d. to £5 5s.	£5 10s.
<i>Oilcake, &c.</i>				
Linseed cake, English ..	£8 15s.	£8 12s. 6d.	£8 12s. 6d.	£8 15s.
Cottonseed cake, London made from Egyptian seed ..	£5 13s. 9d.	£5 13s. 9d.	£5 13s. 9d.	£6.
Cottonseed cake, Indian ..	£4 13s. 9d.	£4 18s. 9d.	£4 18s. 9d.	£4 15s.
Soya cake	£5 8s. 9d.	£5 8s. 9d.	£5 8s. 9d.	£5 15s.
Dried Brewers' Grains (mixed)	£8 10s.	—	—	£8 10s.
	92s. 6d.	92s. 6d. to 97s. 6d.	95s.	(Ale) 100s. (Distillery) 110s.

* Very fine quality.

LIVERPOOL.

The following prices are reported as wholesale prices on the Liverpool markets :—

	6th October.	13th October.	20th October.	27th October.
<i>Milling Offals, &c., ex mill, sacks included.</i>	Per ton.	Per ton.	Per ton.	Per ton.
Bran	£4 16s.	£4 19s.	£4 19s.	£5 2s. 6d.
Bran, broad	£5 6s.	£5 6s.	£5 7s. 6d.	£5 10s.
Fine sharps (thirds) ..	£7 15s.	£7 18s.	£7 18s.	£8 5s.
Coarse sharps	£4 17s. 6d.	£5.	£5.	£5 5s.
Rice Meal	£4 15s.	£4 15s.	£4 15s.	£4 15s.
Maize meal	£7 13s. to £7 17s. 6d.	£7 13s. to £7 17s. 6d.	£7 10s. to £7 15s.	£7 12s. 6d.
Barley meal	£8 1s. 6d.	£8 1s. 6d.	£8 1s. 6d.	£8 1s. 6d.
Dried brewers' grains ..	£3 17s. 6d. to £4 2s. 6d.	£4 to £4 2s. 6d.	£4 to £4 2s. 6d.	£4 1s. 3d.
<i>Oil Cake, ex Mill.</i>				
English linseed cake ..	£8 15s.	£8 15s.	£8 15s.	£8 17s. 6d.
Indian linseed cake ..	£8 5s.	£8 5s.	£8 5s.	£8 7s. 6d.
Egyptian undecorticated cotton cake (English make) ..	£5 12s. 6d.	£5 12s. 6d.	£5 12s. 6d.	£5 15s.
Egyptian undecorticated cotton cake (Egyptian make) ..	£5 10s.	£5 10s.	£5 10s.	£5 12s. 6d.
Indian undecorticated cotton cake	£4 10s.	£4 10s.	£4 12s. 6d.	£4 12s. 6d.
Soya cake	£7 15s.	£7 15s.	£7 15s.	£7 15s.
Decorticated cotton cake (English make) ..	£8 12s. 6d.	£8 12s. 6d.	£8 12s. 6d.	£8 12s. 6d.
Decorticated cotton cake (American make) ..	£8 5s.	£8 5s.	£8 5s.	£8.
Linseed meal (English) ..	£9.	£9.	£9.	£9 2s. 6d.
Decorticated cotton meal (52 per cent.) ..	£7 15s.	£7 15s.	£7 12s. 6d.	£7 5s.
Decorticated cotton meal (48 per cent.) ..	£7 12s. 6d.	£7 12s. 6d.	£7 10s.	£7 2s. 6d.

THE existence of foot-and-mouth disease was confirmed on Sunday, 18th October, amongst cattle (1) on a farm in the parish of Orlingbury, near Wellingborough, Northamptonshire; and (2) on premises in Deal, Kent.

Foot-and-Mouth Disease.

The usual precautions were taken to prevent the spread of the disease, and Orders were made as regards each of the outbreaks prohibiting entirely the movement of animals in a large area surrounding the infected premises. No further cases of the disease have since been confirmed either within the two Scheduled Districts or elsewhere in Great Britain; and by Orders of the Board which came into operation on the 2nd and 9th November the Scheduled Districts in both cases were contracted, and the restrictions on the movement of animals considerably modified.

The position of Ireland with regard to foot-and-mouth disease continues to be as indicated in last month's *Journal*, namely, no outbreak has been confirmed therein since the 17th July last.

Owing to the outbreak of foot-and-mouth disease in the United States of America the Board have prohibited the landing of hay and straw from that country. No "animals" are at present being landed from the United States.

MISCELLANEOUS NOTES.

THE property assigned to the management of the President of the Board of Agriculture and Fisheries as a Commissioner of Woods is as follows :—

The Agricultural Estates and Forest Land Belonging to the Crown.*

- (1.) The principal agricultural estates belonging to the Crown.
- (2.) The Royal forests and principal woodlands (except Windsor and Esher) belonging to the Crown.

(1.) *Agricultural Estates.*—The principal agricultural estates in England belonging to the Crown and under the charge of the President of the Board of Agriculture and Fisheries as a Commissioner of Woods were stated in his Report for 1913 (*Journal*, October, 1913, p. 639) to comprise at 31st March, 1913, about 72,162 acres. This area included about 4,694 acres of woodland now dealt with under (2) but did not comprise the Clearwell Estate in Gloucestershire, containing about 1,718 acres, nor an area of about 2,651 acres of unenclosed commonable waste within certain manors. The area of the agricultural lands at 31st March, 1914, was about 72,515 acres, an increase of about 3,329 acres. The 72,515 acres were divided as follows :—9,640 acres let for small holdings and allotments, 79 farms containing between 50 and 250 acres, 74 between 250 and 500 acres, 21 between 500 and 750 acres, 1 between 750 and 1,000 acres, and 6 farms containing upwards of 1,000 acres, consisting largely of downland; there were also about 1,000 acres of grass-land let annually in lots by auction, and about 758 acres of woodland in small scattered plantations.

* Ninety-second Report of the Commissioners of H.M. Woods, Forests and Land Revenues. [H. C. 311, 1914]. Price 1s.

The area of land let for small holdings and allotments up to 31st March, 1913, was 8,773 acres, and up to 31st March, 1914, the area was 9,640 acres, thus showing an increase of 867 acres during the year. Of this increase, however, about 579 acres of small holdings and allotments were already established on the land acquired in 1913-14. On the land let for small holdings during the year to 31st March last 6 new cottages and 2 new sets of farm buildings have been, or are being, erected, and one cottage is being substantially improved, while a number of homesteads are being altered to fit them for the use of 21 small holders. During the last eight years there have been erected on the 7,788 acres of Crown lands converted into small holdings and allotments 78 cottages and 62 new sets of farm buildings; 41 cottages have been substantially altered and improved, and the homesteads and buildings which were on the farms divided into small holdings have been remodelled to fit them for the use of 59 small holders. Arrangements are in hand for letting a further area of land for small holdings and allotments.

The gross income from these estates during the year ended 31st March last amounted to £76,417 and the total expenditure to £29,094, leaving a net income of £47,323. The expenditure on new buildings and permanent improvements during the year was £15,882, and on repairs £4,635, while the management expenses amounted to £3,383. Of the expenditure on new buildings, £9,428 was expended in equipping small holdings.

(2.) *Royal Forests and Woodlands.*—The Forestry Branch of the Office of Woods has been reorganised, and Mr. R. L. Robinson has been appointed head of that branch as well as of the newly constituted branch of the Board of Agriculture and Fisheries. A special report of the Forestry Branches of the two Offices will in future be published annually; the first report was reviewed in the *Journal* for August, 1914, p. 430.

The Royal forests and woodlands in *England* under the charge of the President of the Board of Agriculture as a Commissioner of Woods, with the relative areas, are as follows:—

Name of Forest, &c.	County.	Total area of Forest.	Area under Wood.
		Acres.	Acres.
New Forest	Hants ..	65,000	23,758
Alice Holt	" ..	2,126	1,884
Woolmer	" ..	2,070	856
Bere	" ..	1,460	1,413
Parkhurst	" ..	1,393	1,056
Dean Forest	Gloucester ..	18,700	15,184
Abbotswood	" ..	646	618
Highmeadow and Great	" ..		
Doward	" ..		
Delamere	Cheshire ..	3,580	3,349
Chopwell	Durham ..	—	2,105
Salcey	" ..	—	845
Hazelborough	Northants ..	—	1,265
	" ..	—	488

The following table shows the receipts and expenditure for the respective areas for the year to 31st March, 1914:—

Wood.	Receipts.			Expenditure.		
	Sales of Produce and Surface Rents	Mines.	Total.	Surface.	Mines.	Total.
	£	£	£	£	£	£
Woods in						
Hants.	11,355	1,970	13,325	—	—	14,636
" Glouc.	13,862	13,956	27,818	—	—	17,938
Delamere ..	615	201	816	1,058	138	1,196
Chopwell ..	450	1,943	2,393	469	131	600
Salcey ..	48	—	48	480	—	480
Hazelborough	20	—	20	194	—	194
Total ..	26,350	18,070	44,420	—	—	35,044

A NOTE published in this *Journal* for November, 1913, p. 733, referred to the steadily increasing wages of agricultural labourers in England and Wales during the ten years, **The Increasing Wages of Agricultural Labourers.** 1903-1912, culminating in a net increase of £5,291 in average weekly cash wages in 1912 as compared with 1911. The Report of the Board of Trade on *Changes in Rates of Wages and Hours of Labour* for 1913 [Cd. 7,635, price 11d.] shows that the corresponding increase in 1913 over 1912 was still greater, viz., £9,964, this amount exceeding the sum total of the increases recorded since the beginning of 1904. The upward movement in wages which has taken place in the years 1912 and 1913 is considerably more marked than any which has occurred since the period 1898-1900.

Particulars for the last ten years are given in the following table * :—

Year.	Estimated Total No. of Agricultural Labourers in Districts in which the predominant rates of wages—		Computed amount of change (compared with each preceding year) in average weekly cash wages of the Agricultural Labourers in Districts affected.		Net Increase (+) or Decrease (—).
	Were Raised.	Were Lowered.	Increase.	Decrease.	
	No.	No.	£	£	£
1904 ..	23,779	9,569	1,032	451	+ 581
1905 ..	6,659	12,438	252	442	— 190
1906 ..	14,758	8,744	704	322	+ 382
1907 ..	14,971	3,439	479	103	+ 376
1908 ..	40,134	13,780	1,411	684	+ 727
1909 ..	29,244	19,772	747	451	+ 296
1910 ..	15,451	271	794	22	+ 772
1911 ..	25,427	4,360	1,214	270	+ 944
1912 ..	102,602	1,846	5,383	92	+ 5,291
1913 ..	182,040	641	9,996	32	+ 9,964

* The method followed by the Board of Trade in estimating these changes is described in the previous note.—Nov., 1913, p. 733.

The total number of labourers in districts affected by the increases reported in 1913 was 182,040, while the total number of labourers living in districts in which no change was reported (for ordinary labourers) was 197,395. The corresponding totals in 1912 were 102,602 and 291,586 respectively.

Most counties shared in the upward movement of wages in 1913. Those counties in which it was most marked, taking into account the total number of labourers covered by the returns, were (in England) Norfolk, Suffolk, Cambridge, Hertfordshire, Warwickshire and Somersetshire, and (in Wales) Carmarthenshire. As in most years, the majority (over 65 per cent.) of the increases which took place in 1913 consisted of amounts varying from 6d. to a 1s. per week; of these increases nearly 93 per cent. were amounts of 1s. exactly.

Inspection of Fruit Exported from South Africa.—The Fruit Export Act of 1914 provides for the inspection of fresh fruit exported from the Union of South Africa for the purposes of sale.

Notes on Agriculture Abroad. Notice must be given by exporters of their intention to export fruit. An inspector of the Department of Agriculture will examine the fruit, and if he is satisfied that the fruit is in accordance with the prescribed standards as to condition and grading, he will brand or stamp each box with the coat of arms of the Union of South Africa encircled by the words "passed by Government Fruit Inspection."

If the inspector refuses to brand or stamp any consignment, the consignor may require the inspector to refer the matter to a board of reference constituted as prescribed by regulation. If the inspector's refusal is upheld by the board of reference or if the consignor does not require that the matter be referred to the board, the consignor must remove the fruit and will be liable for any expense incurred in its storage. If the fruit is not so removed it will be destroyed. A fee will be charged for the expenses of examination.

Distribution of Calcium Cyanamide.—Attempts have been made from time to time to discover a method of treatment likely to render calcium cyanamide less disagreeable to the workmen when it is being applied. Oil has been added to it in some cases, but, while this obviates the unpleasant dust and does not detract from the manurial effect in any way, there is still room for improvement.

Recently Kirchhoff has suggested that the cyanamide should be mixed with kainit and basic slag. He describes his process as follows:—A layer of kainit is placed upon the mixing floor; to this is added a layer consisting of the desired proportion of cyanamide and then the layer of basic slag. This is repeated until there are six or seven layers and the whole heap is then carefully covered with basic slag to prevent the interior portion absorbing moisture from the atmosphere. The mixture may be left for several days without fear of the mass becoming lumpy or losing in weight. If the heap is then thoroughly mixed by turning over several times the manures may if necessary be left from 3 to 12 days more before distributing, and the disagreeable qualities of the cyanamide will not be noticeable. Subsequent examination in the laboratory showed that no loss by reversion to insoluble material had taken place. (*Deutsche Landwirtschaftliche Presse*, 9th May, 1914.)

Area and Value of Agricultural Land in France.—A valuation of all land in France not built on (*i.e.*, the "Land Tax Roll") was ordered by a law of December 31st, 1907, and the results of the valuation were published by the Ministry of Finance in November last. It appears that there are 125,926,000 acres of agricultural land in France, of which, however, 836,000 acres do not come into consideration, as being attached to buildings, other than farmhouses.

The yearly rental value of the remaining 125,090,000 acres is £83,385,000 and the sale value £2,511,722,000.

Similar enquiries were made in 1851 and 1879, and the results are compared with those of 1908 in the following statement:—

	Yearly Rental Value.	Sale Value.
	£	£
1851	72,967,000	2,447,561,000
1879	105,820,000	3,603,359,000
1908	83,385,000	2,511,722,000

In the period 1851 to 1879 the two Departments of Savoy and Upper Savoy, as well as Nice and the Island of Corsica, with a total yearly rental value of £1,687,000 and a sale value of £54,363,000, were added, while Alsace and a part of Lorraine were lost; the last two have, however, been deducted from the figures for 1851. It is evident, therefore, that two-thirds of the increased yearly rental value and practically the whole of the sale value of the first period were lost again in the second period. Compared with 1879 the figures for 1908 show a decrease of 32 per cent. both in the yearly rental value and in the sale value.

The various items which were included in the total of agricultural land in 1908 were as follows:—

	Area.	Yearly Rental Value.	Sale Value.
	Acres.	Thousands of £	Thousands of £
Arable	58,601,000	43,585	1,317,495
Grass	17,073,000	17,900	519,346
Fruit	1,835,000	1,829	48,965
Vines	3,703,000	4,584	121,896
Woods and Willows	24,001,000	6,901	241,011
Heath, rough grazing and marsh	17,798,000	1,248	45,724
Quarries, sandpits and peat cutting	42,000	27	887
Lakes, etc.	435,000	242	6,707
Gardens (other than pleasure gardens)	981,000	3,092	88,413
Docks, building sites, etc.	60,000	1,787	48,524
Pleasure gardens, parks, etc.	267,000	1,750	55,446
Railways and Canals	294,000	434	17,308
	125,090,000	83,385	2,511,722

There were 7,520,922 owners of land in 1908.

Competition in Agricultural Book-keeping in East Prussia.—In order to popularise the keeping of accounts among small farmers the Chamber of Agriculture for E. Prussia holds each year a competition in agricultural book-keeping open to farmers with holdings of not more than 250 acres. The accounts, which must be for a complete year, must have been kept by the farmer himself, or by one of the workers on the farm. They must comprise:—

1. A *cash* account showing the whole of the receipts and payments. The domestic expenses are, if possible, to be kept distinct.
2. A *household expenses* account mentioning everything supplied to the household by the farm.
3. A *stocktaking* account containing a valuation of the buildings, live stock, machinery and implements, and feeding stuffs at the commencement and the end of the year.
4. A *profit and loss* account.

Prizes to the value of £25 are awarded.

The accounts submitted are examined by a special commission composed of the members of the Council of Rural Economy and Book-keeping of the Chamber, and are treated as strictly confidential. (*Bull. of Agric. Intel.*, July, 1914.)

THE Board of Agriculture and Fisheries have issued the following preliminary statement showing the estimated total production of Hops in the years 1914 and 1913, with the acreage and estimated average yield per statute acre in each county of England in which Hops were grown:—

COUNTIES, &C.		Estimated Total Produce.		Acreage Returned on 4th June.		Estimated Average Yield per Acre.	
		1914.	1913.	1914.	1913.	1914.	1913.
KENT	East ..	Cwt. 94,877	Cwt. 47,395	Acres. 6,174	Acres. 6,103	Cwt. 15.37	Cwt. 7.77
	Mid ..	104,405	73,899	7,604	7,481	13.73	9.88
	Weald ..	119,422	65,480	8,848	8,360	13.50	7.83
	Total, Kent	318,704	186,774	22,626	21,944	14.09	8.51
HANTS	..	22,262	7,274	1,580	1,556	14.09	4.67
HEREFORD	..	70,478	22,138	5,507	5,439	12.80	4.07
SURREY	..	8,188	2,959	585	557	14.00	5.31
SUSSEX	..	43,980	22,536	3,036	2,889	14.49	7.80
WORCESTER	..	42,238	13,500	3,194	3,157	13.22	4.28
OTHER COUNTIES*	..	1,408	460	133	134	10.59	3.43
TOTAL	..	507,258	255,641	36,661	35,676	13.84	7.17

* Gloucester, Salop and Stafford.

NOTE.—The total production of Hops in 1914, estimated at 507,258 cwt., represents the largest quantity picked in England since 1905. The yield per acre, 13.84 cwt., is nearly double that of 1913, and has only once been exceeded (in 1905) since returns of produce were first collected in 1885.

THE following preliminary statement shows the estimated total produce and yield per acre of the Corn, Pulse, and Hay Crops in England and Wales in the year 1914, with comparisons Produce of Corn, Pulse, and Hay Crops for 1913, and the average yield per acre of the ten years 1904-1913:—

		Estimated Total Produce.		Acreage.		Average Estimated Yield per acre.		Average of the Ten Years 1904-1913.
		1914.	1913.	1914.	1913.	1914.	1913.	1904-1913.
ENGLAND AND WALES.	Wheat	Quarters. 7,318,083	Quarters. 6,642,178	Acres. 1,807,498	Acres. 1,701,588	Bshls. 32.39	Bshls. 31.23	Bshls. 31.44
	Barley	6,174,549	6,322,840	1,504,771	1,558,851	32.83	32.45	32.95
	Oats	9,585,993	9,378,837	1,929,617	1,974,700	39.74	38.00	40.29
	Beans	1,083,535	914,722	284,371	258,582	30.48	28.30	29.50
	Peas	372,387	421,736	129,528	127,785	23.00	26.40	26.67
	Seeds Hay*	Tons. 2,120,919	Tons. 2,700,068	1,551,907	1,700,481	Cwt. 27.28	Cwt. 31.86	Cwt. 29.09
	Meadow Hay †	5,148,929	6,343,254	4,285,626	5,069,692	21.52	25.02	23.54
	Wheat	Quarters. 7,186,997	Quarters. 6,511,859	1,770,470	1,663,453	Bshls. 32.47	Bshls. 31.32	Bshls. 31.54
	Barley	5,842,100	5,984,154	1,420,316	1,469,776	32.91	32.57	33.07
	Oats	8,684,650	8,531,571	1,730,082	1,772,247	40.16	38.51	40.84
ENGLAND	Beans	1,070,202	910,935	283,194	257,491	30.49	28.30	29.51
	Peas	371,183	420,512	129,116	127,397	23.00	26.41	26.69
	Seeds Hay	Tons. 1,910,162	Tons. 2,472,158	1,390,898	1,533,005	Cwt. 27.47	Cwt. 32.25	Cwt. 29.50
	Meadow Hay	4,604,215	5,704,936	4,239,249	4,504,078	21.72	25.33	23.95
	Wheat	Quarters. 131,086	Quarters. 130,310	37,028	38,135	Bshls. 28.32	Bshls. 27.34	Bshls. 27.28
	Barley	332,449	338,386	84,425	89,075	31.50	30.39	31.01
	Oats	990,443	847,263	199,535	202,453	36.10	33.18	35.15
	Beans	4,333	3,787	1,177	1,091	29.45	27.77	29.82
	Peas	1,204	1,221	412	418	23.38	23.42	22.77
	Seeds Hay	Tons. 210,757	Tons. 239,910	164,009	167,176	Cwt. 25.70	Cwt. 28.29	Cwt. 25.52
WALES	Meadow Hay	514,714	638,318	546,477	565,614	19.94	22.57	20.29

* Hay from Clover, Sainfoin, and Grasses under rotation.
† Hay from Permanent Grass.

NOTE.—The total production of wheat in England and Wales in 1914—7,318,083 quarters—is some 676,000 quarters more than last year; and the yield per acre is practically 1 bushel above the average of the past 10 years. Barley, with 32.83 bushels per acre, is a very small fraction below the average but is better than in 1913; owing to a somewhat reduced acreage, however, the total production amounts to 148,300 quarters less. Oats are half a bushel below the average, but the total production is slightly above last year's yield. Beans are practically 1 bushel over average and the total production exceeds a million quarters. Peas, on the other hand are decidedly the worst crop, being 3½ bushels below average; the acreage reserved for harvesting being small, the total production (372,387 quarters) is the lowest on record. Hay, whether from permanent grass, or from clovers and rotation grasses, is below average, the former by rather over, and the latter by rather under, 2 cwt. per acre. The total production of both kinds of hay together amounts to more than 7,200,000 tons, as compared with over 9,000,000 tons in 1913, which was a very abundant year.

The *Bulletin of Agricultural and Commercial Statistics* for October, 1914, gives estimates of the production of the cereal crops this year.

Notes on Crop Prospects Abroad.

The countries for which it is possible to give estimates are as follows:—In *Europe*—Prussia, Hungary (proper), Belgium, Denmark, Spain, Great Britain and Ireland, Italy, Luxemburg, Netherlands, Rumania, Russia in Europe (63 governments), Sweden, Switzerland; in *America*—Canada, United States; in *Asia*—India, Japan; in *Africa*—Algeria (Department of Constantine), Tunis.

Wheat.—The total production in the above-mentioned countries is estimated at 342,798,000 qr., as compared with 375,765,000 qr. in the same countries last year, the decrease being equal to 8.8 per cent. The area under production was greater than in 1913 by 1.5 per cent.

Rye.—The estimated production in the specified countries, excluding Great Britain, India, Japan, Algeria, and Tunis, is placed at 172,657,000 qr., against 180,137,000 qr. in 1913, or a decrease of 4.2 per cent., while the area planted was smaller by 0.8 per cent.

Barley.—The production in the above countries, with the exception of India, is estimated at 142,502,000 qr., or a decrease of 10.3 per cent. as compared with last year, when the production was 158,818,000 qr. The area sown showed a decrease of 0.6 per cent.

Oats.—For the same countries as above, but omitting India, the estimated production is 339,834,000 qr., against 386,022,000 qr. last year, the decrease amounting to 12.0 per cent., while the area planted was less than in 1913 by 0.7 per cent.

Russia.—According to data collected by the Department of Excise the sowing of winter grain was mostly finished towards the end of September, or nearly so. Arrears occurred in some parts of the northern, eastern and central agricultural regions, partly owing to the scarcity of labour caused by the mobilisation, partly by excessive rains which fell during the last week or two. The northern Caucasus and some sections of the southern Governments are also behindhand. The acreage sown is as a rule not smaller than last year, except in the parts affected by the rains and the scarcity of hands, which have caused a moderate shortening of the sowings.—(*Dornbusch*, October 27th).

Rumania.—The report of the Rumanian Statistical Department states that the total production of wheat in 1914 was 5,500,000 quarters from the 5,200,000 acres under the crop, including the new territory. The average production of the five years 1907-13 was 10,500,000 quarters. The quality of the crop this year is inferior to that of previous years.—(*H.M. Consul-General, Galatz*).

Canada.—A bulletin issued by the Census and Statistics Office at Ottawa, referring to the state of the crops at the end of September, states that the average quality of the grain crops when harvested was wheat 78, oats 79, barley 76, rye 82, peas 75, beans 82 and flax 64. (100 represents grain well headed, well filled, well saved and unaffected to any appreciable extent by frost, rust, smut, &c.). Wheat, barley and oats are on the whole considerably inferior in quality to the crops of last year, owing to the prolonged drought in the north-west provinces; the quality of the crops in the maritime provinces being excellent. The yield of wheat is estimated at 158,223,000 bushels as compared with 231,717,000 bushels last year; oats, 311,426,000 bushels, as compared with 404,669,000 bushels; barley, 34,491,000 bushels against

48,319,000 bushels; and linseed, 7,533,000 bushels against 17,539,000 bushels last year. Conditions during September were favourable for harvesting and threshing, and in the north-west provinces much threshing had been done by the 1st October.

There are indications that the amount of autumn ploughing will be greater than usual this year.

Argentina.—H.M. Minister at Buenos Aires reports (September 22nd) that the crops are in very good condition, and, should the weather continue favourable, a good harvest of wheat, oats and linseed may be expected, especially in the Bahia Blanca district. Locusts have appeared in considerable quantities in the northern portion of the Province of Buenos Aires and some parts of the Provinces of Sante Fé and Cordoba, but, up to the present, they do not seem to have done much damage. Some fears are expressed that there will be a shortage of labour for the harvest, owing to the stoppage of immigration and to the large number of labourers who have left the country to serve in the armies of their respective countries; and the Government have taken steps to ascertain the amount of labour available in the various districts.

Hops.—*Russia.*—The official "Commercial Gazette," of 9th October, states that an average crop of hops of excellent quality was secured this year in Russia. In Volhynia and Poland, owing to the good weather conditions in July and August, the appearance of the crop was exceptionally favourable; whilst in the Guslitski and Kostroma regions, although the local varieties were a very abundant crop, the cultivated sorts were not so satisfactory, owing to drought and cold nights in June and July. The total yield of cultivated hops in Russia is estimated at 77,280 cwt., as compared with 112,700 cwt. in 1913; and the yield of the common local varieties in central and north-east Russia is estimated at 48,300 cwt. There will be no surplus available for export, as the yield of the cultivated varieties is not above the local requirements of Russian breweries, but there is no question of insufficiency, even taking into account the absence of stocks at the breweries.—(*H.M. Commercial Attaché at Petrograd*).

Fruit.—*United States.*—His Majesty's Consul-General at Boston, in a report dated 14th October, regarding the fruit crops in the States of New Hampshire and Maine, states that apples are a very good crop of excellent quality, but, owing to the curtailment of exports, it is expected that the large crop will keep down prices, which vary from 4s. 2d. to 6s. 4d. a barrel. In New Hampshire other fruit crops are abundant, with the exception of pears and peaches.

Live Stock in Germany.—The final figures for the census of 1st December, 1913, compared with those of 2nd December, 1912 (in brackets), are as follows:—Cattle, 20,994,344 (20,182,021); sheep, 5,520,837 (5,803,445); pigs, 25,659,140 (21,923,707); horses (Prussia only), 3,226,640 (3,193,279). (*Bulletin of Agricultural and Commercial Statistics*, October, 1914.)

Live Stock in the Netherlands.—Preliminary data from the census of June, 1913, give the following results, the figures from the census of June, 1910, being shown in brackets.—Horses, 334,445 (327,377); cattle, 2,096,599 (2,026,943); sheep, 842,018 (889,036); pigs, 1,350,204 (1,259,844). (*Bulletin of Agricultural and Commercial Statistics*, October, 1914.)

Live Stock in Canada.—The numbers of live stock existing on 30th June, 1914, compared with the numbers on the same date in 1913, are given as follows:—Horses, 2,947,738 against 2,866,008 in 1913; cattle, 6,036,817 against 6,656,121; sheep, 2,658,045 against 2,128,531; pigs, 3,434,261 against 3,448,326. (*Bulletin of Agricultural and Commercial Statistics*, October, 1914.)

THE reports furnished by the Crop Reporters of the Board on agricultural conditions in England and Wales indicate that the corn crops were everywhere secured in good condition. The quality of the wheat is reported to be good, and better than that of the other two cereals. Barley is variable in quality, and often only a poor sample. Winter oats are generally quite satisfactory, but spring oats are mostly only moderate.

The greater part of the potato crop has now been secured under good conditions. There is a considerable amount of disease in the north, particularly in Yorkshire and Lancashire, but elsewhere, although few districts are quite free from it, there is not much disease, good reports coming from Lincolnshire.

Mangolds have largely been lifted in good condition, and seem generally a satisfactory crop. Turnips and swedes, besides being an inferior crop, are not of very good quality and are frequently mildewed. In the north and west seeds are a strong and vigorous crop, but in the east and south they are patchy and poor; the recent rains, however, have been of considerable benefit.

Autumn cultivation is generally well forward. During the fine weather in the earlier part of the month, much cleaning, and sowing of wheat on the lighter lands, was done; while the rain in the last few days of the month enabled progress to be made on the heavier soils, although there are still some areas where wheat sowing is in arrear. Reports from some districts mention that an increased acreage is being put under wheat.

Live stock have not always done too well during the month, especially on the eastern side, as the drought kept the pastures very bare. Prospects for winter keep are generally very good in the northern and western districts, but in the south-eastern part of the country the shortage of hay and roots renders the position more doubtful.

ACCORDING to statements in the Board's Monthly Agricultural Report (1st November) the supply of agricultural labour in England and Wales during October, while nowhere abundant, was not seriously deficient for the time of year, but from nearly all parts of the country came reports of a certain shortage, generally of skilled labour. The following local summaries give details regarding agricultural labour in the different districts:—

Northumberland, Durham, Cumberland and Westmorland.—The supply of labour was sufficient for requirements in Northumberland; in parts of Durham skilled labour was deficient, and, except in the south-west of the county, casual workers for potato lifting were scarce. In

Cumberland and Westmorland the supply was sufficient for requirements. Fears were expressed that there will be a shortage of men at the November half-yearly hirings.

Lancashire and Cheshire.—In neither Lancashire nor Cheshire was shortage seriously felt. Thanks to the fine weather the supply proved sufficient in most districts. It was thought possible, however, that there may be some deficiency after the November hirings.

Yorkshire.—Almost all districts reported a deficiency, and, as a result, wages tended to rise; the pressure was felt most acutely in the case of skilled labour—milkers, horsemen and the like. Up to the date of the report, thanks to the way in which the fine weather facilitated the working of full time, matters generally had not worn a very serious aspect.

Shropshire and Stafford.—The supply of labour was deficient in nearly every district, particularly as regards temporary labour for potato and root lifting.

Derby, Nottingham, Leicester and Rutland.—In most parts of this district labour was somewhat scarce, especially skilled labour; but owing to the forward state of cultivation it proved just sufficient.

Lincoln and Norfolk.—The supply of labour in Norfolk was in general just sufficient for the demand, with plenty in some districts and slight deficiencies in others. A shortage was felt in some parts of Lincolnshire, although the county as a whole did not suffer severely.

Suffolk, Cambridge and Huntingdon.—In all three counties there was a certain amount of shortage, but it did not seem to be at all severely felt. This was partly due to the fact that work was forward for the time of year.

Bedford, Northampton and Warwick.—In Bedfordshire there was a distinct shortage in many districts, and much work, such as hedge-cutting and draining, will have to be left undone. In Northamptonshire the deficiency did not seem to be so severely felt, except in the case of men to attend to stock or work on Sundays. In Warwickshire the shortage was general in some districts, in others referred only to skilled labour, and in others was hardly felt at all, owing to the fine weather allowing full time to be worked.

Buckingham, Oxford and Berkshire.—There was a sufficient supply of unskilled labour in most districts, but milkers and cattlemen were difficult to obtain in many parts of Buckingham and Oxford. In some places in Buckingham there was a shortage of ordinary labour, and particularly of men who will undertake Sunday work.

Worcester, Hereford and Gloucester.—Generally speaking, there was sufficient supply of labour in Worcester, but in Gloucester the supply was getting short, and wages had risen in places. There was a shortage also in Hereford, where many farmers had difficulty in getting sufficient men for threshing, fruit-picking and root-lifting.

Cornwall, Devon and Somerset.—The supply of labour was generally sufficient for requirements in Cornwall, and, except that milkers were difficult to obtain in the north of the county, the supply was not very short in Somerset. In Devon, however, a shortage of farm workers was felt generally.

Dorset, Wiltshire and Hampshire.—Labour was short throughout most of Dorset; in the other two counties, while there was some scarcity it was generally sufficient, but no more.

Surrey, Kent and Sussex.—In spite of some local scarcity the supply of labour seemed to be fully sufficient.

Essex, Hertford and Middlesex.—There was little shortage except in the centre of Essex and in Herts, but skilled labour was somewhat scarce in other parts of these counties. Middlesex was not much affected, owing partly to the extensive employment of women.

North Wales.—Although in some districts there was a scarcity of temporary labour for potato and root-lifting the supply of labour in the main was quite sufficient, especially as the harvest was fairly early and the weather was good.

Mid Wales.—In Montgomery the supply of labour was deficient owing to recruiting, and in central Cardigan skilled workers were scarce; elsewhere the supply was quite equal to the demand.

South Wales.—Labour was scarce in Monmouth, Glamorgan, and Carmarthen. Generally, skilled labour was the most difficult to obtain, but in east Monmouth casual labour was scarce. In many places higher wages were being paid.

Prevalence of Animal Diseases on the Continent.

THE following statement shows that according to the information in the possession of the Board on November 1st, 1914, certain diseases of animals existed in the countries specified:—

Bulgaria (for the period September 6th—14th).

Foot-and-Mouth Disease, Glanders, Sheep-pox, Swine Fever, Anthrax.

Denmark (month of September).

Anthrax, Foot-and-Mouth Disease, Swine Erysipelas, Swine Fever.

Holland (month of September).

Anthrax, Foot-rot, Swine Erysipelas.

Italy (for the period October 12th—18th).

Anthrax, Blackleg, Foot-and-Mouth Disease (434 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Norway (month of September).

Anthrax, Blackleg.

Rumania (for the period August 29th—September 5th).

Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (18,008 animals), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (month of June).

Anthrax, Foot-and-Mouth Disease (169,549 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of June).

Anthrax, Dourine, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of September).

Anthrax, Blackleg, Swine Fever.

Switzerland (for the period October 12th—18th).

Anthrax, Blackleg, Foot-and-Mouth Disease (347 "étales" entailing 4,883 animals, of which 43 "étales" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries:—Austria, Belgium, France, Germany, Hungary, Montenegro, Servia.

The Weather in England during October.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
<i>Week ending Oct. 3rd:</i>	°F.	°F.	Inches	Inches.		Hours.	Hours.
England, N.E. ...	52.6	+0.3	0.03	-0.37	1	6.1	+2.2
England, E. ...	53.0	-0.6	0.01	-0.52	1	5.7	+1.3
Midland Counties ...	52.1	-0.3	0.02	-0.52	1	5.8	+1.9
England, S.E. ...	53.1	-1.9	0.00	-0.62	0	6.4	+1.9
England, N.W. ...	52.6	-0.3	0.11	-0.71	2	5.2	+1.5
England, S.W. ...	53.6	-0.7	0.01	-0.88	1	5.4	+1.2
English Channel ...	57.0	-0.5	0.00	-0.77	0	5.7	+0.6
<i>Week ending Oct. 10th:</i>							
England, N.E. ...	52.3	+1.9	0.06	-0.47	2	2.5	-1.2
England, E. ...	51.8	+0.3	0.05	-0.53	2	2.7	-1.2
Midland Counties ...	51.8	+1.5	0.00	-0.62	0	2.6	-0.9
England, S.E. ...	52.3	-0.6	0.00	-0.70	0	4.4	+0.5
England, N.W. ...	52.6	+1.5	0.05	-0.88	1	2.7	-0.5
England, S.W. ...	53.0	+0.6	0.01	-0.99	1	4.3	+0.5
English Channel ...	55.9	+0.2	0.00	-0.85	0	6.5	+2.0
<i>Week ending Oct. 17th:</i>							
England, N.E. ...	51.5	+2.7	0.18	-0.48	2	1.5	-1.8
England, E. ...	52.0	+2.2	0.33	-0.30	3	1.8	-1.8
Midland Counties ...	50.8	+2.2	0.53	-0.14	2	1.2	-2.0
England, S.E. ...	52.0	+0.9	0.62	-0.10	4	1.6	-2.1
England, N.W. ...	51.5	+1.9	0.08	-0.85	1	1.3	-1.7
England, S.W. ...	51.9	+1.0	0.38	-0.65	3	2.6	-0.9
English Channel ...	54.1	-0.2	0.55	-0.33	3	4.1	-0.1
<i>Week ending Oct. 24th:</i>							
England, N.E. ...	48.3	+0.8	0.21	-0.53	4	1.9	-1.1
England, E. ...	51.1	+2.8	0.54	-0.11	5	1.3	-2.1
Midland Counties ...	48.8	+1.6	0.55	-0.11	6	1.5	-1.5
England, S.E. ...	51.9	+2.2	0.69	-0.04	5	2.0	-1.4
England, N.W. ...	48.3	0.0	0.10	-0.76	3	3.4	+0.7
England, S.W. ...	50.6	+0.9	0.80	-0.21	4	3.2	-0.1
English Channel ...	55.3	+2.1	0.64	-0.28	4	3.5	-0.5
<i>Week ending Oct. 31st:</i>							
England, N.E. ...	48.1	+1.7	1.57	+0.84	6	3.0	+0.3
England, E. ...	49.4	+2.3	1.10	+0.48	6	3.2	+0.2
Midland Counties ...	48.0	+1.9	1.07	+0.42	6	3.1	+0.5
England, S.E. ...	49.7	+1.1	1.34	+0.57	6	3.1	+0.1
England, N.W. ...	48.0	+0.8	1.38	+0.52	6	2.6	+0.1
England, S.W. ...	49.3	+0.5	1.55	+0.52	6	2.6	-0.3
English Channel ...	52.2	-0.1	2.21	+1.29	7	2.3	-1.2

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	63	47	620	458
Animals attacked	67	54	679	507
Foot-and-Mouth Disease:—				
Outbreaks	2	—	24	—
Animals attacked	17	—	125	—
Glanders (including Farcy):—				
Outbreaks	5	9	86	130
Animals attacked	16	24	265	322
Parasitic Mange:—				
Outbreaks	—	104	1,548	2,103
Animals attacked	—	159	2,683	4,158
Sheep-Scab:—				
Outbreaks	4	14	159	148
Swine Fever:—				
Outbreaks	525	242	3,682	2,110
Swine Slaughtered as diseased or exposed to infection ...	4,441	2,663	35,509	27,650
Tuberculosis:—				
Number of Premises notified...	†	608	3,971	—
Number of bovine animals notified as for slaughter ...	†—	661	4,235	—

* The Tuberculosis Order came into operation on 1st May, 1913.
 † The Parasitic Mange Order, 1911, and the Tuberculosis Order, 1914, were suspended as from 6th August, 1914.

IRELAND.

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

DISEASE.	OCTOBER.		TEN MONTHS ENDED OCTOBER.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Foot-and-Mouth Disease:—				
Outbreaks	—	—	76	—
Animals attacked	—	—	955	—
Glanders (including Farcy):—				
Outbreaks	—	1	—	1
Animals attacked	—	1	—	1
Parasitic Mange:—				
Outbreaks	4	8	71	110
Sheep-Scab:—				
Outbreaks	27	35	434	429
Swine Fever:—				
Outbreaks	17	10	178	126
Swine Slaughtered as diseased or exposed to infection ...	38	101	875	822

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in October and September, 1914.

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

Description.	OCTOBER.		SEPTEMBER.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 3	8 9	9 3	8 9
Herefords	9 1	8 5	9 3	8 8
Shorthorns	9 2	8 4	9 2	8 5
Devons	9 3	8 5	9 5	8 6
Welsh Runts	9 0	8 5	9 1	8 7
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	8½	8	8½	7½
Sheep:—				
Downs	9½	8½	9½	8½
Longwools	9	8	9	8
Cheviots	9½	9	9½	9
Blackfaced	9½	8½	9½	8½
Welsh	9½	7½	—	8
Cross-breds	9½	8½	9½	8½
	per stone.*	per stone.*	per stone.*	per stone.*
	s. d.	s. d.	s. d.	s. d.
Pigs:—				
Bacon Pigs	7 11	7 6	7 10	7 5
Porkers	8 5	7 10	8 3	7 10
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	23 19	19 18	23 4	19 7
—Calvers	22 15	19 11	21 14	18 18
Other Breeds—In Milk ...	20 7	17 4	20 9	18 1
—Calvers	18 16	16 0	17 5	14 0
Calves for Rearing	2 9	1 19	2 10	1 19
Store Cattle:—				
Shorthorns—Yearlings ...	11 13	10 2	11 18	10 1
—Two-year-olds... ..	15 12	13 11	16 2	14 0
—Three-year-olds	20 9	17 4	19 9	16 12
Herefords—Two-year-olds...	17 3	15 5	16 3	14 6
Devons— "	15 6	13 16	15 13	14 5
Welsh Runts— "	16 8	14 3	15 8	13 15
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	42 7	36 6	40 10	35 4
Store Pigs:—				
8 to 12 weeks old	20 10	15 5	21 8	16 2
12 to 16 weeks old	35 0	26 9	34 6	26 10

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in October, 1914.

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

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
BEEF :—		s. d.	s. d.	s. d.	s. d.	s. d.
English ...	1st	61 0	60 6	—	63 6	58 6
	2nd	56 0	58 0	—	59 0	56 0
Cow and Bull ...	1st	54 0	55 6	52 6	55 6	52 0
	2nd	49 0	51 6	45 6	50 6	47 0
Irish: Port Killed ...	1st	58 6	58 6	58 6	62 0	56 6
	2nd	55 6	56 6	55 6	57 6	53 0
Argentine Frozen—						
Hind Quarters ...	1st	62 0	61 0	63 0	62 6	63 0
Fore " ...	1st	53 0	53 0	53 6	53 0	53 6
Argentine Chilled—						
Hind Quarters ...	1st	60 6	60 0	59 6	62 6	59 6
Fore " ...	1st	53 0	52 6	51 6	53 0	51 6
Australian Frozen—						
Hind Quarters ...	1st	60 0	61 0	62 0	62 6	62 0
Fore " ...	1st	53 0	55 0	53 6	54 0	53 6
VEAL :—						
British ...	1st	70 0	67 6	77 0	65 6	75 0
	2nd	65 6	64 0	72 6	56 0	70 6
Foreign... ..	1st	—	—	—	67 0	—
MUTTON :—						
Scotch ...	1st	—	—	79 6	76 0	79 6
	2nd	—	—	74 6	71 0	74 6
English... ..	1st	77 0	80 6	—	71 0	74 6
	2nd	65 6	77 0	—	64 0	70 0
Irish: Port Killed ...	1st	71 0	—	74 0	68 0	73 6
	2nd	60 6	—	68 0	63 0	69 0
Argentine Frozen ...	1st	53 0	53 6	52 0	53 6	52 0
Australian " ...	1st	51 6	51 6	50 6	51 0	50 6
New Zealand " ...	1st	54 6	—	—	57 0	—
LAMB :—						
British ...	1st	78 0	79 6	79 6	76 6	79 6
	2nd	76 0	74 6	73 0	70 0	74 6
New Zealand ...	1st	64 0	61 0	62 0	65 6	62 6
Australian ...	1st	60 6	56 0	57 6	61 6	58 6
Argentine ...	1st	59 6	59 0	58 6	57 6	58 6
PORK :—						
British ...	1st	79 6	70 0	76 6	71 0	76 6
	2nd	70 0	67 0	71 6	66 6	71 6
Foreign... ..	1st	71 0	65 6	67 6	64 0	—

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at
certain MARKETS in ENGLAND in October, 1914.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	15 0	14 0	—	—	15 0	14 0
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
" Factory ...	134 0	130 0	132 0	129 6	132 0	127 0
Danish... ..	120 0	112 0	116 6	109 6	121 6	114 0
French... ..	—	—	143 6	140 6	144 0	140 0
Russian ...	126 0	122 0	123 0	121 0	123 0	118 0
Australian ...	126 0	120 0	—	—	128 0	122 6
New Zealand ...	—	—	—	—	—	—
Argentine ...	—	—	—	—	125 0	120 6
CHEESE :—						
British—						
Cheddar ...	82 0	72 0	83 6	79 6	82 6	76 0
Cheshire ...	—	—	120 lb.	120 lb.	120 lb.	120 lb.
	—	—	81 0	75 0	82 0	76 6
Canadian ...	76 0	74 6	per cwt.	per cwt.	per cwt.	per cwt.
	—	—	76 0	74 0	76 6	75 0
BACON :—						
Irish (Green) ...	83 0	79 0	80 6	75 6	81 6	77 6
Canadian (Green sides)	75 0	73 0	72 0	70 0	74 6	71 0
HAMS :—						
York (Dried or						
Smoked) ...	125 6	119 0	—	—	120 0	111 0
Irish (Dried or Smoked)	—	—	—	—	105 0	96 6
American (Green)						
(long cut) ...	74 6	72 6	72 0	69 6	75 0	71 0
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	—	—	—	—	18 11	18 1
Irish ...	17 0	16 3	15 9	14 7	16 9	15 9
Danish... ..	17 4	16 4	15 0	14 4	17 2	15 9
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
British Queen... ..	76 0	62 6	50 0	45 0	72 6	62 6
Edward VII. ...	83 0	73 6	55 0	51 6	74 6	64 6
Up-to-Date ...	71 6	63 0	51 6	46 6	70 6	63 0
HAY :—						
Clover ...	—	—	95 6	73 0	91 6	83 0
Meadow ...	—	—	—	—	81 6	73 0

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 1912, 1913 and 1914.

Weeks ended (in 1914).	WHEAT.			BARLEY.			OATS.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Jan. 3...	s. d. 33 2	s. d. 30 5	s. d. 31 1	s. d. 33 3	s. d. 28 6	s. d. 26 2	s. d. 20 7	s. d. 19 10	s. d. 18 2
" 10...	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
" 17...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
" 24...	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
" 31...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb. 7...	34 0	31 0	31 0	33 2	28 10	26 7	21 4	20 1	18 9
" 14...	34 4	30 9	31 0	32 10	29 1	26 7	21 7	20 2	18 11
" 21...	34 6	30 11	31 0	32 8	28 8	26 7	21 9	20 7	18 11
" 28...	34 1	31 0	31 0	32 0	28 6	26 6	21 6	20 4	18 11
Mar. 7...	34 1	31 3	31 5	31 7	28 5	26 2	21 8	20 0	18 9
" 14...	34 0	31 1	31 6	31 2	27 11	26 0	21 8	20 2	18 7
" 21...	34 1	31 1	31 5	31 10	28 6	25 8	21 9	19 11	18 6
" 28...	34 4	31 3	31 4	30 3	27 6	25 7	21 8	19 7	18 8
Apl. 4...	34 10	31 4	31 6	30 9	27 0	25 6	21 11	19 2	18 5
" 11...	35 4	31 3	31 5	30 2	27 8	26 8	22 1	19 2	18 4
" 18...	36 7	31 6	31 7	29 11	26 11	25 4	22 4	18 10	18 4
" 25...	37 10	31 8	31 9	30 4	26 7	26 6	22 9	19 3	18 5
May 2...	38 1	32 2	31 9	30 2	25 11	26 0	23 1	19 6	18 5
" 9...	37 11	32 6	32 2	31 1	25 9	25 6	23 7	19 6	18 9
" 16...	37 8	32 10	32 7	31 2	25 4	26 3	23 7	19 9	18 11
" 23...	37 2	32 10	33 0	31 1	25 3	25 10	23 7	19 11	19 0
" 30...	36 10	32 7	33 9	30 0	26 1	26 1	23 9	20 1	19 4
June 6...	36 11	32 10	34 0	29 11	26 2	25 11	24 0	19 8	19 4
" 13...	37 0	32 8	34 1	30 8	24 7	24 11	23 10	20 2	19 8
" 20...	37 5	32 8	34 1	30 8	23 10	25 10	24 0	19 8	19 9
" 27...	37 10	32 8	34 3	30 2	24 3	25 4	23 11	19 1	20 0
July 4...	38 2	33 1	34 4	31 7	25 2	24 6	23 11	21 0	19 9
" 11...	38 3	33 4	34 2	30 2	25 10	24 9	24 1	19 4	20 0
" 18...	38 10	33 6	34 1	30 9	24 9	24 2	24 8	20 5	19 10
" 25...	38 9	33 10	34 0	30 9	24 1	24 7	23 4	20 8	19 9
Aug. 1...	38 4	34 1	34 2	28 6	24 5	25 9	22 2	20 3	19 8
" 8...	39 2	34 1	34 9	30 7	24 9	25 2	22 4	19 0	19 1
" 15...	38 2	34 3	40 3	28 3	24 7	29 4	21 8	18 7	25 1
" 22...	35 6	33 7	38 9	28 1	26 5	29 10	20 10	18 8	24 3
" 29...	34 10	32 7	36 2	28 6	29 0	30 3	20 8	17 10	23 5
Sept. 5...	35 1	31 11	36 5	29 9	30 11	30 6	21 8	17 8	23 9
" 12...	33 5	31 9	37 10	29 0	31 5	29 11	20 5	18 0	23 11
" 19...	32 7	31 7	38 3	29 6	30 9	29 5	19 10	17 11	23 8
" 26...	31 7	31 6	37 6	29 9	30 1	29 3	19 5	17 9	23 3
Oct. 3...	31 8	31 3	37 1	29 7	29 7	29 3	19 8	17 10	22 9
" 10...	31 10	31 0	36 8	30 4	29 1	28 10	19 5	17 10	22 5
" 17...	32 2	30 11	36 7	30 11	28 8	28 8	19 9	17 9	22 4
" 24...	33 1	30 7	37 2	31 6	28 7	28 7	19 10	18 0	22 5
" 31...	33 4	30 1	37 10	31 10	28 2	28 3	19 1	17 9	22 7
Nov. 7...	33 1	30 0	38 8	31 11	28 1	28 6	19 11	17 9	23 7
" 14...	32 10	30 1		31 2	27 8		19 9	17 11	
" 21...	32 1	30 4		30 11	27 5		19 11	18 1	
" 28...	31 9	30 9		30 8	27 0		19 8	18 4	
Dec. 5...	31 0	31 2		29 11	26 8		19 6	18 4	
" 12...	30 8	31 2		29 2	26 5		19 3	18 6	
" 19...	30 7	31 2		28 11	25 11		19 1	18 5	
" 26...	29 10	31 0		28 6	25 10		19 2	18 4	

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.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of October, 1913 and 1914.

	WHEAT.		BARLEY.		OATS.	
	1913.	1914.	1913.	1914.	1913.	1914.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London...	32 4	38 10	28 11	29 8	19 0	24 4
Norwich	31 3	36 9	27 10	28 3	17 4	22 9
Peterborough	29 10	36 6	29 0	29 5	17 4	22 9
Lincoln	30 2	36 1	29 7	29 11	18 6	22 3
Doncaster	29 9	35 7	27 7	27 0	18 0	21 8
Salisbury	30 8	37 7	29 0	29 4	18 1	23 0

ADDITIONS TO THE LIBRARY.

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SUPPLIES OF PIT TIMBER.

In the extraction of coal, large quantities of timber are employed for supporting the roof and sides of the excavations, as well as for tramway sleepers and many miscellaneous purposes. The average annual total coal production of the United Kingdom for the last few years is estimated at 265,000,000 tons, and the amount of pit-wood used at approximately 4,500,000 tons, or 1·7 per cent. of the total weight of coal raised.

Normal Sources of Supply.

The great bulk of the pit-wood used in this country during normal times comes from abroad, the amount of the home supplies being probably not more than 20 per cent. of the total consumption. In recent years the quantity of pit-wood imported has amounted to about 3,000,000 loads of 40 cubic feet per load. About 55 per cent. of the imports normally come from Russia, Sweden and Germany, 4 per cent. from Norway, and the remaining 41 per cent. from France, Portugal and Spain, the proportion varying a little from year to year; the imports from other countries have been relatively very small indeed.

Pit-props have been declared contraband of war by the German Government and trade with the Baltic ports has consequently been seriously hampered. In any case the seasonal pit-wood trade with Northern Europe would almost cease with the approach of winter. On the other hand supplies

from Southern Europe will probably continue to arrive so long as there is sufficient labour available to prepare the material. The Board of Trade have sent a committee to Canada to investigate the possibility of meeting the deficit from that source, but it is unlikely that such pit-wood could reach this country before February, 1915. In the meantime supplies of home-grown timber must be relied on to meet the deficiency.

Type of Material required.

The timbers chiefly in demand for pit-wood are those which combine strength with lightness. Where the roof of the mine is dangerous it is also of importance that the timbers should be of such a character that they give warning of impending movements by gradual fracture; brittle woods are in such cases unsuitable.

As a result of experiments made by Professor Henry Louis at Armstrong College,* it has been found that seasoned props have a distinct advantage in strength and durability over unseasoned props; no timber should, in fact, be used for pit-props while it still contains sap. The absence of large knots or of even slight curves is also of importance, since, when present, they form points of weakness at which an otherwise sound prop readily gives way.

The timber which comes from the North of Europe is either *Scotch Pine* (Redwood) or *Spruce* (Whitewood), and it reaches the mines in the form of clean, straight pieces, sawn into suitable lengths and devoid of bark. It is usually sold at a rate per hundred lineal feet, the price varying with the diameter of the props. The material from France and South Europe is *Maritime Pine*. In this case the timber is shipped in sawn lengths which are unpeeled, the larger sizes being sometimes rather rough from being subjected to the process of tapping for resin. This timber is used chiefly in the South Wales coal fields, where it is sold at a rate per ton.

The three species mentioned in the preceding paragraph represent the bulk of the timber used for mining purposes, but they are generally less esteemed than *Larch*. *Larch* is stronger than any of the other three timbers, is more resistant to fungus attacks and consequently better suited for permanent work, but is, on the other hand, more expensive.

Hardwoods are also used to a small extent, but in normal times the only broadleaved species in any considerable demand

* *Trans. Inst. Mining Engineers*, Vol. XV., p. 343.

is *Oak*. In case of a shortage, however, *Chestnut*, *Beech*, *Birch*, *Sycamore*, *Elm*, *Alder*, etc., will doubtless be used to a much greater extent than formerly.

Dimensions.

The extreme diameters of poles used as pit-wood are 2 in. and 13 in., but, although a good deal of slender timber is used in some districts and large timber in others, it may be said that as a general rule the minimum diameter of timber for which there is any considerable demand is 3 in., and that it is only in exceptional localities, e.g., ironstone mines, that poles of a greater diameter than 6 in. are used to any considerable extent.

Pit timber is used in lengths ranging from 1½ ft. to 18 ft. As a general rule the length varies with the diameter in the ratio of approximately one foot to one inch, but the precise dimensions depend upon the particular locality.

The sizes in greatest demand in various localities are set out in some detail below. It may be stated briefly that in coal-mining districts the greatest demand is for timber 3 ft. to 6 ft. long, although there is considerable demand for lengths as small as 2½ ft. and as large as 7 ft.

Dimensions chiefly in demand in the Principal Coal and Iron-Mining Districts in England and Wales.

District.	Diameter (in.).	Length (feet).
North of England (Tyne district)	3	3-4
Cumberland	2½-4	2-5½
*Yorkshire (Cleveland) } Baulks	6-9½	10-18
} Props	5½-9	6-15
West Yorkshire	4½-5½	3-6
South Yorkshire	2½-8	2½-9
Lancashire and Cheshire	2-7	2-7
Midland Counties (Derby, Leicester and Notts)	3-8	3-9
South Derbyshire	4-6	3½-6½
Nottinghamshire and Erewash Valley	6	6-7
Leicestershire	5-6	3½-6½
North Staffordshire	5-6	6
Cannock Chase	5-6	5-7
South Staffordshire and East Worcestershire	4-8	5-6½
Warwickshire	5-6	5-6½
Shropshire	3-6	2½-6
North Wales	3-6	3-7
South Wales and Monmouthshire	4½-5	6-9
Forest of Dean	3-6	3½-6½
Somerset	2-10	1½-10

* Ironstone Mining.

Methods of Timbering.

Some typical methods of timbering are shown in the accompanying illustrations, but it should be noted that there is no standard practice, the systems used being adapted to the special characteristics of each particular mine.

Figures 1 and 1A show a method of timbering a main gallery leading from the shaft to the coal-face. The methods employed in different mines vary considerably in detail, but the principle is the same in all. The galleries vary greatly in height and width, from, say, upwards of 6 or 7 ft. in height, and 8 or 9 ft. in width; the dimensions of the "legs" and "cap" vary accordingly. "Lagging" is frequently placed behind the "legs" and above the "cap" to prevent falls from the sides and the roof; the "lagging" is generally cut from old props, sometimes in the round and sometimes split. The timbers used for the framework of main galleries may be the ordinary woods used for pit-props, but more substantial timbers such as sawn pitch-pine, oak and larch are also used. Instead of timber, steel girders are in some mines used for "caps." Lateral galleries may be timbered in similar fashion to the main galleries, but on a smaller scale.

Figures 2 and 2A show the method of piling up "cogs" or "chocks" to support places in the roof where support of considerable strength is needed; this method is sometimes adopted for supporting the roof above the "cap" in a gallery. "Cogs" are short pieces of timber about two or three feet long; they vary considerably in diameter, being frequently about 3 in. thick, but sometimes as much as 9 in. Old pit-props and coppice wood are frequently used for this purpose.

Figure 3 shows the method of supporting the roof and coal-face by means of pit-props, "cockermegs" and "sprags." In some cases pit-props only are used. The length and diameter of the props vary with the thickness of the seam. In order to make the prop more effective a "lid" is placed upon it to provide a greater bearing surface; the "lid" is about 15 in. or 18 in. long, 2 in. or 3 in. thick and 5 in. or so wide; it is frequently made of short lengths of pit-props split in halves. Since the excavation has to be kept open for a short period only in some localities, any timbers can if necessary be used at the coal-face in such cases; in others, where this period is longer, good timber is required at the coal-face.

*Called respectively "props" and "crown-tree" in the North of England.

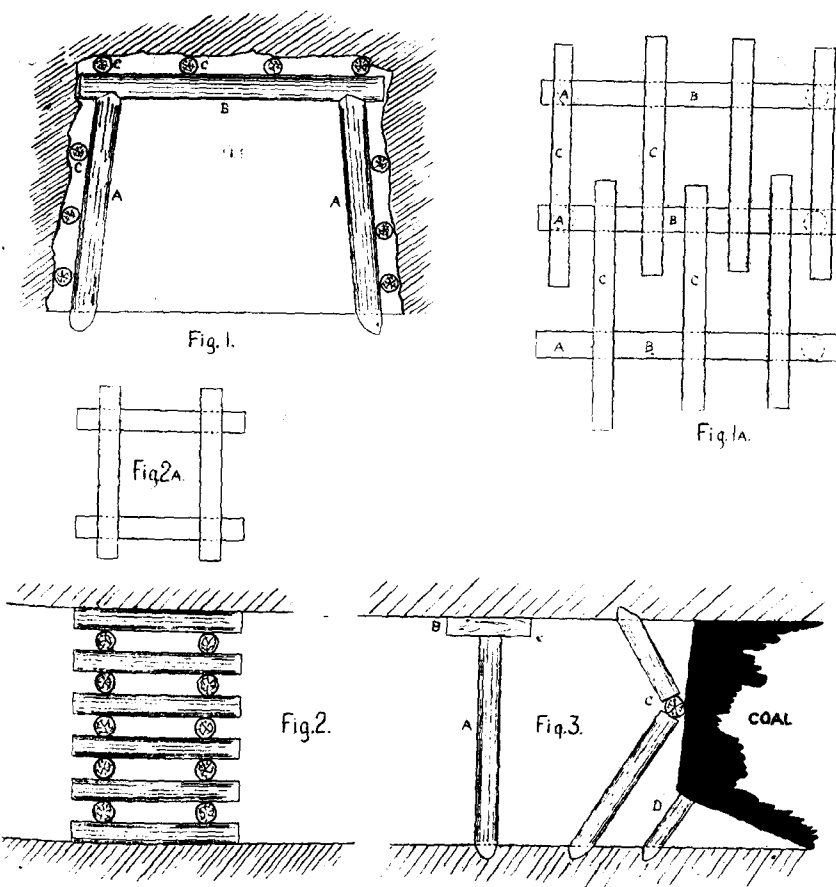


FIG. 1.	Timbering of Main Gallery (elevation)	..	..	A, A—Legs. B—Cap.
" 1A.	" "	(plan)	..		C, C—Lagging.
" 2.	Cogging (elevation).			
" 2A.	" "	(plan).		
" 3.	Timbering at Coal-face	..	..	A—Prop. B—Lid. C—Cockermeg. D—Sprag.

The dimensions of the sleepers upon which the tramlines for the "tubs" or trucks are laid vary greatly according to the width of the galleries or the particular use (*e.g.*, junctions) to which they are put. The minimum dimensions are approximately: length 3 ft., width 5 in., thickness $2\frac{1}{2}$ in.; and the maximum dimensions are approximately: length 9 ft., width 9 in., thickness $3\frac{1}{2}$ in. Sleepers are frequently cut from old pit-props; various species are employed, *e.g.*, larch, Scotch pine, spruce, oak and beech.

Miscellaneous Uses of Timber in Coal Mines.

Apart from its use for pit-props or baulks, the principal uses to which timber is put have been indicated in the preceding section—namely, for “cogs” or “chocks,” for “lids,” for sleepers, and for “tubs” or trucks. For the last-named, rough boarding is used; for “cogs,” “lids,” and sleepers, sometimes old props are used, as above stated, and sometimes new, specially-cut timber.

For the purpose of holding tubs on steep places, “sprags”* or “lockers” of wood or iron are commonly used; there is a tendency now to use iron, but wood is still largely employed. A locker is generally cut from coppice oak or other hardwoods: it is about 3 in. in diameter and about 2 ft. long, being pointed at the ends like a tip-cat.

Probable Demand and Prices.

It is not possible to estimate with any degree of accuracy the extent of the demand for home-grown pit-wood. Certain pits have had to restrict or cease operations as a result of the cessation of foreign demand, and others may have to do the same if an enhanced price of pit-wood is not accompanied by an enhanced price of coal. Moreover, an increase in the price of coal would automatically restrict the demand for coal, and consequently for pit-wood. It may be expected, therefore, that the demand for pit-wood will be considerably below the normal. On the other hand, the normal supplies will, as explained above, be very considerably curtailed, and new sources of supply are likely to be stimulated only if an increased price will compensate for the heavier freight and haulage charges. There is, therefore, every prospect of a largely increased demand for home supplies at enhanced prices; but it is desirable to warn owners of woodlands that it would not be wise to expect famine prices. In certain districts (e.g., South Wales) the high prices which were realised in the early days of the war have very sharply declined in consequence of large shipments from abroad, and elsewhere prices may be expected to follow a similar course.

The value of standing timber naturally varies with the distance over which it has to be hauled by road or rail to the point where required, and it is extremely difficult to make any generalisations on this subject. At the date of writing, the

* Not to be confused with the “sprags” used in holing—see Fig. 3, p. 781.

following prices (excluding extreme and isolated variations) have been noted:—Larch, 4d.—1s.; Pine and Spruce, 4d.—7d.; Oak poles, 1s. 3d., per cubic foot.

Generally speaking, the cost of felling will run from $\frac{1}{2}$ d. to $\frac{3}{4}$ d. per cubic foot, or, at 30 cubic feet to the ton, 1s. 3d. to 1s. 10d. per ton. Haulage to rail will vary considerably with the distance, gradient and type of road.

“Getting out” or “snigging out,” i.e., hauling from the wood to a hard road, will cost anything from 1s. per ton upwards; this, however, is usually included in the price quoted for haulage. Separately, haulage may cost from 9d. per ton-mile, this cost being proportionately higher for short distances. The total cost of felling and haulage to rail, over an average distance of four miles might, therefore, vary from 5s. 3d. per ton, upwards.

Special Railway Rates.

It has been a matter of continual objection on the part of owners of woods that railway rates have been too high to allow home-grown pit-wood to compete with imported material. The railway companies have recently had this matter under consideration, and it is understood that on receipt of special applications they are prepared to quote special emergency rates for long distances. These rates will only apply to pit-wood in length not exceeding 14 ft., consigned direct to a mine, at actual “machine weight,” station to private siding, four tons per truck.

Marketing.

The principal considerations which the vendor of pit-wood should have in view have already been indicated. It need only be added that when sending consignments of pit-wood by rail it should be remembered that timber in the rough is difficult to handle, and that pit-wood should, therefore, as far as possible, be cut into the lengths required at the pits. If this is done there will be little need to employ special railway waggons, since coal waggons (which are unsuitable for carrying rough timber in long lengths) are quite suitable for loading up pit-props cut into lengths most frequently used at the mines. Moreover, if woodland owners adopt this course they are likely to realise better prices than if the timber is sold standing.

For the convenience of timber merchants and owners of woodlands who desire to deal direct with colliery proprietors there is appended a list of local secretaries of coal and iron-mining associations in England and Wales and others who are willing to give either information as to the requirements of the

members of their respective associations, or the names and addresses of colliery proprietors who are likely to require timber.

Name.	Address.
Reginald Guthrie	.. North of England United Coal Trade Association, Coal Trade Offices, Newcastle-on-Tyne.
William Saunders	.. Midland Counties Colliery Owners' Association, Bank Chambers, London Road, Derby.
Thomas Y. Hay	.. Leicestershire Coal Owners' Association, Whitwick Colliery Company, Ltd., Coalville, Leicester.
W. Perrott	.. Shropshire Coal and Iron Trade Association, Priors Lee Hall, Shifnal.
W. North Lewis	.. Insoles, Ltd., Bute Docks, Cardiff. (Monmouthshire and South Wales Coal Owners' Association).
T. E. Watson	.. Ffaldau Collieries Co., Bute Docks, Cardiff.
Ben Day	.. West Yorkshire Coal Owners' Association, 4, Central Bank Chambers, Leeds.
W. D. Haswell	.. North Wales Coal Owners' Association, St. John's Chambers, Love Lane, Chester.
John H. Knight	.. North Staffordshire Colliery Owners' Association, Newcastle-under-Lyme, Staffordshire.
Frank Impey	.. Warwickshire Colliery Owners' Association, 37, Newhall Street, Birmingham.
John Dudley	.. South Staffordshire and East Worcestershire Coal Masters' Association, Castle Foot, Dudley.
Sir Thos. R. Ratcliffe-Ellis.	.. Lancashire and Cheshire Coal Association, 18, King Street, Wigan.
Tom P. Martin	.. Cumberland Coal Association, 19, Falcon Street, Workington.
J. Selby Gardner	.. Cannock Chase Coal Owners' Association, Cannock, Stafford.
F. Parker Rhodes	.. South Yorkshire Coal Trade Association, Rotherham.

George E. Batey	.. Somersetshire Mining Association, Kilmersdon, Bath.
W. R. Champness	.. Forest of Dean Coal Owners' Association, Rock House, Cinderford, Glos.
Oliver W. Hind	.. Notts and Erewash Valley Colliery Owners' Association, 14, Fletcher Gate, Nottingham.
Jos. S. Rowland	.. South Derbyshire District Colliery Owners' Association, 190, Station Street, Burton-on-Trent.
J. T. Atkinson	.. Cleveland Mine Owners' Association, Middlesbrough.

Sylvicultural Considerations.

The most remunerative source of material for pit-wood is from thinnings. The present rise in the price of pit-wood affords an excellent opportunity for thinning woods which need treatment, but which under former conditions could not be treated at a profit. Especially is this the case with Scotch pine woods of 30 years of age and upwards, and with coppice. The following remarks on this subject may be of service :—

(a) *General*.—Any removal of living trees from a crop tends temporarily to weaken the stability of the remainder against wind. The greater the exposure to wind the more gently (and the more frequently) should the crop be thinned so that the trees gradually extend their roots and become more windfirm. This remark applies especially to windward edges of exposed plantations.

Plantations which have remained unthinned for a considerable time should also be treated carefully. Isolation of individual trees in such cases is frequently marked in the course of a few years by dead tops and retardation in the rate of growth. Scotch pine plantations particularly are liable to damage from snow-break after heavy thinnings.

(b) *Thinning of Larch*.—As a rule larch plantations are not thinned frequently enough, with the result that the crowns of the individual trees are reduced to very small dimensions and growth becomes very slow. The presence of "whips" which sway about in light breezes are a sure sign that a larch plantation requires thinning. Such "whips" are a source of danger in a plantation, since in swaying about they injure the crowns and stems of adjoining trees and open the way for attacks of larch canker. They should, therefore, be removed, together with dead, dying and malformed trees.

The opening up of larch crops is frequently followed by a growth of weeds, and crops of 30-40 years of age, which are intended to stand for a number of years, should, where possible, be underplanted with beech; for this purpose 1,000-1,500 plants to the acre are sufficient, and two-year seedlings, of which there is an abundance in the country, can be "notched in" very cheaply.

(c) *Scotch Pine*.—As a rule, Scotch pine plantations under 30 years of age will not yield much pit-wood. A notable exception occurs with woods which have been naturally regenerated. In such cases it is not unusual to find a number of large branching "wolf" trees which, while unlikely ever to develop into timber trees, are spoiling young trees in their neighbourhood. The removal of "wolf" trees is a positive benefit to the remaining crop, and provides a very useful source of revenue. There are large areas of naturally regenerated pine in the South of England which are in need of this treatment.

Generally, pine woods require to be kept fairly dense until about the 50th year, by which time the principal height-growth is furnished and a fair length of clean stem should be obtained. Up to this time, thinnings will consist of dead, dying or misshapen trees, the cuttings being made at such intervals and with such intensity that any gaps made in the leafy canopy will close up completely in the course of 3-5 years. From the 50th year onward the thinnings may be gradually heavier, allowing the best trees to develop their crowns and build fine boles. The transition from dense to more or less open stands requires to be effected very gradually if the ill effects mentioned in paragraph (a) above are to be avoided.

The removal of dying trees is always an advantage in Scotch pine woods, since they form breeding places for the harmful pine-beetle—*Hylesinus piniperda*. (See Leaflet No. 91.)

(d) *Spruce*.—Generally speaking, the same treatment applies to spruce as to Scotch pine, except that the crop requires to be kept denser throughout.

(e) *Coppice*.—Oak, beech and chestnut coppice provide very suitable pit-wood. Smaller birch, which have not yet formed very rough bark, may also be used.

There are three methods of treatment which call for comment:—

- (i.) Simple coppicing with "storing" of standards.
- (ii.) Coppicing and subsequent replanting with young trees to form a high forest.
- (iii.) Thinning the coppice with the object of allowing the better poles to grow into timber size.

Clear cutting naturally affords the maximum amount of pit-wood, but if the area cut over be large, difficulties arise subsequently; the owner may not be able to replant at once (and immediate replanting is desirable if the young plants are not to be smothered by the vigorous new coppice shoots), and, if replanting is not done, the unremunerative coppice system has to be continued for at least another rotation.

The third method of thinning the coppice and allowing it to run on for a number of years has the advantages that considerable amounts of pit-wood may be obtained without clearing large areas, and that in a few years material of timber size will be obtained from the remaining crop. The process consists in reducing gradually the number of shoots on each stool so that in the course of a number of years only the best are left to grow into timber. The growth of these remaining stems after thinning is very rapid, provided that the thinning is not so heavy as to isolate them. Coppice woods valued at £3 or £4 per acre in the Tintern Woods have increased in value to £20-£25 per acre in the 8-10 years following this treatment.

Moist and fairly heavy soils are best suited for successful treatment. Birch or inferior timbers should be cut out where their removal will not make too great a break in the leafy canopy, and where there is an undergrowth of beech it should be carefully retained to cover the soil.

It is difficult to state, without a knowledge of the woods concerned, which of these methods should be adopted. From a silvicultural point of view the area to be clear cut should be governed by the capacity for replanting during the next two years. It is obvious, however, that with an exceptional market a combination of all three methods might prove highly satisfactory.

In addition to pit-props the smaller coppice material of 2½ in. and upwards can be worked up into "cog" wood and "sprag" wood for mining purposes.

General Remarks on Extraordinary and Emergency Cuttings in Woods.

At times like the present the value of a well-considered working scheme for woods becomes more than usually apparent. The owner is, to begin with, in possession of an accurate description of his woods and can estimate with some accuracy the quantity and location of material suitable for any purpose. By anticipating by a few years the thinning and clear

cutting laid down in the scheme, and by distributing the remaining thinnings and cuttings evenly over the rest of the working scheme period, he can make certain that the capital of his woods will remain intact. It is perfectly legitimate, from the point of view of scientific forest management, to take advantage of a temporarily high market, provided that the matter is treated in the above spirit. An example may serve to illustrate this point:—In a working plan recently compiled for the Crown Woods at Tintern, it was laid down that some 250 acres of larch plantations were to be thinned during the next five years. It is now proposed as an emergency measure to thin 150–200 acres forthwith, and thereafter 12½–25 acres annually for the succeeding four years.

Since thinning is an operation which calls for considerable experience and care, it is desirable that the marking should be placed in the hands of a capable man, and that the trees should be marked well in advance of the cutters. The trees to come out can best be marked with a spot of white paint on two sides, so that they can easily be recognised. Four to five acres per day represent the maximum area which a man can mark efficiently, since the work is very tiring.

On the whole, landowners will be well advised to abstain from drastic thinnings in their woods, especially in young crops. If a given quantity of material is required it will prove a wiser policy in the long run to meet the demand as far as possible by rational thinnings and the balance by clear cutting, even should the latter involve the sacrifice of timber which is not yet fully mature.

Provision of Technical Advice.

The Board will be pleased to provide advice as to methods of treatment to such an extent as the calls on the services of their forestry inspectors and advisory officers will permit.

In conclusion, it is desirable to impress upon owners and agents the importance of keeping woodcutters and hauliers fully employed during the winter season. The amount of labour and haulage available for woodland operations is limited, and any possible shortage in pit-wood supplies that may arise will be due, not to any lack of material in the country to make up the deficit in foreign supplies, but to the difficulty of getting the timber in good time to the pits. This difficulty can best be minimised by keeping the available men and teams steadily occupied.

THE VALUATION OF THE MANURIAL RESIDUES OBTAINED FROM THE CONSUMPTION OF FOODS BY GROWING PIGS.

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It is now a matter of common knowledge amongst farmers and valuers that the proportions of the valuable manurial ingredients (nitrogen, phosphate and potash) present in the excrements of farm animals are considerably influenced by the nature of the food consumed. In accordance with this fact, in the valuation of unexhausted manurial residues arising from the consumption of foods by stock, it is rapidly becoming a general practice to base the valuation upon the composition of the foods, the consumption of which originally gave rise to the manure. We are indebted in the first instance to Lawes and Gilbert, and more recently to Hall and Voelcker,* for the evolution of a method, suited to practical conditions, of applying the above principle in the actual practice of tenant-right valuation.

The "compensation tables" now in use in most districts are mainly based upon the tables drawn up by Hall and Voelcker in 1902, and more recently† revised by them in certain respects. These tables were based upon a careful survey of the available evidence as to the extent to which the manurial ingredients present in foods consumed by fattening bullocks are recoverable in the manure produced under the conditions of good farm practice. Strictly speaking, therefore, although "put forward . . . with a view to their utilisation in general," they can only be held to apply to the particular class of feeding and stock mentioned. This is recognised by Hall and Voelcker, and "certain special cases which from time to time have been suggested as demanding separate treatment" are discussed by them in both papers. Of these special cases only one need be touched upon here, viz., the necessity or otherwise for adapting and modifying the tables for different styles of farming, more particularly with reference to the kinds of stock by which the food has been consumed. On this latter point, Hall and Voelcker express the opinion that no satisfactory discrimination can be

* Journal Royal Agric. Soc.; Vol. 63, 1902, pp. 76–114.

† Same Journal, Vol. 74, 1913, pp. 104–119.

made, and that the need for it seldom arises in practice. Moreover, "the losses incurred in making the dung are so much greater than the differences in the proportions of the manure value of the food retained by the different classes of animals, that further differentiation is not called for."

In our intercourse with valuers, however, we have found the feeling expressed in some quarters that special discrimination should be made in the case of pigs, in view of the facts that the feeding of the pig (1) differs radically in many respects from that of other farm animals, and (2) is largely restricted to the intensive feeding of young animals during the period of most rapid growth. It is well known that in proportion to its weight the pig eats more dry substance in the form of food and voids less dung than any other class of farm animal, so that, if the scale of compensation used for cattle is to hold good for the case of the pig, a relatively high compensation value must be paid for a relatively small weight of manure. Viewed from this standpoint, the valuations have in some cases been such as to raise a doubt in the mind of the valuer as to the validity of Hall and Voelcker's Table for the special case of the pig.

On endeavouring to furnish guidance in the matter, we found that, in the literature to which we have access, the available data based upon experiments that bear upon the case are very meagre, if we except the information with regard to the retention by pigs of the nitrogen of foods which is contained in the reports by Lawes and Gilbert on their classical pig-feeding experiments carried out in 1850-60 at Rothamsted.

Of experiments in which a comparison has been made of consumption and outgo with respect to all the important manurial ingredients in the case of the pig, practically no record could be found, and this led to the experiment, the nature and results of which are outlined below.

Description of Experiment.—For the purpose of the experiment, five pigs of Large White Yorkshire breed and of precisely equal age, viz., 63 days, were drawn on June 30th from each of two litters. Although all were fed exactly alike throughout the experiment, the two groups of five animals were kept separate, in order that guidance might be obtained as to the degree of reliability of the results obtained, and upon other points of interest. In order to obtain the required number of animals it was necessary to include one female in the group subsequently referred to as Group B, but all the rest were males, castrated shortly before the commencement of the experiment. When the experiment had been in progress six weeks one of the male

pigs (No. 2 in Group B) was withdrawn owing to its unsatisfactory progress, and a female from the same litter introduced in its place, so that for the greater part of the experimental period this group was composed of three males and two females.

For the purposes of the experiment a range of three adjoining pens, entirely under cover, was used, with good brick walls and smooth concrete floors rounded off at the junctions with the walls. The floor of each pen was drained separately through a short pipe passing through the outer wall into a small sump, in which a bucket could be placed under the mouth of the pipe. The mouth of each sump was raised several inches above the surrounding ground-level, and was covered with a good wooden lid, fitting tightly into the mouth, but provided all round with a projecting rim of thin sheet zinc so that no rain could gain access to the bucket placed in the sump.

Of the three pens, two were used as living-pens for the animals, whilst the third was equipped for feeding purposes with a wooden framework, providing five separate feeding-stalls, each intended for one pig only. Each stall was provided at each end with a door that could be raised or lowered. A separate feeding-trough of galvanised iron was provided for each stall, being introduced and removed at the front, and when in use held down firmly by means of wooden battens fixed against the sides of the stall. By means of this arrangement it was possible to obtain a fairly precise record of the amount of food and water consumed by each animal.

Considerable trouble was experienced at the outset in inducing the animals to accept the system of feeding from separate troughs, but once they became accustomed to it the system worked excellently, and waste of food was reduced to a minimum.

Each living-pen was provided with a roomy wooden platform, raised about 2 or 3 in. from the concrete floor, but no litter of any kind was used at any stage of the experiment.

It was thought inadvisable to attempt to obtain a continuous record of the food-consumption and the excretion of dung and urine for the whole period over which it was desired to carry on the experiment, as the continuous confinement which this would have necessitated would almost certainly have jeopardised the satisfactory development of the animals.

The period of strict confinement was, therefore, cut down to five days in each fortnight. During these five-day periods the pigs received no food of any description other than that supplied in the trough, but on other days they were turned out on grass for a few hours each day. Preliminary experiments

demonstrated that the undigested residues from the food consumed in any one day would be completely voided within 48 hours, and this period was therefore allowed to elapse in each five-day period of confinement before any collection of dung or urine was made. The actual collection of dung and urine was thus restricted to three days in each fortnight. On these days the dung was carefully collected at frequent intervals and immediately transferred to wooden boxes—one for each pen—provided with good covers. In order to prevent loss of ammonia from the dung during the three days' storage in the boxes, it was lightly sprayed with a weak solution of sulphuric acid. The weight of dung produced each day by each group of five pigs was ascertained, and at the end of the three days the total weight in each box was checked, the contents then turned out, mixed thoroughly without delay, and carefully sampled, three samples being taken from the contents of each box. These samples were placed directly in weighed aluminium trays, weighed, dried in the steam-oven in the laboratory at the farm, and finally reweighed. In this way a triple determination of the proportions of moisture and dry matter in the dung of each group was made. The three portions of dried dung from each group, after weighing, were united and ground up for the purposes of the further necessary chemical analyses.

The collection of the urine during the experimental periods was effected as explained above in large buckets placed under each drainage outlet. The amount collected each day from each group was determined, and a composite sample for the three days was made up by transferring to a bottle a definite fraction of each day's accumulation. A little weak sulphuric acid was added to the sample for the purpose of preservation until the determination of its nitrogen-content had been completed.

It will be noted that the methods adopted for the collection of dung and urine were much cruder than those employed in the more precise digestion experiments in which dung and urine are collected directly in special receptacles fixed on or under each animal. From rough tests made in the experimental pens it was estimated that the amounts of excreta collected were probably from five to ten per cent. below those actually voided by the animals. The object, however, was simply to secure a more efficient collection of the excreta than is attainable under the very best conditions of ordinary farm practice, and this was obviously secured by the methods adopted.

The pigs were fed twice daily, viz., at 8.30 to 9.30 a.m. and at 2.30 to 3.30 p.m. For each meal the food for each pig was

weighed out carefully into the trough and thoroughly mixed with a measured volume of water. The allowance of food was carefully adjusted to the appetite of the pig, and only rarely was any food left unconsumed. On these occasions the amount of unconsumed food was determined and allowed for in the records.

As only one feeding-pen with five stalls had been prepared, the two groups were fed in succession, the first group being returned to its living-pen as soon as the meal was completed. Any dung deposited in the stalls or urine draining from the feeding-pen during a meal was carefully removed to the appropriate box or bucket before the next group of pigs was admitted to the stalls.

The method of preparing the food varied somewhat during the course of the experiment. At the outset the food was weighed into the trough and mixed with the water immediately before the meal, but comparison made during the experimental period gave indication that a better utilization of the food was attained when the dry food and water were mixed together several hours before feeding. This practice was therefore followed for the greater part of the period over which the experiment extended.

Samples were taken from each consignment of each food-stuff used, and their content of nitrogen, phosphoric acid, potash and lime was determined.

The general effects of the feeding were ascertained by means of weekly weighings of each animal.

The experiment was commenced on 30th June, and continued until 8th December, 1913, a period of 21 weeks, including twelve three-day periods, when collection of excreta took place. The experiment would have been continued for a few weeks longer but for the contraction of chill by some of the animals in early December, which led to derangement of the digestive organs. The necessity for dispensing with litter throughout the experiment might have led to a similar termination at an earlier stage, but for the exceptionally mild autumn of 1913.

Weights of Pigs. At the outset the weights of the pigs in Group A ranged from 23 lb. 6 oz. to 28 lb. (average, 25 lb. 8 oz.), and in Group B from 21 lb. to 30 lb. 10 oz. (average, 26 lb. 2 oz.). On 8th December the corresponding data were

	Group A	Group B
Group A	168 lb. 11 oz. (average, 25 lb. 8 oz.)	175 lb. 11 oz. (average, 26 lb. 2 oz.)
Group B	175 lb. 11 oz. (average, 26 lb. 2 oz.)	168 lb. 11 oz. (average, 25 lb. 8 oz.)

The average weekly gain of 6½ lb. per pig over the period of 23 weeks thus shown for each group is sufficient evidence of the satisfactory conditions attained in the experiment.

The extremes in the average weekly gains in live-weight per pig were from 1 lb. 11 oz. to 12 lb. 14 oz. in the case of Group A, and from 1 lb. 7 oz. to 12 lb. 2 oz. in the case of Group B. The rate of increase in live-weight was by no means uniform in either group.

Rations.—The foodstuffs used in the course of the experiment were wheat-bran and sharps, pea meal and barley meal. During the last eight weeks of the experiment a weighed small quantity of finely-ground chalk was added at each meal. The general character of the feeding is indicated below, the quantities stated being approximate :—

	Daily ration per pig.					
	Bran.	Sharps.	Pea Meal.	Barley Meal.	Chalk.	Water.
1st four weeks ..	oz.	oz.	oz.	oz.	oz.	qt.
5th to 15th week	3½—7	7—16	—	—	—	2—3
16th to 23rd week	7—9	16—35	2—18	—	—	3—5
		35—50	18—35	5—12½	1—4	5—6

The weekly consumption of dry food rose steadily from 4·6 lb. to 37 lb. per pig, and of water from 35 lb. to 105 lb.

Comparison of Food and Manure.—The composition of the foodstuffs used, with respect to the chief manurial ingredients, is indicated below, the range given in each case referring to the different consignments sampled :—

Food.	No. of Samples.	Nitrogen.	Phosphoric Acid.	Potash.	Lime.
		Per cent.	Per cent.	Per cent.	Per cent.
Bran ..	5	0·26—0·30	1·15—1·09	1·10—1·05	0·19—0·25
Sharps ..	5	0·27—0·29	1·05—1·00	0·90—1·05	0·20—0·15
Pea Meal ..	5	0·26—0·30	0·97—1·05	1·01—1·05	0·20—0·15
Barley Meal ..	5	1·06—1·21	0·67	0·33—0·08	0·04—0·05

The water used was very hard, and contained 18·5 parts per 100,000 of lime and 3·2 parts per 100,000 of potash, together with a trace of nitrogenous matter.

The weights of dung per pen collected during the three-day experimental periods ranged from 12 lb. 10 oz. to 65 lb. 6 oz. in the case of Group A, and from 11 lb. 6 oz. to 61 lb. 14 oz. in the case of Group B.

The corresponding data for the urine ranged from 37 lb. to 138 lb. in the case of Group A, and from 32 lb. to 135 lb. in the case of Group B.

The percentage of dry matter in the dung rose fairly steadily as the food supply was increased, the range being from 16·7 per cent. to 22·6 per cent. in the case of Group A, and from 17·8 per cent. to 24 per cent. in the case of Group B. The variation in the composition of the dry matter is set out below, together with that of the urine :—

	Nitrogen.		Phosphoric Acid.	
	Pen A.	Pen B.	Pen A.	Pen B.
	Per cent.	Per cent.	Per cent.	Per cent.
Dung	2·25—2·61	2·15—2·15	2·4—3·17	2·52—4·10
Urine	0·81—0·46	1·51—1·20	0·60—1·15	0·56—1·89

	Potash.		Lime.	
	Pen A.	Pen B.	Pen A.	Pen B.
	Per cent.	Per cent.	Per cent.	Per cent.
Dung	0·70—1·26	0·70—1·14	1·21—4·60	1·58—4·68
Urine	0·06—0·10	0·15—0·552	0·11—0·060	0·10—0·048

A comparison of the manurial ingredients taken by the animals in their food and the recovery of ingredients in the excreta is given in the following tables :—

Date	GROUP A.			GROUP B.			AVRR-AGE.
	Weight consumed in food.	Weight recovered in Excreta	Per cent. of whole	Weight consumed in food.	Weight recovered in Excreta	Per cent. of whole	Per cent. of whole recovered in Excreta
Nitrogen.							
1913.	lb.	lb.	Per cent.	lb.	lb.	Per cent.	Per cent.
July 13-15 ..	0·26	0·13	50	0·26	0·12	46	48
" 20-22 ..	·34	·16	47	·34	·14	41	44
Aug. 3-5 ..	·50	·21	42	·50	·24	48	45
" 17-19 ..	·72	·30	42	·58	·32	55	48
Aug. 31-Sept. 2 ..	·93	·40	43	·93	·41	44	44
Sept. 14-16 ..	1·25	·55	44	1·25	·57	46	45
" 28-30 ..	1·40	·67	48	1·40	·67	48	48
Oct. 12-14 ..	1·37	·84	61	1·37	·90	66	64
" 25-27 ..	1·56	1·08	69	1·56	1·01	65	67
Nov. 9-11 ..	1·62	1·01	62	1·61	0·96	60	61
" 23-25 ..	1·84	1·03	56	1·84	0·98	53	55
Dec. 6-8 ..	2·03	1·37	67	2·03	1·38	68	68
Average ..			56·1			56·3	56·2

GROUP A.				GROUP B.				AVR. AGR.
Date	Weight consumed in Food	Weight recovered in Excreta	Per cent of whole	Weight consumed in Food	Weight recovered in Excreta	Per cent of whole	Per cent of whole recovered in Excreta	
Phosphoric Acid								
1913.	B.	B.	Per cent.	B.	B.	Per cent.	Per cent.	
July 13-15	0.17	0.11	65	0.17	0.11	65	71	
" 20-22	.21	.15	65	.24	.16	67	66	
Aug. 3-5	.32	.155	48	.32	.20	63	55	
" 17-19	.42	.24	57	.34	.26	76	66	
Aug. 31-Sept. 2	.78	.58	74	.79	.53	67	71	
Sept. 14-16	.75	.53	71	.75	.51	68	69	
" 28-30	.86	.60	70	.86	.53	62	66	
Oct. 12-14	.93	.47	51	.91	.51	55	55	
" 25-27	1.02	.61	60	.91	.51	55	55	
Nov. 9-11	1.00	.49	49	1.02	.52	51	55	
" 23-25	1.18	.90	76	1.17	.81	69	68	
Dec. 6-8	1.15	.74	65	1.15	.81	70	69	
Average			57.7			57.4	57.5	
Potash								
July 13-15	0.13	0.10	77	0.14	0.08	57	67	
" 20-22	.17	.15	88	.18	.12	67	77	
Aug. 3-5	.25	.20	80	.25	.15	60	70	
" 17-19	.34	.28	82	.27	.25	93	87	
Aug. 31-Sept. 2	.45	.32	71	.45	.30	67	69	
Sept. 14-16	.57	.51	89	.56	.49	88	88	
" 28-30	.63	.57	90	.63	.56	89	90	
Oct. 12-14	.66	.62	94	.65	.57	88	91	
" 25-27	.68	.67	99	.68	.64	94	96	
Nov. 9-11	.69	.68	99	.69	.67	97	98	
" 23-25	.70	.65	93	.70	.64	91	92	
Dec. 6-8	.90	.70	78	.90	.70	78	78	
Average			88.5			85.1	86.8	
Lime								
July 13-15	0.15	0.04	27	0.15	0.05	33	30	
" 20-22	.16	.11	69	.16	.11	69	75	
Aug. 3-5	.24	.16	67	.24	.11	46	46	
" 17-19	.25	.15	60	.20	.14	70	64	
Aug. 31-Sept. 2	.33	.15	45	.33	.17	51	50	
Sept. 14-16	.42	.23	55	.42	.21	50	50	
" 28-30	.49	.29	59	.49	.26	53	53	
Oct. 12-14	.49	.25	51	.49	.25	51	51	
" 25-27	.70	.38	54	.70	.32	46	46	
Nov. 9-11	.78	.61	78	.78	.51	65	65	
" 23-25	.67	.46	69	.67	.46	69	69	
Dec. 6-8	.49	.29	59	.49	.35	71	65	
Average			65.6			64.2	64.9	

It will be observed that, taking into consideration the character of the experiment, the results obtained with each group show a close general agreement, the average percentage of manurial ingredients recovered being practically the same for each group.

It will be further observed that, taking the average of both groups, the percentage of the food *nitrogen* recovered ranged from 44 in the earlier stages to 68 in the later stages, a curiously sudden increase taking place in mid-October. The recovery of *phosphoric acid* ranged from 45 to 71 per cent., without showing any marked regularity, beyond a tendency to *fall* from the middle of October onwards, being in marked contrast to the nitrogen in this respect. The phenomenon is a curious one, but is clearly defined in the records of each group. The proportion of *potash* recovered ranged from 67 to 98 per cent., and of *lime* from 30 to 75 per cent., the proportion of the former recovered tending to increase as the animals progressed in growth.

Taking the average of the whole period, during which the pigs advanced in age from 4 to 31 weeks, of the fertilising matters present in the food, there was recovered in the fresh excreta:

Nitrogen	50 per cent.
Phosphoric Acid	58
Potash	87
Lime	65

In ordinary practice the fresh excreta would have been transferred to the manure heap and tank, where further losses, especially of nitrogen, would take place even with the most careful management. A survey of the experimental evidence available at the time led Hall and Vockler* to conclude that even under the very best conditions, where manure is made and stored under the animals producing it, the loss of nitrogen, over and above the proportion which is retained by the animal in increased live-weight, will commonly amount to between 30 and 40 per cent. of the nitrogen fed. This would imply, in the case under discussion, where 44 per cent. of the nitrogen of the food was already missing from the fresh excreta, that by the time the manurial residues were applied in the field, they would contain probably only from 16 to 26 per cent. of the nitrogen originally present in the foods consumed.

There need be little loss from the manure heap and tank of the phosphoric acid and potash present in the fresh excreta if precautions are taken against loss by drainage elsewhere than into the liquid manure tank. A little mechanical loss is inevitable, and is probably not over-estimated at 5 to 10 per cent.

On the basis of the foregoing experimental data and considerations, it is concluded that in assessing the compensation to be allowed for the unexhausted manurial residues arising

* Loc. cit., p. 92.

from the foods consumed by the growing pigs throughout the whole experiment, these residues ought not to be credited with more than 25 per cent. of the nitrogen, 50 per cent. of the phosphoric acid, and 80 per cent. of the potash present in the foods.

Hall and Voelcker, dealing more specifically with the case of fattening cattle, credit the manurial residues with 50 per cent. of the nitrogen and 75 per cent. each of the phosphoric acid and potash.*

In the experiment here recorded, the amounts of each manurial ingredient present in the food consumed per pig were as follows:—

Nitrogen	11.74 lb
Phosphoric Acid	8.97 ..
Potash	6.22 ..

If, for the purpose of valuation, the "unit values per ton" suggested by Hall and Voelcker are adopted, viz., nitrogen 12s. (in later paper, 15s.), phosphoric acid 3s., and potash 4s., the following comparison will be arrived at:—

Estimated Compensation Allowance for Manure Value of Foods Consumed per Pig in Period of Experiment.

Calculated as suggested by Hall and Voelcker.		Calculated from Experimental Data, with Deductions as indicated in text.	
Nitrogen at 12s.	Nitrogen at 15s.	Nitrogen at 12s.	Nitrogen at 15s.
s. d. 5 5	s. d. 6 4	s. d. 3 4	s. d. 3 9

From the data obtained in this experiment, therefore, the compensation allowance would be assessed at only three-fifths of that deduced from Hall and Voelcker's table. The latter value would only be reached by applying the freshly-voided excrements directly to the land.

It must be borne in mind that the data here given were obtained with young, rapidly-growing pigs. The case of the adult pig is different, and would appear to be adequately served by Hall and Voelcker's table. Our data furnish evidence of this, as may be seen in the following summary, in which the results obtained are grouped into three stages, in order to bring out more clearly the improvement in the recovery of the

* In their earlier Paper the whole of the potash is credited to the manure.

manurial ingredients—phosphate excepted—with advancing age of the pigs:—

Age of Animals.	Percentage of Fertilising Ingredients of Food Recovered.		
	Nitrogen.	Phosphoric Acid.	Potash.
Months.	Per cent.	Per cent.	Per cent.
2 4	46	64	77
4 6	51	64	86
6 8	63	51	91

It is clear that from the last stages of the experiment onwards (with pigs aged 8 months and more) the degree of recovery of manurial ingredients would have been practically up to the standards on which Hall and Voelcker's table is based.

One further point of interest in this connection may be noted, viz., the distribution of the manurial ingredients recovered between solid and liquid excreta (dung and urine). One of us has elsewhere* drawn attention to the necessity for careful conservation of urine if the commonly accepted "manure values" of food are to be realised in practice. This is fully borne out by the records of the experiment here under review, as the following data clearly show:—

	Recovered from 100 Parts consumed in Food.		The same expressed as Percentage of Total Amount recovered.	
	In Dung.	In Urine.	In Dung.	In Urine.
	Parts	Parts	Per cent.	Per cent.
Nitrogen	19.6	36.7	35	65
Phosphoric Acid	44.5	13.0	77	23
Potash	15.7	71.2	18	82
Lime	59.7	5.4	92	8

Expressed in different fashion, these data indicate that of the "manure value" assessed above at 3s. 4d. (per pig), practically 2s., or 63 per cent. of the total, represented material voided in the form of urine.

It is realised that the experiment has been carried out on a very limited scale, and hence no generalisations can be based on the results. Any conclusions advanced must be regarded as having application only to the results themselves. From the

* Crowther, *Trans. Highland and Agric. Soc. of Scotland*, XXII. (1910), 125.

close agreement between the results obtained from the two groups, there is good reason to expect, however, that the results would be substantially confirmed in more comprehensive trials.

The writers wish to express their indebtedness to Mr. H. Marshall, past student of the Department of Agriculture of the University of Leeds, for the care and skill shown by him in the feeding and general management of the pigs, and in the collection and preparation of the excreta. The whole success of the experiment obviously hinged upon the efficient discharge of these duties.

Professor Seton kindly assisted in making the general arrangements for the experiment, and in other directions.

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THE PREVENTION OF LOSS FROM MANURE HEAPS IN WINTER AND EARLY SPRING.

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THE management of the manure heap is one of the most important items in the business of the farm, and it is one in which a considerable degree of improvement is still possible. It is estimated that on an average nearly half the value of the yard manure made on an ordinary farm is lost; how much that represents in a particular case may readily be worked out by the farmer, and it would not be difficult to show that the aggregate loss to British agriculture is enormous. The imperative necessity for discovering the causes of the loss and the best methods of reducing it is therefore clear.

The problem has a scientific side which is of even greater importance. Agricultural experts have long known that the efficiency of nitrogenous manuring, *i.e.*, the return obtained for a given application of nitrogen, in whatever form, is not as high as might be expected, there being a considerable margin of unaccounted loss. This has for some time been under investigation at Rothamsted and has proved a very difficult problem, but it has gradually become evident that the key would most likely be found in a study of the losses from the manure heap.

Thus, both practical and scientific considerations pointed to the necessity for making a thorough investigation of the manure heap, and the Hon. Rupert Guinness very kindly provided the means with which to carry on the work. The investigation is still far from complete, but it has already revealed an important source of loss which has not hitherto been adequately recognised, and a brief account of the results at present ascertained is therefore given here.

In the first place, a careful distinction must be drawn between the losses *in making* and the losses *in storing* farmyard manure. No one has yet discovered any method of *making* farmyard manure without loss, and British experiments all agree in showing that this loss amounts to about 15 per cent. under the best conditions,* when the manure is made from fattening beasts in a stall and is left undisturbed and unaffected by drainage until it is carted out. It is certain that the loss occurs in the stall and not in the animal. For the present this 15 per cent. loss must simply be tolerated, for the sufficient reason that no means of overcoming it is known.

The second loss, that on storage, has proved more amenable to treatment, and a heap is described below in which during the three months (January to April) such loss was practically *nil*, the loss of nitrogen in particular being too small to detect. It is also shown, however, that two other heaps stored for the same period in a usual way lost considerably, one 25 per cent. and the other 33 per cent. of its nitrogen, *in addition to the loss incurred in making*. Thus, it is possible to effect a considerable improvement, and there is no real reason why loss should take place at all during storage if a method can be devised consistent with the exigencies of farm work.

The experiments have been confined entirely to the losses in *storing* the heap. These can be traced to three causes—rain-fall, moving the heap, and dissipation of valuable nitrogenous compounds in the form of gas. Heaps have been stored in different ways at Rothamsted and on the Hon. Rupert Guinness's Emigration Farm at Woking; concurrently, a good deal of laboratory investigation has been necessary which, however, need not be described here.

Losses in Heaps left in the Open.—Two heaps were put up in the open, one at Rothamsted and one at Woking—the former was left from January to April, 1914, and the latter from November, 1913, till May, 1914; they were then resampled for analysis. The loss was found to be considerable. The dry matter, *i.e.*,

* Some actual losses were—13 to 18 per cent. (J. A. Vockler, at Woburn), 14 to 17 per cent. (T. B. Wood, at Cambridge), and 15 per cent. (E. J. Russell and G. J. Goodwin, at Woking).

the actual substance of the heap apart from water, suffered losses of 20 and 30 per cent. respectively; the nitrogen, the most costly part of the heap, diminished by 24 and 33 per cent. respectively; and even the phosphates, though they are not very soluble, also fell off by 8 per cent. The actual figures are:—

	At Rothamsted.			At Woking.		
	At start.	After three months.	Percentage loss.	At start.	After six months.	Percentage loss.
Weight of heap, lb.	3,360	2,680	20.2	4,200	2,443	41.8
Weight of dry matter, lb.	609	484	20.5	985	684	30.6
Weight of nitrogen—						
(a) easily available, lb.	3.2	1.3	15.4*	6.0	2.0	21.6*
(b) less available, lb.	9.1	8.0	9.0*	12.5	10.3	11.9*
Total, lb.	12.3	9.3	24.4	18.5	12.3	33.5
Phosphoric acid, lb.	—	—	—	12.1	11.1	8.3

It will be noticed that the loss of nitrogen falls most heavily on the easily available portion, the ammonia and the amides, while the less available portion is not so badly affected. The value of the loss in nitrogen is not less than 1s. 6d. per ton of manure in three months' exposure at Rothamsted, and 3s. per ton in the six months at Woking.

Now, this loss is partly due to rainfall and partly to dissipation as gas, and another experiment was made to ascertain what share each of these factors had in the matter.

Losses in Heaps under Cover.—A similar heap was put up under cover so that no rain could fall on it; any loss resulting was, therefore, due solely to dissipation as gas. The results were:—

	At Rothamsted.			At Woking.		
	At start.	After three months.	Percentage loss.	At start.	After six months.	Percentage loss.
Weight of heap, lb.	2,800	2,316	17.3	4,480	2,788	37.8
Weight of dry matter, lb.	518	479	7.5	1,038	763	26.5
Weight of nitrogen—						
(a) easily available, lb.	2.8	2.1	6.9	4.3	3.7	3.4
(b) less available, lb.	7.4	7.4	Nil.	13.5	12.7	4.5
Total, lb.	10.2	9.5	6.9	17.8	16.4	7.9
Phosphoric acid, lb.	—	—	—	14.2	14.2	Nil.

* In this and subsequent tables the loss, both of easily available and less available nitrogen, is reckoned as a percentage of the *total* weight of nitrogen at the start.

The loss of dry matter at Rothamsted in this case was only 7.5 per cent., as compared with 20.5 per cent. when the heap was exposed in the open, whilst the loss of nitrogen fell from 24.4 to 6.9 per cent. At Woking the loss of nitrogen fell from 33.5 per cent. in the open to 7.9 per cent. under cover, but the dry matter figures differ from those at Rothamsted, the loss being 30.6 per cent. in the open and 26.5 under cover. The loss of phosphoric acid was reduced to nothing. Both at Rothamsted and at Woking there was a great improvement as far as nitrogen was concerned, and the experiment shows that *rain is the most potent source of loss in a manure heap*, more nitrogen being lost in this way than by dissipation as gas.

Finally, a heap was put up to ascertain what loss took place when rain was kept off and gas dissipation was prevented as far as possible by compacting the heap. The results were:—

	At Rothamsted.		
	At start.	After three months.	Percentage loss.
Weight of heap, lb.	3,360	2,878	14.3
Weight of dry matter, lb.	642	614	4.4
Weight of nitrogen—			
(a) easily available, lb.	3.4	2.9	—
(b) less available, lb.	8.5	9.0	—
Total, lb.	11.9	11.9	Nil.

The loss of nitrogen was in this case *nil*, and the dry matter showed only a small diminution. The result is of interest in two ways: it shows that the general line of the experiment was sound, and also that *the loss on storage can be prevented by compacting the heap and keeping it under cover.*

The Action of Rain.—The next step was to discover the action of rain. This is of very great importance, and from the scientific point of view the experiments are not sufficiently advanced for complete discussion. Already, however, a few points have begun to emerge with sufficient distinctness to indicate the general outlines of the matter. It has become evident that the action of rain is something more than a mere washing away of soluble material. This was proved by putting up a heap under cover and watering it daily with a watering can fitted with a rose, but never adding enough water to cause any perceptible increase of drainage from the heap as compared with an adjacent unwatered heap. Proof that no leaching took place is found in

the circumstance that the loss of dry matter was no greater in the watered than in the unwatered heap, and was very much less than in the heap exposed in the open. The results in the case of this watered manure heap were as follows :—

	At Rothamsted.		
	At start.	After three months.	Percentage loss.
Weight of heap, lb. . . .	2,800	2,521	10.0
Weight of dry matter, lb. . .	533	506	5.1
Weight of nitrogen—			
(a) easily available, lb. . .	2.6	1.9	6.8
(b) less available, lb. . . .	7.7	7.0	6.8
Total, lb.	10.3	8.9	13.6

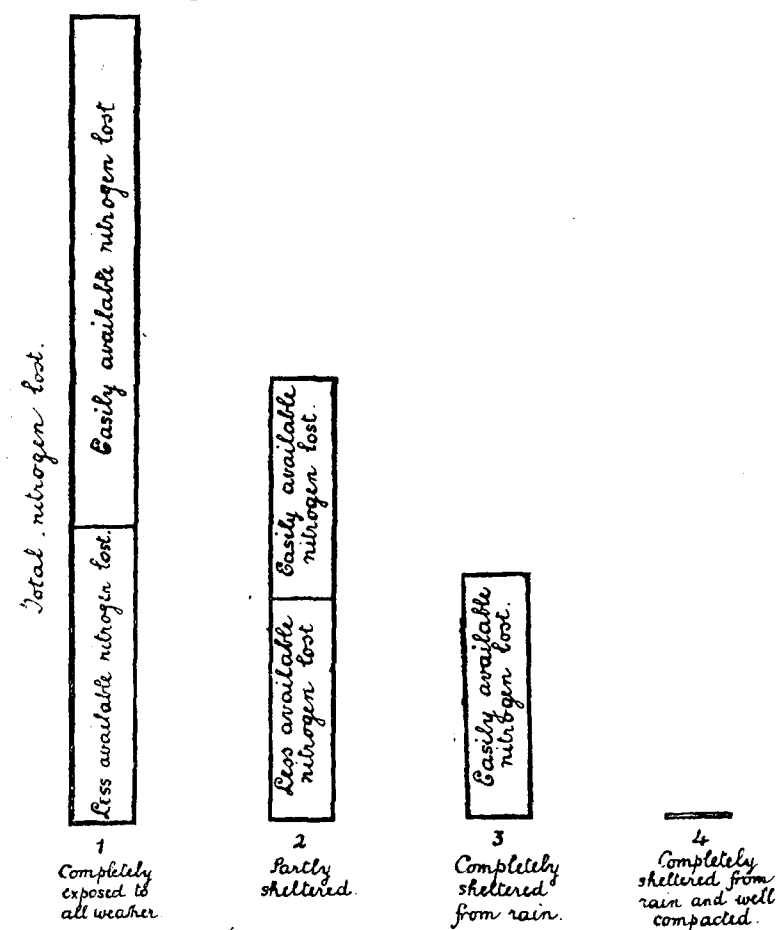
Here, the loss of nitrogen was double that incurred in the unwatered heap, in spite of the fact that there was no appreciable increase in drainage. The losses were, therefore, not due to the washing out of soluble matter. The question arises : How were they caused ?

For a long time it has been thought that a large part of the loss from a manure heap is due to volatilisation of ammonia ; and the farmer has been advised that he could reduce this considerably either by adding “ fixers,” such as superphosphate, kainit, &c., or by pumping back the drainage on to the heap so as to keep it moistened ; by this plan the ammonia is retained in solution and its volatilisation is prevented. Numerous experiments have shown the futility of adding fixers ; no reduction of loss could ever be demonstrated when the method was tested on a farm scale and the practical farmer quite rightly never took kindly to the idea of using them. But the pumping back of the drainage has been to some extent adopted, and on not a few farms pumps have been installed in the yards for the purpose. Our experiments indicate that as a means of reducing the loss from the heap this method also is not a success.

Some volatilisation of ammonia undoubtedly takes place, but the failure of “ fixers ” and the result of the watering method show that it is not the sole or even the main cause of loss. Our experiments have indicated the possibility of a very interesting action quite different from volatilisation of ammonia and yet resulting in a dissipation of nitrogen compounds as gas. They have shown that nitrates may be produced in the outside of a heap but not in the inside, and, moreover, that any nitrate washed inside by the rain rapidly decomposes with loss of

nitrogen. It is not necessary that anything shall be washed out of the heap : it suffices that the nitrate shall be washed a short way down and the decomposition soon becomes complete.

Thus, the old view that loss is due to volatilisation as ammonia can no longer be regarded as accurate, and we can see why some of the conservation methods that ought to have worked have failed in practice : they were conceived on a wrong basis.



LOSS OF NITROGEN FROM MANURE HEAPS VARIOUSLY EXPOSED TO WEATHER.

It now appears that rain is the great enemy, causing loss even when nothing is draining away from the heap, and, of course, more serious losses when visible drainage occurs. In order to save the heap as much as possible it must be protected from rain. The saving is seen in the above diagram, in which the losses from four heaps are illustrated ; as the protection from

rain increases, so the losses diminish, till finally, they become *nil* in a heap protected against rain, and also compacted.

Although we can find no evidence that the pumping of liquid manure on to the heap reduces the loss of nitrogen from the heap, we must point out that the method has other merits. It ensures that the drainings shall be kept, and they can usefully be diluted and applied as liquid manure, or, where this is impracticable, they may be pumped on the heap just before it is applied to the land so that there is no time for decomposition to take place. We have no reason to suppose that any great loss would then occur.

Effect of Moving the Heaps.—It has already been demonstrated that every disturbance of a manure heap entails loss, and our experiments confirm the results obtained by earlier workers. At the end of three months, in April, the Rothamsted heaps were all thoroughly turned over to be sampled for analysis, and were then set up again and left for another three months till July, when they were once more turned over for analysis. It was found that the disturbance in April set the whole chain of processes working, and the losses in the second period of three months were very marked. The temperature was higher, and this, of course, facilitated loss, but the rainfall was lower. Where the conditions change in this way it is impossible to assign the blame very exactly, but it seems clear that the shifting of the heaps was a very potent cause of loss. The actual losses incurred after moving were :—

	Heap fully exposed to rain.	Heap partly exposed, watered artificially.	Heap completely sheltered.	
			Not compact.	Compact.
Loss of dry matter, per cent.	13.23	11.6	24.3	8.6
Loss of nitrogen—				
(a) easily available "	6.6	11.5	20.3	13.2
(b) less available "	3.4	1.0	7.4	0.7
Total, per cent. "	10.0	12.5	27.7	13.9

The cause of this further loss is not yet established, and hence it is impossible to suggest methods for overcoming it, other than that the heap should not be disturbed more than necessary.

Conclusions.—The loss on storage of farmyard manure can be prevented altogether under very favourable conditions, while it may be considerable when the heap is neglected.

The losses arise from three causes—(1) exposure to rainfall, (2) failure to compact the heap, and (3) disturbance of the heap.

Exposure to rainfall proves to be more serious than is usually recognised. Rain causes loss quite apart from the washing away of soluble material, and, therefore, a farmer cannot argue that his manure heap is safe from loss simply because there is no visible drainage of black liquid. The experiment also shows that the pumping of liquid manure on to a manure heap does not reduce loss from the heap.

The question therefore arises : Can more efficient protection against rain be given to manure heaps ? Admittedly, there are many difficulties in the way, since manure has to be carted out during winter in readiness for the spring dressings and set in heaps placed where it will be most convenient for the rush of work in spring. In view of the loss by rain, however, it is strongly urged that all possible precautions should be taken to protect the heap from rain as much as possible. In the experiments recorded above, three months' exposure to weather caused a loss of value of 1s. 6d. per ton, while six months' exposure caused a loss of 3s. per ton. It is easy to realise how serious the loss becomes when large quantities of manure are concerned, even if, as is likely, the loss from a large heap is relatively less than from a small one. The best methods of protection from rain have still to be worked out ; there is some objection to a thick layer of earth, even if it proved effective, but there should be little difficulty in finding some suitable device. This article has dealt mainly with winter and spring storage. However efficient the shelter, the heaps did not during this period become dry enough for " fire fang " to set in, nor would this be likely to happen during these particular months. Most farmers now recognise that the heap must not be disturbed more than is absolutely necessary.

The need for compacting the heap is also generally realised, and the facts given show that the best results are attained by a combination of this method with efficient shelter from rain.

SUBSTITUTES FOR OATS IN FEEDING FARM HORSES.

MANY farmers, especially in the north and north-west of England, use no concentrated feeding stuff except oats in feeding their horses, and in districts which grow oats well there is no better horse corn, and frequently there is none cheaper. At present prices, however, the farm horse's average daily ration of 14 lb. of oats is worth 1s. 2d., and is much too expensive. It should, therefore, be replaced by cheaper feeding stuffs, so that all saleable oats may be marketed. The grain has a special value for military purposes, while it is also desirable that so useful a bread corn should be largely converted into human food.

The Feeding of the Farm Horse.—During the winter months an ordinary farm horse should receive a daily ration of about 16 lb. of digestible food (organic matter), which should include about 1½ lb. of flesh-forming food (albuminoids). When the horse is on ordinary winter work rather more than half of the total ration should come from grain and other concentrated feeding stuffs, and rather less than half from hay and straw. In a ration of 14 lb. of oats and 18 lb. of hay, the proportion would be 8½ lb. of digestible food from the grain and 7½ lb. from the fodder. When work is hard the grain ration should be increased so as to give about 10 lb., and when light reduced to give about 6 lb. of digestible food per day, the hay and straw rations being correspondingly reduced to give from 6 to 7 lb. of digestible food in the former case, and increased to give about 9 lb. in the latter. A horse on light work not only needs less food but has more time to eat, and can therefore subsist to a greater extent on straw than a hard-worked animal. When farm horses are being driven hard, as in the harrows at seed time, or when they have long distances to go by road, a grain ration, supplying as much as 12 lb. of digestible food, may be fed with advantage.*

The foregoing explanations have been given because in what follows it is proposed to take 14 lb. of oats as a standard grain ration, and to suggest cheaper substitutes. The quantities of the substitutes to be fed should vary with the work as above described. It is assumed below that the coarse fodders consist chiefly of oat straw when work is light and chiefly of hay when it is heavy, and that if the supply of hay is scanty a few pounds of swedes or other roots will be available.

* Further information about the properties of feeding stuffs and the compounding of rations will be found in Leaflets No. 74 and No. 79, and in Special Leaflet No. 8, which may be obtained free on application.

Roots are especially useful when barley straw, or inferior oat straw, must be used.

Prices and Composition of Concentrated Foods.—The table given below shows :—

(1) The approximate prices at which oats and certain other feeding stuffs can be purchased at the present time in the larger market towns (the relative prices of the feeding stuffs vary somewhat in different markets in any one week, and under existing conditions are liable to vary much more than usual from week to week, so that before supplies of the substitutes for oats mentioned in this article are ordered, the prices should be compared with those here given, and allowances made where necessary) ;

(2) The cost of 14 lb. of oats and of certain possible substitutes ;

(3) The approximate weight of digestible food (digestible organic matter) ; and

(4) The approximate weight of digestible flesh-formers (albuminoids) present in 14 lb. of each of the feeding stuffs.

Feeding Stuff.	Approximate Price.	Fourteen pounds Feed would approximately—		
		Cost.	Contain Digestible Organic Matter.	Contain Digestible Albuminoids.
		d.	lb.	lb.
Oats...	28s. per 336 lb.	14	8½	1½
Beans ..	36s. " 532 "	11½	10½	3
Maize ..	29s. " 480 "	10½	11½	1
Dried Brewers' Grains	£5 10s. per ton	8½	7½	1½
Rice Meal ..	£5 .. " ..	7½	8½	1½
Bran ..	£5 10s. " ..	8½	8	1½
Sharps ..	£5 12s. " ..	8½	8	1½

The marked differences in the figures, especially those in the last column, should be noted. Hard-worked, growing and nursing animals all require plenty of flesh-forming food, and, as straw is deficient in this, care should be taken to supply enough in the concentrated feeding stuffs.

Rations for Farm Horses.—As illustrating some of the ways in which the different feeding stuffs may be blended to make a

substitute for oats, certain rations have been drawn up, and are shown in the following table. This table gives :—

(1) A grain ration composed of 14 lb. of oats only, and seven alternative rations.

(2), (3), and (4) The total weight, the weight of digestible food and of digestible flesh-formers supplied in each of the eight rations.

(5) The cost of each ration. (It should be noted that the costs are based on market prices, and that oats are, and beans may be, already on the farm, resulting in a saving of carriage, not only from, but to, market; but that carriage will have to be paid on the other feeding stuffs. A halfpenny added to the cost of each ration would allow 6s. 8d. per ton for such charges.)

Feeding Stuff.	Oats Ration.	Alternative Rations.						
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Oats	14	—	—	—	—	—	—	—
Crushed Beans	—	2	4	—	3	—	3	—
Crushed Maize	—	3	3	2	—	—	—	6
Dried Brewers' Grains ..	—	3	—	7	4	8	3	4
Rice Meal	—	3	3	6	4	4	6	—
Bran	—	1	3	—	3	1	2	3
Sharps	—	2	—	—	—	2	—	—
Total	14	14	13	15	14	15	14	13
Containing :—								
Total digestible food ..	8½	9	8½	9	8½	8½	8½	8½
Digestible flesh-forming food ..	1½	1½	1½	1½	1½	1½	1½	1½
Cost	1s. 2d.	9d.	8½d.	8½d.	8½d.	8½d.	8½d.	8½d.

The grain ration should as a rule be mixed with some chaffed hay or straw or with wheat cavings, but this is not essential. As a rule it will be convenient to use not more than three or four of the feeding stuffs mentioned, but one ration has been given showing a blend of all six.

While some of the rations suggested are unusual it must be remembered that the present state of the market is also unusual and useful feeding stuffs should not be neglected because they have not been tried before. All the feeding stuffs mentioned in the tables may be fed successfully in larger quantities than here suggested after experience has

been gained in using them. All feeding stuffs, however, have a specific effect, some slight, others (such as bran) marked, and their effects must be carefully watched when new diets are being tried.

As compared with light-legged horses, the digestion of farm horses in regular work is not easily upset, but in any farm stable there may be an animal whose dieting calls for care. In any case farmers replacing oats by the diets here suggested should make the change gradually. If reasonable care is exercised the horses should do as well on these cheap substitutes as on oats. It is not to be expected, however, that a horse-keeper or ploughman who has always had home-grown oats for his horses will look with favour on a mixture chiefly composed, for example, of dried grains and rice meal, and while it can be asserted that the substitutes are much cheaper than oats, the question whether they can be made "just as good" is one that depends largely on close supervision by the farmer himself.

Rations for Mares.—Mares when in foal may either remain idle and at grass, or be at work and wintered indoors. In the former case the concentrated ration during winter may consist of about 3 lb. dried grains, 3 lb. rice meal, and 1 lb. bran, the quantity of the last being increased to 2 lb. before foaling. Mares which are worked during the winter months must be liberally fed; in addition to as much hay as they will eat, they may get one or other of the following :—5 lb. dried grains, 4 lb. rice meal, 3 lb. beans, and 3 lb. bran; or 5 lb. crushed maize, 5 lb. dried grains, 1 lb. beans, 1 lb. linseed cake, and 2 lb. bran. Each of these rations would contain about 9½ lb. of digestible food, including 2 lb. of digestible albuminoids. They would cost about 9¼d. and 9½d. respectively. The bran should be increased to 3 lb. or 4 lb. just before and just after foaling, when mashes should be given.

Rations for Young Horses.—A foal may have a mixture of equal parts bruised oats, bran, and crushed beans, starting with about 1 lb. before weaning in the autumn, and rising to 3 lb. daily when a year old. Colts from one to two years old may get from 3 lb. to 5 lb. daily of a mixture of equal parts of dried grains, rice meal, bran, and crushed beans. After two years old, until work begins, the colt's ration of concentrated food should rise to 7 lb. or 8 lb. daily. The last-named quantity would cost 5d., and contain 4½ lb. of digestible food, including 1 lb. of digestible albuminoids.

THE ERADICATION OF MOSS.

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THE question of the eradication of moss from pastures has recently been discussed in an Irish agricultural paper. General experience in some parts of Ireland would seem to indicate that basic slag often encourages the growth of moss. The opinion has also been expressed that the presence of moss is not a serious disadvantage on upland pastures. The writer has often noticed that sheep tend to congregate on mossy banks in exposed situations in winter, and it has been observed that the grass is greener under the moss than elsewhere; also, that the moss tends to protect the delicate Dutch clover during severe seasons.

A. Effect of Manures.—The effect of manures on moss has not been extensively studied, and when botanical analyses of manurial plots are made it is not customary to give separate figures for moss. Hawk* has, however, clearly shown that newly-made superphosphate is very injurious to moss, and this he attributes to the acidity of that manure. The Board also allude to the fact that "in some unexplained way superphosphate has a directly destructive effect" on moss.† In his report on the improvement of poor permanent pasture, Wright‡ refers, in some detail, to the effect of manures on fog, and he therein states that fog in pastures can be effectively destroyed by applications of basic slag, and more especially of basic slag and kainit.

In the spring of 1913 the writer made a series of botanical analyses on several manurial plots under the management of the Agricultural Department of the Aberystwyth College. The amount of moss was estimated on these plots by cutting off the herbage of a square foot on several typical areas, separating out the components of the herbage (including the moss), and weighing the separations.

* Hawk, W., *The Feeding and Management of Cattle and the Manuring of Crops*. (Cornwall C. C., 1911.)

† Board of Agriculture and Fisheries, Leaflet No. 275 (*Improvement of Poor Hill Pasture*).

‡ The West of Scotland Agricultural College, Bulletin No. 54: R. Patrick Wright, *Report on Experiments on the Improvement of Poor Permanent Pasture by Manuring* (1910).

Two series of plots were thus analysed: (1) At Glandyfi at an altitude of 900 ft., where the plots were arranged on a natural fescue pasture; (2) at the College Farm, where the plots stood on a rather wet field.

(1) *The Glandyfi Plots at an altitude of 900 ft.*—The analyses were made on May 18th, 1913, and each plot was two acres in area. The dressings consisted of superphosphate, $5\frac{1}{2}$ cwt. per acre, and muriate of potash, 98 lb. per acre.

The manures were applied in April, 1910, and have not been repeated, so that the analyses were made three years after the manurial dressings.

The results of the analyses showed that the percentage of moss on the various plots was:—

Unmanured plot.	Superphosphate and Potash.	Potash alone.	Superphosphate alone.
20	10	10	1

The decrease in the amount of moss due to superphosphate was thus 19 per cent.

The effect of the manures on the flowering plants is shown below:—

	Gramineæ. Per cent.	Leguminosæ. Per cent.	Miscellaneous Plants. Per cent.	Total. Per cent.
Unmanured	77	5	18	100
Superphosphate and Potash	65	16	19	100
Potash alone	76	10	14	100
Superphosphate alone	66	15	19	100

The herbage was composed as follows:—Bent (*Agrostis vulgaris* et *A. canina*) and Sheeps' Fescue (*Festuca ovina*), together 69 per cent.; Sweet Vernal (*Anthoxanthum odoratum*), Yorkshire Fog (*Holcus lanatus*), Heath grass (*Triodia decumbens*), and Crested Dogs' Tail (*Cynosurus cristatus*), together 8 per cent.; Dutch Clover (*Trifolium repens*) and Bird's-foot trefoil (*Lotus corniculatus*), together 5 per cent. The chief miscellaneous plants were Tormentilla (*Potentilla erecta*), Heath Bedstraw (*Galium saxatile*), Milkwort (*Polygala vulgaris*), Woodrush (*Luzula erecta*), Wild Violet (*Viola lutea*), Germander Speedwell (*Veronica Chamaedrys*), and Sedges (*Carex* spp.), together 18 per cent.

(2) *The Plots on the Aberystwyth College Farm.*—The plots were at an altitude of 450 ft., the analyses were made on February 27th, 1913, and each plot was $\frac{1}{20}$ acre. The dressings consisted of superphosphate, 4 cwt. per acre; muriate of potash, 50 lb. of potash (K_2O) per acre; and nitrate of soda, 20 lb. nitrogen (N) per acre.

The manures were first applied in 1908 and have been given each successive spring. The results showed the percentage of moss present to be as follows :—

Unmanured.	Muriate of Potash and Nitrate of Soda.	Superphosphate.
45	32	8

The decrease of moss due to superphosphate has thus been 37 per cent.

The effect of the manures on the flowering plants is shown below :—

	Gramineæ. Per cent.	Leguminosæ. Per cent.	Miscellaneous Plants. Per cent.	Total. Per cent.
Unmanured ..	78	16	6	100
Muriate of Potash and Nitrate of Soda ..	89	6	5	100
Superphosphate ..	70	25	5	100

The herbage was composed as follows :—Cocksfoot (*Dactylis glomerata*), Bent (*Agrostis vulgaris*) and Sweet Vernal (*Anthoxanthum odoratum*), together 59 per cent.; Yorkshire Fog (*Holcus lanatus*), Tall Oat-grass (*Avena elatior*), Tall Fescue (*Festuca elatior*), Timothy (*Phleum pratense*), Perennial Ryegrass (*Lolium perenne*) and Crested Dog's Tail (*Cynosurus cristatus*), together 19 per cent.; Dutch Clover (*Trifolium repens*), Red Clover (*T. Pratense*) and Meadow Vetchling (*Lathyrus pratensis*), together 16 per cent. The chief miscellaneous plants were Ribgrass (*Plantago lanceolata*), Daisy (*Bellis perennis*), Self Heal (*Prunella vulgaris*) and Wood Rush (*Luzula erecta*), together 6 per cent.

These results confirm Hawk's work as to the effect of superphosphate. They also appear to go somewhat further, since on the Glandyfi plots the influence of superphosphate was very considerable three years after the manure was added, while on the College Farm it had occasioned a great decrease although the current year's dressing had not been added at the date the analyses were made.

B. Competition with the Taller Grasses.—It is generally realised that moss gives place to the other vegetation as the season advances. This fact may be made use of as a means of eradicating moss. Elliot,* quoting Arthur Young, alludes to the ancient practice of "fogging" (allowing the growth of the whole year to stand on the field until the ensuing winter or spring). He also quotes an informant who says "Fogging of the land certainly tends to destroy moss," and he gives it as his own opinion that "moss is usually caused by the

* Elliot, *The Clifton Park System of Farming*, London, 1908, pp. 72-73.

consolidation of the surface soil which commonly takes place where pastures are continuously and closely grazed." Elliot enclosed a small plot "in a young, closely-grazed pasture in which moss had made its appearance," and he found that "when the grass was let up in the enclosed plot the moss soon disappeared."

The effects of "fogging" above alluded to are amply borne out by the nature of a number of natural fescue pastures on the hills of Mid-Wales (at an altitude of about 700 ft. to 1,000 ft.). These pastures form either a very fine sward or, owing to the fescue and heath grass becoming taller and rank, and also sometimes to the addition of some *Nardus* to the flora, the herbage assumes a very tufted habit. A number of these pastures have been analysed and the following figures as to moss are interesting :—

MOSS IN NATURAL FESCUE PASTURES.

Analyses March, 1913.

	Sward Type. 22 per cent. of total partially dried herbage.			Tufted Type. 11 per cent. of total partially dried herbage.		
Example 1.	27	"	"	4	"	"
"	3.	17	"	2	"	"
"	4.	30	"	(No tufted equivalent)."		

The chief mosses contributing to the above flora were *Hypnum* spp., *Hylocomium* spp., *Thuidium tamariscinum*, *Dicranum scaparium*, *Plagiothecium undulatum*, and *Fissidens* spp.

The natural habitats of moss are various in the extreme, and although on pastures a consolidated soil is, as Elliot says, perhaps the chief contributing factor favouring excess of moss, areas are common on natural heath pastures where the conditions are the direct opposite to this. Such situations are met with at the bottoms of steep slopes where a very loose soil collects and where the flora is excessively mossy, mosses sometimes constituting as much as 50 per cent. of the total dried herbage.

Conclusion.—Moss on exposed sheep walks at high elevations is probably not a serious disadvantage, for it protects the clover (if any) and the young grass. Moss is usually most prevalent on pastures from February to April, but then decreases as the taller grasses gain ground. Evidence drawn from various natural fescue pastures confirms the view that the practice of "fogging" has a deleterious effect on moss. In general it may be said that moss tends to be abundant when the conditions are not favourable to a good development of the pasture grasses.

Crampton* has shown that a firm soil is a very important factor in the environmental conditions favouring grass land. Moss tends to be excessive on lowland fields which are heavily grazed, especially when overstocked in the winter. This is probably in part due to ultra-consolidation of the soil, which makes for a habitat suitable to some species of moss.† The mosses are also encouraged by the fact that on such situations the relatively dwarf "Mat" herbs (e.g., plantains) gain considerably on the ground at the expense of the grasses. On these areas the toothed harrow, as well as pulling out the moss renders the conditions less favourable to it by breaking the surface of the ground.

A loose or moving soil also favours some species of moss, chiefly because it is not firm enough for a good gramineous vegetation. Thus mossy banks are frequent on both natural pastures and on tenced pasture land. The moss is often decreased on these areas by rolling, presumably because the rolling tends to firm the soil without producing ultra-consolidation.

The effect of manures on moss would appear to be two-fold. In general, manures tend to decrease the moss in proportion as they favour the grasses. Observation suggests that, on some soils, basic slag tends actually to increase moss, at all events immediately after its application; manurial trials have, however, shown that on other soils the same manure tends to decrease moss.

Superphosphate would seem to have a decidedly deleterious effect on moss, although it is far from certain that phosphates, as such, have any particular effect on it. The results here quoted with regard to superphosphate are very striking (especially those given three years after its application); and it would be interesting to know if similar results have attended its use on a limestone soil.

Lime on some soils is known to eliminate mosses, although these plants may be abundant on limestone soils. The action of lime and superphosphate would seem to suggest that both excessive acidity and excessive alkalinity are destructive to moss.

* Crampton, C. B., *The Geological Relations of Stable and Migratory Plant Formations*, The Scot. Bot. Review, Jan., April, and July, 1912. *The Vegetation of Caithness considered in relation to the Geology*, 1911.

† A number of different species of moss occur on grass land. Some of these are common to both the consolidated pastures of lowlands and to the looser soils of hill pastures. A comparative study of the moss flora of the various pasture types is necessary before the behaviour of moss under various conditions can be elucidated. This study has not yet been carried far enough for detailed moss flora to be given.

CONTINUOUS CROPPING*—cont.

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IN addition to those already dealt with, there are many other fodder and forage crops suitable for growing in connection with the Continuous Cropping system of tillage. Among such crops are white mustard, trifolium, lucerne or alfalfa, and various combinations of vetches, rape, &c., which are grown to serve as pasturage for cattle, sheep, and especially pigs.

Continuous Cropping Rotations: the "Kilteragh" Rotation.—In discussing rotations, one must not dogmatise, since there are many factors, such as soil, markets and labour supply, which the farmer must consider when planning his rotation. The details given in the subjoined rotations are, therefore, intended to act simply as a guide. The first rotation which may be considered is known in Ireland as the Kilteragh rotation (having been first put into operation on the farm of Sir Horace Plunkett, Kilteragh, Dublin), and is specially designed for the purpose of supplying food for the feeding of dairy cattle. The rotation is as follows:—

First year—Winter Tares for sectional grazing and soiling.

Second year—Winter Tares made into hay, followed by Winter Greens.

Third year—Potatoes and Roots.

Fourth year—Winter Tares for hay, with which "seeds" are sown.

Fifth year—"Seeds" used for soiling.

In the first year the winter tares are sectionally grazed and soiled, as shown in the diagram given on page 705 of the *Journal* for November, 1914, plots 1 and 2, as there described, being also sown with rye-grass to provide further grazing in August and September. In the following October a mixture of winter tares suitable for cattle feeding is sown. This is cut for hay in the following June and divided into four sections—A, B, C, D—which are respectively sown with giant rape, hardy green turnips broadcasted, a mixture of giant Essex rye and giant rape, and rye alone (see p. 706, *et seq.*, *Journal*, November). In the third year potatoes are sown on Plots A and B, mangolds on

* This article and the previous one which appeared in this *Journal* for November, 1914, p. 701, are based on experiments conducted in Ireland. The suggestions contained in them are intended primarily to apply to Irish conditions, and must not be read as proposing drastic changes in the farming methods practised elsewhere. It is possible, however, that some of the suggestions may be found to be applicable locally in England and Wales.

Plot C, and turnips on Plot D. In the autumn of the third year a mixture of tares, half suitable for horse feeding and half for cattle feeding, is sown immediately the root and potato crops are removed from the land. In the following spring, grass seeds are sown with the tares. The "seeds" consist chiefly of Italian rye-grass and broad red clover, and are used for soiling in the fifth year of the rotation. This crop is liberally manured, and gives three good cuttings of soiling and an aftermath, which is grazed. One acre will provide more food than 3 or 4 acres of similar land in pasture.

This particular farm consists of 67 statute acres of land, 10 acres being very poor pasture, with rocks and furze, while there are 8 acres in each "break" of the rotation (that is 40 acres of arable land altogether), and 17 acres of permanent pasture. As no straw crops are grown on the farm, peat moss is used for litter.

The salient points of the above rotation are :—

1. Four leguminous crops are grown in the rotation, which enrich the soil in nitrogen.
2. A large amount of humus is ploughed into the land.
3. The amount of stock carried is very high, being the equivalent of 50 full-grown beasts.
4. Heavy stocking means heavy manuring and enhanced fertility of the soil.
5. The crops grown provide balanced rations without the use of imported foodstuffs.
6. Both horse and manual labour are evenly distributed throughout the season, and are comparatively very cheap, considering the amount of arable land.
7. The land is practically never idle.

"*Dry Stock Farm*" Rotation.—Another rotation which is followed by the writer, on a farm practically devoted to the production of beef and mutton, is as follows :—

First year—Winter Lea Tares, cut for hay in June, followed by Winter Greens.

Second year—Roots and Potatoes.

Third year—Half Winter Tares, sown in autumn, and half Winter Oats for horse feeding, with "Seeds" sown in the following spring and grazed the following autumn.

Fourth year—"Seeds" mown once, grazed, and then ploughed as in first year.

This particular farm is situated at a considerable distance from the farm buildings, so that it is necessary to eliminate carting as far as possible. The tares grown in the first year are

made into hay, the ricks being built either in the field itself or on land adjacent to it. After the hay is cleared, a mixture of 5 stones of giant Essex rye, 3 stones of winter barley, and 3 lb. of giant rape per statute acre is sown on the tare stubble about the month of July. This is grazed in the following October and November, and, whilst grazing, the cattle are fed with the tare hay. On such feeding bullocks thrive extraordinarily well; the average daily live weight increase of good store cattle so fed will be from 2 to 2½ lb. per day. At the end of November the cattle are turned off this artificial pasture and in the following February an application of from 1 to 2 cwt. per statute acre of nitrate of soda is given. By 1st March the artificial pasture is again ready for grazing. During this second grazing, which is done in sections as previously described, the land is heavily stocked so that the crop is cleared away quickly to allow of the putting down of the succeeding crop in time. By such means the carting of both crop and manure is avoided.

Other Rotations.—Another rotation followed, where potato growing is combined with the production of beef and mutton, is as follows :—

First year—Potatoes on the lea.

Second year—Autumn-sown Rye after Potatoes, followed by Winter Greens.

Third year—Spring-sown Cereal.

Fourth year—Autumn-sown Tares with "Seeds" sown in spring.

Fifth year—"Seeds" grazed twice and cut once for hay.

As is well known, very satisfactory crops of potatoes, both as regards quantity and quality, can be obtained from lea land. Until quite recently, however, considerable difficulty was often experienced in tilling lea land. The introduction of the disc harrow has solved this difficulty. It is as easy to till even very old lea for a drill crop with a good implement of this kind as to till stubble land without it. There are about 20 statute acres in each "break" of the rotation. On the potato "break" 5 acres are sown with early potatoes, 5 acres with second earlies and 10 acres with late varieties, the point aimed at being the even distribution of labour. The early potatoes are lifted in the latter part of June, the second earlies in late July, and the late varieties in early October.

Immediately each section of potatoes is lifted, rye is broadcasted and simply covered by the harrow. The rye sown after the first and second early potatoes is grazed in November and

again in the following April and May, by which time that sown after late potatoes is also ready for feeding. Whilst the cattle are grazing the rye they are fed with dry forage, *e.g.*, tare hay, &c., receiving in addition from 3 to 4 lb. of un-decorticated cotton cake which serves the dual purpose of pushing on the cattle and preventing their being purged by the rye. This grazing of the crop on the land again eliminates to a large extent the carting of manure. After the rye is grazed, winter greens (generally half the area with giant rape and the other half with hardy green turnips) are sown in the following June and July. This particular work is generally left over until rain stops hay harvesting.

The two forage crops mentioned give feeding from September to the end of March, the rape used in September and early October yielding a second crop in spring. This second growth is usually grazed by ewes with lambs, for which purpose it answers admirably. The grain grown in the third year provides cereal food for horses and pigs as well as the necessary litter. The autumn-sown tares in the fourth year are cut in June; the "seeds" sown with these tares is grazed in the following autumn and then cut for hay in the summer of the fifth year, when the aftermath is again grazed.

Another very useful rotation is :—

First year—Autumn-sown Tares grazed the first year and allowed to grow for hay for the second year.

Second year—Tares cut for hay, followed by Winter Greens.

Third year—Potatoes and Roots.

Fourth year—Winter Oats, Wheat or Winter Tares, with "Seeds" sown in spring.

Fifth year—"Seeds" for either soiling or hay making.

The above rotation is well suited to poor pasture land on an outlying farm. The growing of the two pulse crops (with artificial manures where necessary) enriches the soil considerably in preparation for the winter greens, which may be consumed on the land, thus manuring it ready for the potatoes and roots.

Still another rotation would be :—

First year—Lea Oats.

Second year—Autumn-sown Tares for hay, followed by Winter Greens.

Third year—Potatoes and Roots.

Fourth year—Winter Wheat with "Seeds."

Fifth year—"Seeds."

This is simply the ordinary Norfolk rotation extended one year so as to include a crop of vetch hay and winter greens. On very heavy land and in wet districts the growing of roots can be dispensed with. A suitable rotation for this purpose would be :—

First year—Lea Corn or Winter Beans.

Second year—Autumn-sown Winter Tares sectionally grazed and soiled, followed by Giant Rape, etc.

Third year—Spring Corn and "Seeds."

Fourth year—"Seeds."

As will be seen from the above, many varieties of Continuous Cropping rotations can be devised. The safe policy for the individual farmer to pursue is to consider whether his present rotation is the best possible or whether some modification on the lines indicated might not be introduced with advantage.

THE VALUE OF DRIED BREWERS' GRAINS AS A FEEDING MATERIAL.

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DRIED brewers' grains have formed the subject of a number of investigations with cattle and sheep, and the evidence derived from the experiments enables one to define within comparatively narrow limits their value as a feeding stuff. The experiments are dealt with below, together with the conclusions deduced therefrom.

1. Sattig (*Milch Zeitung*, 1886, p. 185) reports using dried brewers' grains and finding them a cheap winter feed for horses.

2. At the New Jersey Agricultural Experiment Station, dried brewers' grains were substituted for oats in the following ration :—Hay 6 lb., wheat bran 2 lb., whole maize 4 lb., and oats 8 lb. Street car horses were used in the experiment, and as a result the veterinary expert in charge of the horses came to the conclusion that "brewers' grains were equal to oats, weight for weight," in the ration of working horses.

3. According to Kellner, horses may be given half their corn ration as dried brewers' grains, cows and bullocks should not get more than 6 lb. daily, and fattening sheep may be given up to 1 lb. a day. Pigs are not able to digest dried grains satisfactorily, and they should not therefore be used for feeding pigs.

4. In 1893-1894, in continuation of a series of experiments to determine the most profitable feeding stuff to give when fattening sheep on a basal diet of swedes and hay, the Norfolk Chamber of Agriculture included a diet containing dried brewers' grains. Fourteen sheep were used in each trial lot, and the basal dietary consisted of $\frac{1}{2}$ lb. of hay per head per day and swedes *ad. lib.* The foods added were as follows:—

- Pen 1.—Linseed cake.
 „ 2.—Decorticated cotton cake and barley, $\frac{1}{2}$ and $\frac{1}{2}$.
 „ 3.—Crushed linseed and dried grains, $\frac{1}{2}$ and $\frac{1}{2}$.
 „ 4.—Crushed linseed and wheat, $\frac{1}{2}$ and $\frac{1}{2}$.
 „ 5.—Decorticated cotton cake and dried grains, $\frac{1}{2}$ and $\frac{1}{2}$.
 „ 6.—Linseed cake and common cotton cake.

The additional food was given at the rate of $\frac{1}{2}$ lb. per head per day in the first month, $\frac{3}{4}$ lb. in the second month, and 1 lb. in the third month.

The following table shows the average gain per head per week and the average gain per 100 lb. initial live weight per week:—

Additional Food.	Average gain per head per week.	Average gain per 100 lb. initial live weight per week.
Linseed cake	lb. 2'80	lb. 2'48
Decorticated cotton cake and barley ..	3'00	2'66
Decorticated cotton cake and dried grains	3'13	2'77
Crushed linseed and wheat	3'04	2'68
Crushed linseed cake and dried grains	3'14	2'79
Linseed cake and common cotton cake	2'81	2'48

This experiment clearly indicates that, weight for weight, dried grains are a more satisfactory feeding stuff than either wheat or crushed barley, when fed either with decorticated cotton cake or crushed linseed to sheep. The following were the prices per ton of the foods added:—

	£	s.	d.
Linseed cake	8	17	6
Decorticated cotton cake	7	2	6
Crushed linseed	13	10	0
Dried grains	6	0	0
Wheat 28s. per quarter	6	4	6
Barley 30s. per quarter	7	10	0

The amount of roots consumed per head daily for each lot was in all cases 16 lb., so that the differences obtained may

safely be attributed to the foods added. Brewers' grains at £6 per ton seem, therefore, to be a more economical food for fattening sheep than wheat or barley at 28s. and 30s. a quarter respectively.

For the particulars of the above experiment the author is indebted to an unpublished manuscript belonging to Professor T. B. Wood.

5. In 1898-1899 Dr. A. P. Aitken conducted sheep-feeding trials for the Highland and Agricultural Society of Scotland (*Transactions*, 1900). Each experimental lot consisted of 20 sheep, and linseed cake, maize, oats and dried grains were added to a basal dietary of swedes, and the effects of the different rations were compared, $\frac{1}{2}$ lb. per head per day of the additional food being given in each case. The results obtained were as follows:—

Additional food.	Increase per head per week (9 weeks period).	Turnips consumed per head per day.
Linseed cake	lb. 1'36	lb. 16'9
Turnips	1'46	16'7
Oats	1'77	17'2
Maize	2'22	15'5
Dried Grains	2'79	18'7

The dried grains proved much superior to any of the other foods, and at the price fed, £4 8s. 2d. per ton, seemed to be well below their true value as a feeding stuff.

6. In Bulletin No. 4, Edinburgh and East of Scotland College of Agriculture, W. Bruce reports sheep-feeding trials undertaken in 1903-1904 with a view to establishing what is the most profitable feeding stuff to use with swedes, *ad. lib.*, and a daily allowance of $\frac{1}{4}$ to $\frac{1}{2}$ lb. of hay, for the winter feeding of sheep. In these trials 38 animals per lot were used. The additional foods used were:—

- Lot 1.—Basal dietary only. No additional food.
 „ 2.—Decorticated cotton cake and dried distillery grains, $\frac{1}{2}$ and $\frac{1}{2}$.
 „ 3.—Linseed cake.
 „ 5.—Undecorticated Bombay cotton cake.
 „ 6.—Bombay cotton cake and distillery grains, $\frac{1}{2}$ and $\frac{1}{2}$.

The experiment was divided into two periods, and the amounts of hay and concentrated foods consumed varied in each lot. The increase per head per week is, therefore, given for the two periods, and the cost of the increase in each case.

	Period 1. 44 days.		Period 2. 49 days.	
	Increase per head per week.	Cost.	Increase per head per week.	Cost.
Lot 1	lb.	d.	lb.	d.
" 2	2'17	3'506	1'96	3'814
" 3	3'43	3'067	2'14	4'707
" 5	3'39	3'091	2'51	4'123
" 6	3'14	2'920	2'35	3'888
" 6	3'06	3'124	2'38	3'910

Taken together, the Bombay cotton cake comes first, Bombay cotton cake and grains second, linseed cake third, decorticated cotton cake and grains fourth, and swedes fifth. The following were the prices of the foods :—

	£	s.	d.	
Bombay cotton cake	4	6	8	per ton.
Linseed cake	7	6	8	"
Dried grains	5	1	8	"
Decorticated cotton cake	6	16	8	"

From the fact that Lot 6 did worse than Lot 5, Bruce came to the conclusion that distillery grains were not equal to Bombay cotton cake in feeding value, and that the price of dried grains—£5 1s. 8d. per ton—was too high. The consumption of swedes per head varied from 16 to 18 lb. per day.

In 1905 another series of experiments was instituted, the feeding in addition to the basal dietary of swedes and hay being as follows :—

- Lot 1.—Bombay cotton cake.
 " 2.—Bombay cotton cake and linseed cake, $\frac{1}{2}$ and $\frac{1}{2}$.
 " 3.—Linseed cake.
 " 4.—Bombay cotton cake and oats.
 " 5.—Dried distillery grains.
 " 6.—Decorticated cotton cake and crushed maize, $\frac{1}{2}$ and $\frac{1}{2}$.

The prices of the foods used were as follows :—

	£	s.	d.	
Bombay cotton cake	5	2	6	per ton.
Linseed cake	8	5	0	"
Dried grains	5	12	6	"
Decorticated cotton cake	7	10	0	"
Crushed oats	6	9	2	"
Crushed maize	5	7	6	"

The amounts of added foods consumed were practically equal, and worked out at about 13'31 oz. per head per day.

The experiment extended over 12 weeks. The increase in live weight and cost were as follows :—

Additional food.	Increase per head per week.	Gross cost of food per cwt. increase.	Net cost allowing for manurial value.
	lb.	£ s. d.	£ s. d.
Bombay cotton cake ..	2'07	2 1 3	1 11 7
Bombay cotton cake and linseed cake	2'35	2 0 9	1 11 1
Linseed cake	2'54	2 1 4	1 11 7
Bombay cotton cake and oats	1'99	2 3 4	1 14 1
Dried distillery grains ..	2'18	2 0 2	1 11 1
Decorticated cotton cake and maize	2'16	2 1 11	1 12 4

Considered on the cost of live-weight increase alone, the best results were obtained from brewers' grains, and a mixture of linseed cake and Bombay cotton cake. When the costs were reckoned on the carcass weight, however, the foods took the following order of preference :—(1) Linseed cake, (2) linseed cake and Bombay cotton cake, (3) Bombay cotton cake, (4) dried distillery grains, (5) decorticated cotton cake and maize, (6) Bombay cotton cake and oats.

Bruce therefore came to the conclusion that, with linseed cake at £8 5s., dried distillery grains are dear at £5 12s. 6d.

Analyses of Brewers' Grains used.

	Aitken.	Bruce. 1.	Bruce. 2.
Moisture	11'95	12'05	12'57
Proteins	19'25	22'09	19'56
Oil	5'27	8'90	9'75
Fibre	11'17	11'50	14'52
Nitrogen free extract	50'06	42'46	40'95
Ash	2'30	3'00	2'65

These experiments indicate that dried grains may be used successfully to replace the more expensive cereals in the feeding of sheep.

At the present time many householders will be especially anxious to curtail their domestic expenses by devoting increased attention to the cultivation of vegetables in their gardens and allotments, and land which has previously borne flowers may consequently in some cases be used for growing vegetables. In such circumstances there is no vegetable which can be grown more profitably than the potato, and the following suggestions are offered for the benefit of those who cannot devote more than half an acre of land to this vegetable.

Potato Growing in Allotments and Small Gardens. *The Soil.*—Growers on a small scale cannot usually choose the soil in which to plant, but they may do much to enable such soil as they have to produce a satisfactory crop. Potatoes do best in moderately light soil with good drainage. When heavy land must be used it should be thoroughly dug over during the autumn and winter and should be prevented from becoming water-logged by being thrown up in ridges or narrow stitches if necessary. Twitch (couch grass), docks, nettles, or similar perennial weeds should be forked out, and if there is any reason to suspect that leather jackets (grubs of the daddy long-legs), wireworms (grubs of the click beetles), or millepedes (also known as false wireworms) are present in large numbers, the land should be repeatedly turned over as recommended in Special Leaflet No. 1. If the land is sandy or open in texture it may be improved by adding "humus," that is, anything in the nature of dead leaves, or decaying vegetable matter, provided that care is taken not to add any plant that has been diseased, or is likely to harbour insect pests or reproduce itself as a weed. Impoverished land should be enriched with stable or farmyard manure, which may be dug in during autumn or winter or before planting in spring.

Lime should not be applied in large quantities to land on which potatoes are to be the next crop, as it may under certain circumstances induce Scab. Nevertheless, small quantities (say 7 lb. per rod) are beneficial in the presence of humus, and on heavy soils, or soils that have lain in grass for some years, 14 lb. of lime per rod may be applied. Lime corrects acidity, improves the texture of clay, and may liberate some potash (see Leaflet No. 170).

Time of Planting.—If the soil is in reasonably good condition, potatoes may be planted as soon as mild weather arrives in spring. If, however, wet weather has made the preparation of the soil difficult, planting should be deferred for a time.

It is better to plant in May with the land in good condition than in March with the land in bad order.

In a very few districts potatoes may be planted in February, but March and April are the usual months, the former for the early varieties, the latter for the main crop.

Selection and Preparation of "Seed."—Seed potatoes of a suitable size should be procured, or saved from the previous crop, provided that it has been a satisfactory one. It is undesirable to plant the very small potatoes known as chats, or even the largest tubers, except in the case of first early varieties. In the case of earlies, cut potatoes should not as a rule be planted. As potatoes lose their vitality if grown continuously in the same locality, frequent change of seed is recommended, and experience has shown that it is better to obtain seed tubers from a district farther north than that in which they are to be planted. It is customary with the best growers to procure new seed every alternate year from Scotland; in recent trials, however, Irish potatoes have given as good results as Scotch. In the warmest and driest districts a change is desirable every year.

All potatoes intended for "seed" should be carefully "boxed." Boxing is done by placing the seed potatoes in layers in a shallow box, and keeping them in a dry shed or other place where they are exposed to light and air but not to frost. They then "green" and ultimately form two or three short strong shoots which produce more vigorous plants than potatoes which have been kept in the dark till they are planted. Large growers are often unable to box the later varieties owing to want of space, but small growers are advised to box all seed potatoes, though it is more important to box the early than the late varieties.

It should be unnecessary to add that diseased potatoes should on no account be planted.

Manuring.—The potato is a gross feeder, and a liberal supply of soluble plant food is necessary for the production of a large crop. When it can be obtained, perhaps the best source of such food is farmyard manure, or, failing that, town stable manure. When such is available it should be used at the rate of 15 to 20 tons per acre—say 2 to 2½ cwt. per rod. (A large wheelbarrow usually holds about 1 cwt.) On heavy land it may be useful to apply the dung when digging the ground in autumn or winter, but on very light soils dung, moistened if necessary, may best be applied shortly before planting the tubers.

Alternatively $1\frac{1}{4}$ cwt. per rod may be applied, and at the time of planting, $\frac{3}{4}$ lb. to 1 lb. of sulphate of ammonia, 2 to $2\frac{1}{2}$ lb. of superphosphate and $\frac{3}{4}$ lb. of sulphate of potash per rod may be added, but as the supply of potash manures may be limited a liberal supply of ashes from burnt wood or vegetable matter may be used instead.*

If no dung is available, good results will usually be obtained by the application at planting time of $1\frac{1}{2}$ to 2 lb. of sulphate of ammonia, and $4\frac{1}{4}$ lb. of superphosphate per rod, in addition to the ashes already referred to.

Method of Planting.—The depth and distance apart at which potatoes should be planted vary according to the soil and the climate, but, generally speaking, potatoes should be planted fairly shallowly. In light and friable soil they may be put in at a depth of from 5 to 6 in., and in heavy land at about 4 in. Early potatoes should be planted at the shallower depth in order that they may get the full benefit of the sun's warmth.

The standard distance at which early varieties should be planted from each other is from 8 to 12 in. apart in the rows and from 20 to 24 in. between the rows. Mid-season and late varieties may be given from 12 to 18 in. between the sets, and from 24 to 28 in. between the rows.

General Cultivation during Growth.—It should be the aim of all growers to keep the land in which potatoes are growing frequently stirred during the period of growth, and all weeds should be kept down. The plants should be earthed up the first time when they are about 6 inches high, and a second time about 3 weeks later.

This drawing up of the soil to the plants promotes the formation of tubers, prevents the soil from getting too wet, and supports the haulm. If the soil has a tendency to get wet the ridges should be made as steep as possible, but the covering of soil should only be sufficiently deep to prevent the potatoes as they form from being exposed to the air and light. Small growers when lifting a few potatoes at a time should lift alternate plants or pairs of plants, or even alternate rows, as may be convenient, in preference to working straight through the plot. By doing so the ground is stirred and the plants that are left often bear a larger crop in consequence, while an additional advantage is that cauliflowers, cabbages, broccoli, Brussels sprouts, kale, etc., may at once be planted in the vacant spaces or opposite them in the furrows between the rows.

It is desirable to lift all potatoes as soon as ripe in order to avoid disease.

* See *Journal* for September, 1914, p. 562, and December, 1914, p. 694.

Varieties to Plant.—The selection of the best variety to plant is a matter of great importance, and growers must to a certain extent be guided by the experience of the district in which they live. Some varieties of potatoes which do well in one district prove disappointing in another, and nothing but actual testing will prove whether any new variety is worth planting locally. Some general indications can, however, be given:—

First Earlies.

1. *Duke of York*.—A kidney-shaped variety bearing a heavy crop of good cooking quality. The flesh is yellow.
2. *Midlothian Early*.—A kidney-shaped variety resembling Duke of York. The cooking quality is good.
3. *Sharpe's Express*.—Not quite so early as the two preceding varieties. A fair cropper of good quality. The flesh is white.
4. *Epicure*.—A round and deep-eyed variety. A very heavy cropper but of poor cooking quality. Usually somewhat later in ripening than the three varieties already mentioned. Being a strong grower it is adapted to soils not specially suited to potato growing.

Second Earlies.

5. *Eclipse*.—Sometimes classed as an early: matures soon after Epicure and is more marketable. Crops well, and cooking quality good.
6. *British Queen*.—One of the best all-round varieties. A heavy cropper of good cooking quality. It is, however, very liable to ordinary potato disease.
7. *King George V*.—Similar in type to British Queen. A heavy cropper of good cooking quality.
8. *Conquest*.—A good cropping variety of fair quality. Rather liable to ordinary potato disease, but resistant to wart disease.
9. *Windsor Castle*.—One of the best second early potatoes. Crops well and is of good quality. A great favourite for exhibition.

Maincrop Varieties.

10. *King Edward VII*.—A good-cropping kidney-shaped variety. Sometimes classed as a second early. Commonly grown in the south of England. The skin is white blotched with pink. It suits heavy land and is resistant to disease.
11. *Sutton's Abundance*.—A well-known heavy-cropping late variety, oval in shape, and of good quality. It is rather liable to ordinary potato disease, but is resistant to wart disease.
12. *The Factor*, *Dalhousie Seedling*, and *Up-to-date*.—White-skinned potatoes of similar type. Oval in shape, heavy croppers, and of good quality. Liable to ordinary potato disease.
13. *Golden Wonder*.—A late white-fleshed kidney-shaped potato with a yellowish-brown tinge on the skin. The "seed" should be of good size, and if unsprouted should be planted before the end of March, as the variety requires a long growing season. Liberal manuring is essential and in gardens bastard trenching is recommended. It is of excellent quality and is one of the best late-keeping potatoes.

Occupiers of premises declared to be infected under the Wart Disease of Potatoes Order of 1914, or situated in an area

declared infected under the Wart Disease of Potatoes (Infected Areas) Order of 1913, must make application for a licence to plant potatoes before any potatoes are planted. As most of the varieties mentioned above are susceptible to wart disease, which, however, seldom appears except on ground repeatedly cropped with potatoes, they will not be authorised for planting on such premises, and application should be made to the Board for a list of immune varieties.

SOME account of the aims of the International Institute of Agriculture at Rome and of its proceedings during its last Session was given in this *Journal* for September, 1914. The new Session of the Institute was opened by a meeting of the Permanent Committee on the 31st October, which was followed by a second meeting on the 7th November. At the first meeting, the President, the Marquis Cappelli, the representative of Italy, urged upon the delegates, and especially upon those who represent states now at war with each other, the duty that lies upon them in the present circumstances of working together with the single aim of accomplishing the beneficent objects of the Institute, so as to give the world the most accurate information possible regarding the out-turn of, and trade in, agricultural produce, and aid the countries devastated by war to re-establish their means of production as soon as the war is over. He also announced that the Senate and House of Representatives of the United States had passed a joint resolution instructing their delegate to request the Permanent Committee to take steps to call together an International Conference to consider the advisability of drawing up a convention for the establishment of an International Commerce Commission, having consultative, deliberative and advisory powers regarding ocean trade and ocean freights, with the object of giving greater stability to the prices of agricultural produce throughout the world. It was decided to defer discussion of this important motion until Mr. Lubin (the United States representative) was himself able to be present.

The General Secretary presented a report on the working of the Institute during the vacation then ended, and gave an account of the difficulties which had been experienced, owing to the outbreak of war, in carrying on its regular duties. Of the hundred or so members of the permanent staff, who are drawn

from many different countries, altogether eighteen had been summoned to military service under their respective flags. Besides this there had been a great falling off in the amount of material available, in the shape of statistics and reports, for the preparation of the monthly Bulletins. Everything possible had been done, however, to continue the work, and to publish Bulletins with all the information available, and with the least possible delay.

It was agreed that it would be impossible to hold the General Assembly of the Institute next May in accordance with the usual programme, and the Committee decided to ask the Governments of the adhering countries to postpone the next General Assembly to a date to be fixed later.

At the second meeting on the 7th November, the Vice-President and the members of the four sub-committees were re-elected for the next three years without discussion. A report, submitted by the delegate for Great Britain and Ireland, on the Third International Congress of Tropical Agriculture, which was held in London last June, was referred to the office for report as to what could usefully be done to establish co-operation between the Institute and the Association which arranges for these Congresses, with the object of securing joint action between the two bodies for the benefit of tropical agriculture.

Careful consideration was given to the financial position of the Institute, which is temporarily embarrassed, owing to delay on the part of several of the adhering Governments in paying the contributions due from them for the calendar year 1914; but as there is reason to expect that most of them will pay up their arrears within the next few months, and as the reserve fund on 30th September amounted to over £20,000, it was not thought necessary to stop any of the work at present being carried on by the Institute. The Governments in arrear are being asked to remit their contributions as soon as possible, and the General Secretary has been called upon to exercise the greatest economy possible in all branches of the expenditure. Progress, however, will continue to be made in the study of the questions which are being prepared for discussion at the next General Assembly, such as the unification of the systems of collecting agricultural statistics, the collection of statistics regarding milk and its principal products, visible and invisible stocks, the consumption and prices of meat, chemical manures, farming accounts, protection against locusts, and maritime freights for the conveyance of agricultural produce.

THE following note has been prepared by Mr. J. C. F. Fryer, the Board's Entomologist.

The Raspberry or Clay-coloured Weevil. *Otiorhynchus picipes*, sometimes known as the "Clay-coloured," "Red-footed," or Raspberry Weevil, is well known to most nurserymen and fruit growers. When present in numbers it may be exceedingly

destructive to nursery stock, and, since it is most difficult to kill, it is at times the cause of serious loss. The year 1914 seems to have been favourable to it, and complaints of its ravages were received at various times between the end of April and the beginning of July. Among the various cases reported, one in the west of England seems worthy of detailed record, since it is peculiar and suggestive in several ways. This attack took place in an orchard of about three acres situated on the side of a rather steep hill. The land above and on one side of the orchard was formerly forest, the timber from which has been removed, though the area is now being replanted, chiefly with oak. Below the orchard is a narrow lane, and on the other side of the orchard a paddock containing a few old fruit trees. Before planting, the orchard was in part rough pasture, with much bracken, and in part old cultivated garden land, but in the autumn of 1912 the grass land was broken up and the whole area thrown into one. Pears, black currants and a few apples were then planted, and the new orchard subsequently received little attention till July, 1913, when it had become very foul; it was then hoed twice, but no attempt was made to clean it thoroughly until the early months of 1914, when it was dug over.

There is no record of any attack by the beetle in 1913, but the condition of the trees showed that some damage was done. In 1914 injury was first noticed at the beginning of May, and the attack continued throughout the month and well into June. The beetles confined their attention mainly to the pears and black currants, many of which were seriously injured. At first the leaves only were devoured, then the buds and the ends of the twigs were attacked, and finally even the bark on the younger branches was eaten. The apples, of which there were few, were only slightly injured as regards foliage, but the blossom was said to have been completely destroyed. The attack as a whole, therefore, was exceptionally severe.

Turning to the points of special interest, in the first place it was noticed that the trees on the old garden land had almost escaped in spite of the fact that this part of the orchard

bordered on the remainder along its whole length, and was not separated from it by hedge, path or ditch. Further, it comprised the same variations in elevation and also bore the same varieties of fruit trees.

A second point of interest is that even on the affected portion of the orchard the intensity of the attack varied within wide limits from tree to tree. There was no gradual increase of intensity from one side of the orchard to another, but trees badly or slightly attacked were scattered about without any reference to local conditions such as variations in elevation or proximity to the adjacent woodland. Further there was no connection between the varieties of fruit tree and the severity with which they were attacked. These points are well illustrated by two rows of "Conférence" pears:—

Severity of Attack.			
Row A.			Row B.
Tree 1	..	General.	Slight.
" 2	..	Very bad.	Very bad.
" 3	..	Very bad.	Very bad.
" 4	..	Bad.	General.
" 5	..	General.	Slight.
" 6	..	General.	General.
" 7	..	General.	Bad.
" 8	..	Bad.	Very bad.
" 9	..	Bad.	Very bad.
" 10	..	General.	Slight.
" 11	..	Very slight.	Very slight.

The scale of intensity is of course relative and only suited to the present case, but roughly speaking "very slight" means slight defoliation, "slight" means considerable defoliation, "general" means extensive defoliation, (possibly only one third of the total leaf area left), "bad" means almost total defoliation and some attack on the twigs, and "very bad" means total defoliation and considerable attack on twigs and bark.

Black currants were planted between the pears, and are not given above. Owing to their small size they suffered more than the pears and several bushes were dying or dead.

A search was made at the roots of the trees and bushes to discover whether the larvae of the weevil had also been responsible for damage, but little evidence of attack could be found, and it was decided that the roots of weeds—possibly of bracken—must have formed the greater part of their food.

The facts above stated are not easily explained, but some deductions of interest may be made. In the first place it must be assumed that the beetles were all bred in the orchard in which the damage was done. *Otiorhynchus picipes* is wingless, and therefore if the land had been infested by a migration from the neighbouring woodland, the edges of the orchard should have been most severely attacked, and this was not the case. It follows that the number of these beetles which can be produced on a small area of land is very large.

Secondly, it appears that the beetles are unwilling to travel far along the surface of the ground in search of food. This is shown by the fact that trees on the old garden land were barely touched, while within a few yards trees on the old pasture were completely defoliated, and the weevils were reduced to feeding on the bark and twigs.

This lack of any migratory instinct is also the most probable explanation of the varying intensity of the attack on the affected portion of the orchard. It may reasonably be assumed that the partial cleaning which the orchard received would have destroyed a great number of the shallow-rooted weeds, while clumps of deep-rooting forms, such as bracken, would be likely to have persisted here and there. In this case, the larvae of *Otiorhynchus* must have been concentrated round the roots of any surviving clumps of their food plant, below which they would also have pupated. The beetles, therefore, are likely to have emerged in great numbers from certain areas in the orchard, the trees in the neighbourhood of which would naturally have been first attacked. The beetles feed only at night, descending again to the soil before daybreak, and, therefore, unless they possessed a migratory instinct which induced them to wander freely, they are likely to have attacked the same trees night after night, and their spread from an infected area must naturally have been slow.

The above remarks are based on assumptions, and are more or less tentative. From the practical point of view a final deduction may be made involving no assumption. This is the necessity for taking full precautions against insect pests whenever rough pasture or derelict land is brought under active cultivation. The herbage on such land comprises a wide range of plants which form the food of a great variety of insects. These insects, perhaps, do little harm to the pasture, but under fresh conditions they may become destructive pests. A partial cleaning of the land will not eradicate them completely, and when the fresh crop is planted there is every chance that it will

be attacked by numbers of some insect for which the natural vegetation no longer provides a food supply.

In the case under consideration spraying with lead arsenate was not successful, and the laborious and expensive process of hand collecting was employed night after night for weeks in order to save the trees from complete destruction. All this might probably have been avoided if proper care had been taken to clean the land in the first instance, and the time and money so spent would have been well repaid.

THE small insects known as Thrips, Black Fly, or Thunder Fly, are extremely abundant in this country, and may be responsible for considerable damage to

Pea and Bean	cultivated plants. Species are known
Thrips, or	which attack cereal crops, others damage
Black Fly.	fruit, and there are several which are
	injurious to plants grown under glass.

The insect dealt with in the present article, *Frankliniella robusta*, Uzel, was formerly known to science as *Thrips pisivora*. It has been recorded as harmful to peas and beans for many years, but its life history has only recently been worked out, and there is little doubt that in the past several species have been confused under one name. The group, as a whole, has been insufficiently studied, and much still remains to be discovered before our knowledge of these insects in relation to practical agriculture can be considered as satisfactory.

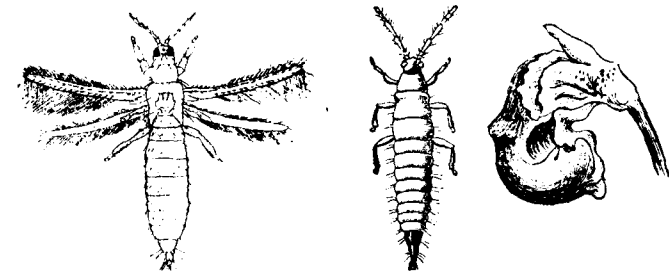


FIG. 1. Adult Pea Thrips.*

FIG. 2. Larval Pea Thrips.

FIG. 3. Distorted pod.

Description of Insect.—The adult insects of the pea thrips cannot be distinguished from other species of thrips without entering into minute features only to be observed under the microscope. They are small black insects about $\frac{1}{15}$ in. in length, elongate in form and tapering towards both head and

* Fig. 1 is from a drawing kindly supplied by Mr. C. B. Williams, who has investigated the life history of the Pea Thrips.

tail, the latter appearing to be sharply pointed. They have four wings, each consisting of a narrow membrane surrounded by a broad fringe of hairs, which give the insects sufficient expanse of wing to enable them to fly or drift for long distances. The general appearance of the adult pea thrips is shown by Fig. 1. The young pea thrips are somewhat like the adult in form but have no wings; they are bright orange in colour, with a conspicuous black tip to the abdomen (see Fig. 2), the latter feature serving to distinguish them from most other species likely to be found in peas and beans.

Distribution in Great Britain.—The pea thrips is distributed over the whole of England and is recorded from Ireland. The districts where most damage is done, however, are chiefly in the south and east of England, though records have been received occasionally from as far north as Cheshire.

Life History.—The eggs of the pea thrips are laid in June. They are minute, kidney-shaped and are imbedded in the tissues of the stamen sheaths, young pods and, rarely, in the petals of the pea or bean flower. After about nine days they hatch and the small orange-coloured young feed on the petals, stamens, and inner parts of the flower, and later on the pods. Their method of feeding is peculiar, and consists in scraping away the surface tissues of the plant and then sucking up the liquid and minute fragments from the wound. After feeding for three or four weeks the thrips leave their food plant and descend into the earth, where they remain quiescent for the rest of the summer, through the autumn and winter until the spring, when they pass through two stages, which, together, may be likened to the pupal stage of many other insects. These two intermediate stages last about one month and the insects then become mature winged thrips which leave the soil in May and June and go in search of pea or bean flowers on which to lay their eggs. The males emerge earlier than the females and are at first quite common, but before much damage is visible they have mostly disappeared and only females can then be found.

Plants attacked and Nature of Injury.—The pea thrips here described is only known with certainty to attack the ordinary eating pea and the broad bean, or varieties of these plants. In the case of attacks on scarlet runner beans it is not known which species is responsible, and it may possibly be one of which the life history is still unknown. The damage done by the pea thrips is two-fold. In the first place the flower may be so injured that no further development takes place, and secondly

when a damaged pod develops it has a curious silvery or shining appearance, more or less mottled with brown. Some distortion may also occur but the appearance of the pod is the most characteristic feature of an attack. In this country injury to the haulms does not seem to be common, but it is known in Sweden, and may frequently pass unnoticed here.

Treatment.—Where an attack is in progress it is difficult to suggest any remedy. The insects are well protected by the flower of the pea or bean, and it is considered unlikely that any treatment by means of spraying would be effective. Since the immature thrips pass the winter under ground, fields affected during the summer should be ploughed deeply and, if possible, should receive a dressing of lime in the following winter. In gardens this dressing of lime might be replaced by one of the well-known naphthalene or other soil fumigants. It is obviously unwise to grow peas or beans on land adjacent to that which has been attacked during the previous year. The burning of the old pea-sticks, formerly recommended, is of no avail against this insect.

ON 14th June, 1912, the President of the Board of Agriculture and Fisheries appointed a Departmental Committee to make further investigations as to the characteristics of Foot-and-Mouth Disease and the manner in which it is contracted and spread. The experiments carried out by the Committee appointed for this purpose are described in a recently issued Report [Cd. 7270, price 4½d.].

The investigation took place in India, and on Indian cattle. At the outset it was intended to experiment with "hills" cattle (the disease in these animals bearing some resemblance to the European type), but this was afterwards found impossible, and the "plains" cattle, sheep and swine, which formed the bulk of the animals coming under experiment, unfortunately proved absolutely unsuitable for the purpose in view, owing to their exceptionally high degree of natural insusceptibility to the disease. In these circumstances an irregularity in the experimental results was naturally to be expected, but the investigation is of value up to a certain point, and an account of it may be given.

The total number of animals employed was 228, viz., 165 cattle, 23 buffaloes, 9 sheep, 11 goats, and 20 pigs; the methods of infection employed were by contact, intravenous inoculation, scarification, subcutaneous inoculation, and feeding. In 49

experiments relating to 147 animals, the results were entirely negative, while in 18 experiments, in which 81 animals were used, 37 animals became infected (including 2 doubtful); and whereas the failure of infection in the first group may have been due to the death of the virus, negative results, where they occurred in the second group, must have been due to the marked insusceptibility of the animals. The results in this latter group were as follows:—

(1) Intravenous inoculation infected 12 cattle and 3 buffaloes, and failed to infect 10 cattle and 1 buffalo.

(2) Inoculation by scarification infected 8 cattle (2 doubtful) and 1 pig, and failed to infect 4 cattle and 1 buffalo.

(3) Subcutaneous inoculation infected 1 pig and failed to infect another.

(4) Contact with diseased animals led to the infection of 6 cattle and 1 buffalo, and failed to infect 12 cattle, 3 sheep and 5 goats.

In the great majority of cases the period of incubation after intravenous inoculation was two days, but in the case of one bull the first lesions did not develop until the tenth day after inoculation. In cases of infection produced by scarification, the period of incubation varied from 2 to 8 days, and after contact from 3 to 13 days.

The experiments furnished evidence of the rapidity with which the mouth lesions may develop and pass beyond the vesicular stage; thus, it was found that in the morning ulcers might be present in the mouth of an animal which on the previous evening showed no abnormality of the mucous membrane. In 25 cases the period within which ulcers developed in the mouth did not exceed 24 hours, but in 12 cases fresh vesicles appeared on two or more successive days.

The usual course is for the inflammatory liquid escaping from the vessels of the mucous membrane to accumulate between the layers of the epithelium in quantity and to raise the latter, the surface epithelium soon giving way, with the result that the vesicle collapses, and the loose shred of epithelium becomes completely detached very soon afterwards, leaving on the membrane a shallow defect or ulcer. In these experiments, although the rapidity with which the vesicles formed and burst made it difficult to be certain about the point, cases occurred in which it seemed that ulcers had been formed by the shedding of epithelium without any preceding vesiculation.

It is well known that cicatrisation usually takes place rapidly in the mouth lesions, but in the case of one buffalo calf an ulcer

was found to be still uncicatrised 23 days after it was first noted in the mouth.

In concluding their Report, the Committee urge the need for a joint international investigation in Europe into the disease, collaboration with France and Germany being suggested, as these countries have established island investigation stations.

The Report is illustrated by photographs of the fore-feet of an affected pig, and the tongues of affected bulls and calves.

SUMMARY OF AGRICULTURAL EXPERIMENTS.

FIELD CROPS.

Varieties of Oats—(CORRECTION).—In the experiment with varieties of oats, summarised in this *Journal* for November, 1914, p. 737, owing to a printer's error in the Lancashire bulletin, from which the experiment was taken, the yield of the Wide Awake variety of oats was given as 68½ bush. per acre. This yield should be 52 bush. per acre, and the variety thus took third place, being exceeded in yield by Victory and Propsteier.

Rotation of Crops (*Armstrong Coll., Newcastle-upon-Tyne, College Bull. No. 10; D. A. Gilchrist, M.Sc.*).—These experiments have lasted for 20 years, and five four-course rotations have now been completed. The rotation in each case has been swedes, barley, hay and oats. The soil is a sandy loam, changing into a clay loam at the lower end of all the plots. The results of the fifth rotation have led to the following conclusions:—

The most profitable result was obtained by the application of dung for swedes and artificials for hay. The dung was applied in the drills before sowing the swedes. The artificials for hay consisted of 100 lb. nitrate of lime applied in spring, and 2 cwt. superphosphate, 2 cwt. basic slag, and 100 lb. muriate of potash applied the previous autumn.

Dung is of considerably more value than artificials for this light soil, and when given alone has produced a good crop of swedes, though dung combined with artificials has considerably increased the three crops following the swedes.

When artificials alone are used on such light land it is essential that a potash manure should be included, as the crops suffer greatly from its omission. When full dressings of dung are applied, however, the need of potash is not so urgent.

Medium dressings of nitrogenous manures for oats were not profitable.

Basic slag gave more profitable results throughout the rotation than superphosphate, but the swede crop was somewhat larger when the latter manure was applied.

Dung applied as soon as possible after it was "made" gave considerably better results than dung kept in a heap for some months, and better results also than dung applied in quite fresh condition.

Manuring of Grass for Hay (*Roy. Agric. Coll., Scientific Bull. Nos. 4 and 5*).—The experiments were carried out on six farms in 1912; the soil on three farms was a calcareous loam, on two a stone brash,

and on one a stiff loam on clay subsoil. The manuring and the average yields of hay per acre were as follows:—

Manure.	Yield. Cwt.
No artificials	22'7
Superphosphate, 4 cwt., and sulphate of potash, 1 cwt. ..	25'5
Superphosphate, 4 cwt., sulphate of potash, 1 cwt., and sulphate of ammonia, 1½ cwt. ..	32'6

Detailed analyses of the botanical composition of the herbage were made on two farms. On the first (calcareous loam) it was found that the application of phosphate and potash, whilst producing hardly any effect on the total yield of hay in the following crop largely increased the proportion of leguminous herbage (notably Meadow Vetchling) and proportionately reduced the grasses; the addition of sulphate of ammonia distinctly raised the total yield of hay, reduced the leguminous plants to their former level and restored the proportion of purely gramineous herbage, but with an alteration in the proportion of individual grasses, Upright Brome being decreased, while Perennial Rye Grass, Sheep's Fescue and the Poas were encouraged. On the other farm (stone brash) also, phosphates and potash greatly increased the leguminosæ at the expense of both grasses and weeds; when sulphate of ammonia was used in addition, there was again a very considerable increase in the total yield, the grasses being encouraged, especially Sheep's Fescue, the leguminous plants remaining nearly stationary, and the weeds largely decreasing (especially Buttercups and Silver Weed).

The Effect of One Crop upon Another (*Jour. Agric. Sci.*, Vol. VI., Part II.; *The Duke of Bedford, K.G., F.R.S., and S. U. Pickering, M.A., F.R.S.*).—Every growing crop results in the formation of a substance which is toxic to the growth of other plants, and still more so to itself.

By oxidation this toxin loses its toxic properties and enhances the fertility of the soil. The plants previously poisoned eventually outstrip those which had not been subjected to the poisoning except in cases where the toxic effect has been sufficient to produce a permanent stunting.

The toxic effect must necessarily vary considerably with the different conditions obtaining, such as the nature of the soil, the plant affected, and the vigour of growth of the plant producing the toxin.

There is no reason for assuming the excretion of any toxic matter from a plant; the debris from the growing roots is probably sufficient to account for the formation of the toxin.

The heating of a soil produces toxic matter from the organic substances present in it, and in much greater quantities than that produced by the growth of a crop. In both cases the toxin, after oxidation, increases the fertility of the soil.

LIVE STOCK AND FEEDING STUFFS.

Estimation of Condition in Cattle (*Reprint of a Paper read at the Meeting of the British Association, 1914; J. A. Murray, B.Sc.*).—The author is of opinion that the terms used by farmers to denote the "condition" of cattle, viz., "fat," "half-fat," "store," &c., are vague and indefinite, and that some method of exactly expressing the condition is wanted. From a purely practical standpoint the condition of animals is of interest chiefly in regard to its bearing on the question of valuation; but the question of maintenance rations is also involved,

more especially in connection with feeding trials. A formula is arrived at by which the condition may be found from the live weight, girth, and length.

Feeding Value of Different Grass Seed Mixtures (*Trans. Highland and Agric. Soc. of Scotland, 1914; J. Hendrick, B.Sc., F.I.C., and W. M. Findlay, N.D.A.*).—A field of 24 acres, consisting of fertile red loam on the Old Red Sandstone, was divided into 4 plots each of 6 acres and each having access to water. In 1910 the four plots were sown with the following grass seed mixtures:—

Species of Seed.	No. of Plot.			
	I.	II.	III.	IV.
	lb.	lb.	lb.	lb.
Perennial Rye-grass	38	9	—	—
Italian Rye-grass	3	—	—	—
Cocksfoot	1	9	9	7½
Timothy	1	3	3	2½
Meadow Fescue	1	—	9	7½
Tall Fescue	—	—	—	7½
Crested Dogtail	—	3	3	3
Tall Oat-grass	—	—	—	1½
Hard Fescue	—	—	—	3
Meadow Foxtail	—	—	—	2
Rough-stalked Meadow-grass	—	—	—	—
Red Clover	3	3	3	3
White Clover	1½	1½	1½	1½
Alsike Clover	1½	1½	1½	1½

It was determined to hay the whole field in 1911, and after that to fence the different plots and graze them for a period of years with sheep and cattle. The yields of hay per acre in 1911 were: Plot I., 48 cwt.; Plot II., 47'3 cwt.; Plot III., 43'6 cwt.; Plot IV., 41'4 cwt.

On May 9th, 1912, the plots were stocked with sheep, 36 being placed on Plot I. and 38 on each of the others. The number of sheep on each plot was varied from time to time according to the state of the herbage, and all the plots were given a month's rest in July. On July 31st 80 of the fattest sheep were withdrawn and on August 28th a further 14. The results for 1912 were as follows:—

	No. of Plot.			
	I.	II.	III.]	IV.
	lb.	lb.	lb.	lb.
Total increase in 16 weeks	1,122	1,221	1,468	1,086
Increase per acre	187	203'5	244'6	181
Average increase per sheep in 16 weeks	43'9	45'2	51'5	42'6
Average increase per sheep per week	2'74	2'82	3'22	2'66
Value of increase per acre at 4d. per lb.	s. d. 62 4	s. d. 67 10	s. d. 81 6	s. d. 60 4

It was decided to graze the plots mainly with cattle in 1913, and on May 15th 6 animals were placed on each plot. The plots were given a

rest of about six weeks during July and August. After this the number of cattle on each plot was slightly varied according to the condition of the herbage, and on September 23rd the cattle were taken off. The results obtained from the cattle were as follows:—

	No. of Plot.			
	I.	II.	III.	IV.
Total increase in 12 weeks	cwt. lb. 13 85	cwt. lb. 15 90	cwt. lb. 14 103	cwt. lb. 16 92
Increase per acre ..	2 33	2 71	2 54	2 90
Increase per head per week	2'27	23'3	23'2	26'2
Value of increase per acre at 40s. per cwt. ..	£ s. d. 4 11 9	£ s. d. 5 5 4	£ s. d. 4 19 3	£ s. d. 5 12 3

The results with cattle are not held to be so trustworthy as those with sheep owing to the greater opportunity for individual variations consequent upon the smaller numbers.

After the removal of the cattle 13 sheep were placed on Plot I., and 11 on each of the other plots; after 6 weeks they were replaced by fresh sheep, 15 on Plot I., and 10 on each of the other plots, which were grazed for 4 weeks. The average weekly increases per sheep as the result of this autumn grazing were: Plot I., 1'15 lb.; Plot II., 1'68 lb.; Plot III., 1'5 lb.; Plot IV., 1'26 lb.; while the values of the increases per acre at 4d. per lb. were 8s. 10d., 9s. 11d., 8s. 10d., and 7s. 5d., respectively, on the four plots.

The value yielded by each plot per acre in 1911, 1912 and 1913 may be given as follows:—

	No. of Plot.			
	I.	II.	III.	IV.
Hay, 1911	s. d. 144 0	s. d. 142 0	s. d. 131 0	s. d. 123 3
Sheep, 1912	62 4	67 10	81 6	53 8
Cattle, 1913	91 9	105 4	99 3	112 3
Sheep, 1913	8 10	9 11	8 10	7 5
Total Value	306 11	325 1	320 7	296 7

The results obtained from these plots for the three years show that a heavy seeding with rye-grass, such as was given on Plot I., is not superior to a lighter seeding, such as was given on Plot II., or to a mixture without rye-grass such as that on Plot III. The prices of seeds per acre for 1910 were for Plots I. and II. about 16s., for Plot III., 25s., and for Plot IV. 43s.

Wintering of Store Cattle (*Jour. Dept. Agric. for Ireland*, October, 1914).—This experiment has been carried on at the Department's Agricultural Station at Athenry during the past four winters, the results obtained being remarkably uniform from year to year. The 100 animals tested comprised 48 Aberdeen Angus cross-bred bullocks,

30 Aberdeen Angus cross-bred heifers, and 30 Shorthorn cross-bred bullocks. To eliminate any error from differences of breed and sex, only animals of the same breed and sex were included in any one winter. The animals averaged 21 months of age, and the experiment lasted in each year from the end of November until the end of April.

The animals were divided into three lots. Lot I. were kept housed, day and night, through the winter; they were fed with roots, cake and meal, and straw. Lots II. and III. were not housed, but were given hay on the grass from about January to the end of March, Lot II. being allowed cake in addition.

After each winter experiment was concluded it was thought advisable to graze the cattle together under similar conditions for twelve weeks with the object of ascertaining whether the winter feeding had any effect on subsequent growth. The following table shows, for the average of the four years, the increase per head during the winter and summer periods respectively, and the cost of feeding, per head, during the winter period (roots were charged at 8s. per ton, straw at 30s. per ton, hay at 40s. per ton, cake and meal at 8s. per cwt., and pasturage at 20s. per head). No figures were given for the cost of feeding during the summer period as this was regarded as the same for all three lots:—

	Cost, per head, of Winter Feeding.	Winter Increase, per head.	Summer Increase, per head.	Total Increase, per head.
	£ s. d.	c. q. lb.	c. q. lb.	c. q. lb.
Lot I.	4 7 3	1 1 9	0 3 9	2 0 18
Lot II.	3 1 6	0 2 22	1 2 13	2 1 7
Lot III.	2 5 6	0 1 18	1 2 27	2 0 17

Considering the winter feeding only, the increase of Lot I. over Lot II. of 71 lb. per head was made at a cost of £1 5s. 9d., or 40s. 7d. per cwt.; the increase of Lot I. over Lot III. of 103 lb. per head was made at a cost of £2 1s. 9d., or 45s. 5d. per cwt.; so that, if weight only is considered, the increases of Lot I. over Lots II. and III. would hardly, if at all, pay for the extra food consumed. Further, it was found that the out-wintered cattle invariably increased much more rapidly during the ensuing summer than those in-wintered, until there was not much to choose between them at the end of that time.

Under the conditions prevailing at Athenry, in the west of Ireland, it appears that greater profit can be obtained from out-wintering if the animals are kept over as stores; and, further, that, for summer grazing as stores, in-wintered cattle are worth less per cwt. at the beginning of May than out-wintered animals.

With regard to the advisability of feeding cake to out-wintered cattle, it will be seen that the extra increase in weight of 32 lb. was produced by cake costing 16s.; the cake-fed lot were in better condition, however, and would probably have realised 1s. more per cwt. if sold about the end of April. The difference in condition between the two lots was lost at the end of the summer, while the difference in weight was only 18 lb. per head.

Suggested Rations for Dairy Cows in Suffolk during the Winter 1914-15 (*E. Suffolk County Educ. Com.; A. W. Oldershaw, B.Sc., N.D.A., and John Bewley, C.D.A.*).—From the point of view of the cowkeeper

the outstanding feature of the coming winter in Suffolk will be scarcity of roots, green food and hay. This scarcity of home-grown foods will render the feeding of cows more expensive than usual, and the following daily rations are therefore suggested for 11 cwt. cows giving 2 gals. of milk daily:—

(1) 40 lb. mangolds or cabbage, 12 lb. barley or oat straw (chopped), 5 lb. medium hay, 3 lb. maize meal, 2½ lb. decorticated cotton meal or cake, 3 lb. bean meal or maize gluten feed.—Total cost 1s. 1d.

(2) 30 lb. mangolds or cabbages, 8 lb. barley or wheat straw, 4 lb. oat straw, 5 lb. medium hay, 3 lb. best Rangoon rice meal, 2 lb. maize meal, 1½ lb. bran, 3½ lb. decorticated cotton meal.—Total cost 1s. 0½d.

(3) 20 lb. mangolds, 5 lb. pea or bean straw, 10 lb. barley, oat or wheat straw, 5 lb. meadow hay, 2 lb. decorticated cotton cake or meal (or 1 lb. decorticated cotton meal and 2 lb. undecorticated cotton cake), 3 lb. bran, 4 lb. dried grains, 3 lb. best Rangoon rice meal, 1 lb. treacle.—Total cost 1s. 1½d. (Dried sugar beet pulp may be substituted for bran in this ration, but in this case ½ lb. more decorticated cotton meal must be used).

(4) Where no roots whatever are available the following is suggested: 20 lb. wet grains (or 6 lb. dried grains), 5 lb. bean or pea straw, and 10 lb. oat, barley, or wheat straw, 7 lb. meadow hay, 3½ lb. wheat middlings, 4 lb. bran, 1 lb. bean meal.—Total cost 1s. 1½d.

The prices are based on the approximate prices per ton at Ipswich in the autumn of 1914. Smaller cows will require less food per day. For every extra gallon of milk above the 2 gal. daily, 2 or 3 lb. more concentrated food or its equivalent in roots must be added, while for every ½ gal. of milk less than 2 gal., 1 to 1½ lb. of concentrated food may be deducted. If it is possible to give more roots and green stuff than is outlined above, 1 lb. of concentrated food may be deducted for every 10 lb. of extra roots given.

DAIRYING.

The Devitalisation of Tubercle Bacilli in Milk by Means of Electricity (*The Tuberculosis Year Book*, 1915; F. C. Lewis).—Experiments carried out at the University of Liverpool showed that electricity could be applied as a sterilising agent in milk, and suitable large scale apparatus based on the experimental data was designed and built. The results obtained with the large sized plant, all confirmatory of those obtained with the smaller one, are as follows: (1) The total bacterial count is greatly reduced (by about 99.93 per cent. on fifteen consecutive daily tests). (2) All *Bacillus coli* and its allies are destroyed. (3) Tubercle bacilli are destroyed. (4) No chemical change in the milk can be detected. (5) The taste of the milk is quite unaltered.

The fact of the destruction of tubercle bacilli was demonstrated not only by examination of treated milk as compared with untreated milk as ordinarily supplied, but also by tests in which guinea pigs were inoculated with treated and untreated milk from the same sample, and examined after the lapse of six weeks; all those inoculated with untreated milk were found to be tuberculous, while with none of those inoculated with treated milk was this the case. This latter test was carried out both (1) with milk as ordinarily supplied, and (2) with milk from a specially selected tuberculous cow. Further experiments were carried out in which milk was deliberately infected with human tubercle bacilli and in which guinea pigs were inoculated with treated and untreated samples, confirmation of the above results being obtained.

Variations in the Composition of Milk from Individual Cows (U.S. Dept. of Agric., Bureau of An. Ind., Bull. 157).—An investigation was held into three factors possibly affecting the composition of the milk from the individual cow, namely (1) the normal variations from milking to milking; (2) the composition of morning compared with evening milk; and (3) the composition of the first as compared with the last drawn milk.

(1) The protein content of the milk varied to a comparatively small extent. Over 90 per cent. of the analyses showed a variation of less than 0.2 per cent. from the average of the animal supplying the sample, and no samples showed a variation of more than 0.3 per cent. from the average. In the case of sugar some animals showed a wider variation than others; about 90 per cent. of the samples showed a variation of less than 0.2 per cent. but variations of 0.5 per cent. were not uncommon with certain animals.

The extreme variation of the fat content almost reached 2 per cent. Only 56 per cent. of the samples came within 0.3 per cent. of the average; 27.7 per cent. ranged between 0.3 and 0.6 per cent.; 11.7 per cent. varied between 0.6 and 0.9 per cent., and 4.6 per cent. varied more than 0.9 per cent. from the average.

As regards the Reichert-Meissl number, 58 per cent. of the samples varied less than 1 from the average; 23.4 per cent. varied between 1 and 2; 13.4 per cent. between 2 and 3; 4.6 per cent. between 3 and 4; and 0.5 per cent. more than 4. The fluctuation in the Reichert-Meissl number was found to be very marked. The same was found to apply to the iodine number, since only 48 per cent. of the total came within 1 of the average of the cow supplying the sample, while 24.6 varied more than 2 from the average. In the case of the saponification number, 62.2 per cent. of the determinations varied less than 2 per cent. from the average; 24.7 per cent. varied between 2 and 4; 9.3 per cent. between 4 and 6; while 3.7 per cent. varied more than 6. The melting point of the fat varied in only 3.5 per cent. of the samples more than 1° C. from the average, which indicates that the melting point of the fat is not greatly influenced by a small change in the other constants of the fat.

(2) No variation in the protein and sugar content was observed that could be attributed to any difference in composition of morning and evening milk from 5 cows that were milked twice daily (5.30 a.m. and 5.30 p.m.). The fat was noticeably higher in the morning with three of the cows and apparently unchanged with two. The Reichert-Meissl number with each of the five cows was lower in the evening, while the iodine number in each case was higher in the evening. The saponification value for the evening sample was decidedly lower with two animals, slightly lower with two, and higher for one. The melting point showed no variation sufficiently large to be taken into account.

Samples from two animals milked three times (5 a.m., 1 p.m. and 9 p.m.) and four times (4 a.m., 10 a.m., 4 p.m. and 10 p.m.) daily, respectively, showed no appreciable variations in the total protein, sugar and ash. The percentage of fat varied considerably at the different milkings, the highest content being found in milk drawn near the middle of the day.

(3) It was found that there was practically no difference as regards content of protein and sugar between the first drawn milk and the strippings, the change in composition being confined to the amount

of fat present. On the average of all the determinations, the first drawn milk contained 1.87 per cent. of fat and the strippings 6.28 per cent. The fat content of the strippings from individual cows ranged from twice that of the first drawn milk to ten times as much. The Reichert-Meissl number was lower in the strippings with six cows, the iodine number with seven cows, and the saponification number with six cows out of the eight animals tested. The melting point of the fat was practically unchanged.

FORESTRY.

The Economic Disposal of Coniferous Timber (*Trans. Roy. Scot. Arbor. Soc.*, 1914).—The observations made in this paper seem to indicate that, at present, growers of timber do not market their crops at the most opportune time nor in an economic manner. The purchasers of timber are unfortunately severely handicapped in their handling and marketing of the material by the unfair and needless restrictions imposed upon them by the growers; as a result of this they naturally offer less than the true value of the timber.

The importance of either a detailed or approximate survey of the crop previous to sale is emphasised, followed by the grading of the material. Disposal of timber by private bargaining is the best method of sale, while sale by auction is not to be recommended. All trees should be measured over bark, and no allowance for bark made.

Sylvicultural Treatment of Douglas Fir (*Trans. Roy. Scot. Arbor. Soc.*, 1914).—From his experience the author comes to the conclusion that Douglas fir is best planted pure, and at a distance of $4\frac{1}{2}$ ft. to 5 ft. apart. Planted 6 ft. apart mixed with spruce the spruce was suppressed, and the Douglas fir grew too branchy, necessitating expense in pruning and providing no thinnings; while planted pure, $3\frac{1}{2}$ ft. apart, the trees were too much drawn up, considerable thinning had to be undertaken, and the thinnings were of no value.

At the distance recommended it is stated that the lower branches would be killed off before they have grown too strong, and at the same time the trees will develop sufficient crowns to keep them in vigorous health. Thinnings at twenty years would be 4 in., or possibly 6 in. in diameter at 12 ft.; probably half the trees would have to be taken out at that time, and half the remainder would probably have to be removed after another ten or fifteen years, the rest being left for the final timber crop. The second thinning would be suitable for fencing posts, pit sleepers, and box making; and the final crop at seventy to eighty years of age would be useful for railway sleepers, boarding, and all constructional purposes.

MISCELLANEOUS.

Determination of "Quality" in Wool (*Jour. Agric. Sci. Vol. VI., Part 3*; P. G. Bailey, M.A., and F. L. Engledow, B.A.).—This investigation dealt chiefly with the relation between "fineness of fibre" and the commercial grading of the wool. The classes into which the wool was sorted were those employed by the Bradford trade, and were based upon the spinning capacity of a given weight of wool. At shearing, samples were taken from both of the shoulders, the neck, the britch and the belly. Four sub-samples were taken from each sample of wool. From each sub-sample three portions were cut off, one from the hip, another from the middle and a third from the basal end, and each portion was prepared on a glass slide for microscopical examination.

The measurements of the fineness of the fibres were made with a microscope, so adjusted that each division of the scale represented $\frac{1}{80000}$ of an inch. The following conclusions were reached:—

The method of taking four sub-samples and making in all 160 measurements of these sub-samples gives a satisfactory value for the average diameter of the sample from which the sub-samples were selected. The average of the samples from each shoulder gives a good indication of the shoulder wool for each sheep.

A relationship exists between the fineness as measured by the average diameter and the commercial quality into which the wool is graded; but this relationship is not absolute and is not regularly modified by the number of crimps per inch and various other factors.

The average diameter at the tip is the best guide from a genetic point of view as to the fineness of the wool, owing to the marked pathological influences which may affect the average base diameter.

The distribution of the fibres of different sizes has a modifying effect upon the commercial quality which would be assigned from a consideration of the average size only. It is suggested that the standard deviation of the distribution of the fibres should be used as a measure of this modifying effect.

The Destruction of Fly-Larvæ in Horse Manure by Borax (*U.S. Dept. of Agric., Bull. No. 1118*).—By far the most effective, economical, and practical of a large number of substances tried with the object of destroying fly larvæ in horse manure was borax as sold commercially. In addition to destroying the eggs and maggots it increased the content of water soluble nitrogen and of ammonia, and the alkalinity of the manure, and did not apparently injure the bacterial flora. The application of manure treated with borax at the rate of 0.62 lb. per 8 bushels (10 cubic feet) to soil did not injure the plants tested, although it was not determined whether it had any cumulative effect.

The flies lay their eggs on the fresh manure, and the borax, when it comes in contact with the eggs, prevents their hatching. Borax, in the above quantity, should, therefore, be applied to the manure immediately on its removal from the stable; and as the maggots congregate at the outer edges of the pile, most of the borax should be applied there.

Since the effect of the borax-treated manure was not tried with all crops it is recommended that not more than 15 tons of such manure should be applied per acre. The following plants were tested with the manure without apparently any injurious effect, except, perhaps in the case of wheat:—Wheat, tomatoes, peas, beets, radishes, kohlrabi, oats, maize, cucumber, lettuce, apple seedlings and rose bushes.

Road Dust Prevention (*Roy. Agric. Coll., Scientific Bull. Nos. 4 & 5*; W. A. Thain).—From this experiment granular calcium chloride would appear to be a particularly suitable, effective and cheap dust preventive for estate and farm roads. The granulated material was spread evenly over the road surface with a shovel at the rate of $\frac{1}{4}$ lb. per square yard on two successive evenings, giving a complete dressing of 1 lb. per square yard; this application was found effective for two months. The material is hygroscopic, i.e., it absorbs available moisture and so keeps the road surface continuously sufficiently moist to prevent the formation of dust. It is free from offensive odours, and does not adhere to, or injure, boots of pedestrians, rubber tyres or the feet of animals. The cost of the material was 50s. per ton, so that the cost of the dressing per square yard was just over $\frac{1}{4}$ d.

NOTES ON AGRICULTURAL CO-OPERATION.

SOHAM is the largest village in Cambridgeshire, the parish having an area of about 13,000 acres and a population which increased from 4,230 in 1901 to 4,682 in 1911. There are about 300 acres of common, locally known as "The Shade" or "The Commons," on which

The Soham Cattle Club. every resident whose rateable value is not more than £6 is entitled to graze three head of cattle, two horses, or three geese and a gander. There are also 1,140 acres of "open-field," mostly held by small holders of long standing, the occupation of 12 acres of which carries the right to graze one horse or cow on 102 acres of pasture, known as "The Horsefens." The total acreage under crops and grass is nearly 11,000 acres, of which about 8,000 acres are arable land and 3,000 acres permanent grass. The crops grown include nearly 2,000 acres of wheat, 1,200 acres of barley, 1,000 acres of potatoes, and 900 acres of clover and rotation grasses. The parish contains about 800 horses, of which over 500 are used for agricultural purposes, 1,200 cattle, including 500 cows, and nearly 3,000 pigs. There are about 200 holdings above 1 acre, of which 150 are under 50 acres in area, so that the parish is essentially one of small holders.

In 1908 the County Council took on lease for fourteen years the Tile House Farm, with a total area of about 660 acres, of which 500 acres are arable and about 150 acres pasture. The grazing ground has been formed into common pasture for the tenants, the lease of each 8 acres of arable land carrying with it the right to graze one head of stock. This farm is now held by about 24 small holders. On the whole the small holders of the parish form a prosperous community.

Formation of the Club.—The Soham Cattle Club was formed in 1866 and registered as a cattle insurance society under the Friendly Societies Act in 1875. It was established "for the purpose of making good any loss that the Members may sustain by the death of Cattle or Stock." It insures horses, mares, foals, and young horses; and cows, calves, bullocks and young stock. A member must be elected by a majority of the members present at a meeting of the Club, and must pay 2s. 6d. as entrance money and 4d. per quarter for expenses of management. The society is managed by a committee consisting of two stewards, a secretary, a treasurer and two other members, who are elected annually. It meets every quarter and the contributions of members are payable at the quarterly meetings.

The society now consists of about 180 members, almost all of whom are small holders, commoners or labourers, more than 100 of them having land which they cultivate. The committee includes three small holders, one of whom is a tenant of the County Council, a butcher, and a builder; the secretary and the two stewards are small holders. The operations of the society are confined to the parish of Soham, the furthest point of which is about five miles from the village.

Rules of the Club.—A member wishing to insure an animal must inform the stewards, who examine and pass it, and no animal can be entered which is diseased, crippled, or aged. All the insured animals are valued twice a year, in April and October, and the value that is placed upon each animal by the valuers determines, with effect from the next

club night, the amount of insurance contribution to be paid by the owner, and the amount to be paid him by the Club in case the animal should die within the following half year, the amount payable in case of death being seven-eighths of the value of the animal, *i.e.*, at the rate of 17s. 6d. in the £. At the half-yearly valuation the two stewards and the secretary go round and inspect the animals on their owners' premises, receiving £2 10s. to pay the expenses of their inspection tour. Any member may also have an animal valued and insured at any time by paying 6d. to the stewards and a full quarter's insurance contribution. A steward is paid 1s. from the funds each time he has to inspect a sick animal.

Both cattle and horses are accepted for insurance if over a fortnight old, and there is no age fixed above which an animal will be rejected merely on account of old age. A horse of even 20 years of age is accepted if fit for work, and no animal once insured is deprived of insurance merely on the ground of old age. Cows are not accepted for insurance for the first time within six weeks of calving, nor are mares within eight weeks of foaling.

An important provision is that no horse can be valued for insurance purposes at over £35 and no cow at over £15, so that the valuation put on the animals is in many cases less than their true market value. Some of the insured horses are worth £50 or £60, and some of the insured cows are worth £23 or £24.

When any member finds one of his insured animals ill, he must inform the stewards, who inspect it, and if they think it advisable, order it to be killed, the skin and carcass being sold and the proceeds credited to the society; but no horses or cattle are slaughtered "simply from old age, or if condemned as unfit for work, which are otherwise in good health." No compensation is payable if the death of the animal is due to the wilful neglect of the owner, and no claim is payable "unless the stewards dispose of the carcass alive or dead."

The rules provide that in case any losses should occur and there should not be funds enough to meet the demands on the society, the members shall pay an extra subscription of any sum in the £ sufficient to pay such loss, as occasion may require. They also provide that the reserve fund shall be £600, and that if the funds fall below this amount extra subscriptions of any sum in the £ sufficient to raise it to this amount shall be paid. Thus the rate of insurance contribution varies according to the state of the funds. It is also sometimes made to vary according as the animals are kept on high land or on fen land, a higher rate being charged on the fen animals, because of their greater liability to disease and accident than in the case of animals kept on high land. In the Fens there are a number of open drains in which animals, especially horses, are apt to be drowned, and as the air is damp and often foggy, animals kept in the Fens are more liable to lung-trouble and other diseases, so that altogether the casualty rate is generally higher on the low than on the high ground.

Statistics of Animals Insured.—Statistics are available for 316 of the insured cattle. Of these 74 are cows, 105 heifers, 68 "buds" (stirks) and 69 calves: 111 of them are valued for insurance at the maximum of £15 and 205 at under that figure. The value for insurance of the whole number, old and young, is £3,290, and their average value £10 8s. Similarly 236 of the insured horses comprise 68 mares, 45 fillies, 17 geldings, 22 nags, 39 ponies, 18 colts, 6 yearlings and 21 foals. Of

these 68 are valued at £30 or over, 53 at £20 and under £30, and 115 at under £20. Their total value is £4,928 and their average all-round value is £21. Except the nags and ponies, which are chiefly owned by tradespeople and used for light road-work, practically all the adult animals are used for ordinary farm-work. No difference is made in the premium with reference to the class of work on which an animal is employed, and no extra charge is made to cover calving or foaling risks.

In July, 1914, the number of animals insured was 316 cattle and 273 horses, an average of 1·8 cattle and 1·5 horses per member, and as a member must insure all his stock, this shows that most of the members have only a small number of animals each. Members who have no stock are allowed to continue as members on paying 6d. per quarter to the management fund.

During the eleven years ending 1913 the number of members rose from 125 to 180, the number of cattle insured from 260 to 380 and the number of horses insured from 172 to 230. The total amount paid on claims averaged £186, and the total expenditure of the insurance fund averaged £188, annually. On the other hand the average income of the insurance fund was as follows:—

Insurance Contributions	..	..	..	..	£
Fines	..	..	..	..	137
Interest	..	..	..	..	1
Sale of Carcasses	..	..	..	..	16
Other Income	..	..	..	..	11
					2
Total Income	..	..	..	..	£167

The net average loss on the working of the insurance fund during the 11 years has therefore been £21 per annum, and the amount at the credit of the insurance fund has fallen in that period from £770 to £534.

The cost of management has averaged £12 4s. per annum, or less than 6d. per animal insured, and has been met almost entirely by the contribution for management expenses of 1s. 4d. per annum per member. Of the £12 3s. spent last year the stewards received £5 15s., and the secretary, assistant-secretary and treasurer £3. The balance sheet for 1912 shows that the total assets of the society were £534, of which £404 was deposited in the Post Office Savings Bank.

From 1890 to 1900 the contributions from members were at the rate of 1½d. in the £ per quarter on all the horses and cattle insured, and the amount at credit of the insurance fund rose from £420 to £775. The society then in 1900 reduced the rate all round to 1d. per £ per quarter, and even at this rate the balance continued to rise until in 1906 it was £813. Then followed two bad years, partly owing to an epidemic of "Pink-eye," and the funds fell to £630. An enquiry made by the society showed that during the last 4½ years the contributions levied on the stock kept on the high land had amounted to £399 against a loss of £357, while for the stock kept in the fen land the contributions had been £142 and the losses £359. As this showed conclusively that the mortality had occurred chiefly among the fen stock, an extra ½d. per £ per quarter was charged on animals kept in the Fens. Notwithstanding this the funds had again fallen to £534 at the end of 1913, and as this is below the £600 aimed at by the rules, all insured stock, wherever kept,

are now charged at the rate of 1½d. per £ per quarter. In the valuation, each animal is valued in even pounds, so that it is easy for a member to calculate for himself what his quarterly payment will be. The rate of 1½d. in the £ per quarter is equivalent to 6d. in the £ per annum, i.e., 2½ per cent. per annum on the value placed on the animal at valuation, and, as the amount payable on the death of an animal is seven-eighths of its valuation, this rate of premium equals just under 3 per cent. per annum on the amount payable in case of death. When the rate of insurance contribution was 1d. per £ per quarter it equalled 1⅔ per cent. per annum on the value placed on the animal, or just under 2 per cent. per annum on the amount payable in case of death.

Taking cattle and horses together, on the average of the eleven years, of 541 animals insured 17·2 died—an average death-rate of 3·2 per cent. per annum. The average amount paid on claims was £186, but £11 was received for carcasses, so that the net annual loss to the Club was £175, equivalent to £10 per animal that died, and to 6s. 6d. per animal insured. For cattle the average amount paid per claim was £7 8s., while for horses it was £14 4s. Spread over the number of animals insured the amount paid on claims equalled for cattle 4s. 2d. per animal, and for horses 11s. 5d. The amount of premiums received averaged £137, or 5s. 1d. per animal insured, so that although the Club received an average of £16 in interest on its reserve fund, its expenditure exceeded its income, and, as already said, it had to draw on the reserve fund at the average rate of £21 per annum. Last year, at the enhanced rate of 1½d. per £ per quarter applied to all animals, the average amount of premium received for animals insured was 7s. 2d., and as this exceeds the average net loss per animal insured for the last eleven years, it may reasonably be expected that the reserve fund will now mount up again.

It is interesting to compare the experience as regards cattle and horses separately. On the average of the eleven years, of 335 cattle 8·9 died, an average death-rate of 2·7 per cent., while of 206 horses 8·3 died, an average death-rate of 4 per cent. Further, if we compare the experience of the first four years during which the reserve fund rose to £813, with that of the last seven, during which it fell to £534, we find that for the first period the death-rate among cattle was 2·7 per cent. per annum, and in the second period again 2·7, while on the other hand the death-rate among horses rose from 3·1 in the first period to 4·4 in the second. It is obvious, therefore, that the main reason why the reserve fund has decreased in the last seven years has been that there has been a higher mortality among the horses. It is also clear that, if the insurance contribution for a cow is 2½ per cent. per annum (i.e., 1½d. per £ per quarter) on her value for insurance, that paid for a horse should, according to the recent mortality experience, be about 4 per cent. per annum on his value for insurance, i.e., 2½d. per £ per quarter. If the Club were to raise the charge on horses to this amount, the distribution of the total insurance charges would be fairer; the reserve fund might be expected to increase above the £600 aimed at (which is probably sufficient, as it exceeds three times the average annual net loss on claims), and the Club might then safely give a reduction on the animals kept on the high land, among which the death-rate is lower than it is on the fen land. It might at least raise the rate to 2½d. per £ per quarter on horses kept in the Fens, as being the class of animal most responsible for the recent rise in the death-rate and consequent depletion of the reserve.

The fact remains that this society of small holders, entirely dependent on its own resources and management, has for many years insured its members' cattle and horses from death by disease and accident from a fortnight old up to any age, on payment of an insurance contribution never exceeding 3 per cent. per annum on the amount payable in case of death, and of a management contribution of 1s. 4d. per member per annum (equivalent to less than 6d. per animal insured); while, if the members had individually insured their animals with an ordinary live stock insurance company, they would have had to pay as premium at least 7½ per cent. on their dairy cows and 5 per cent. (for animals owned singly) on their farm-horses in the prime of life, while the rates charged on the very young or very old animals, now insured by the Club, would have been prohibitive, and an extra charge would have been made to cover foaling risks. Meanwhile the Club has accumulated a reserve fund, which now amounts to £534. It thus affords an excellent example of the success of the co-operative insurance of live stock, worked by the small stock-owners themselves.

OFFICIAL NOTICES AND CIRCULARS.

THE purpose of the Board's Special Leaflets was explained in the note in the *Journal* for September, 1914, p. 566, and a list of those issued was given at the time and again in the *Journal* for October, 1914, p. 658, and November, 1914, p. 755. The following further Special Leaflets have since been prepared:—

- Issue of Special Leaflets.**
- Special Leaflet No. 17.—Supplies of Pit Timber.
- " " 18.—Potato Growing in Allotments and Small Gardens.
- " " 19.—Substitutes for Oats in Feeding Farm Horses.

No outbreak of Foot-and-Mouth-Disease has been confirmed in Great Britain since those which were confirmed on the 18th October last at Orlingbury, Northamptonshire, and at Deal, Kent, as recorded in last month's *Journal*. All the remaining restrictions imposed by the Board on the movement of animals on account of those two outbreaks were withdrawn as from the 23rd November.

Owing to the reappearance of foot-and-mouth disease in Denmark, the Board have reimposed the prohibition of the landing in Great Britain of hay and straw brought from that country. The landing of animals from Denmark is already prohibited.

THE Board desire to draw the attention of farmers to the value of Malt Culms for feeding purposes. Not many years ago practically the whole output of this commodity was consumed in this country, but lately the bulk has been exported. At the present time considerable stocks are accumulating and will probably be obtainable at relatively low prices. Malt culms, or coombs, consist of the dried rootlets and

shoots screened from the kilned malt. High quality culms are light coloured, crisp, and nearly free from dust, and they possess a pleasant aromatic smell. As regards chemical composition they are subject to considerable variation, but on the average contain 23 per cent. of crude albuminoids, 2 per cent. of oil, 44 per cent. of carbohydrates, and 12½ per cent. of fibre.

It should be noted, however, that a considerable proportion of the ingredients classed as crude albuminoids are not "true albuminoids" and possess a relatively low nutritive value. Nevertheless, malt culms are highly palatable, and are readily eaten by all classes of stock. They impart a relish to less appetising foods and are specially suitable for feeding to sheep and milking cows. Malt culms may be fed in the same way as dried grains, and in somewhat similar quantities. At present prices they are well worth a trial.

IN view of the difficulties and delays which are liable to arise under present conditions in the transport of goods by rail, the Board of Agriculture and Fisheries consider that farmers would be well advised to place their orders for fertilisers and other farm requirements so as to allow ample time for delivery.

Transport of Goods by Rail.

MISCELLANEOUS NOTES.

Budget of the United States Department of Agriculture for 1914-15 (*Expt. Sta. Rec.*, July, 1914).—The amount provided for in the Budget of the United States Department of Agriculture for the year 1st July, 1914, to 30th June, 1915, is £4,138,715, or an increase of £391,435 over the amount provided in the previous year. The following are the amounts allotted to the principal Bureaus in the two years:—

	1914-15.	1913-14.
	£	£
Weather Bureau	347,348	355,752
Bureau of Animal Industry	483,339	423,166
Bureau of Plant Industry	753,343	555,833
Forest Service	1,155,887	1,124,933
Bureau of Chemistry	224,496	220,446
Bureau of Soils	75,132	69,587
Bureau of Entomology	172,796	154,627
Bureau of Biological Survey	58,602	35,623
Bureau of Crop Estimates	57,412	50,767
Office of Experiment Stations	402,246	396,096
Office of Public Roads	73,450	58,208

The sum allotted to the Bureau of Animal Industry is additional to a permanent annual grant of £625,000 for meat inspection, and to a special grant, in February, 1914, of £125,000 for the investigation and treatment of dourine and swine fever, and for the inspection of viruses, serums, &c., used in the treatment of animal diseases.

The greater part of the large increase in the expenditure of the Bureau of Plant Industry is due to the increased activities of the Bureau in demonstration work.

Of the vote for the Office of Experiment Stations £300,000 is paid to the state experiment stations.

An account of the growth of the United States Department of Agriculture was given in this *Journal* for July, 1913, p. 317.

Government Bounties to Agriculturists in Italy.—A recent Order of the Italian Minister of Agriculture authorises the awarding of prizes to farmers in the Roman *campagna* (a district consisting chiefly of swamps) who make special efforts, by planting trees and in other ways, to improve the agricultural condition of the land in this part of the country, which had been abandoned for many centuries.

A prize, which may reach a maximum of £20, is allotted to owners or lessees of land for every 2½ acres of ground occupied by shrub nurseries. A grant of 8*d.* for every tree planted in 1914 is also provided for, of which half is to be given to the person owning or renting the land, and the other half distributed among those who have manured the tree.

A special prize is established for distribution among hands employed on farms, for the purpose of encouraging the preservation of trees already existing. The prize may not exceed a total of £8 in respect of farms of less than 500 acres, and £12 for larger farms. Another prize, which may reach £20, is granted to any person who adopts a practical and cheap method of protecting trees.

A grant not exceeding £20 for every 2½ acres will be paid to owners of existing nurseries which are capable of yielding sound grafts for new plantations. This grant can only be paid once. (*Foreign Office Reports, Ann. Series, No. 5368*).

Agriculture in Friesland, Holland (*Foreign Office Reports, Ann. Series, No. 5315*).—*Cattle Breeding.*—Frisian cattle belong to a large group of lowland races. They are chiefly black-and-white speckled in colour, but a red-and-white speckled variety is also found. Pure bred stock have always existed in Friesland, and in 1879 the "Frisian Herdbook" was initiated with the view of permanently establishing the breed. The conditions are very stringent, and even pure bred descendants of registered animals are not accepted for registration unless their external characteristics are satisfactory. The two colours are strictly separated in the herdbook, and mixed colours cannot be registered. Space is provided in the book for recording the milk yield, percentage of fat, and the number of days in milk for each animal, as well as a complete family history of the animal, and the name of the owner, but the registration of figures in relation to the milk and butter yield is not compulsory. An excellent organisation exists for the constant inspection and control which are necessary. Annual grants are given by the Dutch Government and the provincial authorities for judging bulls and for supporting associations working in the interests of cattle breeding.

Official testing of breeding-cattle for exportation is carried out with great care and accuracy by experienced veterinary surgeons, and includes clinical examination with regard to contagious and other diseases and the tuberculin test for the detection of tuberculosis. The charge for the inspection, tuberculin test included, and the Government certificate is 12*s.* 6*d.* per head, or without the tuberculin test 8*s.* 4*d.* per head.

Egg Production.—Leeuwarden, the capital of Friesland, is the headquarters of the Netherlands society for the encouragement and promotion of poultry farming. This society, which is subsidised by the Government, and works entirely on a co-operative system, aims at making a reputation for Dutch new-laid eggs. No egg is exported before it has been carefully tested and has been stamped with the society's special mark ("V.P.N.") and a number, which corresponds with a number on a register indicating the name of the farmer and the date of delivery of the egg at headquarters. A subscriber or member of the association is fined if it happens more than once that one of his eggs fails to pass the electric light test in a dark room. The grading of the eggs is carried out both by putting them in different sized holes and by weighing them. The sales at the Leeuwarden depot amounted during 1913 to 13,293,400 eggs against 11,750,960 in 1912, the greatest demand being from the United Kingdom. The association has formed a department for dealing with poultry, alive and killed, and rabbits; the total number disposed of during 1913 was 60,845, realising about £4,200. The farmers who are members of the society have the benefit not only of the best advice in respect of poultry breeding, curing disease, and other matters, but also can purchase from the association poultry food selected on scientific principles at the lowest prices.

Dairying.—In 1913 Friesland dealt with close upon 880,000,000 lb. of milk by means of more than 100 steam factories. The greatest attention is given to the quality of the milk, which is constantly tested by a well-trained staff of inspectors. The co-operative system has been almost generally adopted, not only for manufacturing, but also for selling and finding the best markets. The system of State control of butter is excellent, and every pound of butter exported is provided with the Government mark of guarantee as to its purity.

It is expected that before long a similar system of control will be established in respect of cheese. Four main varieties of cheese are manufactured, viz., Gouda, Edam, "Cheddar," and "Cheshire." Of "Cheddar" cheese two sorts are prepared, called "full-meat" and "half-meat," respectively. The former have a minimum percentage of fat of 50 per cent. and the latter of 30 per cent. "Cheshire" cheeses are not made of full cream and the percentage of fat is 30 per cent. The total production of cheese of all descriptions in Friesland in 1913 amounted to some 28,530 tons.

THE following preliminary statement shows the estimated total produce and yield per acre of the potato and root crops in England and Wales in the year 1914, with comparisons for 1913, and the average yield per acre of the ten years 1904-1913.

—	Crops.	Estimated Total Produce.		Acreage.		Average Estimated Yield Per Acre.		Average of the ten years 1904- 1913.
		1914.	1913.	1914.	1913.	1914.	1913.	
England and Wales	Potatoes ..	Tons. 2,955,299	Tons. 2,894,655	Acres. 461,621	Acres. 442,035	Tons. 6'40	Tons. 6'55	Tons 6'13
	Turnips and Swedes ..	13,450,781	12,794,323	1,042,438	1,048,843	12'90	12'20	13'16
	Mangolds ..	7,918,767	7,611,123	431,366	419,456	18'36	18'15	19'47
England	Potatoes ..	2,809,395	2,754,487	436,172	416,697	6'44	6'61	6'19
	Turnips and Swedes ..	12,598,326	11,936,443	986,869	992,380	12'77	12'03	13'04
	Mangolds..	7,719,680	7,434,471	420,335	409,150	18'37	18'17	19'51
Wales	Potatoes ..	145,904	140,168	25,449	25,338	5'73	5'53	5'26
	Turnips and Swedes ..	852,455	857,880	55,569	56,463	15'34	15'19	15'35
	Mangolds..	199,087	176,652	11,031	10,306	18'05	17'14	17'98

NOTE:—The total production of potatoes in England and Wales amounts to 2,955,299 tons, or some 60,000 tons more than last year; while the yield per acre, although slightly less than in 1913, is about $\frac{1}{4}$ ton above the average. Turnips and swedes have given a yield considerably better than in 1913, but rather below the ten-year average. The yield of mangolds, on the other hand, is only slightly above that of 1913, and a ton below the average. Both kinds of roots are, speaking generally, above the average in most of the western counties, and below the mean, sometimes considerably so, in the eastern half of England. The total production of turnips, swedes and mangolds in England and Wales is some 960,000 tons greater than last year.

THE *Bulletin of Agricultural and Commercial Statistics* for November, 1914, contains estimates of the production of cereal crops this year.

Notes on Crop Prospects Abroad.

The countries for which it is possible to give estimates are as follows:—In *Europe*—Prussia, Hungary (proper), Belgium, Denmark, Spain, Great Britain and Ireland, Italy, Luxemburg, Netherlands, Rumania, Russia in Europe (63 governments), Sweden, Switzerland; in *America*—Canada, United States; in *Asia*—India, Japan; in *Africa*—Algeria (department of Constantine), Tunis.

Wheat.—The total production in the above-mentioned countries is estimated to amount to 342,540,000 qr., against 375,765,000 qr. in 1913, the decrease being equal to 8.8 per cent., while the area under production was greater by 1.5 per cent.

Rye.—The estimated production in the specified countries, excluding Great Britain, India, Japan, Algeria, and Tunis, is placed at 173,136,000 qr., against 180,137,000 qr. in the corresponding countries last year, or a decrease of 3.9 per cent. The area sown was smaller by 0.8 per cent.

Barley.—In the above countries, excluding India, the forecast gives the production as 142,061,000 qr. this year, or a decrease of 10.6 per cent. as compared with last year, when the production amounted to 158,818,000 qr. The area planted was smaller by 0.6 per cent.

Oats.—For the same countries as above, but omitting India, the estimated production is 336,990,000 qr., against 386,022,000 qr. last year, the decrease amounting to 12.7 per cent., while the area sown was less than in 1913 by 0.7 per cent.

New Zealand.—Preliminary figures of the areas sown to cereals in 1914-15 place the acreage under wheat as 168,000, as compared with 190,000 acres in 1913-14, the decrease amounting to 11.6 per cent. Barley is estimated at 33,000 acres, against 35,000 acres, or a decrease of 5.7 per cent., and oats at 363,000 acres, against 400,000 acres, or a decrease of 9.2 per cent.

France.—The Director of the Ministry of Agriculture states that the crop of wheat is estimated at 39,044,000 quarters. An allowance will have to be made, however, for the crops in the north which have been damaged by the invasion.—(*Broomhall's Corn Trade News*, November 21st.)

Italy.—An official bulletin relating to the period November 10th to 20th states that in northern Italy fine weather has prevailed, which has allowed of the carrying out of the field-work. Sowing has been completed under good conditions and the wheat plant is strong. The low temperature freed the soil from pests especially in Emilia. In central Italy, in the southern districts and in Sardinia, frequent rain interrupted field-work; but it did much good to meadows in Latium and Apulia.

Favourable reports are received from the central provinces as to the growth of wheat, and good hopes are entertained also in the south and the Islands. (*Broomhall's Corn Trade News*, December 3rd.)

Canada.—A bulletin issued by the Census and Statistics Office at Ottawa on the 12th November gives the yield of potatoes in the Dominion as 85,672,000 bush. from the 476,000 acres under this crop, the yield per acre being higher than in any year since 1909. Roots yielded 69,003,000 bush. as compared with 66,788,000 bush. in 1913; hay, 10,477,000 tons against 11,097,000 tons; fodder corn, 3,251,000 tons against 2,616,200 tons; and sugar beet, 146,000 tons against 148,000 tons in 1913. The acreage sown with autumn wheat at the end of October was estimated at 1,294,000 acres in the five autumn wheat provinces, as compared with 1,184,800 acres at the same date last year.

The early harvest and favourable conditions for threshing in western Canada enabled farmers to make excellent progress with autumn ploughing on land intended for sowing in the spring. In Manitoba, 92 per cent., in Saskatchewan, 77 per cent., and in Alberta, 56 per cent. of the autumn ploughing was completed by October 31st.

These figures compare very favourably with the two previous seasons when the highest percentage was not more than 58 in Manitoba.

United States.—The Department of Agriculture estimated the total production of the crops, from reports relating to the 1st November, as follows (in bushels, and final figures for 1913 in brackets):—Wheat, 891,950,000 (763,380,000); oats, 1,139,741,000 (1,121,768,000); barley, 196,568,000 (178,189,000); and potatoes, 406,288,000 (331,525,000). The estimated weights per bushel of the corn crops are wheat 58.0 lb.

compared with 58.7 lb. last year and 57.9 lb. the average of the last ten years; oats 31.5 lb. against 32.1 lb. and 31.7 lb. respectively, and barley 46.2 lb. against 46.5 lb. in 1913 and 46.8 lb. in 1912.

Egypt.—According to an official report for Lower Egypt and Giza, the weather is favourable for the maize crop, and water supply ample. The warm weather has benefited the late sown areas to a great extent, and the crop promises to give excellent results. In Upper Egypt crop conditions are generally favourable, although there are some complaints regarding late sown being poor and not making up for lost growth. Indications point, however, to a fairly good yield. (*Broomhall's Corn Trade News*, December 3rd.)

Argentina.—A considerable amount of rain fell in the South, West and Pampa during the latter part of October, and at the end of the month conditions were very favourable for all growing crops, and an early harvest was expected. In Santa Fé and Cordoba locusts were very abundant, but they were not expected to do any harm to the wheat or linseed crops.—(*The Review of the River Plate*, 30th October.)

Further rains fell in the Province of Buenos Aires and the Pampa at the end of October, and on two nights there were heavy frosts in the Bahia Blanca zone and also in the south of the province of Cordoba. The representative of a leading grain firm in Bahia Blanca states that the advanced oats have suffered damage to the extent of 20 per cent., and that rye and barley have been seriously damaged. The real effect of the damage done will probably not be seen for three or four days. In Coronel Suarez the damage is estimated at from 15 to 20 per cent., whilst in Pringles damage has been slight, due to the amount of moisture in the earth. The frosts have all followed very heavy rains, and the damage to the growing crops is therefore not expected to be serious. Frosts were also reported in parts of the Province of Santa Fé and throughout the west of the Province of Buenos Aires. The weather still remains very cold and a change to warm is essential, for, if the frosts continue, considerable damage is likely to be done. (*The Review of the River Plate*, November 6th.)

THE Crop Reporters of the Board, in reporting on the crops and the agricultural conditions in England and Wales on the 1st December, state that the weather was more favourable for autumn cultivation and wheat sowing in the south than in the north; it was nearly everywhere wet, and frosts were experienced in the second half of the month. Good progress was, however, very generally made. It is estimated that some four-fifths of the area intended for wheat had been sown by the 1st of the month; while, comparing the position then with that a year ago, there would appear to be an increase of about 10 per cent. in the area under this cereal. Where the autumn-sown corn is above ground it is everywhere looking healthy and satisfactory.

Mangolds had practically all been lifted in good condition, and the roots are generally sound, although usually small in the south. The total production in England and Wales is estimated at 7,918,767 tons, some 300,000 tons more than in 1913. The yield per acre, 18½ tons, is rather greater than last year, but about a ton below the average. Turnips and swedes are less satisfactory in quality: their yield of 12.9 tons per acre is considerably better than in 1913, but rather below the ten-year average; while the total production (13,450,781 tons)

is some 650,000 tons more than last year. Both kinds of roots are, speaking generally, above the average in most of the western counties, and below the mean, sometimes considerably so, in the eastern half of England.

The total production of potatoes in England and Wales is returned at 2,955,299 tons, which is some 60,000 tons more than in 1913. The yield per acre is estimated at 6.40 tons, slightly less than last year, but ¼ ton above the average. There appears to be a considerable amount of disease in the north, more particularly in the chief potato growing district of Lancashire, where it is estimated that not less than half the crop was affected. In Lincolnshire, however, and in the midlands and south generally, little damage from disease has been reported.

ACCORDING to statements in the Board's Monthly Agricultural Report (1st December) the supply of agricultural labour during November was nearly everywhere rather short, but the deficiency was nowhere serious. At the

Agricultural Labour in England and Wales during November. November half-yearly hirings in the north there was some increase to be noted in the wages agreed upon. The following local

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

Northumberland, Durham, Cumberland and Westmorland.—In the western countries, although the supply of labour was somewhat short, it was not so deficient as to be seriously felt. Casual labour was scarce in the eastern counties except near the sea. There was some increase in the wages obtained at the half-yearly hirings at the beginning of the month.

Lancashire and Cheshire.—The supply of labour seemed to present no exceptional difficulties in Lancashire, only one or two districts having a shortage to report. In Cheshire there seemed to be no serious deficiency.

Yorkshire.—In some districts the supply of labour was sufficient, especially in the West Riding, but generally there was a considerable shortage of both skilled and casual labour, and wages rose in most places.

Shropshire and Stafford.—There was a general shortage of both skilled and casual labour, and the lifting of root crops was delayed in some places through lack of men.

Derby, Nottingham, Leicester and Rutland.—A deficiency in the supply seemed general, skilled labour being especially short. Only one or two districts reported a sufficiency.

Lincoln and Norfolk.—In spite of some local complaints of a shortage, the labour supply in Lincolnshire as a whole seemed sufficient. In Norfolk there seemed to be no general deficiency and the shortages reported were not serious.

Suffolk, Cambridge and Huntingdon.—Owing to the early harvest and the small crop of roots, the supply of labour was generally sufficient for requirements, but in Huntingdon there was difficulty in getting enough men to work the horses and feed the stock.

Bedford, Northampton and Warwick.—The supply of labour, more particularly casual labour, was generally short, but work was well forward and the deficiency was therefore not being very seriously felt.

Buckingham, Oxford and Berkshire.—Labour was becoming somewhat short owing to recruiting, milkers, stockmen and casual labourers being wanted in places.

Worcester, Hereford and Gloucester.—In Worcester the supply of labour seemed fairly ample, for the winter at all events. Herefordshire was suffering from shortage, and Gloucestershire returned a shortage in some districts and a sufficiency in others.

Cornwall, Devon and Somerset.—There was sufficient labour in most of Cornwall, but the supply in Devon and Somerset was getting rather short. Milkers were wanted in mid-Somerset.

Dorset, Wiltshire and Hampshire.—The supply of labour seemed to be getting rather short, and to vary from just sufficient to carry through the winter to deficient.

Surrey, Kent and Sussex.—There was some shortage in parts of Surrey and Sussex, and the supply was usually only just sufficient for the current needs.

Essex, Hertford and Middlesex.—Labour was getting distinctly short in the western half of Essex and in parts of Hertford, but in other parts of the division the supply was sufficient to meet current demands.

North Wales.—In Anglesey, Carnarvon and Flint the supply of labour was sufficient for requirements, except as regards horsemen in north-west Flint. In Merioneth and Denbigh, however, there was a shortage.

Mid-Wales.—Montgomeryshire reported a distinct shortage; in Radnor temporary labour was deficient and the general hands had in some cases to do all the swede pulling. In Brecon no pronounced difficulties had been experienced, but wages had risen. In Cardiganshire the supply seemed fairly adequate, and no general rise in wages had taken place.

South Wales.—The supply of labour was generally deficient and often of inferior quality, cowmen being very difficult to get in East Glamorgan.

Prevalence of Animal Diseases on the Continent.

THE following statement shows that according to the information in the possession of the Board on December 1st, 1914, certain diseases of animals existed in the countries specified:—

Bulgaria (for the period September 6th—14th).
Anthrax, Foot-and-Mouth Disease, Glanders, Sheep-pox, Swine Fever.

Denmark (month of September).

Anthrax, Foot-and-Mouth Disease, Swine Erysipelas, Swine Fever.

France (for the period September 6th—19th).
Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Sheep-pox.

Holland (month of October).
Anthrax, Foot-and-Mouth Disease (5 outbreaks), Foot-rot, Swine Erysipelas.

Italy (for the period November 9th—15th).
Anthrax, Blackleg, Foot-and-Mouth Disease (365 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Norway (month of October).
Anthrax, Blackleg, Swine Fever.

Rumania (for the period September 20th—October 6th).
Anthrax, Foot-and-Mouth Disease (9,728 animals), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Russia (month of July).

Anthrax, Foot-and-Mouth Disease (110,920 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of September).

Anthrax, Blackleg, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of October).

Anthrax, Blackleg, Swine Fever.

Switzerland (for the period November 9th—15th).

Anthrax, Blackleg, Foot-and-Mouth Disease (78 "étales" entailing 1,117 animals, of which 19 "étales" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries:—Austria, Belgium, Germany, Hungary, Montenegro, Servia.

The Weather in England during November.

District.	Temperature.		Rainfall.			Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	Number of Days with Rain.	Daily Mean.	Diff. from Average.
<i>Week ending Nov. 7th:</i>	°F.	°F.	Inches.	Inches.		Hours.	Hours.
England, N.E. ...	49.4	+3.8	0.85	+0.19	6	1.1	-1.2
England, E. ...	50.7	+4.4	0.64	+0.07	6	2.7	-0.1
Midland Counties ...	48.9	+3.5	1.25	+0.59	6	1.6	-0.6
England, S.E. ...	52.3	+4.3	1.14	+0.33	5	3.3	+0.7
England, N.W. ...	49.2	+2.6	0.77	-0.14	5	2.1	0.0
England, S.W. ...	50.2	+2.0	1.32	+0.22	6	2.9	+0.4
English Channel ...	53.3	+1.7	0.63	-0.32	4	3.7	+0.7
<i>Week ending Nov. 14th:</i>							
England, N.E. ...	46.6	+2.0	0.54	-0.04	4	2.8	+0.9
England, E. ...	47.0	+1.9	0.47	-0.06	3	1.8	-0.6
Midland Counties ...	47.1	+2.8	0.79	+0.16	4	2.2	+0.3
England, S.E. ...	48.4	+1.5	0.40	-0.37	4	2.3	+0.5
England, N.W. ...	47.6	+1.9	1.91	+1.04	7	2.1	+0.3
England, S.W. ...	49.6	+2.2	1.07	-0.01	5	1.4	-0.8
English Channel ...	51.2	+0.4	0.74	-0.25	6	1.9	-0.8
<i>Week ending Nov. 21st:</i>							
England, N.E. ...	38.4	-4.8	0.60	+0.04	5	2.2	+0.3
England, E. ...	38.8	-4.6	0.58	+0.08	5	3.0	+0.9
Midland Counties ...	36.8	-5.9	0.20	-0.35	2	2.6	+0.9
England, S.E. ...	38.6	-6.6	0.74	+0.08	3	3.7	+1.7
England, N.W. ...	37.8	-6.4	0.23	-0.57	2	3.5	+1.8
England, S.W. ...	39.1	-6.9	0.51	-0.43	2	3.7	+1.6
English Channel ...	45.0	-4.6	0.83	-0.01	3	3.6	+1.1
<i>Week ending Nov. 28th:</i>							
England, N.E. ...	41.2	-0.8	0.58	+0.05	5	0.9	-0.8
England, E. ...	41.3	-0.5	0.64	+0.17	5	2.0	+0.2
Midland Counties ...	40.7	-0.7	0.63	+0.13	4	0.7	-0.9
England, S.E. ...	41.9	-1.7	0.84	+0.25	5	1.8	0.0
England, N.W. ...	42.5	-0.5	1.35	+0.56	6	0.6	-0.9
England, S.W. ...	41.8	-2.8	1.00	+0.12	5	0.8	-1.1
English Channel ...	46.6	-1.7	0.49	-0.30	4	1.0	-1.2

Unit Prices of
Artificial Manures.Statement of cost to the purchaser of 1 per
cent. per ton of Nitrogen, Soluble and In-
soluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d.	s. d.	s. d.	s. d.
Nitrogen from:				
Sulphate of Ammonia	11 5	—	11 2½	{ 11 1½
95% pure ...	—	—	—	{ 93% pure
Calcium Cyanamide ...	11 11	—	12 2	—
Nitrate of Soda ...	13 5½	—	13 9½	13 8
Nitrate of Lime ...	15 10½	—	15 3½	15 6
Soluble Phosphates from:				
Superphosphate 35%	1 10½	1 10	2 0	1 11½
" 33%	1 11	—	2 0½	1 11
" 30%	1 11½	1 11	2 1½	2 0½
" 25%	2 1	2 0	2 2½	2 2½
Dissolved Bones ...	2 11½	—	2 9	2 9½
Allowed for Nitrogen	15 5	—	14 5½	14 7½
Allowed for Insol. Phos.	2 0	—	1 11	1 11½
Insoluble Phosphates from:				
Basic Slag ...	1 8	—	1 5½	1 3½
Bone Meal ...	1 9½	—	1 7	1 8
Allowed for Nitrogen	13 3	—	12 0	12 4
Steamed Bone Flour ...	1 4½	—	1 5	1 6
Allowed for Nitrogen	10 2½	—	10 7½	11 2½
Potash from:				
Kainit ...	—	—	—	—
Sulphate of Potash ...	—	—	—	—
Muriate of Potash ...	—	—	—	—
Potash Salts ...	—	—	—	—

NOTE.—These unit prices are based on the probable retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified. They are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the manure are multiplied by the per-

various sources, at certain Ports and Manufacturing Centres, for December, 1914.

Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
—	11 0	11 0	11 3	10 6	{ 11 4½
—	—	—	11 11	11 11	{ 93% pure
—	13 5	12 9	15 0	14 8½	13 3
—	—	—	—	15 8	15 6
2 0	1 8½	1 8½	2 0½	2 8½	2 0½
—	—	—	2 1	2 1	2 1
2 1	1 11	1 11	2 1½	2 1½	2 1½
2 3	1 10	1 10	2 3½	2 3½	2 3½
2 11½	—	—	3 2	3 3½	3 3
15 5½	—	—	16 8	16 4½	17 0
2 1	—	—	2 3	2 1	2 3½
—	1 4½	1 4	1 4½	1 10½	1 7½
1 8½	1 2½	1 5	1 8½	1 7	1 10½
12 8	8 10½	10 7	12 8	11 8	14 0
1 5½	1 3½	1 3½	1 3	1 6	1 6½
10 9½	9 5½	9 5½	9 4	10 10½	11 6
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

centages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and re-bagging the ingredients, bags, and loss of weight.

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	44	70	664	523
Animals attacked	46	74	725	581
Foot-and-Mouth Disease:—				
Outbreaks	—	1	24	1
Animals attacked	—	23	125	23
Glanders (including Farcy):—				
Outbreaks	5	9	91	139
Animals attacked	8	13	273	335
Parasitic Mange:—				
Outbreaks	†—	107	†1,547	2,210
Animals attacked	†—	184	†2,682	4,342
Sheep-Scab:—				
Outbreaks	29	31	188	179
Swine Fever:—				
Outbreaks	374	224	4,056	2,334
Swine Slaughtered as diseased or exposed to infection ...	2,259	1,871	37,768	29,521
Tuberculosis:—				
Number of Premises notified...	†—	550	†3,973	*—
Number of bovine animals notified as for slaughter ...	†—	587	†4,237	*—

* The Tuberculosis Order came into operation on 1st May, 1913.

† The Parasitic Mange Order, 1911, and the Tuberculosis Order, 1914, were suspended as from 6th August, 1914.

IRELAND.

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

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1914.	1913.	1914.	1913.
Anthrax:—				
Outbreaks	—	—	1	—
Animals attacked	—	—	1	—
Foot-and-Mouth Disease:—				
Outbreaks	—	—	76	—
Animals attacked	—	—	955	—
Glanders (including Farcy):—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	1
Parasitic Mange:—				
Outbreaks	3	2	74	112
Sheep-Scab:—				
Outbreaks	20	45	454	474
Swine Fever:—				
Outbreaks	7	4	185	130
Swine Slaughtered as diseased or exposed to infection ...	37	33	912	855

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES in November and October, 1914.

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

Description.	NOVEMBER.		OCTOBER.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	9 4	9 0	9 3	8 9
Herefords	9 5	8 9	9 1	8 5
Shorthorns	9 4	8 7	9 2	8 4
Devons	9 5	8 8	9 3	8 5
Welsh Runts	9 2	8 6	9 0	8 5
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	9	8½	8½	8
Sheep:—				
Downs	10	9	9½	8½
Longwools	9½	8½	9	8
Cheviots	10	9½	9½	9
Blackfaced	9½	8½	9½	8½
Welsh	9½	8	9½	7½
Cross-breds	9½	8½	9½	8½
	per stone.*	per stone.*	per stone.*	per stone.*
	s. d.	s. d.	s. d.	s. d.
Pigs:—				
Bacon Pigs	7 9	7 4	7 11	7 6
Porkers	8 4	7 9	8 5	7 10
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	24 13	20 13	23 19	19 18
—Calvers	24 0	19 17	22 15	19 11
Other Breeds—In Milk ...	21 16	18 7	20 7	17 4
—Calvers	—	16 2	18 16	16 0
Calves for Rearing	2 10	1 19	2 9	1 19
Store Cattle:—				
Shorthorns—Yearlings ...	12 0	10 5	11 13	10 2
—Two-year-olds... ..	15 19	14 0	15 12	13 11
—Three-year-olds	20 3	17 8	20 9	17 4
Herefords—Two-year-olds... ..	17 4	15 3	17 3	15 5
Devons—Two-year-olds... ..	15 14	14 6	15 6	13 16
Welsh Runts—Two-year-olds... ..	16 8	14 18	16 8	14 3
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	4½ 11	36 6	42 7	36 6
Store Pigs:—				
8 to 12 weeks old	19 4	14 0	20 10	15 5
12 to 16 weeks old	35 5	26 2	35 0	26 9

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in November, 1914.

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

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
BEEF:—		s. d.	s. d.	s. d.	s. d.	s. d.
English	1st	62 0	60 6	—	64 0	59 0
	2nd	57 6	58 0	—	60 0	56 0
Cow and Bull	1st	55 0	56 0	51 6	55 0	52 0
	2nd	50 6	50 6	46 0	50 6	47 0
Irish: Port Killed	1st	58 6	59 0	58 6	62 6	56 6
	2nd	55 6	56 6	55 0	58 6	54 0
Argentine Frozen— Hind Quarters	1st	60 6	57 0	60 6	59 0	60 6
Fore "	1st	53 6	53 0	53 6	53 0	53 6
Argentine Chilled— Hind Quarters	1st	60 6	57 6	59 6	61 6	59 6
Fore "	1st	54 6	51 6	53 0	54 0	53 0
Australian Frozen— Hind Quarters	1st	56 6	57 0	59 0	58 0	59 0
Fore "	1st	51 6	53 6	53 6	53 6	53 6
VEAL:—						
British	1st	70 0	70 6	78 6	74 0	77 6
	2nd	65 6	67 6	73 0	64 6	73 0
Foreign	1st	—	—	—	77 6	—
MUTTON:—						
Scotch	1st	—	—	80 0	75 0	79 6
	2nd	—	—	74 6	70 6	74 6
English	1st	75 0	81 6	—	72 6	75 0
	2nd	66 0	77 0	—	66 0	71 0
Irish: Port Killed	1st	73 6	—	76 0	70 0	74 0
	2nd	63 0	—	70 6	63 0	69 0
Argentine Frozen	1st	53 0	52 0	52 6	53 6	52 6
Australian "	1st	52 0	51 6	50 6	51 6	50 6
New Zealand "	1st	53 6	49 0	—	58 6	—
LAMB:—						
British	1st	—	—	—	—	—
	2nd	—	—	—	—	—
New Zealand	1st	64 6	58 6	62 6	64 6	63 0
Australian	1st	60 6	56 0	59 0	62 0	59 0
Argentine	1st	59 6	56 6	58 6	58 6	59 0
PORK:—						
British	1st	79 6	70 0	79 6	69 6	77 0
	2nd	71 0	66 6	74 6	65 6	71 6
Foreign	1st	70 0	63 0	67 6	65 0	—

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at
certain MARKETS in ENGLAND in November, 1914.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	15 0	14 0	—	—	15 6	14 6
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	130 0	128 0	131 0	128 6	129 0	125 0
" Factory	119 0	113 0	117 6	111 0	120 6	113 0
Danish	—	—	138 0	135 6	139 6	135 6
French	—	—	—	—	126 6	118 6
Russian	124 6	120 6	123 0	121 0	121 6	117 6
Australian	130 0	128 0	130 6	128 0	128 6	122 6
New Zealand	134 0	130 0	134 0	132 0	130 6	125 6
Argentine	—	—	128 6	126 6	126 6	122 6
CHEESE:—						
British—						
Cheddar	83 6	73 0	85 6	81 0	84 0	78 0
			120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	86 0	78 6	89 0	83 0
			per cwt.	per cwt.	per cwt.	per cwt.
Canadian	76 0	74 6	76 6	75 0	76 6	74 6
BACON:—						
Irish (Green)	78 6	74 0	75 6	71 0	76 6	72 0
Canadian (Green sides)	70 0	67 0	69 0	66 0	69 0	65 6
HAMS:—						
York (Dried or Smoked)	114 0	112 0	—	—	112 0	104 0
Irish (Dried or Smoked)	—	—	—	—	98 6	90 6
American (Green) (long cut)	72 0	69 0	73 0	68 6	73 0	70 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	22 1	20 10
Irish	19 9	18 9	18 7	17 7	19 7	18 6
Danish	19 9	18 9	18 9	17 9	19 6	18 0
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	85 6	76 6	61 6	56 6	77 6	68 6
Scottish Triumph	70 0	60 0	55 0	50 0	—	—
Up-to-Date	77 6	65 0	55 0	50 0	73 0	63 6
HAY:—						
Clover	—	—	98 6	75 0	94 0	83 6
Meadow	—	—	—	—	84 6	75 6

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 1912, 1913 and 1914.

Weeks ended (in 1914).	WHEAT.			BARLEY.			OATS.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Jan. 3...	s. d. 33 2	s. d. 30 5	s. d. 31 1	s. d. 33 3	s. d. 28 6	s. d. 26 2	s. d. 20 7	s. d. 19 10	s. d. 18 2
" 10...	33 1	30 3	30 11	33 0	28 4	25 11	20 8	19 2	18 4
" 17...	33 4	30 5	31 0	33 3	28 6	26 0	20 11	19 4	18 6
" 24...	33 7	30 11	30 11	33 1	28 10	26 3	21 1	19 4	18 11
" 31...	33 8	31 1	31 1	32 10	28 11	26 6	21 3	20 2	19 1
Feb. 7...	34 0	31 0	31 0	33 2	28 10	26 7	21 4	20 1	18 9
" 14...	34 4	30 9	31 0	32 10	29 1	26 7	21 7	20 2	18 11
" 21...	34 6	30 11	31 0	32 8	28 8	26 7	21 9	20 7	18 11
" 28...	34 1	31 0	31 0	32 0	28 6	26 6	21 6	20 4	18 11
Mar. 7...	34 1	31 3	31 5	31 7	28 5	26 2	21 8	20 0	18 9
" 14...	34 0	31 1	31 6	31 2	27 11	26 0	21 8	20 2	18 7
" 21...	34 1	31 1	31 5	31 10	28 6	25 8	21 9	19 11	18 6
" 28...	34 4	31 3	31 4	30 3	27 6	25 7	21 8	19 7	18 8
Apl. 4...	34 10	31 4	31 6	30 9	27 0	25 6	21 11	19 2	18 5
" 11...	35 4	31 3	31 5	30 2	27 8	26 8	22 1	19 2	18 4
" 18...	36 7	31 6	31 7	29 11	26 11	25 4	22 4	18 10	18 4
" 25...	37 10	31 8	31 9	30 4	26 7	26 6	22 9	19 3	18 5
May 2...	38 1	32 2	31 9	30 2	25 11	26 0	23 1	19 6	18 9
" 9...	37 11	32 6	32 2	31 1	25 9	25 6	23 7	19 6	18 11
" 16...	37 8	32 10	32 7	31 2	25 4	26 3	23 7	19 11	19 0
" 23...	37 2	32 10	33 0	31 1	25 3	25 10	23 9	20 1	19 4
" 30...	36 10	32 7	33 9	30 0	26 1	26 1	23 9	20 1	19 4
June 6...	36 11	32 10	34 0	29 11	26 2	25 11	24 0	19 8	19 4
" 13...	37 0	32 8	34 1	30 8	24 7	24 11	23 10	20 2	19 8
" 20...	37 5	32 8	34 1	30 8	23 10	25 10	24 0	19 8	19 9
" 27...	37 10	32 8	34 3	30 2	24 3	25 4	23 11	19 1	20 0
July 4...	38 2	33 1	34 4	31 7	25 2	24 6	23 11	21 0	19 9
" 11...	38 3	33 4	34 2	30 2	25 10	24 9	24 1	19 4	20 0
" 18...	38 10	33 6	34 1	30 9	24 9	24 2	24 8	20 5	19 10
" 25...	38 9	33 10	34 0	30 9	24 1	24 7	23 4	20 8	19 0
Aug. 1...	38 4	34 1	34 2	28 6	24 5	25 9	22 2	20 3	19 8
" 8...	39 2	34 1	34 9	30 7	24 9	25 2	22 4	19 0	19 1
" 15...	38 2	34 3	40 3	28 3	24 7	29 4	21 8	18 7	25 1
" 22...	35 6	33 7	38 9	28 1	26 5	29 10	20 10	18 8	24 3
" 29...	34 10	32 7	36 2	28 6	29 0	30 3	20 8	17 10	23 5
Sept. 5...	35 1	31 11	36 5	29 9	30 11	30 6	21 8	17 8	23 9
" 12...	33 5	31 9	37 10	29 0	31 5	29 11	20 5	18 0	23 11
" 19...	32 7	31 7	38 3	29 6	30 9	29 5	19 10	17 11	23 8
" 26...	31 7	31 6	37 6	29 9	30 1	29 3	19 5	17 9	23 3
Oct. 3...	31 8	31 3	37 1	29 7	29 9	29 1	19 8	17 10	22 9
" 10...	31 10	31 0	36 8	30 4	29 1	28 10	19 5	17 10	22 5
" 17...	32 2	30 11	36 7	30 11	28 8	28 8	19 9	17 9	22 4
" 24...	33 1	30 7	37 2	31 6	28 7	28 7	19 10	18 0	22 5
" 31...	33 4	30 1	37 10	31 10	28 2	28 3	20 1	17 9	23 7
Nov. 7...	33 1	30 0	38 8	31 11	28 1	28 6	19 11	17 9	23 7
" 14...	32 10	30 1	39 8	31 2	27 8	29 0	19 9	17 11	24 8
" 21...	32 1	30 4	41 0	30 11	27 5	29 8	19 11	18 1	25 5
" 28...	31 9	30 9	41 11	30 8	27 0	30 1	19 8	18 4	25 8
Dec. 5...	31 0	31 2	42 2	29 11	26 8	30 2	19 6	18 4	25 9
" 12...	30 8	31 2		29 2	26 5		19 3	18 6	
" 19...	30 7	31 2		28 11	25 11		19 1	18 5	
" 26...	29 10	31 0		28 6	25 10		19 2	18 4	

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.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of November, 1913 and 1914.

	WHEAT.		BARLEY.		OATS.	
	1913.	1914.	1913.	1914.	1913.	1914.
London...	s. d. 31 1	s. d. 42 4	s. d. 28 4	s. d. 30 10	s. d. 19 7	s. d. 24 11
Norwich...	30 5	39 10	26 6	28 9	17 4	25 3
Peterborough...	29 8	40 10	28 5	30 3	17 9	25 3
Lincoln...	30 0	40 5	28 6	29 8	18 5	25 3
Doncaster...	29 6	40 7	27 1	29 3	18 3	24 5
Salisbury...	28 8	40 1	27 10	29 4	17 7	24 9

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THE CULTIVATION OF SUGAR BEET IN NORFOLK AND SUFFOLK.

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SUGAR beet has been grown experimentally in many parts of Great Britain for several years, but it is only during the last three seasons that the industry has assumed an economic form, and that the growers have been linked up in anything like a practical way with the sugar market. This link between the growers and consumers has been provided by the erection of the factory of the Anglo-Netherland Sugar Corporation Ltd., at Cantley, on the River Yare between Norwich and Yarmouth. Some 200 farmers grew beet for the factory last year (1914), and the area devoted to the crop was about 2,300 acres. Almost the whole of this lies in the counties of Norfolk and Suffolk, although there are several growers as far away as South Lincolnshire, Hertfordshire and North Essex. The largest area grown by any one farmer was 100 acres, the next largest being 70 acres, after which there was a gradual diminution in the extent down to small plots of 2 acres.

The yield of beet from this area is quite insufficient to keep the factory running at full pressure. To secure this, and consequently to obtain conditions under which the production of sugar would be most profitable, 8,000 acres yielding about 100,000 tons of beet are required. The factory "campaign" is a short one at best, as the beet must be turned into sugar as soon as possible after it is lifted, in order to prevent waste. From this it will be apparent that the industry has by no means

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reached the stage of development at which the most satisfactory results can be expected, and it cannot be assumed that the experience of the Cantley factory is typical of what would be expected by factories running under conditions where the industry was more fully developed.

The two processes on which beet sugar production depends are the growing of the beet by the farmers, and its manufacture into sugar in the factory. The purpose of this paper is to deal with the former only. Taking the production of the beet, the cost of this operation in relation both to the immediate and ultimate returns to farmers is the matter of most importance. Evidence on this point is submitted in the following figures showing the cost of growing the roots on a number of farms in Norfolk and Suffolk, and the price received for them.

All figures given here (or elsewhere) for the cost of growing the crop can be taken as being only approximately correct, for nowhere have accurate cost accounts been kept, and where conventional values have to be assigned to the various tillage operations, error is bound to enter. It will be noted that the amount of cultivation differs widely on different farms, due, no doubt, to varying soil conditions.

NORFOLK.

Farm A.—70 acres: 1914.

Cost of 1 acre.

	£	s.	d.
Ploughing	0	12	0
Harrowing and drilling	0	3	0
Horse-hoeing	0	3	0
Hand-hoeing	1	0	0
Lifting	1	4	0
Carting	1	10	0

Cost of Labour	4	12	0
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Artificial manure:—

3 cwt. kainit @ 2s. 6d.	}	2	8	6
1 " superphosphate @ 3s.				
1 " sulphate of ammonia @ 12s.				
2 " nitrate of soda @ 10s.				

Seed	0	7	0
Rent and rates	1	6	0
Sundries	0	2	0

Cost per acre	£8	15	6
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Weight of crop delivered	700	tons.
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" " after washing	560	"
Yield per acre of washed beet	8	"

	£	s.	d.
Cost per ton of washed beet	1	1	11
Price received	700	0	0
Received per acre	10	0	0
Received per ton	1	5	0

The grower is one of the largest growers, and is quite satisfied with his crop, but thinks the price should be another 5s. per ton if farmers are to be attracted into the industry. He has no difficulty with labour. He notes that the beet does best on the lighter parts of the farm. In 1912 his crop was two tons heavier off the same land.

Farm B.—5 acres: 1912.

	£	s.	d.
Subsoiling (13 in.)	3	12	0
Ploughing	1	16	0
Rolling	0	12	0
Harrowing	0	8	0
Cultivating	0	5	0
Sowing	0	6	3
Horse-hoeing	1	4	0
Singling	2	3	2
Scoring	1	12	6
Sowing manure	0	3	6
Sowing nitrate of soda (twice)	0	5	0
Carting manure from station	0	5	0
Taking up and lumping	10	0	0
Carting to station, 95 tons, 3½ miles @ 1s. per mile	16	12	6

Cost of Labour	£39	4	11
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Artificial manure:—

3 cwt. super.	}	£2	11s.	6d.	per acre	12	17	6
1 " sulph. potash								
½ " sulph. ammonia								
2 " nitrate of soda								

Seed @ 9s. per acre	2	5	0
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Rent, rates, etc., say 25s. per acre	6	5	0
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Total cost	£60	12	5
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Cost per acre	£12	2	6
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Weight of crop carted to station	95	tons	16	cwt.
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" " after washing at Cantley	64	"	6	"
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Yield per acre of washed beet	12	"	17	"
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	£	s.	d.
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Cost per ton of washed beet	0	18	10½
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Price received, 64 tons 6 cwt. @ 23s.	73	18	11
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Less carriage to Cantley, 95 tons 16 cwt. @ 3s. 4d.	15	19	4
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Total received	57	19	7
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Received per acre	£11	11	11
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Received per ton	0	18	0½
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According to the factory returns $31\frac{1}{2}$ tons of earth were removed with the crop, equivalent to 6 tons per acre, or nearly 7 cwt. per ton of unwashed roots. The roots were analysed twice, once on September 16th and again on November 1st, when they showed 15.9 per cent and 17.9 per cent. of sugar respectively, the variation being attributed partly to difference in the degree of ripeness, and partly to bad sampling.

Farm B.—5 acres: 1913.

(Cultural operations, etc., as last year.)

	£	s.	d.
Labour	33	16	8
Artificial manure @ £3 15s. 2d. per acre	18	15	10
Seed @ 9s.	2	5	0
Rent, rates, etc., 25s. per acre	6	5	0
Total cost	£61	2	6
Cost per acre	£12	4	6
Weight of crop carted to station	72 tons	16 cwt.	
" " after washing	52 "	4 "	
Yield per acre of washed beet	10 "	9 "	
	£	s.	d.
Cost per ton of washed beet	1	3	5
Price received, 52 tons 4 cwt. @ 23s.	60	0	7
Less carriage to Cantley, 72 tons 16 cwt. @ 3s. 4d. ..	12	2	8
Total received	£47	17	11
Received per acre	9	11	7
Received per ton	0	18	4½

Labour amounted to less in the second year because the field adjoined the road, and haulage was thereby reduced. The loss on washing as returned by the factory was appreciably less than in the previous year (6 cwt. per ton, against 7 cwt. per ton), so that the amount received per ton of washed roots was proportionately greater.

This grower complained of the extra labour necessary in producing this crop, and of the consequent partial disorganisation of the rest of the farm work.

Farm C.—5 acres: 1912.

	£	s.	d.
Ploughing and subsoiling @ 20s. per acre	5	0	0
Twice harrowing @ 10d. per acre each	0	8	4
Twice rolling (2 horses) per acre	0	8	4
Rolling (1 horse) @ 6d.	0	2	6
Sowing, 2 men and 1 horse	0	9	0
Harrowing @ 10d.	0	4	2

	£	s.	d.
Rolling @ 6d.	0	2	6
Horse-hoeing, hand-hoeing, and cutting out @ 24s. ..	6	0	0
Lifting, topping, loading and carting to station—			
Horse labour	6	15	0
Manual labour	14	13	5
Cost of Labour	34	3	3
12 loads dung per acre—60 loads @ 4s.	12	0	0
Artificial manure:—			
3 cwt. super.	6	11	3
3 " kainit	2	3	4
1 " nitrate of soda	5	15	0
Seed			
Rent, rates, etc., 23s. per acre			
Total cost	£60	12	10
Cost per acre	£12	2	7
Weight of crop carted to station	66 tons	4 cwt.	
" " after washing	43 "	10 "	
Yield per acre of washed beet	8 "	14 "	
	£	s.	d.
Cost per ton of washed beet	1	7	10
Price received, 43½ tons @ 21s. 6d.	46	15	3
Received per acre	9	7	0
Received per ton	1	1	6

Here, again, one-third of the weight of the crop delivered at the factory was returned as soil. The factory analysis gave a sugar content of about 17 per cent. This grower likewise complained of labour difficulties in connection with the growing and raising of the crop.

Farm D.—2 acres: 1914.

	£	s.	d.
Ploughing three times @ 10s. per acre	3	0	0
Harrowing, rolling and drilling @ 5s.	0	10	0
Hand and horse-hoeing @ £1 3s.	2	6	0
Lifting @ 25s.	2	10	0
Carting, 32 tons @ 1s.	1	12	0
Cost of Labour	9	18	0
Fish manure, 10s. per acre	1	0	0
Dung, 10 loads @ 5s.	5	0	0
Seed, 12s. 6d. for 2 acres	0	12	6
Rent and rates, £2 5s. per acre	4	10	0
Tithe, 5s.	0	10	0
Total cost	21	10	6
Cost per acre	10	15	3

Weight of crop delivered	32 tons
" " after washing	26½ "
Yield per acre of washed beet	13½ "
	£ s. d.
Cost per ton of washed beet	0 16 3
Price received, 26½ tons @ 25s.	33 2 6
Less barge carriage, 32 tons @ 1s. 9d.	2 16 0
Total received	£30. 6 6
Received per acre	£15 3 3
Received per ton	1 2 11

This grower occupies some very useful land by the side of the river Yare. The field in which the beets were grown practically adjoined a wharf from which the roots could be sent direct to Cantley by wherry. Being also the owner of a brick-field he was always able to get labour at the requisite moment. The earth removed amounted to 17 per cent. of the total weight.

Farm E.—28 acres: 1914.

Cost of 1 acre.

	£ s. d.
Cultivating, twice, by steam (including water, carting and coal)	0 12 0
Harrowing twice	0 1 6
Horse cultivating twice and harrowing twice	0 4 6
Collecting and burning rubbish	0 1 0
Ploughing	0 9 0
Rolling, drilling and harrowing	0 2 6
Three times horse-hoeing	0 2 0
Twice hand-hoeing	1 0 0
Lifting	1 2 6
Carting 4 miles	2 0 0
Carting and sowing manure	0 3 0
Cost of Labour	5 18 0
Artificial manure £1 2s. 6d. and 1½ cwt. nitrate of soda, 16s. 6d.	1 19 0
Seed 18 lb. @ 5d.	0 7 6
Rent, rates, etc.	1 0 0
Cost per acre	£9 4 6

Weight of crop delivered	280 tons 0 cwt.
" " after washing	239 " 14 "
Yield per acre of washed beet	8 " 11 "
	£ s. d.
Cost per ton of washed beet	1 1 7
Price received, 239 tons 14 cwt., @ 25s.	299 12 6
Received per acre	£10 14 0
Received per ton	1 5 0

The grower is enthusiastic. He found no difficulty with labour, which was evidently well managed, for the percentage of earth removed with the crops is exceptionally low, being about 14 per cent.

Farm F.—11 acres: 1912.

Cost of 1 acre.

	£ s. d.
Skimming and working after harvest	0 12 0
Ploughing and subsoiling	0 14 0
Working, rolling and drilling	0 3 2
Horse-hoeing twice	0 5 0
Hand-hoeing and singling	0 13 6
Lifting	1 5 0
Filling, carting, and spreading dung	0 9 6
Carting, mixing, and sowing artificials	0 3 0
" " nitrate of soda	0 2 0
Filling carts, carting to station 2½ miles and loading into trucks	2 10 0
Cost of Labour	6 17 2
10 loads dung @ 3s. 6d.	1 15 0
Artificial manure:—	
3 cwt. super.	0 19 7
4 " kainit	1 2 0
2 " nitrate of soda	0 5 6
Seed	1 15 0
Rent, rates, etc.	£12 14 3
Cost per acre	177 tons 10 cwt.
Weight of crop delivered	137 " 10 "
" " after washing	12 " 10 "
Yield per acre of washed beet	£ s. d.
	1 0 4
Cost per ton of washed beet	144 9 4
Price received	13 2 8
Received per acre	1 1 0
Received per ton	

This grower found the labour difficulty rather serious, and objected strongly to the removal of so much soil with the roots. About 22½ per cent. of the weight removed was soil.

Farm G.—20 acres: 1912.

	£ s. d.
Subsoiling @ 16s.	16 0 0
Ploughing @ 9s.	9 0 0
Rolling	0 10 0
Harrowing	0 10 0
Horse-hoeing	0 11 8

Cutting out, first time @ 10s.	..	..	..	£	s.	d.
.. second time @ 8s.	..	..	..	10	0	0
Drilling	..	..	..	8	0	0
Lifting @ 25s. . . .	..	..	..	0	10	0
Carting and unloading into trucks, 350 loads (286 tons) @ 1s.	..	..	..	25	0	0
	..	..	..	17	10	0
Cost of Labour	..	..	..	87	11	8
Artificial manure :—	..	..	..			
2 tons nitrate of soda	..	..	..	22	0	0
6 tons "Special Sugar Beet Manure" @ £4 os. 0d.	..	..	..	24	0	0
Seed, 15 lb. per acre, 300 lb. @ 5d.	..	..	..	6	5	0
Rent, rates, etc., @ 25s.	..	..	..	25	0	0
Total cost	..	..	..	£164	16	8
Cost per acre	..	..	..	8	4	10
Weight of crop delivered	..	..	..	286 tons	0 cwt.	
" " after washing	..	..	..	238	"	0
Yield per acre of washed beet	..	..	..	11	"	18
	..	..	..	£	s.	d.
Cost per ton of washed beet	..	..	..	0	13	10
Price received	..	..	..	238	8	8
Less rail carriage on 48 tons soil @ 1s. 6d.	..	..	..	3	12	0
	..	..	..	£234	16	8
Received per acre	..	..	..	11	14	10
Received per ton	..	..	..	0	19	8½

Farm G.—12½ acres : 1914.

The costs per acre are estimated at the same figure as in 1912, with the addition of 15 loads of dung :—

Cost per acre as in 1912	..	..	..	£	s.	d.
15 loads dung @ 3s. 6d.	..	..	..	8	4	10
Filling, carting and spreading @ 1s.	..	..	..	2	12	6
	..	..	..	0	15	0
Cost per acre	..	..	..	£11	12	4
Yield per acre (about)	..	..	..	10 tons.		
	..	..	..	£	s.	d.
Cost per ton	..	..	..	1	3	3
Received per ton	..	..	..	1	5	0

This grower believes that the crop is a profitable one, and would always be willing to grow it up to 5 per cent. of his total acreage: In 1912 about 17 per cent. of the gross weight of the crop was deducted as soil. The proportion in 1914 is not available.

Farm H.—4 acres : 1912.

Cost per acre estimated at	..	..	..	£	s.	d.
Weight of crop delivered	..	..	..	12	4	10
" " after washing	..	..	..	87 tons	8 cwt.	
Yield per acre of washed beet	..	..	..	77	"	13
	..	..	..	19	"	8
	..	..	..	£	s.	d.
Cost per ton of washed beet	..	..	..	0	12	7½
Price received	..	..	..	89	7	9
Received per acre	..	..	..	22	6	11
Received per ton	..	..	..	1	3	0

Farm H.—8½ acres : 1914.

Cost of 1 acre.

Twice ploughing	..	..	..	£	s.	d.
Once cultivating	..	..	..	0	16	0
Harrowing and rolling	..	..	..	0	2	0
Drilling	..	..	..	0	2	6
Horse-hoeing	..	..	..	0	1	0
Hand-hoeing and picking	..	..	..	0	2	0
Carting manure	..	..	..	1	0	0
Lifting and topping	..	..	..	0	7	6
Manual and horse labour, carting to station	..	..	..	1	5	0
	..	..	..	1	10	0
Cost of Labour	..	..	..	5	6	0
Artificial manure	..	..	..	2	0	0
10 loads dung	..	..	..	2	0	0
Seed	..	..	..	0	6	0
Rent and rates	..	..	..	1	10	0

Cost per acre	..	..	..	11	2	0
Weight of crop delivered	..	..	..	118 tons	4 cwt.	
" " after washing	..	..	..	101	"	8
Yield per acre of washed beet	..	..	..	11	"	19
	..	..	..	£	s.	d.
Cost per ton of washed beet	..	..	..	0	18	7
Price received	..	..	..	126	12	3

Received per acre	..	..	..	14	17	11
Received per ton	..	..	..	1	5	0

This grower is very keenly interested in the crop. He attaches a very high value to the leaves and crowns for feeding all classes of stock, and he has noticed a marked increase in fertility following beet.

SUFFOLK.

Farm I.—40 acres : 1914.

Cost of 1 acre.

Twice ploughing and once subsoiling	..	..	..	£	s.	d.
Three times harrowing	..	..	..	1	6	0
Drilling	..	..	..	0	3	0
	..	..	..	0	2	0

	£	s.	d.
Rolling twice	0	1	6
Three times horse-hoeing	0	6	0
Hand-hoeing twice, and singling	1	10	0
Carting manure	0	1	0
Sowing manure three times	0	1	6
Lifting	1	5	0
Carting 5 tons per acre @ 2s. 6d.	0	12	6
Filling into trucks @ 4d.	0	1	8
Cost of Labour	5	10	2
Artificial manure :—			
1 cwt. sulph. ammonia	3	0	0
1 „ sulph. potash			
3 „ superphosphate			
2 „ nitrate of soda			
Seed	0	7	6
Rent, rates, etc.,	1	10	0
Cost per acre	10	7	8
Weight of crop delivered 201 tons 10 cwt.			
„ „ after washing	151	„	15
Yield per acre of washed beet	3	„	16
	£	s.	d.
Cost per ton of washed beet	2	14	9
Received per acre	6	6	3
Received per ton	1	13	4

Farm J.—40 acres : 1914.**Cost of 1 acre.**

	£	s.	d.
Steam ploughing	1	0	0
Harrowing	0	8	0
Three hoeings at 4s.	0	12	0
Drilling	0	1	6
Sowing artificials and carting	0	3	0
Filling, carting, and spreading dung	1	3	0
Lifting	1	2	6
Carting to station	0	15	0
Cost of Labour	5	5	0
Artificial manure :—			
3 cwt. nitrate of soda at 10s.	1	10	0
2 „ superphosphate at 2s. 6d.	0	5	0
26 loads dung at 3s. 6d.	4	11	0
Seed	0	5	6
Rent, rates, etc.,	1	10	0
Cost per acre	£13	6	6

Weight of crop delivered	*
„ „ after washing	*
Yield per acre of washed beet	*
	£ s. d.
Cost per ton of washed beet	*
Price received	*
Received per acre	*
Received per ton	1 5 0

The crop was grown on heavy land, and the men seemed to find a difficulty in lifting the roots whole, about one in three being broken. This grower does not subsoil, and finds no difficulty with labour.

Farm K.—20 acres : 1914.**Cost of 1 acre.**

	£	s.	d.
Steam ploughing	1	0	0
Harrowing	0	5	0
Drilling	0	1	6
Hoeing	1	0	0
Lifting	1	2	6
Carting to station	0	12	6
Carting and sowing artificials	0	3	0
Cost of Labour	4	4	6
Artificial manure	3	0	0
12 lb. seed at 7d.	0	7	0
Rent, rates, etc.	1	10	0
Cost per acre	£9	1	6
Weight of crop delivered 287 tons 16 cwt.			
„ „ after washing	135	„	14
Yield per acre of washed beet	6	„	16
	£	s.	d.
Cost per ton of washed beet	1	6	9
Price received	169	13	0
Received per acre	8	9	8
Received per ton	1	5	0

Farm L.—12 acres : 1914.**Cost of 1 acre.**

	£	s.	d.
Ploughing and harrowing	1	15	0
Steam subsoiling	1	0	0
Harrowing, drilling and rolling	0	10	0
Horse-hoeing	0	10	0
Hand-hoeing and singling	1	7	6
Sowing manure	0	5	0
Lifting	1	12	6
Carting to station	0	9	9
Cost of Labour	£7	9	9

* Figures not available for these items.

	£	s.	d.
Artificial manure:—			
2 cwt. sulph. ammonia	1	7	6
2 „ superphosphate	0	5	0
2 „ nitrate of soda	1	2	6
Seed	0	7	0
Rent and rates	1	5	0
Cost per acre	£11	16	9
Weight of crop delivered	41	tons	19 cwt.
„ „ after washing	28	„	11 „
Yield per acre of washed beet	2	„	7½ „
Cost per ton of washed beet	4	19	8
Price received—28 tons 11 cwt. @ 25s.	35	13	9
Deducted by Factory for carriage on dirt in excess of 20 per cent of weight, viz., 5 tons at 3s. 5d.	0	17	1
Net price received	£34	16	8
Received per acre	£	s.	d.
Received per acre	2	18	1
Received per ton	1	4	5

A large part of the area was bare, as owing to the drought a good deal of the seed did not germinate. This grower had received £4 per acre on account in advance from the factory, and had to refund a considerable sum when the final reckoning took place. In 1913 he grew 11 tons, and if the costs had been the same in that year the cost per ton would have been £1 1s. 6d. The percentage of dirt was 33·5.

Farm M.—5 acres : 1912.

	£	s.	d.
Horse Labour	14	13	7
Manual Labour	10	4	3
Cost of Labour	24	17	10
Artificial manure:—			
1 ton of 26 per cent superphosphate	6	13	0
5 cwt. muriate of potash and sowing			
2½ „ sulphate of ammonia			
5 „ nitrate of soda	3	0	0
Rail carriage	10	8	10
Seed	£44	19	8
Rent, rates, etc.	1	17	6
	6	5	0
Total cost	£53	2	2

	£	s.	d.
Cost per acre	10	12	5
Weight of washed beet	46	tons	8 cwt.
Yield per acre of washed beet	9	„	6 „
Cost per ton of washed beet	1	2	10
Price received—46 tons 8 cwt., @ 25s.	58	0	0
Received per acre	11	12	0
Received per ton	1	5	0

Farm M.—6 acres : 1914.

The costs were estimated to be at the same rate per acre as in 1912, except that the factory company paid the railway rate:—

	£	s.	d.
Cost per acre	8	10	7
Weight of crop delivered	28	tons	14½ cwt.
„ „ after washing	24	„	9½ „
Yield per acre of washed beet	4	„	1½ „
Cost per ton of washed beet	2	2	0
Price received	29	2	0
Received per acre	4	17	0
Received per ton	1	3	9

About an acre of the crop did not germinate. The amount of dirt delivered with the roots was 14 per cent. of the gross weight.

Farm N.—17½ acres : 1914.

	£	s.	d.
Twice ploughing	17	5	0
Harrowing, rolling and drilling	4	7	0
First hoeing and singling	12	18	9
Second singling	2	11	9
Second hoeing	10	15	8
Horse-hoeing	2	10	0
Lifting	15	10	6
Carting	11	4	3
Cost of Labour	77	2	11
Artificial manure	37	1	9
Seed	4	13	4
Rent, rates, etc.	21	6	0
Total cost	£140	4	0
Cost per acre	8	2	6½

Weight of crop delivered	141	tons	4½ cwt.
„ „ after washing	115	„	10½ „
Yield per acre of washed beet	6	„	14 „

Cost per ton of washed beet	£ s. d.
Price received	114 8 3
Received per acre	6 12 8
Received per ton	0 19 10

This was the best crop in Suffolk in 1914, but the grower thinks it is 50 per cent. below a fair average yield.

It will be convenient to tabulate these experiences as to the cost of producing the sugar beet crop on the various farms, and the figures are brought together in the table on p. 983.

Some of these figures call for explanation. The low yield in Suffolk in 1914 as compared with Norfolk was due to the excessive drought. The subsoil in south-east Suffolk, where practically all the beet in the country is grown, is mostly sharp sand and gravel. During the summer of 1914 there was a much lighter rainfall here than in Norfolk, and subsoil and drought together were responsible for the entire failure of the root crops on many farms, land that was sown with mangolds having to be ploughed up, as the seed failed to germinate. Small as the crop of beet was, therefore, the farmers were unanimous in saying that it had stood the dry weather better than the other roots. From the figures submitted it will be seen that the returns to the farmers are considerably less in several cases than the costs of growing. These figures, however, cover too short a period, and, in respect of weather, much too abnormal a period, to be taken as representing the average yield.

The year 1912 was also unfavourable to the crop in the Eastern Counties, the month of August seeing no progress in its growth owing to the low temperature accompanied by excessive rain.

It is regrettable that records for a greater number of years are not available. The general estimate of the average yield by farmers of longest experience, both those who favour the crop and those who are indifferent and even opposed to its development, is 12 tons per acre washed. In certain publications 15 tons is said to be the average, but it seems better to accept the farmers' estimate. On the other hand, the cost of growing represented by the preceding figures may be taken as typical or average for any year, the only item which would be higher with large crops being the charge for lifting and carting. The total average cost of growing on all

Statement of Yield and Cost of Sugar Beet Crops Grown in Norfolk and Suffolk on various Farms.

Farm.	Area under Beet.	Cost of Crop (rent, cultivation, &c.) per acre.	Yield (washed roots) per acre.	Cost (washed roots) per ton.	Cost of putting on rail (washed roots) per ton.	Cost of Rail carriage to Factory.		Total cost per ton. (Washed roots.)
						Unwashed roots per ton.	Equivalent to washed roots per ton.	
NORFOLK.	acres.	£ s. d.	tons. cwt.	£ s. d.	s. d.	s. d.	s. d.	£ s. d.
A 1914 ..	70	7 5 6	8 0	0 18 2	3 9	*	*	1 1 11
B 1912 ..	5	8 16 0	12 17	0 13 9	5 2	3 4†	4 11†	1 3 10½
C 1912 ..	5	9 16 0	10 9	0 18 8	4 10½	3 4†	4 8†	1 8 2
D 1912 ..	5	9 1 11	8 14	1 0 11	6 11	—	—	1 7 10
E 1914 ..	28	9 19 3	13 5	0 15 1½	1 2½	1 9†	2 1†	0 18 5
F 1912 ..	11	7 4 3	8 11	0 16 11	4 8	*	*	1 1 7
G 1912 ..	20	10 7 4	12 10	0 16 4	4 0	—	—	1 0 4
H 1912 ..	12½	10 14 10	11 18	0 12 5	1 6	*	*	0 13 11
I 1912 ..	4	12 4 10	10 8	0 12 8	1 9	*	*	1 3 3
H 1914 ..	3½	9 12 0	11 19	0 16 1	2 6	*	*	0 12 8
Average on acreage ..	..	8 3 1	9 15	0 17 1½	3 7	3 1	4 4	0 18 7
Average per farm ..	..	9 6 0	11 12	0 16 7½	3 7½	2 10	3 11	1 0 11
SUFFOLK.	..	..	..	..	..	..	..	..
I 1914 ..	40	9 13 6	3 16	2 10 11	3 9	*	*	2 14 8
J 1914 ..	40	12 11 6	—	—	—	*	*	—
K 1914 ..	20	8 9 0	6 16	1 4 11	1 10	*	*	1 6 9
L 1914 ..	12	11 7 0	2 7½	4 15 7	4 1	—	0 7*	4 19 8
M 1912 ..	5	8 10 7	9 6	0 18 4	—	—	4 6†	1 2 10
N 1914 ..	6	8 10 7	4 11	2 2 0	—	*	*	2 2 0
N 1914 ..	17½	7 9 7	6 14	1 2 3	2 0	*	*	1 4 3
Average on acreage ..	..	10 2 3	5 0	2 4 0	3 0	—	1 9	2 6 11
Average per farm ..	..	9 10 3	5 6	2 2 4	2 11	—	2 6½	2 5 0

* Railway charges paid by sugar factory in this year, but grower's account debited with the extra cost where the proportion of soil consigned with roots exceeded 20 per cent. of total weight.

† Railway charges paid by grower, the difference between cost per ton of roots washed and unwashed being due to soil carted off with the crop. These figures emphasise the necessity for removing as much soil as possible before carting the roots off.

the farms for which figures are given is £9 7s. 8d. per acre. If it be assumed that for three or four years the price of sugar will be high owing to the disorganisation of the industry in Germany, France and Belgium, and that the price of beet will be 25s. per ton f.o.r., as it was in 1914, a crop of 12 tons will give the farmer a return of £15 per acre, and a profit of £5 12s. 4d. per acre, less the cost of placing the crop on rail.

So far therefore as the immediate future is concerned, there is the prospect of farmers being able to start the industry on a sound and remunerative basis. The scarcity of sugar arising from the war will, however, probably cease in a few years, and with the increase in supply the price of beet will fall. It is necessary to keep such a contingency in view, and to consider its possible effect on the position of farmers who may have devoted a part of their rotation to beet growing. This will be referred to among more general considerations later, but it may be affirmed that during three or four years of high prices farmers would gain an experience which should enable them to reduce the cost of growing and to secure a somewhat heavier and steadier yield. After that time they will simply be in the position in which they are to-day as producers of corn, wool and other commodities, in competition with other countries, and there seems to be no reason why they should not hold their own in this department as they do in others.

Indirect Advantages of Growing Sugar Beet.—The question of the indirect advantages received by farmers in crops following beet in the rotation is a matter on which opinions and estimates have to be taken instead of figures, as these are not available. There is almost general agreement that benefit does accrue from the more thorough and deeper cultivation for beet, and from the heavier applications of manure. On one farm the improvement was so noticeable that the labourers remarked upon it to the farmer, and one of the larger growers said that his only reason for growing at all was that the after effects were so good. In two cases growers maintained that their barley crops after beet yielded fully a sack more per acre, and only one man, who grew for *one* season only, was prepared to maintain that there was no appreciable advantage. These opinions, however, are not without a basis of support in the figures giving the cost of growing. These are higher in the case of beet than in the case of turnips and mangolds. The difference is found in the charges for labour and for manure. If the cost of lifting and carting is eliminated from the accounts, as having nothing to do with improved cultivation, the average

cost of manual and horse labour on twelve of the farms for which figures are given is £2 17s. 8d. per acre, and the average cost of manure applied on thirteen farms is £2 19s. Average figures for the cost of growing swedes in the Eastern Counties were unfortunately not available, but it is probable that the cost of labour in growing beet is from 15s. to 20s. per acre more than in the case of swedes. There is, perhaps, a similar difference between the sums spent on manures, but since most of the additional expenditure on beet under this head is for nitrogenous manures, from which no benefit passes to the next years' crops, the expenditure that is beneficial to the succeeding crops may be placed at about £1. It is reasonable, however, and almost necessary to conclude that extra cultivation in the form of subsoiling and cleaning and manuring produces some effect beyond the beet crop itself, and that, if it were carried round a large area of the farm, it would in the course of time raise the standard of production. The full return, therefore, from the larger expenditure should not be expected from the beet crops alone.

A further item or by-product of some value must be set against the cost of £9 7s. 8d. per acre. The factory requires that when the beet is topped, the tops shall include not only the leaves but a good thick slice of the crown from which they spring.

There were cases where feeding on the tops had been let at 20s. per acre, and there is no doubt but that they constitute a palatable food, for in one field on which the grass was exceptionally fresh and good a cart-load of tops was spread, and cows, sheep, pigs and a pony which occupied the field left the grass and started to feed on the beet tops as eagerly as they would on cabbage. On another holding it was said that 25 acres of beet tops had kept 300 ewes from the middle of November, 1913, to the middle of February, 1914, without other roots. Their value as keep was said to be equivalent to that of 15 acres of turnips. In a third case 20 acres of tops in the autumn of 1912 kept 250 ewes and 200 hoggets for 5 weeks. Where growers do not trouble to feed the tops, they plough them in for green manure. Whatever use is made of them, however, they have a considerable value.

Slices (*i.e.*, the residue after treatment at the factory) are a commodity easily transported compared with roots, and when it is known that they can be obtained they will be sought after by the large number of people who own cattle and pigs, and who are always looking for food at a moderate price. The

enterprise of beet growing seems to justify itself; in fact, there is no feature of the whole industry that is essentially novel or unfamiliar. As part of a farming system it is comparable in some respects with potato growing. Potatoes carry fewer by-products for the farmer than beet, and yet potatoes have played a handsome part in the economy of British agriculture, taking one year with another and one period with another.

A comparison may be made of the value of beet with the value of mangolds, when the latter are used for feeding bullocks. During the years 1903-1907, experiments were carried out on Burgoyne's Farm, Cambridgeshire, and on Ryston Hall Home Farm, Norfolk, under the auspices of the Agricultural Department of Cambridge University, to ascertain the proportion of the increased weight of bullocks attributable to the mangolds fed to them as the basis of a mixed ration. The other constituents were varied slightly, but generally they were linseed cake, decorticated cotton cake, meadow hay and oat straw. The proportion of the added weight due to each constituent of this ration was determined by elimination. Taking the price of fat cattle at 40s. per cwt., live weight, it was found that on an average a ton of mangolds produced about 5s. 6d. worth of increase. Apart from the value of the manure, the value of a 25-ton crop of mangolds converted into beef would thus be about £7 per acre.

Chief Economic Features of Beet Growing.—From the farmer's point of view the main economic features of beet growing are as follows. The market for sugar in the United Kingdom is increasing; it is comparable with the market for flour, and in this respect, therefore, beet is comparable with wheat. The growers of wheat are subject to competition with foreign growers, and so will the growers of beet be, but there is no more reason for apprehension in the one case than in the other. Owing to the absence of factories for turning beet into sugar the passage between the beet-grower in England and the sugar-consumer is practically closed, but this difficulty is not insuperable. The market or demand basis of the industry being so sound, and the present circumstances being so favourable, there is a unique opportunity for providing factories to enable the supply to meet the demand.

Once having gained a position in the market proportionate to his production, it would be to the interest of the English farmer to retain that hold. In the Ipswich district several farmers state that they were indifferent to the growing of beet chiefly because their other branches of farming

were paying so well at the moment, the implication being that if their present system were less prosperous, they would be willing to try beet on the chance that while markets for other commodities were low, the market for sugar might be high, and, therefore, might steady their position. The introduction of beet growing into the agricultural economy of the country would be of permanent advantage, strengthening the industry and rendering it more stable, just as the introduction of an additional spoke into a wheel strengthens it. The advantage may be appreciated with reference to agriculture in Norfolk and Suffolk. The system of farming in these counties is corn growing with the feeding of bullocks, sheep and pigs, the last class of stock being particularly numerous in Suffolk. The addition to this system of sugar beet, a crop with a reasonably quick cash return, and depending on a market which at times may be more favourable to it than to the other commodities produced in the system, would place agriculture on a wider and firmer basis. In the present state of its development this industry is most secure where a variety of branches are included in the system. For example, farming in East Lothian is perhaps as sound as in any part of the country, not because it is purely a potato-growing district, but because there is a good mixed system with potatoes, singularly well grown. There seems to be no reason why sugar beet should not play a part in the agriculture of the eastern counties of England and elsewhere not unlike the part played by potatoes in East Lothian. The labour requirements and the general management of the two crops are not dissimilar. The introduction of beet need not do away with the feeding of live stock, and to whatever extent it diminished the numbers kept, this diminution would be less than it has been in the case of potato growing.

While the production of sugar in England in relation to the total amount consumed might not be very large, any more than is the production of wheat in relation to the total consumption, yet, as in the case of wheat, it is salutary in the interests of the consumer that there should be as many sources of supply as possible. It is unnecessary to anticipate the actual circumstances in which a scarcity might arise, but it is as well to recognise that scarcity from various causes is not beyond the bounds of possibility.

NOTES ON THE SUGAR BEET CROP.

THE foregoing report on the cultivation of sugar beet in Norfolk and Suffolk, by Messrs. Orwin and Orr, indicates that farmers whose land is adapted for beet have successfully grown this crop for the Cantley Factory of the Anglo-Netherland Sugar Corporation.

In view of the present high price of sugar it appears probable that satisfactory prices will be paid for sugar beet in the Eastern Counties this year, and as there is a widespread desire for information on the cultivation of the crop, the following notes have been prepared. An article giving an account of the ordinary continental practice in growing sugar beet appeared in the *Board's Journal* for January, 1911, but as the article is now out of print some of the information there given is repeated. It is desirable that English farmers should have at their disposal such of the results of extended continental experience as appear to be applicable to this country.

The sugar beet, of which there are many varieties, has been derived, like the mangold and garden beet-root, from the wild *Beta maritima* or *Beta vulgaris* of the sea coast. In general appearance the plant resembles a small mangold, but there is relatively more leaf and the root lies more deeply in the soil. During the past thirty years the sugar beet has become of ever-increasing importance as a source of sugar for human consumption, until at the present day it represents an annual trade of many millions sterling. The percentage content of sugar in the best types of sugar beet fifty years ago was much lower than at present, but the care bestowed in selection and cultivation has steadily increased the amount of sugar present. Fifty years ago the sugar beet contained 10 to 12 per cent. of sugar; now it contains 16 to 18 per cent., and, under favourable conditions, as much as 20 per cent. may be obtained. The root has also undergone some change in shape, and the best varieties now grown more closely resemble large parsnips than mangolds.

The Importance of Sugar Beet to Agriculture.

Many statements have been published showing that on the Continent the cultivation of sugar beet has raised the yields of grain, rendered possible the keeping of more stock, and consequently increased the output of dung for the benefit of soil and crops. The following definite statement (*Rübenbau*, Knauer-

Hollrung) is given as an illustration of the effect produced on the agriculture of a district in 20 years by the cultivation of sugar beet. In a district of Hildesheim the stock kept before and after the introduction of sugar beet growing (1870 and 1890 respectively) were as follows:—

	1870.	1890.
Work oxen	106	594
Cows and other cattle	3,431	5,469
Young stock	732	1,087
Fattening cattle	635	2,681
Pigs	3,146	9,119

Another writer (Lilienthal) estimated, on the basis of eight farms, that the introduction of the cultivation of sugar beet had led to the following increases over a period of years:—

Increase of live stock in the ratio	100 : 115
Increase in corn production in the ratio	100 : 111
Increase in wages in the ratio	100 : 141
Increase in net profit in the ratio	100 : 134

It should be pointed out, however, that these increases may be partly due to the introduction of a profitable root crop where such a crop was not previously grown. In Great Britain root crops have long held an important place in farm economy, and similar results from the introduction of sugar beet could not be anticipated, except in districts where the difficulty of converting root crops into cash limits the area of arable land.

Climate.

The influence of climate on the beet crop is very marked—temperature, rainfall and sunshine all having an important effect on the percentage of sugar. By comparisons of meteorological observations for many years since 1870, one observer* concluded that the temperature in May, June, and July has the greatest influence on the yield of the crop, while that of September has a very marked effect on quality.

For the production of heavy crops of beet a moderate rainfall is necessary, but once the crop is established it withstands drought better than any of our other root crops owing to its deeper rooting habit.

The average rainfall, in inches, of certain great sugar beet growing centres in France and Germany has been compared

* M. Pagnoul, quoted in *La Betterave à Sucre*, L. Malpeaux.

with the average of centres in the Eastern Counties of England. The result is shown graphically in the accompanying diagram.

In arriving at the figures for the English district, the monthly averages were taken for Cambridge, Hillington, and Rothamsted for the five years, 1902-6.

In the case of France and Germany, the monthly averages have been taken in the same way, the centres for the French district being Arras, Amiens, and Soissons (four years only), and for the German district, Halle, Magdeburg, and Erfurt (four years only).

A comparison of the figures shows that in April all three regions have a rainfall between 1 in. and 1.6 in.; in May the rainfall for the English and German centres is almost identical (2 in.), while that for France is 2.6 in. In June—a month when plentiful rain is needed for the crop—the English centres have a distinct advantage, which is, however, lost in July, but recovered in August; and in the critical month of ripening—September—the three districts may be considered about equal. On the whole, therefore, the Eastern Counties appear to compare very favourably as regards rainfall with two typical sugar beet growing districts in France and Germany, and are not apparently at a disadvantage in this respect.

Soil.

The sugar beet may be grown successfully on a wide range of soils, varying from light sands to heavy loams; the soil must be deep, and fairly free-working. Owing mainly to the difficulties of harvesting, beet cannot be grown profitably on the heavy clays on which mangolds are frequently so successful. The best soils are deep loams, which are cool without being wet, and deep sandy or calcareous loams if moderately supplied with humus. Any soil adapted for growing barley, potatoes, or swedes, easy to work, and readily penetrated by roots, if in a suitable climate, would grow sugar beet well.

The sugar beet is grown to perfection on the rich loams of Saxony, between Magdeburg and Halle, in mid-Silesia, Brunswick, and Anhalt; it is also grown successfully on heavy soils in Westphalia, Thuringia, Saxony, the Northern and Southern slopes of the Hartz, and on light soils in Mecklenburg, Pomerania, Southern Posen, and Altmark. In France sugar beets are chiefly grown in the north, in the Departments of Aisne, Nord, Oise, Pas-de-Calais, Somme, and Seine-et-Marne.

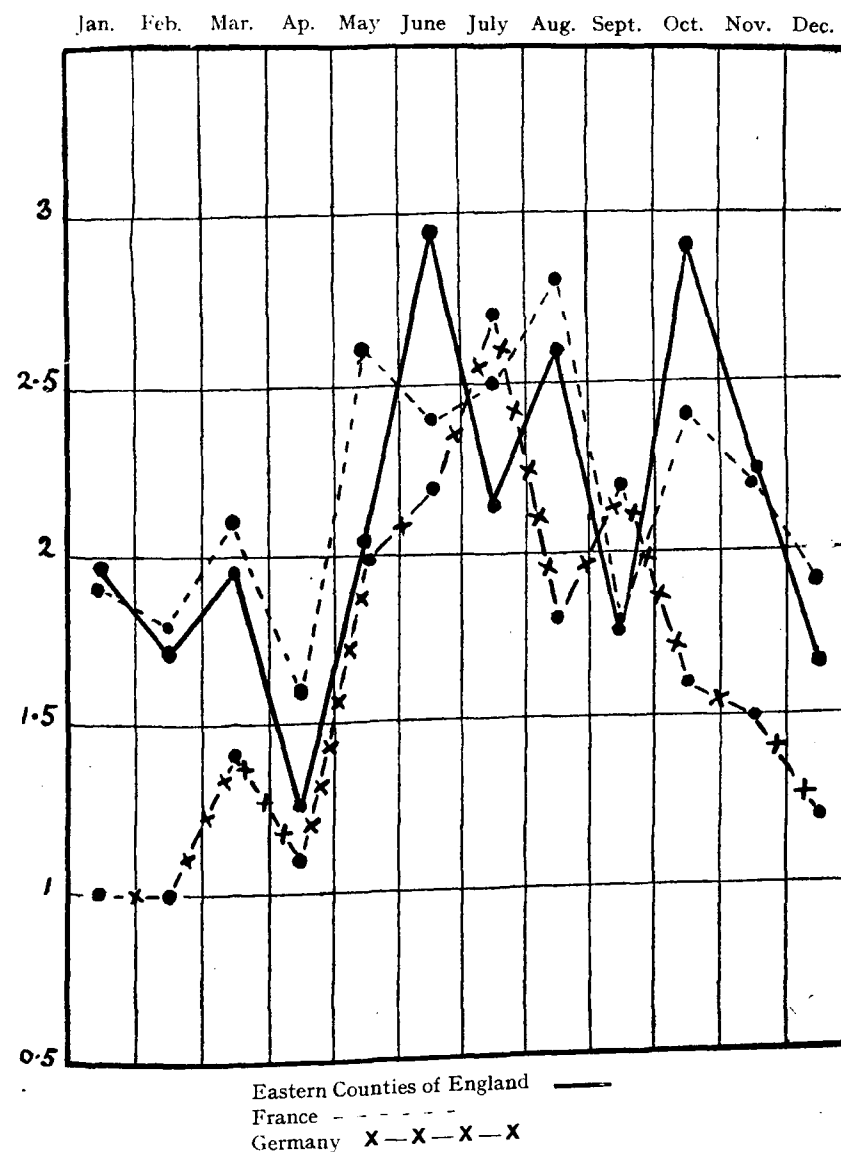


Diagram showing the Average Rainfall (in inches per month), of the Eastern Counties of England, and of sugar beet growing districts in France and Germany.

Rotation of Crops.

A satisfactory rotation is of much importance, and the sugar beet should not be grown on the same land oftener than once in three or four years; if grown too frequently the crop is liable to be small and the sugar content reduced, while the multiplication of parasites, such as eel-worms, is much favoured. It seems, in fact, that with repeated cultivation on the same soil the land becomes "beet-sick."

The following are examples of rotations practised in different localities on the Continent:—

	France.		Austria.	Belgium.
	Nord.	Pas-de-Calais.	Bohemia.	Hainault.
1st year	Sugar Beet.	Sugar Beet.	Sugar Beet.	Sugar Beet.
2nd "	Wheat.	Wheat.	Spring Cereal.	Wheat.
3rd "	Oats.	Oats.	Sugar Beet.	Oats or Rye with Clover.
4th "	..	Clover and annual fodders.	Spring Cereal.	Clover.
5th "	..	..	Red Clover.	Wheat or Winter Barley.
6th "	..	..	Winter Cereal.	..
	Germany.			
	Saxony.	Magdeburg.	Hanover.	
1st year	Sugar Beet.	Sugar Beet.	Potatoes with dung.	
2nd "	Potatoes.	Barley or Oats.	Sugar Beet.	
3rd "	Winter Cereal.	Clover, Peas or Vetches.	Winter Cereal.	
4th "	Sugar Beet.	Wheat.	Oats or Barley.	
5th "	Spring Cereal or Peas.	..	..	
6th "	Winter Cereal.	..	..	

Manuring.

The manuring of the sugar beet is of great importance in securing crops of good quality, and it is necessary to consider not only the kind and quantity of manures to use, but the time and method of distributing them, while the rotation adopted must also be taken into account. Though the sugar content of the sugar beet is large, this in itself does not mean the extraction from the soil of any of the fertilising ingredients; the sugar is formed in the leaves, chiefly from the carbon dioxide of the

air. In order that the sugar beets may grow well and rapidly, however, the soil requires to be in a high state of fertility so as to supply the rest of the plant constituents, and to enable the accumulation of the sugar to take place in the root.

The expenditure on manures is not necessarily lost when the crop is harvested. Although the sugar is extracted for sale, a large part of the plant food may be returned to the soil in the leaves and crowns of the crop, while the pulp from which the sugar has been removed may be fed to stock and thus in part converted into meat and milk, and in part returned to the soil as dung. Use is also made of other residual products. When the pulp is fed to stock (as is usually practicable in the area served by a factory) and the dung is well managed, the manurial losses are small and comparable to those which take place in feeding mangolds. If the pulp is not fed the losses are heavy, as when roots are sold off the land.

For the purpose of raising a crop of sugar beet, large quantities of nitrogen, phosphoric acid, potash, and lime are required. Lime and nitrogen are said to be* the ingredients most needed by the crop during the first two months after the sowing of the seed, after which phosphoric acid and potash are increasingly required, though lime is the dominant ingredient to the end of growth.

The quantities of manures recommended are from 8 to 12 and not more than 16 tons per acre of dung, according to the soil and conditions of cropping; with $2\frac{1}{2}$ to $4\frac{1}{2}$ cwt. of superphosphate, $1\frac{1}{2}$ to 2 cwt. nitrate of soda, and $1\frac{1}{2}$ cwt. sulphate of potash or 6 cwt. of kainit. Artificials are usually distributed broadcast, and, with the exception of nitrate of soda, may be harrowed in or drilled. In experiments conducted in Germany between 1890 and 1899, on an area of over 1,700 acres, it was found that nitrate of soda gave the best results as a top-dressing applied in three lots, viz., when the seedlings first appear, and after the first and second hoeings. It may, however, be applied at two operations, half before sowing and half after singling. On moorland soils basic slag may be used, being distributed in the autumn previous to sowing the seed.

For medium loams in the South of England, the following manuring would probably be found to be satisfactory: 10-12 tons of dung ploughed in after harvest, with 1 cwt. sulphate of ammonia, 4 cwt. superphosphate, and $\frac{3}{4}$ cwt. sulphate of potash applied before sowing, and 1 cwt. nitrate of soda applied as a top-dressing after singling. The essential point in manuring sugar

* *Les Engrais*, Garola, quoted by Malpeux, *La Betterave à Sucre*.

beet is to secure a well-ripened crop in October. In a dry climate dressings of dung and nitrate of soda may safely be used that in a wetter district would delay ripening and seriously injure the value of the crop. In manuring the sugar beet, attention to quality is of great importance.

Cultivation.

As already stated the cultivation of the sugar beet is similar to that required for mangolds. Assuming the crop to follow a cereal the stubble should be ploughed as deeply as possible, and subsoiled in October or November, so as to secure a depth of 11 or 12 in., the special objects in view for sugar beet being to secure good tilth, conserve moisture in the subsoil, and destroy weeds. Subsoiling may usually be carried out by stirring the furrow bottom left by the ordinary plough, with a plough from which the breast has been removed. In deep soils, free from pan, subsoiling may be dispensed with. The ploughed stubble should be left to weather, and in spring an endeavour must be made to obtain a well-worked mellow seed-bed. Some soils will need cross-ploughing in spring, but, generally speaking, cultivating and harrowing will be sufficient to provide a well pulverised seed-bed, and in dry seasons the Crosskill roller will do good service. As in the case of mangolds, a firm seed-bed must be secured.

The Choice of Seed.

It is of great importance in the case of sugar beet that the seed sown should be of the highest quality, and of a variety yielding a high percentage of sugar. It is held that good "seed" should contain no more than 15 per cent. of water, and should have a purity of 97 per cent. Of 100 "seeds" or fruits, 60 at least should germinate within 5 days, and 80 after 14 days, and they should furnish about 150 healthy seedlings. The energy or speed of germination is of great importance, quick germination indicating good, sound seed.

The following standard is one that has been adopted by the Association of the German Sugar Industry:—

1. One kilogramme (2.2 lb.) of sugar beet seed must yield at least 70,000 seedlings in 14 days.
2. Of these, at least 46,000 must have germinated in 6 days.
3. Of 100 "seeds" or fruits, 75 must have germinated.
4. The water-content is normal up to 15 per cent. inclusive; the seed is saleable up to 17 per cent. inclusive, but from 15 to 17 per cent. the extra weight of water must be made good.

5. Foreign substances are fixed at not over 3 per cent.; seed containing up to 5 per cent. of foreign substances may be sold, but from 3 to 5 per cent. the excess of weight of such foreign matter must be made good.
6. Infraction of only one of the Clauses 1-5 renders the seed unsaleable.
7. Differences in testing shall be decided by the average of a new test on the part of the station which made the disputed test, and a test undertaken in the Association's laboratory.

Varieties.

There are a number of varieties and seedsmen's strains in cultivation. One of the best is sent out by a Saxon seed-growing firm established at Klein Wanzleben, and is sold as Klein-Wanzlebener. Similar types, the specialities of particular seedsmen, are commonly used in Germany. Among French strains may be mentioned Vilmorin's Improved White.

A good variety of sugar beet should possess, according to Knauer and Hollrung, the following qualities:—(1) Slender form, lightly drawn in about half-way down, with a moderate length for the whole root; (2) Somewhat spirally-twisted root grooves (Wurzelrille); (3) A small top, not appearing above the surface of the soil, and resembling a truncated cone; (4) Short-stemmed leaves, which are not too small, but rather broad, lightly waved, and standing at an angle of about 45 degrees from the bulb; (5) Not liable to "bolt"; (6) Considerable power of retaining the greater part of the non-sugars in the leaves; (7) Exceptional power of producing sugar.

Sowing.

The time of sowing depends upon local climate and soil. In France it varies between the beginning of April and the second week of May, mid-April being the usual time. In East Prussia seeding seldom begins before the end of May, while in mid-Germany it is usually completed by the middle of May. When sown too early there is some danger of frost, and the crop is more liable to bolt should its growth be checked. When large acreages of beet are grown sowing must be spread over about a month so that not all the crop may require singling at the same time. For experimental crops English farmers should sow in the last week of April or the first week of May.

The seeds are drilled on the flat in the same way as turnips or mangolds, or on small areas they may be dibbled in several together at regular distances apart, and about $\frac{3}{4}$ in. deep. The

quantity of "seed" used is about 26 to 35 lb. per acre in Germany, and 18 to 26 lb. per acre in France, when drilling is practised; dibbling requires only about one-third as much seed. The amount of seed varies with the width between the rows, the period of sowing, the soil and climate, and especially the germinating capacity of the seed.

In the experiments conducted in 1911 at seven English centres, three rates of sowing were tested—10 lb., 15 lb., and 20 lb. per acre. A good "plant" was obtained in every case. At Wye 10 lb. were considered ample; at the Midland, the Harper Adams and Seale Hayne College centres, the heavier rate was found preferable, while at Cirencester 7 lb. were considered sufficient. In England, for rows 16 in. apart, 14 to 16 lb. of good seed should be ample, provided a good seed-bed has been secured.

The question of spacing has received much attention; the width between the rows must be sufficient to permit easy hoeing, while the variety grown and the condition of the soil must also be taken into account. In France usual working distances are 16 to 18 in. between rows on the flat, and 10 to 12 in. between the sugar beets when singled in the rows. In Germany the distances vary from 14 to 18 in. and 8 to 12 in. respectively.

In England a distance of from 16 in. to 18 in. between the rows will usually be found most suitable. An effort must be made by careful singling to secure an even "plant" in the rows 8 in. to 10 in. apart.

After-Cultivation.

When the seedlings begin to show well in the rows the horse-hoe should be put to work as in the case of mangolds, and there after two to three horse and hand-hoeings will be needed. It has been shown in some German trials, in which from one to five hoeings were given (the times being arranged so that the third hoeing on one plot was given at the same time as the fifth hoeing on another plot) that the yields increased with the number of hoeings, as follows:—One hoeing, 6 tons per acre; two hoeings, $7\frac{1}{4}$ tons; three hoeings, $9\frac{1}{2}$ tons; four hoeings, $11\frac{1}{4}$ tons; and five hoeings, $11\frac{3}{4}$ tons.

"Singling" takes place, as with mangolds, six weeks or so after planting; the crop is "bunched" by the hoe and usually singled by hand. Some skill is required to do this work with success, more than one seedling appearing from one "seed" or fruit, and it is necessary to remove all but the finest one at the distances apart decided upon, without injuring the seedling left. Singling should be done about the time the plants have four leaves, as they then suffer less than if the operation is delayed.

When the crop is well forward, and in full growth, as little damage should be done to the foliage as possible, for the leaves constitute the sugar factory of the plant, and if they are removed the plant feeds more slowly. The leaves bear an important relation to the production of sugar, and it has been found that the bulbs which are richest in sugar are those which bear the most developed leaf system.

Harvesting the Crop.

Sugar beets must be harvested when "ripe," that is, when they cease growing, contain the highest percentage of sugar, and when the juice is purest. Such conditions may generally be decided by the appearance of the crop, the leaves becoming yellowish-green in colour, and drooping more or less, some falling flat on the ground. About three-fourths of the foliage should have wilted, but the central leaves should still be fresh and green. The decision, however, should be made with care, since the appearance described may to some extent follow prolonged drought, the crop again growing and increasing its sugar content after good rains. The needs of the sugar factories must also be considered by beet growers; in France the earliest crops frequently realise 1s. to 2s. per ton more than the later ones. As a rule harvesting is commenced on the Continent towards the end of September, or at latest the first week in October, and must usually be completed early in November, before hard frost sets in. In most parts of England harvest may safely be continued later than on the Continent. Beet is well protected, and there is not much danger from frost before mid-December. This is from some points of view a great advantage, for it allows the harvesting of part of the beet crop to be left over until wheat has been sown and mangolds have been stored.

The crop is generally lifted by hand labour with the aid of a special spade or two-tined fork, according to the soil and the variety of sugar beet grown, but special horse implements, lifting one to three rows at a time, are now being much used. Lifting must be carefully done so that the skin is not broken, or loss of sugar will occur. The tops should be removed at the point whence the lowest leaves spring. At the same time, any part of the root that has become green from exposure to light should also be cut off.

Yield.

France and Germany.—As in the case of other farm crops, the yield of sugar beet varies widely with soil, manuring, general

treatment, and local climatic conditions. In France the yield on the farms of good growers in favourable seasons is expected to be 12 to 14 tons per acre. In dry seasons it may be difficult to grow 10 to 12 tons. In exceptional situations and favourable years up to 16 tons may be grown, but such a yield is only obtained on rich, deep soils. The average yield for France during the ten years 1897-1906 is given as 10½ tons per acre.* According to Mentzel and Von Lengerke† the yield in Germany varies from 9½ to 16 tons, and an exceptional crop of 20 tons per acre may be secured.

England.—As regards England, yields have varied widely. At five centres in Essex, in 1905, the average yield of unwashed roots was 18½ tons per acre, with a sugar content of 16¾ per cent. The results of 21 trials in Suffolk, in 1906, gave an average yield of 14¾ tons of unwashed roots per acre, with a sugar-content of 16½ per cent.

Experiments at Histon, reported by the Cambridge University Department of Agriculture, gave 17 tons of unwashed roots with 17·6 per cent. of sugar in 1905, and 18 tons with 16·9 per cent. of sugar in 1906.

In the experiments conducted for the Board of Agriculture and Fisheries at seven centres in 1911—an abnormally dry year—the following average yields were obtained for several varieties of sugar beet:—

Station.	County.	Gross yield per acre.‡	Estimated net factory weight per acre.§
		Tons.	Tons.
Wye College	Kent ..	26·6	18·8
Midland College, Kingston ..	Nottingham ..	14·4	12·6
Harper Adams College ..	Shropshire ..	15·0	13·4
Cirencester College ..	Gloucester ..	9·4	8·2
County Laboratories ..	Essex ..	8·7	7·5
Seale Hayne College, Newton Abbot	Devon ..	5·0	4·5
Ridgmont Farm School ..	Bedfordshire ..	13·8	12·9
Average	—	13·27	11·1

* *La Betterave à Sucre*, L. Malpeaux.

† *Landwirtschaftlicher Kalender*, O. Mentzel und A. v. Lengerke.

‡ According to ordinary farm methods of weighing, after removal of leaves. These are not weights that would be accepted by a sugar factory.

§ After deductions for adhering soil, and weight of the crown, or that portion of the root above the lowest leaf bud. A sample of the roots was washed and trimmed in each case, and from this the deductions were calculated.

Under ordinary farming conditions, soil of moderate quality may be expected to yield 10 to 12 tons of washed beet per acre in the Eastern Counties, and in the west similar soils should produce from 12 to 15 tons.

Percentage of Sugar.—The following figures show the net yield of roots in the experiments conducted at the seven centres in 1911, previously mentioned, compared with the percentage of sugar as determined by analysis:—

Station.	Net Yield.		Sugar.	
	Tons.		Per cent.	
Wye	18.8		17.0	
Nottingham	12.6		16.5	
Newport, Salop	13.4		17.7	
Cirencester	8.2		19.8	
Chelmsford	7.5		15.8	
Newton Abbot	4.5		15.8	
Ridgmont	12.9		18.5	
Average	11.1		17.3	

The statistics* given on p. 999 were prepared by the National Sugar Beet Association, Limited, and relate to the beet sugar industry in the principal countries of Europe during the last three seasons, and show the area cultivated, total yield, yield per acre, and production of sugar.†

Cost per Acre.

France.—The cost of growing and harvesting an acre of sugar beets depends largely on the soil and local conditions. According to data given by the agricultural school (comice) at Laon, the net cost of an acre may be stated as £12, including a charge of £4 15s. for dung and artificial manures. This figure, however, is often surpassed in France.

Germany.—In the neighbourhood of Halle the cost per acre has been estimated at £14, including charges of £5 3s. 6d. for manures, and £2 17s. for rent, taxes, etc.

In other parts of Germany the cost has been estimated at from £10 to £14 per acre, viz.:—

	Per acre.		
	£	s.	d.
Near Breslau	9	17	4
West Prussia	12	10	0
Hanover	10	18	0
Brunswick	14	5	6

On 99 sugar beet farms the cost of producing a ton of sugar beet in Germany between the years 1893 and 1898 amounted in round figures to:—

* From *Board of Trade Journal*, November 19th, 1914.

† The Board have added the percentage of raw sugar from the total yield of roots of the different countries.

				s.	d.	s.	d.
On 3 Farms	..	..	..	12	6	to 14	6
" 4 "	..	..	..	14	6	" 16	6
" 15 "	..	..	..	16	6	" 18	6
" 25 "	..	..	..	18	6	" 20	6
" 22 "	..	..	..	20	6	" 22	6
" 9 "	..	..	..	22	6	" 24	6
" 9 "	..	..	..	24	6	" 26	6
" 5 "	..	..	..	26	6	" 28	6
" 4 "	..	..	..	28	6	" 30	6
" 1 "	..	..	..	30	6	" 32	6
" 2 "	..	..	..	32	6	" 34	6

SUGAR BEET: Area Cultivated, Yield, and Production of Sugar.

	Factories.	Beetroot.			Raw Sugar Production.	Percentage of Sugar.
		Area Cultivated.	Total Yield.	Yield per Acre.		
<i>Austria—</i>						
<i>Hungary—</i>	No.	Acres.	Tons.	Tons.	Tons.	
1911-12 ..	196	1,012,250	7,770,000	7.67	1,145,572	14.7
1912-13 ..	201	1,121,250	12,540,000	11.19	1,901,615	15.2
1913-14 ..	201	1,078,250	10,840,000	10.05	1,692,000	15.6
<i>Belgium—</i>						
1911-12 ..	73	152,625	1,600,000	10.45	244,908	15.3
1912-13 ..	72	165,000	1,960,000	11.88	298,584	15.2
1913-14 ..	68	138,250	1,510,000	10.90	230,300	15.3
<i>Denmark—</i>						
1911-12 ..	8	62,500	760,000	12.09	114,000	15.0
1912-13 ..	9	80,925	1,020,000	12.65	149,400	14.6
1913-14 ..	9	77,250	950,000	12.31	146,000	15.4
<i>France—</i>						
1911-12 ..	224	562,125	4,020,000	7.15	506,046	12.6
1912-13 ..	213	571,250	6,580,000	11.54	960,900	14.6
1913-14 ..	209	540,500	5,980,000	11.07	786,000	13.1
<i>Germany—</i>						
1911-12 ..	341	1,267,782	8,930,000	7.04	1,504,459	16.8
1912-13 ..	342	1,369,625	16,400,000	11.97	2,706,327	16.5
1913-14 ..	341	1,333,272	16,700,000	12.52	2,725,000	16.3
<i>Italy—</i>						
1911-12 ..	37	132,800	1,510,000	11.34	171,045	11.3
1912-13 ..	37	132,500	1,680,000	12.71	213,632	12.7
1913-14 ..	39	150,000	2,770,000	18.46	327,800	11.8
<i>Netherlands—</i>						
1911-12 ..	27	136,457	1,700,000	12.45	266,970	15.7
1912-13 ..	27	172,555	1,990,000	11.54	316,177	15.9
1913-14 ..	27	154,250	1,530,000	9.89	228,600	14.9
<i>Russia—</i>						
1911-12 ..	281	1,968,375	13,040,000	6.63	2,053,840	15.8
1912-13 ..	288	1,908,240	10,270,000	5.38	1,374,550	13.4
1913-14 ..	294	1,811,700	12,180,000	6.72	1,731,000	14.2
<i>Spain—</i>						
1911-12 ..	32	83,085	780,000	9.39	92,000	11.8
1912-13 ..	32	92,500	1,160,000	12.59	173,500	15.0
1913-14 ..	31	127,415	1,220,000	9.55	160,000	13.1
<i>Sweden—</i>						
1911-12 ..	21	72,610	810,000	11.14	127,807	15.8
1912-13 ..	21	68,080	830,000	12.11	132,018	15.9
1913-14 ..	21	71,787	870,000	12.16	136,500	15.7

On most of the farms included in the figures it will be observed that the cost of producing a ton of the sugar beets lay between 16s. 6d. and 22s. 6d.

England.—It is generally agreed that the cost of cultivating sugar beet differs from the corresponding cost for mangolds mainly in respect of (a) deeper cultivation required, which may add 7s. 6d. per acre to the cost of preparation; (b) hand-hoeing and singling, the cost of which might be 10s. to 12s. for a mangold crop, and 20s. to 24s. for a crop of sugar beet; (c) lifting, the cost of which might amount to 6s. or 8s. an acre in a crop of 20 tons of mangolds, as against 22s. 6d. to 30s. in a crop of 10 tons of sugar beet.

At seven English centres in 1911 the cost of growing sugar beet was as follows:—

Centre.	Total cost per acre.
Wye College	£ 11 14 0
Midland College	10 17 0
Harper Adams College	10 19 0
Cirencester College	11 11 0
Essex County Laboratories	9 3 0
Seale Hayne College	10 12 0
Ridgmont Farm School	9 11 0
Average	£10 12 5

In each case 1s. per ton was charged for carting and spreading dung, but no charge was made for dung itself.*

The ordinary cost of cultivation on light land in the Eastern Counties may be estimated at:—

	£	s.	d.	to	£	s.	d.
Ploughing and subsoiling	0	18	0		1	0	0
Preparation of seed-bed, harrowing, rolling	0	4	0		0	7	6
Drilling	0	1	0		0	1	6
Seed	0	6	6		0	7	0
Artificial manure	2	10	0		3	0	0
Hand-hoeing (twice) and singling	1	0	0		1	4	0
Horse-hoeing (three times)	0	3	0		0	5	0
Lifting	1	2	6		1	10	0
Carting to station: 10-12 tons at 2s. 6d.	1	5	0		1	10	0
Rent, rates and taxes	1	0	0		1	10	0
Total	£8	10	0		10	15	0

In this case no charge has been made for farmyard manure. If land is in good condition beet might be grown with artificial manures only. If 10 tons of dung per acre were applied in autumn and half the cost charged to the beet, and if 10s. worth of artificials were omitted, the net increase in cost for dung would be 15s. per acre.

* Full details of the cost of growing in each case will be found in *Report on Experiments in the Cultivation of Sugar Beet in 1911*, Cd. 6162 (price 5d.).

On loamy soils in other parts of England it may be estimated that the cost of growing sugar beet with farmyard manure and artificials will range from £10 to £12 an acre.

Sugar Beet as a Food for Live Stock.

When the beet crop is lifted considerable residues are left in the field in the form of leaves and crowns removed when preparing the roots for the factory. The leaf stalks are much thicker than those of mangolds and contain a fair amount of sugar. Altogether, the quantity of feeding material available per acre of crowns and leaves in an average year might amount to 10 tons gross, containing 20 cwt. of dry matter. Most growers in the Eastern Counties attach considerable value to this material, particularly for feeding to sheep, for which purpose, in an ordinary season, it is said to be worth from £1 to £1 10s. per acre, or from one-fourth to one-sixth of the value of an ordinary crop of swedes. The Continental estimate of the value is about £1 15s.

On the Continent the leaves and crowns are fed to other classes of stock. It should be remembered, however, that they have a laxative effect, and should never be fed in a wet or dirty condition. According to Kellner one-third of the ration of dairy cows may consist of beet leaves, but fattening stock may be given more. It is desirable to feed about 1 lb. of ground chaff with each 1,000 lb. of leaves to render insoluble the oxalic acid which they contain.

The leaves and tops are sometimes dried and converted into "hay," and are then held to be equal to a fair quality meadow hay. They may also be satisfactorily ensiled, say in alternate layers with oat-straw which would absorb the excessive moisture from the leaves. About 6 to 8 lb. of salt per ton of leaves may be sprinkled over the layers. According to *10 Years' Experience* (Pear Book, U.S. Department of Agriculture, 1908), this mixture, if properly treated, will keep sound for several years, and is considered very satisfactory by dairymen.

Roots.—It may be pointed out that the sugar beet has a considerable value as a feeding crop apart from any question of the production of sugar. In cases, therefore, where trial crops are grown to ascertain the capabilities of the soil and locality for growing sugar beet, the crop can be utilised, even where it is not possible to dispose of it for sugar manufacture. Analyses made at the Government Laboratory show that the proportion of dry matter in the sugar beet grown in 1911 varied from 20 to

29 per cent. Owing to the very dry, hot character of that season these figures cannot be taken as representing normal crops, but it may be assumed that on an average 20 to 25 per cent. of dry matter may be expected. In mangolds the proportion varies greatly, but 9 to 13 per cent. are about average limits. For feeding purposes it is estimated that about 4 lb. of sugar beet are equal to 8 lb. of mangolds or 1 lb. of cereal meals in mixed rations.

In an experiment carried out during the winter of 1911-12, at the Harper Adams Agricultural College, bullocks fed on sugar beets (in addition to concentrated foods) increased in live weight at the rate of 2.04 lb. per head per day, while bullocks fed on mangolds increased at the rate of 1.7 lb. In the case of both roots, the animals were allowed as much as they would consume, namely, 57 lb. sugar beet and 75 lb. mangolds per head per day respectively.

About 20 to 30 lb. of sugar beet per head per day may be given to dairy cows, and as much as 50 lb. to fattening cattle, while from 10 lb. upward may be fed per head per day to young cattle, and from 10 lb. downward to calves.

In an experiment carried out in Michigan* with sheep, 100 lb. gain in live weight was produced by 4,000 lb. sugar beet and 1,018 lb. hay.

Experiments in the United States* have shown that 1 lb. of barley can be replaced by from 4 to 8 lb. of sugar beet for pigs in a mixed ration.

Sugar Beet Pulp.

Of the by-products of the sugar beet the most important is the pulp, which is the residue left after the bulk of the sugar has been extracted from the beets. The pulp may be used wet or dried. On the Continent and in the United States the farmer, in contracting to grow beets for the factory, often stipulates that he shall receive a certain amount of pulp free of charge, or at less than the market price.

Composition of Pulp.—The composition of the pulp varies according to the process of sugar extraction used in the factory. On the average, in the common (diffusion) process, 100 lb. washed roots, containing 15 per cent. of sugar, produce 45 lb. fresh pulp with about 93 per cent. of water, or 30-35 lb. pressed

* Michigan Agricultural Experiment Station, Bulletin 128.

pulp with 85-90 per cent. of water, or 5-6 lb. dried sugar beet slices with 10 per cent. of water.

In a pamphlet issued by the German Agricultural Society* the following figures are given as showing the composition of various kinds of pulp:—

	Fresh Dif- fusion Pulp.	Pressed Dif- fusion Pulp.	Ensilage from Diffusion Pulp.	Dried Dif- fusion Slices.	Dried Molasses Slices.	Dried Steffen Slices.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Water	93.0	85.0	88.4	11.2	10.0	8.6
Crude protein ..	0.6	1.3	1.0	8.1	8.7	7.1
Digestible						
albuminoids	0.3	0.6	0.3	3.6	2.7	3.5
Crude fat	—	0.1	0.2	0.6	0.3	0.4
N. free extract						
substances	4.7	9.9	7.2	58.5	60.8	67.9
Sugar	0.3	0.4	—	4.5	16-20	30-35
Crude fibre ..	1.4	3.0	2.3	17.6	13.8	11.8
Ash	0.3	0.7	0.9	4.0	6.4	4.2
Starch equivalent	5.0	10.6	6.5	51.9	50.5	58.9

The "Steffen" process, which has been installed in some factories on the Continent, and is the process in use at Cantley, gives a pulp rich in sugar (see Table above).

Beet pulp is very digestible. In digestibility experiments on sheep, the following co-efficients were obtained:—Dry matter, 86 per cent.; crude protein, 60 per cent.; carbohydrates, 94.5 per cent.; and crude fibre, 76 per cent.

Wet Pulp.—There are certain disadvantages connected with the use of *fresh* pulp, the chief of which are its bulk, and the fact that it must be carted away from the factory at a time when labour is badly needed for other work on the farm. The factory season lasts in mid-Europe for about 10 to 11 weeks, so that if the pulp is to be given to stock throughout the year more than one-half of the total amount must be preserved, as fresh, undried pulp soon deteriorates when exposed to the air. Wet pulp is therefore usually preserved in silos both in America and on the Continent. A common form of silo in the United States is a large slanting trench dug in the ground, the walls being made of wood, brick, or cement, and the top covered with hay, straw or boards. A system of drainage is considered desirable.†

* *Flugschriften der Deut. Landw. Gesell.*, Heft 10. Melasse, Futterkalk und Salz, 1911.

† *Progress of the Beet Sugar Industry* (U.S.A.), 1903.

Wolff* states that the fermentation of the pulp in a silo always results in considerable loss of dry matter and in reduced digestibility.

It is very important in ensiling that the fermenting mass should be well trodden down to a compact and air-tight consistency.

Dried Pulp.—Many factories in Germany have apparatus for drying the pulp into flakes, this dry pulp containing as much dry matter as eight times its bulk of wet pulp. The advantages claimed for dry pulp are: (1) the ease with which it can be transported; (2) the destruction of disease germs by drying; (3) the ease of preservation without deterioration; and (4) the freedom from objectionable flavour in the milk of animals fed on it. In feeding it to cattle it is usual to soak it in water for 24 hours.†

Dried pulp, prepared by the Steffen process, containing 8.6 per cent. of moisture, if soaked with nine parts by weight of water would contain as much dry matter as mangolds of good quality. The composition of pulp made up to ten times its original weight by adding water, and of Golden Tankard mangolds may be compared thus:—

	Golden Tankard Mangolds.	Soaked "Steffen" Pulp.
Water	86.4	86.0
Albuminoids	1.2	5.4
Sugar	8.8	3.0
Other carbohydrates	2.0	3.9
Fibre	.8	1.2
Mineral matter	.8	.5
	100.0	100.0

The chief difference in the dry matter of these two foods is that mangolds are the richer in sugar and pulp in albuminoids. The albuminoids in mangolds and pulp are impure, about half only being true albuminoids equal in value to the albuminoids of cereals and oilcakes. Correcting for this difference in quality, the food units in the respective feeding stuffs work out at 14 per cent. in mangolds and 17.5 per cent. in the soaked pulp.

At £4 15s. per ton for dry pulp, the soaked pulp costs 9s. 6d. per ton, and if the actual values of the two foods are represented by the ratio 17.5:14, then with soaked pulp at 9s. 6d. mangolds

* *Farm Foods*, Wolff.
† *Rübenbau*, Knauer-Hollrung.

would be worth 7s. 7d. per ton. It would seem, therefore, that the stockfeeder who can afford to value his mangolds at 7s. 7d. per ton, would have little difficulty in providing a substitute if in place of putting all his root land under mangolds he devoted a share to sugar beet and bought in pulp for his live stock at £4 15s. per ton.

In the manufacture of dried pulp, molasses is often mixed with the pulp (see composition of dried molasses slices, p. 1003). Both in France and Germany commercial feeding stuffs are made from dried sugar beet slices, having approximately the following composition—Water, 10-12 per cent.; crude protein, 6-7 per cent. (albuminoids, 3-4 per cent.); crude fat, 0.1 to 0.4 per cent.; carbohydrates (including sugar, 54-64 per cent.), 60-74 per cent.; fibre, 4-7 per cent.; and ash, 4-14 per cent.

Feeding Value of Pulp for Live Stock.—The feeding value of the pulp may be seriously diminished by giving excessive quantities, thus inducing a lax condition of the bowels. It is therefore advisable to give other foods with it, such as barley, maize, cotton cakes and similar foods, and clover and lucerne hay. In the case of wet pulp the best practice is to begin by feeding a comparatively small amount, say 20 to 30 lb. per day for fattening cattle, and gradually increase the supply according to the age and digestive capacity of the animal. Milch cows may at first be given 10 to 20 lb. and be gradually accustomed to such quantities as 40 or 50 lb. per day, and be kept regularly at that amount. Fattening lambs or sheep may be given from 1 to 2 lb. at first, gradually increasing up to 7 or 8 lb., and gradually reducing to 2 lb. for "finishing." Animals should be allowed a liberal supply of salt when fed on pulp.

Dried slices have a sweet malt-like taste, their dietetic properties have a very favourable effect on the animal organism, and, as a rule, the animals soon learn to eat them readily.

In experiments carried out in January, 1911, at the Royal Agricultural College, Cirencester, dried sugar beet slices gave quite as good results as mangolds in a ration for dairy cows. The composition of the mangolds and dried slices was as follows (mangolds are given first):—Water 87.6, 15.1; nitrogenous matter, 1.2, 8.2; fibre, 1.0, 19.7; ash, 1.1, 2.7; and carbohydrates, 9.1, 54.3.

From experiments with bullocks conducted at the Norfolk Agricultural Experimental Station in 1912 and 1912-13, it was estimated that if roots are worth 10s. a ton, dried slices should be worth from £3 10s. to £4 a ton. The composition of the dried slices was as follows:—

	1912.	1912-13.
	Per cent.	Per cent.
Water	9.5	10.48
Crude protein	10.6	8.12
Carbohydrates	61.8	67.44
Fibre	15.3	10.40
Ash	2.8	3.56
	100.0	100.0

Experiments were carried out at Wye College in the autumn of 1911 with two kinds of dried slices, viz. :—

	Ordinary Slices.	"Steffen" Slices.
	Per cent.	Per cent.
Crude protein	8.1	6.3
Crude fat	0.5	0.5
Carbohydrates, including Sugar	64.4	68.6
Crude fibre	18.7	10.5
Ash	3.4	4.5
Moisture	6.9	9.6

The ordinary slices when soaked in water and mixed with chaff were found to form a sound and useful food for fattening cattle. With animals tied up in stalls it was not found advisable to give more than 7 lb. of slices per day, the animals eating 7 lb. of slices and 8 lb. of mangolds with chaff more readily than 8 lb. of slices without mangolds. One lb. of the ordinary dried slices used was found to be equivalent to 8 lb. of mangolds.

The "Steffen" slices, when soaked in water and mixed with chaff, etc., formed an appetising food for milking cows, more appetising than mangolds and chaff, etc.; 8-10 lb. per head per day of the Steffen slices were given to cows of 9-11 cwt. without any notable laxative effect; 10 lb. per head per day had no effect on the percentage of butter fat in the milk, or on the colour and flavour of the butter produced.

The experiments at Wye with ordinary slices indicated that (taking the ratio of the value of mangolds to dried slices as 1 : 8), if mangolds are worth 10s. per ton, dried slices should be worth £4 per ton.

Mangolds were compared with dried slices at the Harper Adams Agricultural College in 1912. The slices had the following composition :—Oil, 1.21 per cent.; albuminoids, 10.50 per cent.; carbohydrates, 60.50 per cent.; fibre, 15.90 per cent.; ash, 3.60 per cent.; and moisture, 8.29 per cent. The mangolds were Sutton's "Yellow Globe," containing 10.90 per cent. of dry

matter and 6.80 per cent. of sugar. The mangolds were fed at the rate of 84 lb. per head per day, and the dried slices at the rate of 12 lb. per head per day, the slices being first soaked in water for 24 hours, and absorbing about 45 lb. of water. In addition, straw chop, cake and corn were fed. The experiment was conducted with eight shorthorn bullocks during eight weeks, and the average gain per head per day for the period of the experiment was 1.88 lb. in the case of beet slices, and 1.74 lb. in the case of mangolds.

The Cantley Beet Sugar Factory.

The only factory for the manufacture of beet sugar in the United Kingdom is that opened in 1912 at Cantley, in Norfolk, by the Anglo-Netherland Sugar Corporation, Limited. This company purchases sugar beet and gives advice on the cultivation of the crop, the purchase of seed, lifting and cleaning of the roots, etc. Farmers wishing to grow sugar beet should apply for particulars to the Manager, Beet Sugar Factory, Cantley, Norfolk.

FLAX GROWING.

THE first reference to flax-growing in England occurs in official records of the year 1175, but the introduction of flax probably synchronises with the Roman occupation. From time to time various steps appear to have been taken to encourage the growth of flax, and about the beginning of the nineteenth century flax was grown more or less in every part of England, and in many counties several thousand acres were annually under this crop. The supply of raw material, however, did not keep pace with the home demand, and the amount imported steadily increased. The introduction of cotton was a serious blow to the flax industry and although, from time to time, a revival occurred, notably about 1850, development was arrested by the greatly enhanced price of corn current about the time of the Crimean war. Further, following the conclusion of peace, large quantities of cheap Russian fibre came to British markets, and flax production in England received a set-back from which it has never properly recovered. Nevertheless, in 1914, there were still 623 acres in England and Wales devoted to this crop.

In the latter part of the nineteenth century flax-growing became restricted to certain localities, *e.g.*, the districts of Selby in Yorkshire and Yeovil in Somersetshire, where depots had been established for receiving the straw and extracting the fibre,

thus marking the disinclination of farmers to do more than grow the crop and harvest it. In 1896 only two mills survived, and both of these were conducted as central retteries.

According to the Report of the Departmental Committee on the Irish Flax-growing Industry, published in 1911, "The area under flax in Ireland in 1910 was 45,974 acres and the value of the crop was estimated at over £500,000 sterling. In 1847, the earliest year for which official records are available, the acreage was 58,312. A study of the statistics for the intervening years shows that from time to time there have been great fluctuations in the area under this crop. For example, while in 1853 it had risen to 174,579 acres, three years later it had fallen to 97,075 acres. Stimulated by the unprecedented scarcity of cotton during the American War, the area again increased rapidly, until in 1864 it reached 301,693 acres—the highest recorded. From that date, although the area fluctuated within wide limits, on the whole it gradually declined, and in 1898 stood at 34,469 acres—the minimum recorded. Since then some improvement has taken place. . . . " (In 1914 the area under flax in Ireland was 49,253 acres).

The report explains that the fluctuations referred to are, no doubt, largely due to the fact that flax is not an essential part of the rotation of crops as practised in Ireland. Accordingly the farmer in growing it is influenced solely by one consideration, viz.: the net return he will get for the crop. A year of profitable return is generally followed by an increase in the area under flax, while a bad year has the reverse effect. As regards the future of the industry the Departmental Committee were encouraged by certain considerations to believe that flax-growing in certain districts of Ireland will be continued and even extended. In the first place, the area over which the cultivation of the crop is now general has, by degrees, become restricted to the Ulster counties nearest the chief centres of the spinning industry. "In these counties the falling off has been less marked, and, indeed, in certain parts of them flax growing shows comparatively little sign of decay." A second consideration to which the Committee attached even greater importance is that "some classes of Irish flax possess in a special degree strength and spinning qualities so well adapted for thread and certain other yarns that they are almost a necessity in certain branches of the Irish linen industry." A third point from which the Committee derived encouragement is the contemporary decline of flax-growing

in other countries. It would appear that "there has been a decrease—in some cases a serious one—in the area under the crop in Austria, Belgium, France and Germany. In Holland, Hungary and Russia the area may be regarded as stationary at present, while in Great Britain the cultivation of the crop has practically ceased." A fourth consideration noted was evidence of the fact that "the world's production of cotton is not keeping pace with increasing requirements and that the price of cotton is therefore likely to maintain a higher level in future. This must create a greater demand for linen goods, which will in turn result in an improvement in the demand for and price of fibre."

At the present time the value of flax is about 100 per cent. higher than it was last year. This enormous advance is mainly attributable to the war. Apart from the flax produced in Ireland, the United Kingdom is chiefly dependent for supplies upon Russia, Belgium and the Netherlands. France, Germany and other foreign countries and British possessions send relatively very small quantities.

The average net annual imports (i.e., total imports less re-exports) for six years ending 31st December, 1913, are as follows:—

		Tons.	£
Flax	.. .. .	73,497	= 3,412,979
Tow	.. .. .	17,396	= 466,565
			<u>£3,879,544</u>

About $\frac{3}{4}$ of the average annual imports of flax and $\frac{2}{3}$ of those of tow come from Russia; about $\frac{1}{5}$ of the flax and $\frac{1}{4}$ of the tow come from Belgium. Of the other exporting countries the next in importance is the Netherlands.

There is considerable variation in the value of the imports per ton. The average value of Belgian flax, the highest grade on the market, for the six years ending 31st December, 1913, was £78 7s. per ton, whereas the value of Russian, a comparatively low grade product, was £37 10s. per ton.

In Great Britain flax has always been harvested both for its fibre and its seed, although the former has been the chief object in view. Quite recently, however, it has been receiving attention as a seed-crop, the price of linseed and linseed cake having risen to such an extent that it has become a profitable crop in England for seed alone. This aspect of the subject is dealt with in Leaflet No. 278 (*The Growing of Linseed for Feeding Purposes*). At the present time prospects appear distinctly

favourable to a revival of flax production in this country, as, apart from the war, prices have on the whole tended to attain a somewhat higher level during the past few years. In the following pages an account is given of the methods of cultivation and manufacture of flax which have been found suited to British and foreign conditions.

Soil.—Flax thrives on a wide range of soils, but is best suited to deep, moist, medium loams which are well drained and in a good state of fertility, overlying rather heavy, compact subsoils. Alluvial soils and land reclaimed from the sea are suitable, but extremes of clays and sands and chalky soils should be avoided. Although much depends on the class of soil and its fertility, the preparation of the land as it affects mechanical condition is also of great importance.

Rotation.—No hard and fast rules are possible as to the place of flax in a rotation. The main considerations are clean soil and a fairly long interval, usually from five to seven years, between successive flax crops. Excellent results are often obtained after a heavy corn crop which leaves a clean stubble, or after mangolds or some other root crop which permits of soil disturbance before winter. Clover or pasture is also a suitable preparatory crop, especially on inferior soils. Flax may be sown by itself or with clover which, according to some writers, does better with flax than with any other crop. The following rotations are common in Ireland :—

- (1) Oats—flax—manured green crop—oats or barley with “seeds”
—hay—pasture (2 years).
- (2) Oats—manured green crop—oats or barley—flax with “seeds”
—hay—pasture (2 years).

Preparation of the Soil.—A fine, clean, compact seed-bed is required to secure uniform and rapid germination and growth. The land should be ploughed fairly deeply in autumn, and be worked into a fine tilth in spring by deep stirring, after which it should be consolidated. On no account must the seed-bed be loose and friable; rolling is usually necessary both before and after sowing.

Manuring.—Farmyard manure is most suitable when applied to the crops preceding flax. Since flax has a short period of growth and a comparatively small root system, the food material should be in a readily available state. Excellent results can be obtained by the judicious use of artificial manures. Potash is the main requirement of the plant.* The Department of Agri-

* As potash manures are not at present available growers of flax in 1915 should select land after a green crop dunged in 1914 or fed off on the land.

culture and Technical Instruction for Ireland recommend the application of 1 cwt. of muriate of potash per acre, or about 4 cwt. of kainit. About $\frac{1}{2}$ cwt. per acre of sulphate of ammonia may also be given if the land is not particularly rich. From earliest times it has been held that flax is an exhausting crop, but this is not borne out by experiment.

Seed.—Flax belongs to the genus *Linum*, of which there are about 90 known species, but only one (*Linum usitatissimum*) is commonly cultivated.

The general practice of flax-growing countries is to rely upon Russia for the supply of seed, such seed coming chiefly from the Baltic Provinces by way of Riga. It is then grown in other countries for about three seasons, giving rise to crops bearing seed known as “Riga Child” and “Riga Grandchild.” In Belgium it is commonly considered the best practice to procure “Dutch-Riga-Child” from a reliable source in Holland, where the seed is better ripened naturally in the field than in other countries. Large quantities of “Dutch-Riga-Child” are sown in Holland, Belgium, France and Ireland, where in many cases it is preferred to Russian “original” seed. The main consideration, however, is not whether the seed comes from Russia or Holland but that it is of good quality. Its germination should be well over 90 per cent., and the purity ought not to be less than 96 per cent.

Seed saved from British-grown crops, if of good quality, gives satisfactory results, but it is generally believed that if seed is saved in this way for more than three years in succession the yield and quality of both seed and fibre suffer.

Time of Sowing.—No special time of sowing can be suggested owing to diversity of climate and season. As a rule the crop is sown some time in April or just after the cereal crops are disposed of; if sown later there is a risk either of the plant becoming stunted through drought or of its making too rapid growth.

Method of Sowing.—Either broadcasting or drilling may be practised. In districts where the best fibre is produced the former method is adopted. The seed, being flat and slippery, runs readily between the fingers and great care is required to secure a uniform distribution. In several flax-growing countries sowing is now effected by means of a simple hand broadcasting machine, known as the “fiddle.” Drilling is not much practised when the production of fibre is the main object, although it can be followed with advantage when flax is grown mainly for seed, for not only does it effect a considerable

saving of seed, but it enables weeding and after cultivation to be more readily carried out. The chief disadvantage of drilling, where fibre is concerned, is that the outermost plants in the row branch more than those in the centre, a result that is fatal to uniformity of fibre. The use of a drill with coulter set 3 to 4 in. apart, or ordinary cross drilling would minimise the tendency to branching. For the production of the maximum amount of long, uniform, fine-quality fibre it is necessary to sow the seed somewhat thickly and thus discourage early branching. Thin sowing results in an increased yield of seed, but the fibre suffers in being coarser, shorter and smaller in quantity than where thick sowing is practised.

Rate of Sowing.—In Ireland the rate of sowing is from $1\frac{3}{4}$ to 2 bushels per acre, in Yorkshire about 2 bushels, while in Holland and Belgium as much as 3 bushels per acre are sown. The actual amount sown should be regulated by the germinating capacity of the seed. For example, Russian seed germinating only 75 to 80 per cent. will not go so far as Dutch seed germinating 95 per cent., and this is about the extent of the differences found. The following figures may be taken as a guide in making allowances for seed germination:—

100 per cent. germination,	$1\frac{1}{2}$ bushels per acre.
90 " " "	$1\frac{3}{4}$ " "
80 " " "	2 " "

The character of the seed-bed must also be taken into account, more seed as a rule being required on heavy soil than on light soil, or on a poor compared with a fine seed-bed.

Depth of Sowing.—In order to secure the best fibre it is very desirable to have all the seeds covered, as nearly as possible, to the same depth. It is not difficult to accomplish this with a drill on a uniformly fine and compact seed-bed, but considerable cultural preparation and skill are required when the seed is broadcast. About $\frac{1}{2}$ in. of covering should be aimed at, and after the final harrowing the surface should be rolled. If rain falls before rolling can be done this operation may have to be dispensed with.

Weeding.—Perhaps no crop shows the advantages of clean farming more than flax. Weeds not only lessen the amount of food material available for the flax plant, but retard drying at harvest time and reduce the value of the fibre. Convolvulus, thistles, dock, charlock, knotweed, spurrey and persicaria are among the more common weeds which require removal. Charlock may be largely destroyed without harm to the flax,

by spraying the crop with a solution of copper sulphate (see the Board's Leaflet No. 63). A weed of a parasitic nature, viz.: Dodder, is sometimes troublesome. It attaches itself to the flax plant, derives its nourishment therefrom and flourishes to the detriment of its host (see Leaflet No. 180). Care should be taken that the seed sown contains none of the seeds of these weeds.

Harvesting.—Flax is usually ready for harvesting just before the corn crops. For fibre purposes it should not be allowed to remain standing till the seed is ripe. It should be harvested when the lowest third of the stem has changed from green to yellow, and when the leaves for about a like distance have shrivelled and fallen. At that stage an examination of the seeds within the capsule shows them to be just changing from a full green colour to a brownish tint. Although not then ripe the seed will come to maturity on the straw.

If harvesting is deferred till the plant is dead ripe, the fibre suffers in quality, becoming dry and brittle, and ultimately weighing less.

Flax is everywhere harvested by hand pulling. It is regarded as bad practice to cut it, on account of the loss of fibre involved, and because the cut ends lower the quality of the fibre for spinning purposes. It is possible, however, that these disadvantages are exaggerated. The root end of flax up to a distance of $1-1\frac{1}{2}$ in. from the ground contains very little fibre, so that the loss in that respect would be negligible and would probably be outweighed by the advantage of the less expensive method of harvesting by close cutting. If a reaping machine is used the knife must be very sharp, the teeth on the cutting board fairly close and the crank action quick, otherwise the process will be one of "chewing." One advantage of pulling lies in harvesting the crop more or less free from weeds, and another is the evenness of the root-ends of the sheaves. It is an expensive process, however, costing from 20s. to 25s. per acre, at least, and in some years considerably more.

The flax is made into sheaves or "beets" weighing from 7 to 10 lb., is tied with its own straw and then stooked in the same way as cereals. The general practice in France, Belgium and Holland is to let the flax dry in the field in the same way as grain crops, to allow the seed to ripen sufficiently to be suitable for sowing and for the expression of oil, and also because the flax must be dried to avoid heating of the crops when stacked. (In Ireland, however, saving of the seed is often prevented

by unfavourable climatic conditions, and, as a rule, the straw is retted directly it is pulled.) It is frequently stated that the fibre improves by keeping, and many growers store their crops in stacks till the following year before de-seeding and retting. On the other hand, green-straw retting is said by some buyers to produce a finer and more silky fibre. In either case in most climates the seed may be saved equally well. Where green-straw retting is practised the seed bolls are removed by "rippling" or other means, after which the straw is ready for retting. The bolls are subsequently dried, and threshed, either by the boll-breaker mentioned later, or by pulling a roller over them on a stone floor, or by some other convenient means. Less valuable seed will be obtained in this way, and the risks of damage attending the storage of such seed are accentuated.

De-seeding.—For separating the seed from the straw one or other of the methods described below will usually be found expedient in this country.

On the Continent the seed is usually removed by hand labour, either by beating the heads with a wooden stamper on a hard floor, or by "rippling." Rippling is effected by drawing handfuls of flax straw through a vertically placed iron comb, which does not allow the seed capsules to pass between the closely arranged teeth: the capsules are thus broken off and fall below the comb. The seed is subsequently removed from the capsules by means of a boll-breaker, which is a simple machine consisting of a hopper and a revolving wooden roller faced with small-mesh wire netting, which breaks the bolls by pressure and rubbing. There are two types of power de-seeding machines also in use, the one working on the stamping principle, the other by compression between rollers. The latter has the advantage of quieter working and less wear and tear of parts, although the stamper is possibly the more expeditious on the whole. The action of both machines is to release the seed from the bolls or capsules, separation of the seed from the chaff being afterwards effected by winnowing. After the seed is removed the straw is tied in bundles ready for retting.

Retting.—The valuable part of flax straw, namely the fibre, forms a series of irregular "bundles" almost on the outside of the stem. The long fibres composing these bundles are themselves made up of chains of shorter fibres, which are held together and in position by gummy or resinous material. Successful separation of the fibre from the straw depends upon the isolation of the long fibres without going so far as to weaken

the binding between the smaller individual fibres composing them. Up to the present time this has been best accomplished by a natural fermentation process which sets in when the straw is soaked in water, and which is known as retting. Like other fermentation processes, retting proceeds most quickly during warm weather, hence, as a rule, the retting season extends only through the summer months. Soft water gives the best results, although it seems possible to ret flax successfully in almost any naturally occurring water which is free from iron.

Fibre of the highest class is produced in south Belgium where flax is retted in the river Lys. The success achieved on the Lys is probably due in a great measure to the slow movement of the water and the exceptional bacterial development resulting from continuous retting. The Lys retting period lasts from the middle of April to the middle of October. For many miles along the river wooden crates, full of flax bundles standing vertically and weighted with stones, are moored a few feet from the banks. Much of the flax is double-retted—*i.e.*, it is taken out when about half retted, dried and stacked for about a month, and then returned to the river for retting to be completed. This method is said to improve the quality of the fibre considerably. Only the best straw is used, and extreme care is taken throughout the whole course of working. The bulk of the Continental flax, however, as well as that grown in Ireland, is retted in ponds or ditches in which the water is either stagnant or moves very slowly. Steeping ponds are usually long rectangular excavations made in the vicinity of a suitable water supply. They are mostly about 5 or 6 ft. deep, and vary in length and breadth according to requirements. An acre of flax requires an area of about 300 sq. ft. for steeping purposes. For the most part the ponds are simple excavations in the ground with clay bottoms, although some are roughly paved and have boarded sides to help in keeping the fibre clean. It is the general practice to let sufficient water into the pond several weeks before use and then to pack in the straw fairly tightly, arranging the bundles vertically or slanting one row deep, root ends downwards, and keeping them submerged by weighting with large stones. The usual time occupied in steeping is from 10 to 14 days. The correct stage for removal may be said to be reached when, if a stem is broken in two places about 4 in. apart, the central woody core can be drawn away easily from the surrounding fibres without carrying fibre with it.

Retting is sometimes conducted in tanks of wood or concrete in which the water is frequently warmed by steam. This

method was first practised about 1846, since when many retting establishments have been organised and worked on this principle in various countries, including England. Indeed, warm-water retteries survived the longest in this country. Such retteries, however, require considerable capital and fairly large premises for carrying on the work.

Still another method practised in some countries, notably Russia, is dew-retting. This is the easiest of all forms of retting, consisting simply in spreading the straw thinly over the ground to allow alternate dew, sunshine and rain to carry the process forward until the fibre is easily detachable from the wood. The resulting product, however, is frequently very variable and of relatively low value.

Drying.—When retting is complete the straw is thoroughly dried either by spreading it out in thin rows on grass or by setting it up in "steeples," i.e., small sheaves standing upright and spread out wide at the bottom. When the outside of the "steeples" is dry they are rearranged to bring the inside part to the outside so that drying may be as regular as possible. This is the method of drying adopted in the best flax districts. As soon as the flax is perfectly dry it is gathered up—care being taken to keep all straws straight—put into bundles, and stacked under cover for at least six weeks.

Breaking.—This consists in passing handfuls of the dried flax between six or eight pairs of metal rollers, fluted or corrugated to varying depths: the object being to break up the woody part of the stem, rendered brittle by retting, and remove as much of it as possible without injuring the fibre.

Scutching.—This is the final separation of the fibre from the straw. Details of scutch mills vary in different countries, but the principle is the same throughout, and consists in submitting handfuls of broken straw to the beating action of wooden blades fixed to a rotating wheel. The number of blades varies from 5 to 12, and when the wheel revolves, at the rate of from 100 to 250 revolutions per minute, the blades pass close to a rigid upright wooden "stock" over which the flax is held.

The effect is to throw out the woody part known as "shoves" or "shives." With careful manipulation of the bunch of flax, nothing remains in a very short time but a handful of pure fibre which is ready for sale after being baled. Scutching usually takes place during the winter months as it is considered that good fibre cannot be prepared during dry summer weather.

Mechanical Methods of Fibre Separation.—Although comparatively little attention seems to have been given to the removal of the fibre from the flax straw by methods other than retting,

a limited amount of fibre separation, by mechanical means only, is annually effected in this country. It appears that the fibre thus obtained is used, after mixing with other fibres, for making ropes. Since the suspension of retting in Yorkshire small areas of flax have continued to be grown in that county solely to meet this demand.

Yield and Prices.—Prior to the war, from £3 to £4 per ton, f.o.r., was realised for the threshed straw, but considerably higher prices should now be obtainable. About 2 tons of straw together with 1½ qr. (48 stones) of seed per acre is generally reckoned a good crop. As much, however, as 3 qr. of seed are sometimes grown. In January, 1915, Lincolnshire linseed was making 60s. to 62s. per qr. of 424 lb., and prices are tending upwards. The straw is threshed in the usual way, either by stamping or by passing the heads between rollers. Care should be taken to keep the straw straight and unbroken. After threshing it is baled ready for sale in the same way as corn-straw or hay.

Cost of Production.—The cost of growing and harvesting a crop of flax will generally somewhat exceed that for corn. The chief differences will be in respect of weeding and pulling. Hand-pulling of flax costs from 20s. to 25s. per acre, the usual rate of pulling being from ⅛ to ¼ acre per man daily. Including rent, say 30s. per acre, the cost up to the time the crop is stacked prior to de-seeding will be about £7 per acre. When flax fibre is the main object the following may be taken as representing the average returns obtainable per acre:—

4-5 cwt. fibre.	1½ qr. seed.
1-1½ " tow.	4 cwt. chaff.

According to January quotations in Belfast, Belgian and Dutch flax was worth £100 to £140 per ton, Russian £85 per ton, while tow was worth from £40 to £45 per ton. There is reason to believe that flax fibre produced in this country would be able at once to occupy a position intermediate in quality between Belgian or Dutch and Russian. It must be remembered, however, that these figures are approximately 100 per cent. above the level of the past few years. Linseed chaff usually makes about 3s. a cwt. for feeding purposes. Regarding the cost of fibre separation and preparation for market, details of a sufficiently reliable character are not at present available. Through the medium of the Development Fund, however, an experimental flax-retting station has been established at Selby and is now in active operation. In connection with this undertaking due attention is being paid to the economic aspect of flax-growing, and full particulars will be published as soon as available.

Marketing.—There are several ways in which the farmer may undertake flax growing: (1) he may prepare his land and let it to another person desirous of sowing flax and taking the crop; (2) he may himself grow the crop and sell it "on foot," i.e., standing ready for harvest; (3) he may harvest the crop and sell it entire or retain the seed and sell the straw only; (4) he may grow and ret the crop, send it to a mill to be scutched and sell the fibre; (5) he may carry all the operations through and finally dispose of the fibre; or (6) he may combine with other growers and work the industry on co-operative lines. As a rule, circumstances decide which of these different modes of marketing can best be adopted. One or other of the three first-mentioned courses is suitable for adoption in connection with a central rettery. The third course prevails largely in France, Holland and Belgium. The straw is de-seeded at the retting depot where it can at the same time be conveniently sorted and graded. The fourth system is that carried on almost exclusively in Ireland. The fifth plan is extensively adopted in Russia, Hungary and Austria. Where hand or treadle scutching is still carried on, it is suitable as a means of providing employment within the household of small farmers during the winter months, but it is not conducive to uniformity in the marketable fibre. Retting is a technical operation involving problems of a highly scientific character, scarcely within the province of the average farmer. The cultivation of flax he can thoroughly master, but the separation of the fibre and its disposal to the best advantage is, in reality, a business by itself. Another drawback to individual working is the disposal of the flax-water. The Report of the Irish Departmental Committee points out that flax-water when discharged into streams of small volume is fatal to the fish life therein, and even when it is considerably diluted it is probable that fish-life is adversely affected by it. The disposal of flax-water is regulated by Act of Parliament, and the solution of the difficulty is usually found (1) in the provision of a catch dam into which the water from the flax ponds can be discharged and subsequently run off slowly when the river is in flood or when the flax-water has become innocuous, or (2) by diverting the flax-water over ground through which it would gradually percolate.

The Report, however, further points out that there are many rivers, streams and lakes in which flax might be steeped, or into which flax-water might be discharged, without doing any material harm to the fishing industry.

Financial.—A flax-retting depot could not be successful unless arrangements were made with farmers in the neighbourhood to grow flax at an agreed price. It would probably be advisable to arrange for the payment of a guaranteed minimum price, which would be supplemented according to the quality of the crops produced.

It is also obvious that such a depot would require to be upon a sufficiently large scale, and from the data available, 500 acres of flax would seem to be an area large enough to allow of economical working. With regard to the amount of capital necessary to provide and equip a rettery capable of dealing with this crop, much depends on the fitness or otherwise of existing buildings, the water supply, and the facilities for the disposal of the retting effluent, and little information is available upon which to base an estimate. The necessary machinery, however, would be of a very simple character.

Some of the information contained in this article is based on the "Report on the Possibility of Reviving the Flax Industry in Great Britain," submitted to the Development Commissioners by Dr. J. Vargas Eyre and published by the Board in the form of a Supplement to this *Journal* for January, 1914. The article also includes information kindly supplied by Mr. F. K. Jackson, Superintendent of the Leeds University Flax Experiment Station at Selby.

THE CULTIVATION OF CHICORY.

IN past years the United Kingdom has relied chiefly on Belgium and, to a much less degree, Germany, for its supplies of Chicory (*Cichorium Intybus*). The extent to which this has been the case will be seen from the following table, showing the imports in the three years 1911—1913 of raw or kiln-dried chicory:—

*Total Imports of Raw or Kiln-dried Chicory.**

	1911.	1912.	1913.	1911.	1912.	1913.
	cwt.	cwt.	cwt.	£	£	£
Germany ..	3,395	—	85,836	2,706	—	—
Belgium ..	84,274	87,263	—	69,810	51,460	36,802
Total ..	87,677	87,556	86,432	72,522	51,460	37,083

* Roasted or ground chicory was also imported, mainly from Germany and Belgium, to the extent of 4,460 cwt. (1913), representing about 120 acres. A certain quantity of chicory is also imported already mixed with coffee.

Of the above total quantity for 1913 the amount imported for home consumption was 65,016 cwt. This must practically all have come from Belgium and might possibly represent the produce of nearly 2,000 acres. Although the imported chicory is in no way superior to the English-grown article, the cultivation of the crop in this country has fallen to a very low point, the area actually under the crop in England and Wales being 391 acres in 1912, 93 acres in 1913 and 77 acres in 1914. The gap left by the cessation of Belgian imports might be filled by an export trade from Holland and Denmark, but at enhanced prices, and there appears, therefore, to be some likelihood of a good demand for English-grown chicory. In view of the limited extent of the market, however, growers would probably be well advised to ensure a sale for the roots by obtaining an agreement from the dryer or (if several growers could unite to dry their own roots) from the coffee blender.

Soil.—A deep loam with a slight excess of clay is usually regarded as the best soil for chicory, though the crop often does well on light land that is not too dry. The roots yield a larger proportion of dry matter when grown in a soil of good body than when grown on lighter land, although in the former case there is a larger expenditure of labour in lifting and washing the roots. Fen land and potato land seem to suit the crop very well, although it would probably not be profitable to substitute it for market-garden crops where the latter are doing well, especially where two crops can be grown in the year. An open and friable subsoil is necessary for the success of the crop.

Varieties.—There are two main varieties of chicory, viz.: "Tête d'Anguille" or "Palingkop," which has few, crisp, much serrated and reddish veined leaves, and a long, regular root; and "Magdeburg," which has large, upright, lanceolate leaves and a longer root than Palingkop, the root being also thicker at the top.

Place in Rotation.—In Yorkshire, chicory used to follow either wheat or potatoes, and was occasionally grown for several years in succession on the same land. In France it is substituted for sugar beet, while near Magdeburg it follows sugar beet. As a result of the manuring and cultivation given, it may be followed by a cereal crop with good results. In Belgium it is usually followed by flax.

Preparation of Soil and Manuring.—When chicory is to be grown on a corn stubble the soil should be lightly skimmed in October, well harrowed, and manured with 10 to 12 tons per

acre of farmyard manure, which should be ploughed in 5 or 6 in. deep. The land may then be left undisturbed until April, when it should again be ploughed or deeply cultivated according to the character of the soil and climate, and worked into a fine seed-bed.

Deep working of the soil is necessary, as the tap-root of chicory penetrates to a depth of 15 in. or more. If the soil is thin or close-bottomed it will be an advantage to use the subsoil plough.

Dung is not usually applied after potatoes, but about 5 cwt. of artificials are harrowed in when the seed is sown in the spring. An application of 10 tons of dung in the autumn, and 1 cwt. nitrate of soda, 2 cwt. superphosphate, and 1 cwt. sulphate of potash (48 per cent. pure K_2O) in the spring, might be tried; if no dung is used the artificials should be doubled. The quantities of artificials are less than those commonly applied in Belgium.

The application of dung in spring is not recommended, as it favours the production of foliage at the expense of the root, which is liable to be watery and forked, and have its aromatic qualities injured.

Sowing.—The land must be thoroughly clean, have a fine tilth, and be well consolidated before sowing. Belgian growers prefer the seed to be two to three years old, as it is held that plants from such seed are less liable to develop flowering shoots. The seed is drilled from the middle of April to the middle of May, at the rate of 3 lb. to 6 lb. per acre, in rows about 12 to 18 in. apart to allow horse-hoeing between the rows. The ridge system might be tried if the land is foul, 19 in. being allowed between the ridges, but it is better not to sow chicory on foul land. If sown too early the plants are apt to run to seed at the expense of the roots.

Where a farmer contracts to grow roots for a drying factory the manufacturer commonly supplies the seed.

Cultivation and Singling.—After sowing, the land is sometimes harrowed; it is always rolled.

The first hoeing should be carried out at the end of May or the beginning of June, when the young plants show their fourth leaf, and a fortnight later the plants may be singled. The general opinion is that the plants should be left at least 6 in. apart in the rows; in France the distance is from 8 to 10 in., and in Flanders the average is about $8\frac{1}{2}$ in. With thin seeding it might be possible to avoid the cost of singling. The plants should be singled by hand when the soil is soft with rain

in preference to cutting with a hoe, as the roots are very tenacious of life and will throw out new buds even when cut a good deal below the surface.

Hoeing should be done once or twice at the end of June or the beginning of July, and be repeated so long as it is possible to get between the plants. In July the plants which are running to seed should be weeded out as their roots are woody and valueless.

Harvesting.—Harvesting is undertaken when the leaves are yellow; it usually commences about the beginning of October and proceeds until frosty weather sets in.

Some growers cut the foliage of the plants in the summer for feeding to stock. This practice, however, must be condemned, since it is certain to retard the development of the root, but when the plants approach maturity, the foliage may be gradually removed and utilised to mix with other fodder for dairy cows. The roots are dug with a fork or spade; care must be taken on heavy soils that the roots are not broken, and special lifters similar to those employed for sugar beet are sometimes used in such cases.

Yield.—As regards yield, the average returns obtained per acre in Belgium in 1909, 1911 and 1912 were 12½, 11½ and 13 tons, while in Holland both in 1910 and 1911 about 9½ tons were obtained. In France the yield is stated to approximate to 12 tons per acre. An English grower who communicated his results to the Board stated that he obtained an average of 9 tons from 89 acres, the biggest yield being between 16 and 17 tons. If the roots are topped on the field the tops may be ploughed in; or otherwise they may be fed to animals in small quantities.

The roots may be washed on the field after harvesting, or washing may be undertaken at the kiln, especially where the roots are obtained from small growers.

Cost of Cultivation.—The expense of labour contributes to making the cost of cultivation high. From examples furnished to the Board in 1904 it was estimated that the average cost of cultivation after wheat was £15 per acre, viz.: Twice ploughing and harrowing, £1; seed and sowing, 10s.; manures, £4 10s.; hoeing and singling, £2 10s.; digging and washing, £2 15s.; carting to factory, £1 10s.; rent, rates and taxes, £2 5s. After potatoes there would be a saving of £3 per acre for manures and the labour bill would be less owing to the land being in better condition. An English grower who has recently made an estimate arrives at a cost of £10 2s. per acre, but allows only 6s. for manures. In France an estimate in 1908 was

£12 per acre (12 tons of roots being produced); in Belgium £14 per acre seems to have been reckoned as an average cost.

It would seem that the cost of production per ton of roots is about 24s. The labour bill might be largely reduced if the cultivation of the crop were undertaken by small holders and their families.

Drying the Roots.—At the factory or drying kiln the roots are again washed, and afterwards passed through a slicing machine which cuts them into disc-like slices, about ⅛ in. thick. The cut root is then taken to the drying chambers and spread in a layer on the floors, which consist of perforated iron plates arranged over coke fires. In the most simple form of kiln each lot of root is deposited on the perforated floor in a layer 9½ in. to 11½ in. deep, and is left exposed for 24 hours to the action of the hot air, which is kept at a temperature of about 140° F. During this period the mass is turned over with a shovel every two hours to prevent the chicory from burning and to make the drying as uniform as possible. The root so dried is known as "ordinary dried" chicory.

The quantity of roots produced on separate farms would probably be so small that it would be more profitable for an individual grower to send the raw produce to a central kiln, unless he could co-operate with other growers in the maintenance of a common kiln. "Ordinary dried" chicory yields on roasting from 90 to 92 lb. of ground chicory per cwt.

It was stated in the Board's Report on the Cultivation and Drying of Chicory (1904) that most Belgian growers had their own kilns, a small kiln with one or two fireplaces and hearths being built for £60-£80, while a large well-arranged kiln, with six fireplaces and two drying floors would cost about £240 to build.

When the chicory is sufficiently dried it is removed from the hot floors and put into linen sacks of loose texture, in which it is kept for some hours to cool; during this time it further dries and gradually hardens. It is then emptied from the sacks and stored in a heap in a dry, dark warehouse free from draughts. A small quantity of quick-lime is often placed in an unused corner of the warehouse to dry the air and to attract moisture from the chicory. Heating and deterioration in quality may set in after a few months if the chicory has been insufficiently dried.

It is usually reckoned that 4 tons of raw roots are needed to produce 1 ton of "ordinary dried" roots. In the Board's

Report of 1904 the cost of producing 1 ton of kiln-dried roots in Flanders was given as £5 17s. 2d. (4 tons of raw roots were reckoned), and if £12 duty be added the cost comes to £17 17s. 2d.

If several smallholders could combine to erect a kiln, or to use one already existing, so that they could dry their own roots, they would have the advantage of both growers' and driers' profits. On the other hand, it may in some cases prove advisable to contract with the drier or coffee blender before growing the crop.

Belgian chicory intended for export to the United Kingdom is nearly always subjected to a further process of drying in specially constructed kilns before shipment, the object of this second drying or "high-drying" being to make the article as light as possible and thus lower the Customs duty; kiln-dried chicory usually loses 20 per cent. of its weight after it has been "high dried." The operation of high-drying is, however, one requiring a considerable amount of care and skill in addition to the use of special kilns.

It has been stated recently by an English drier that if the crop is raised in autumn 5 tons of raw roots are required in England to produce 1 ton of "high-dried" root, and if left in the ground till February 7 tons are required.

The cost of producing 1 ton of "high-dried" chicory, allowing for 5 tons of raw roots at the cost of production of 24s., and a duty of £12 per ton, is given as £21 12s. 3d. This figure is made up as follows:—Roots, £6; duty, £12; rent and rates, 7s. 6d.; wages, £1 1s. 3d.; coke, £1 3s.; oil, 2s. 6d.; seed, 6s.; superintendence, 5s.; bags, 4s.; carting, 3s.; total, £21 12s. 3d.

The drier in question heats up to 260° F. until the slices get quite crisp. This dried chicory, it is said, is equal in all respects to that produced on the Belgian high-drying system. The kiln, machinery for washing, slicing, etc., cost about £1,200.

The roots are cleaned by scraping and washing, split where they are thickest, and cut across in pieces about 2 to 3 in. long. Some nicety is required in drying to prevent the root from being scorched and to keep the proper flavour.

Prices and Profit.—At the end of January the price, duty paid, for "ordinary dried" chicory root was £39 to £40 per ton and for "high dried" chicory root £43 to £44 per ton; these are nearly double the prices paid in January, 1914. At these prices, and on the basis of the above figures showing the cost of

production and drying, chicory should be a highly profitable crop.

Even supposing the cost of ordinary drying to be the same as high drying (and it should be much less), and the amount of raw roots required to produce 1 ton of dry by ordinary drying to be the same as that required by high-drying (and it should be 20 per cent. less), the figures suggest that a very substantial profit would be obtained by growing and "ordinary drying" chicory, at present prices.

Duty.—The Excise Duty on chicory is 12s. 1d. per cwt., reckoned, not on the weight on delivery from the warehouse (chicory absorbing moisture during storage in the warehouse), but on the computed weight of the chicory at the time of its deposit in the warehouse. Even here, however, it will be seen that duty is paid on the water in the kiln-dried chicory at the time of its deposit in the warehouse, and if high-drying were generally adopted in England the effect would be to reduce the duty to an equivalent of £10 per ton of kiln-dried chicory.

Imported kiln-dried chicory is subject to a Customs duty of 13s. 3d. per cwt.; the advantage of 1s. 2d. per cwt. in favour of the home grower is supposed to off-set the trouble to which he is put by having to dry and store his roots under Excise regulations.

COCONUT CAKE AND PALMNUK KERNEL CAKE.

COCONUT cake and palmnut kernel cake are two feeding stuffs which are being brought prominently to the notice of stock owners as a result of the war. The main reason for this is that part of the large quantities of the raw products from which these cakes are manufactured, viz., "copra" and palmnut kernels respectively, which were formerly exported to Germany and Austria-Hungary, has now been diverted to the United Kingdom. A certain amount of coconut cake is manufactured in England, but hitherto practically all the palmnut kernels produced in Nigeria and other British Colonies have been exported to Germany.

Further, the closing of the German market has made it necessary for such parts of the Empire as depend largely on the export of copra and palmnut kernels to find new markets, and efforts are being made to establish new coconut and palmnut kernel crushing industries in the United Kingdom. The success which might attend the establishment of such industries would partly depend (at any rate during the continuance of the war) on the extent to which the cakes could be disposed of to British farmers who purchase very large quantities of feeding stuffs, and are always ready to utilise new oil cakes if they can be shown to be good value.

Experiments with one or other of these cakes are being undertaken at a number of Agricultural Colleges, but the results will probably not be available for some time. For this reason the results of such few English experiments as have already been conducted have had to be supplemented from German sources of information.

Copra and palmnut kernels are obtained by removing the shell from the coconut and palmnut respectively. The principal products obtained from the crushing of copra and palmnut kernels are coconut oil and palmnut oil respectively, these being used in the soap industry and in the manufacture of butter substitutes, chocolate fats, and various other edible fats.

The oil is obtained either by pressing the copra and palmnut kernels or by extraction with chemical solvents. In the former case the residues mostly take the form of cake; in the latter case, when the copra or palmnut kernels are ground the residues take the form of meal.

The composition of the cakes naturally varies with the efficiency of the crushing process employed to express the oil, and as the process improves the resulting cakes tend to show a lower percentage of oil and a correspondingly larger percentage of other nutrients than cakes produced by the older methods. When the oil is extracted by solvents, much less is left in the residue than would be left by the crushing process.

Analyses.

The following tables show, for coconut and palmnut kernel cakes, the average of a large number of analyses given by various experimenters, together with the minimum and maximum figures found for each individual constituent :—

Coconut Cake (Crude Nutrients).

(Average of 25 analyses, many of which are themselves averages.)

—	Moisture.	Oil.	Crude Protein.	Carbo-hydrates.	Crude Fibre.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Minimum	4.17	7.20	17.87	25.92	7.04	4.10
Maximum	13.16	21.96	24.50	48.00	20.60	9.55
Average..	10.05	11.18	20.80	39.09	12.51	5.95

Palmnut Kernel Cake (Crude Nutrients.)

(Average of 11 analyses, some of which are themselves averages.)

—	Moisture.	Oil.	Crude Protein.	Carbo-hydrates.	Crude Fibre.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Minimum	9.70	4.40	15.89	33.40	10.00	3.55
Maximum	13.40	12.91	19.12	50.00	24.08	4.00
Average..	11.06	7.90	17.15	41.54	18.29	3.83

For purposes of comparison the composition of average samples of the commoner feeding cakes are given below :—

—	Moisture.	Oil.	Crude Protein.	Carbo-hydrates.	Crude Fibre.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Linseed Cake..	12	10	30	34	9
Decorticated Cotton Cake ..	8	9	41	26	8
Undecorticated Cotton Cake ..	12	5½	22	34	20

The approximate prices for the various cakes named in Liverpool in the middle of January were as follows, per ton :— Linseed cake, £11; decorticated cotton cake, £9 5s.; undecorticated cotton cake, £6; coconut cake, £7 18s. 9d.; palmnut kernel cake, £6 8s. 9d. On the basis of these figures, and of the average crude nutrients given above, the price per food unit* (crude, and disregarding fibre) would average about 1s. 7½d. for linseed cake; 1s. 2½d. for decorticated cotton cake; 1s. 2d. for undecorticated cotton cake; 1s. 4d. for coconut cake; and 1s. 2½d. for palmnut kernel cake.

* The number of food units, is obtained by multiplying the oil and albuminoids by 2½ and adding to the carbohydrates. This assumes that the differences in the manure values will be sufficiently allowed for in the high value assigned to the albuminoids (see also Leaflet No. 74, *The Composition and Properties of Concentrated Feeding Stuffs*).

Digestibility.

The following results of digestibility experiments are given by various German authorities (per cent.) :—

Digestibility Coefficients.

	Organic Substances.	Oil.	Crude Protein.	Carbo-hydrates.	Crude Fibre.
<i>Coconut Cake.</i>					
<i>Ruminants :</i>					
Kellner	80	97	78	83	63
Pott	—	100	81	84	—
<i>Pigs :</i>					
Kellner	80	83	73	89	60
<i>Palmnut Kernel Cake.</i>					
<i>Ruminants :</i>					
Kellner	70	98	75	77	39
<i>Pigs :</i>					
Kellner	68	78	69	77	36
<i>Sheep :</i>					
Weiniger (Kuchenmehl)	77	79	77	89	39
<i>Linseed Cake, Decorticated Cotton Cake, and Undecorticated Cotton Cake.</i>					
<i>Ruminants :</i>					
Kellner—					
Linseed Cake	79	92	86	78	32
Decorticated Cotton Cake	76	94	86	67	28
Undecorticated Cotton Cake	55	93	77	52	18

As regards digestibility of total organic matter, coconut cake is equal to linseed cake, and ranks above decorticated cotton cake, while palmnut kernel cake falls below decorticated cotton cake.

Applying Kellner's digestibility coefficients for ruminants to the average analyses given on p. 1027, the proportion of digestible nutrients of coconut cake and palmnut kernel cake, with the corresponding figures for the commoner cakes, would be approximately as follows :—

	Oil.	Crude Protein.	Carbo-hydrates.
	Per cent.	Per cent.	Per cent.
Coconut Cake	10.84	16.22	32.44
Palmnut Kernel Cake	7.74	12.86	31.99
Linseed Cake	9.20	25.80	26.52
Decorticated Cotton Cake	8.46	35.26	17.42
Undecorticated Cotton Cake	5.11	16.94	17.68

On the basis of their digestible nutrients the price per food unit* would be about 1s. 7d. for coconut cake, and 1s. 6½d. for palmnut kernel cake, compared with about 1s. 5½d. for decorticated cotton cake, 1s. 8d. for undecorticated cotton cake, and 1s. 11d. for linseed cake.

In considering the digestibility of a food, the amount of fibre and its condition must be taken into account. The amount of crude fibre in both coconut and palmnut kernel cakes (especially the latter) seems to be well above that found in linseed and decorticated cotton cakes ; but the fibre of coconut and palmnut kernel cakes (especially the former) appears to be much more digestible than that of the two latter cakes. In the most recently made samples of palmnut kernel cake the proportion of fibre is not very much more than that found in linseed cake.

Coconut Cake and Palmnut Kernel Cake as Foods for Stock.

Palmnut kernel cakes in the past have had the reputation of soon going rancid, and this is generally ascribed to an excess of oil present. At the present day, before the kernels are crushed they are subjected to a process of cooking, by which the ferment that causes the oil to turn rancid is rendered inactive ; if palmnut kernel cake is stored in a suitable, dry place, there is little danger of fermentation taking place.

When cakes contain a very low percentage of oil the great pressure which has been employed makes the cake excessively hard and renders full utilisation by stock difficult. Specific effects are ascribed to the oil (see later) so that from this point of view also the percentage of oil should not be too low. In any case it is not advisable for users of palmnut kernel cake to lay in large stocks ; and the cake should be kept unbroken until actually needed for feeding to stock.

These considerations as to the oil content of palmnut kernel cake probably apply also in great measure to coconut cake.

Good samples of coconut cake are bright red or brown to brownish-grey in colour, while those of palmnut kernel cake are of a whitish-grey colour. Adulteration is not common.

When gradually accustomed to the foods both kinds of cake seem to be readily eaten by all classes of stock. They are mostly fed dry. When prepared with warm water palmnut kernel cake has an unpleasant taste ; if it is moistened at all it should not be allowed to stand long. Manufacturers sometimes recommend steeping coconut cake in water, but this is hardly necessary when the animals are receiving quantities of roots.

* See footnote on p. 1027.

Dairy Cows.—Both coconut cake and palmnut kernel cake have been used in Germany, principally for dairy cows, and are said to have a favourable effect on the quantity and quality of the milk fat. This characteristic appears to depend on the special nature of the fats in the two cakes.

Up to 5 lb. per head per day may be fed in the case of palmnut kernel cake and up to 4 lb. in the case of coconut cake. Larger quantities of the cakes than these have, however, been fed to dairy cows without any ill effects. The larger quantities are liable to induce excessive hardness in the butter, while serving to correct the effect of foods which give rise to softness in butter. Small amounts would probably prove useful in warm weather, when difficulty is experienced in making firm butter. It is important that the cakes should not be rancid, since, if this is the case, the milk and butter produced are likely to have a bad flavour.

According to Pott the limits of the favourable effect on butter production appear to be reached in the case of palmnut kernel cake when $2\frac{1}{2}$ lb. are fed per head per day, but Kellner (1911 report) doubts whether smaller quantities than 5 lb. per head per day of palmnut kernel cake would have any effect on the fat content of the milk.

Recent English experiments on the feeding of coconut cake to dairy cows have been conducted at the South Eastern Agricultural College, Wye, and at the Midland Agricultural and Dairy College. In the Wye College experiment, the quantity of coconut cake fed reached 6 lb. per head per day. In the Midland College experiment the addition of 5 lb. per head per day of coconut cake to the basal ration of shorthorn cows was compared with $4\frac{1}{2}$ lb. of linseed cake. The total milk yields during the fortnight were 2,472 lb. from linseed cake, and 2,429 lb. from coconut cake. The live weight increase, however, was greater in the case of coconut cake, while the butter obtained from this food was firmer and better flavoured than that from linseed cake. The results were financially in favour of coconut cake, "this cake at £6 15s. per ton appearing to be well worth consideration when linseed cake is more than £9 per ton."

In a comparison between butter from coconut cake feeding and linseed cake feeding it was observed that the former butter had better keeping properties than the latter. No very great differences were shown in the flavour and texture of the two lots of butter. The coconut cake butter had, as a rule, a firmer and less oily texture and a better flavour.

Palmnut kernel cake was recently compared with decorticated cotton cake in an experiment at the Lancashire County Council Farm at Hutton.

It was concluded that palmnut kernel cake could be recommended as a safe food for milk cows, although it was not more profitable to feed it at £5 2s. 6d. per ton than decorticated cotton cake at £8 12s. per ton. No difficulty was experienced in getting the cows to eat $7\frac{1}{2}$ lb. per head per day of palmnut kernel cake, when this amount was gradually worked up to, but this amount was large and better results might have been obtained had the food been fed as only part of the cake ration. Even the large quantity of palmnut kernel cake fed had no undesirable effect on the butter produced.

The following daily rations containing coconut cake or palmnut kernel cake might be tried by dairy farmers:—

I. (Approximate Cost 1s. 0½d.)	II. (Approximate Cost 1s. 2d.)
42 lb. swedes or mangolds.	28 lb. swedes or mangolds.
5 „ hay.	15 „ hay.
14 „ straw.	7 „ straw.
4 „ coconut cake or palmnut kernel cake.	2 „ coconut cake or palmnut kernel cake.
3 „ dried grains.	2 „ undecorticated cotton cake.
2 „ bran.	3 „ dried grains.
	3 „ bran.

Fattening Cattle.—At the prices which prevailed in Germany before the outbreak of war, both coconut and palmnut kernel cake would seem to have been found less suitable for fattening cattle than were several other concentrated foods.

An experiment carried out by the Edinburgh and East of Scotland College of Agriculture (Report XXVII.), in which the addition of 4 lb. of coconut cake per head per day to the basal ration was compared with 4 lb. of linseed cake, showed the average daily increase from coconut cake to be 1.91 lb. per head compared with 2.25 lb. from the linseed cake. Taking into account the respective manurial values,* the conclusion was reached that when the price of good average linseed cake is £9 per ton, the value of coconut cake for fattening purposes is £6 1s. 8d. per ton.

Pigs and Sheep.—Although these animals eat coconut and palmnut kernel cakes very readily, and good results have been obtained in Germany from their use, especially in the direction of obtaining a very firm bacon, they have been

* The manurial values of Hall and Voelcker for the different cakes are as follows, per ton:—Coconut cake, 34s. 7d.; palmnut kernel cake, 22s. 11d.; decorticated cotton cake, 64s. 9d.; undecorticated cotton cake, 37s. 1d.; linseed cake, 44s. 4d.

found on the whole too expensive when compared with other concentrated foods for fattening pigs and sheep. The foods in question are recommended, however, in Germany for suckling sows and ewes.

Horses.—Both kinds of cake or meal are recommended in Germany for replacing part of the oats in the ration, especially in the case of horses with a weak digestion; 1 lb. to 2 lb. of either may be used for this purpose. Coconut meal was tried about 20 years ago by the French Ministry of War for ten cavalry horses, part of the oats ration being replaced for four weeks by coconut meal. Horses fed on oats made an average loss of 13 lb., while those fed on oats and coconut meal gained 7½ lb. There was no difference in the capacity of the two lots for work and it was stated that the substitution of the coconut meal would have reduced the cost of feeding by 50 francs (£2) per horse per annum.

Conclusions.

1. Palmnut kernel and coconut cakes or meals are valuable foodstuffs, particularly for milch cows, when they can be obtained of good quality at a price which compares favourably with the prices of such feeding stuffs as linseed cake and cotton cake. They are also useful for replacing oats for horses, but are probably of less value for fattening bullocks, sheep and pigs.

2. Farmers should buy under guarantee as to analysis, paying special attention to the percentage of oil, fibre, albuminoids and carbohydrates. They should insist on fresh, well-made cake, and should not buy more than a three months' supply.

Note.—Further information respecting copra and palm kernels will be found in Nos. 3 and 4 of the *Bulletin of the Imperial Institute* for 1914 (London: J. Murray).

MANUFACTURE OF CHARCOAL.

In consequence of the war the demand for charcoal both for heating purposes and for munitions of war has already greatly increased and it is probable that this will be the case as long as hostilities continue. Owners of woodlands may find it advantageous to consider whether they could not profitably turn some of their less valuable material into charcoal. There is no great difficulty in manufacturing charcoal in kilns: the initial expenditure is small, and the amount of skilled

labour required is not very great, while at the same time wood which might not otherwise be utilised is turned to account. It would be unwise, however, to attempt to make charcoal without some skilled labour, and although it has been found possible in an emergency to employ 20 to 30 unskilled men under a skilled charcoal burner and a good foreman, there are some operations which only a skilled and experienced man can efficiently perform.

Selection and Preparation of Wood.—Since it is important that carbonisation should proceed evenly, different woods varying much in density should not be burned in the same kiln. Thoroughly air-dried wood is most suitable, but green wood can be used if a small amount of dry wood is put in the centre of the kiln. Decayed wood should on no account be used. Large pieces of wood (*i.e.*, of about 8 in. or more in diameter) should be split and trimmed straight. Crooked and bent branch-wood can be used only in short pieces. Usually cord-wood in lengths of 2-3 ft. is employed.

Site for the Kiln.—Level, well-drained ground, sheltered from the wind* and in close proximity to the wood and to a water supply, represents the best site for a kiln. A sandy loam is the best soil upon which to make the hearth. The soil of the hearth should be of a uniform nature and for this reason the ground must be freed from vegetation, etc., and prepared as carefully as a garden bed. The centre of the hearth is raised 8 to 12 in. above the circumference, and slopes evenly down to it, in order that the liquids produced in the process may drain away and that the draught may be increased.

An old hearth is always preferable to a new one: in any case the admixture of charcoal dust from old kilns with the soil of the hearth produces conditions most favourable to efficient carbonisation.

Before the kiln is piled, a heap of brushwood or other easily combustible firewood should be burned upon the hearth in order to dry it.

The method of constructing and burning charcoal-kilns differs in detail from place to place. The method described below is the one followed in the Forest of Dean, but in general it may be taken as typical of the practice of English charcoal-burners. The illustrations represent operations in the Sussex Weald, but they also are typical of the country.†

* If the ground is not naturally sheltered wind-screens are used, see Fig. 2.

† It will, however, be noted that in Fig. 1 a central pole has been used upon which to build up the chimney.

Construction of the Kiln.—It is found that convenient sizes for kilns are from 6 to 8 ft. in height and 13 to 20 ft. in diameter: a usual size is 7 ft. high and 18 ft. in diameter, giving a capacity of about $8\frac{1}{2}$ cords.*

The first step in construction is to build a central flue by laying two billets (about 1 ft. or 1 ft. 6 in. long) parallel on the hearth, and piling others across them, continuing in this fashion to a height of several feet: it is not necessary to build this flue to the total height of the kiln, the walls of the top part of the flue being formed in the process of packing the kiln. Around the flue other billets are closely stacked, leaning against it in a nearly vertical position, the thick ends being usually downwards. Dry, slender billets, are placed next to the flue, the thicker ones being placed about halfway between the centre and the circumference. When some progress has been made with the first tier of billets a second tier is commenced, and later a third and sometimes a fourth. Finally the kiln is made as symmetrical as possible by filling with thin sticks any spaces left by the packing: the top of the kiln is by this process made almost horizontal.

Covering the Kiln.—In order to exclude all air from the kiln other than that absolutely necessary to maintain carbonisation, it is covered with an inner and an outer covering. The inner covering consists of turf, the sods being placed grass downwards. This covering is built upwards from the ground, and varies from 2 in. to 6 in. in thickness. Where suitable turf is not available a covering of dead leaves or grass takes its place. An outer covering of damp earth or of a mixture of damp earth and charcoal dust, about 1 in. thick, is next put on, commencing from the base and working upwards: this is lightly patted down with the back of a spade to keep it in place. The top of the flue is left open.

Firing the Kiln.—Red-hot charcoal is thrown down the flue and the fire so made is kept well alight: when this is assured the flue is filled with small billets of wood. An iron plate is placed over the top of the flue and removed every few hours in order to admit more billets, which are rammed tight with a wooden pole. When the flue is filled with a mass of burning wood the plate is removed and the flue covered in with the same substances as the sides of the kiln.

Regulation of the Burning.—The proper regulation of the burning is a very difficult operation, for which it is absolutely

* A cord = 128 (piled) c. ft. or about 64 c. ft. solid of cordwood.

necessary to have the assistance of an expert charcoal burner. Constant attention is required day and night until carbonisation is complete: the process may continue from 4 to 6 days according to the size and quality of the wood. The burner is guided in his work by the colour and position of the smoke. When the kiln is first kindled steam is given off, which changes in time to a white, thick smoke and then to a clear, blue smoke. The method of regulation is to make vent holes to increase the draught and expedite burning, and to close vent holes and thicken or water the covering to retard burning. Vent holes are not made until the second day of burning: they are then made on the sheltered side of the kiln at about two-thirds its height. As the burning proceeds these holes are covered and others made lower down, each series of holes being covered in turn until the base is reached and carbonisation completed.

As the temperature rises and the moisture in the wood is converted into steam there is some danger of explosion. Great care is required to keep the cover in proper condition, so that it is sufficiently porous to let the steam out and not so porous as to let in too much air.

If through uneven packing or other causes hollows appear in the kiln, these must be filled: the cover is removed, the wood or charcoal inside pressed down and the hollow filled with half-charred wood or fresh wood and the covering replaced as speedily as possible.

Opening the Kiln.—As soon as it is perceived that carbonisation is completed down to the base of the kiln, the covering is made air-tight. The kiln has now considerably shrunk and is only about 3 ft. high. The outer covering is raked off with a long-pronged rake,* leaving only the charred turf. The surface is smoothed down with a "rable" (a large wooden hoe) all loose dust being scraped off. Fresh damp earth is thrown on to form a layer of about half-an-inch thick, and finally the kiln is covered with a layer of fine dry dust to fill up all small holes and to make it air-tight. If large wood has been used the kiln is cooled down by sprinkling water on it after scraping off the first layer, but this is not necessary with coppice wood.

When the kiln is sufficiently cooled down the covering is raked off about one-sixth of the kiln on the sheltered side and the charcoal is drawn out with a long-pronged rake as rapidly as possible. The covering is next taken off the adjoining portions of the kiln and is thrown over the first opening to prevent flam-

* See Fig. 2.

ing and to reduce the amount opened at any one time. This process is continued round the kiln till all the charcoal is removed. A kiln is ready for opening on about the fourth day if small wood has been used and on the sixth day in the case of large wood.

As soon as the charcoal is removed from the kiln it is spread over the ground and sprinkled with water. All half-charred pieces are picked out by hand and reserved for filling the chimney of the next kiln. The rest is riddled through a wide-meshed screen and is packed into sacks according to size. The earth and charcoal dust remaining in the centre is riddled and is used for covering the next kiln burnt on the hearth.

Yield of Charcoal.—The yield of charcoal depends upon many factors—the kind of wood used, the situation of the kiln, the state of the weather, the methods adopted by the charcoal burner and the degree of his expertness. In similar circumstances coniferous wood will yield more charcoal than wood from broad-leaved species and, of the latter, soft-woods will yield more than hard-woods.

As a result of recent operations in the Forest of Dean it was found that $61\frac{3}{8}$ cords of cord-wood and $47\frac{3}{8}$ cords of pit-wood (all of oak) together yielded in 13 burnings 31 tons 19 cwt. of charcoal, i.e. a little under 6 cwt. to the cord.

Since a cord of oak cord-wood weighs roughly $1\frac{1}{4}$ tons and a cord of oak pit-wood a little more than this, the weight of charcoal produced was approximately 20 per cent. of the weight of wood used.

Cost and Financial Return.—In the Forest of Dean the burning is usually given on contract at from 18s. to 25s. per ton.* This sum does not include any payment for the cutting or preparation of the wood, which is provided ready cut. Such wood is sold at 5s. per cord, so that to the sum paid for labour about 15s. per ton of charcoal may be added for the value of the wood.

Besides labour and wood the only other considerable items of expense are sacks for packing and cartage. The sacks used in the Forest of Dean cost about $3\frac{1}{2}d.$ each and about 40 are required to pack a ton: they are returnable and can be used several times.

In normal circumstances charcoal in large consignments sells at from £2 to £2 10s. per ton on rail, while for small quantities

* When the burner is paid by the ton he may, if unscrupulous, water the charcoal to increase its weight, and it is, therefore, found convenient in some places to pay by the bushel.



FIG. 1.—Making the Heap.



FIG. 2.—Opening the Kiln.

(say two or three tons) such as are used for drying hops in the South of England, as much as £4 per ton may be obtained. At the present time, however, prices are higher, and large quantities are being sold at from £3 10s. to £4 per ton on rail.

THE plans formulated by many farmers last autumn for increasing the area under wheat were in great measure frustrated by the almost continuous wet weather experienced during the last months of the year. As a result, attention is now being directed to the possibilities of spring-sown wheat. Before dealing with this question it may be of interest briefly to discuss in a general way the relationship between autumn and spring varieties of wheat.

The widespread cultivation of wheat, coupled with the well-known tendency of plants to adapt themselves to their environment, has led to the existence of a large number of more or less distinct types and varieties. Wheats of dry countries and of countries exposed to severe winds have, as a rule, narrow leaves, pliant straw, bearded ears and velvety chaff, characteristics which enable them to resist drought and wind, while wheats of moist climates have broader leaves which admit of more rapid transpiration.

In recent years the attention devoted to hybridisation and selection has still further contributed to the multiplication of varieties suited to particular requirements.

From the farmer's point of view the features of outstanding importance are yield, strength, disease resistance and power of resisting drought, and he must, accordingly, consider which variety, or varieties, will best suit the conditions of his locality, and grow that which will yield him most profit. In countries such as Russia and Canada, where the winter is long and severe and the summer is a period of almost uninterrupted light, quickly-maturing spring wheats of the highest quality have been produced. Such varieties when grown in this country maintain, as a rule, their characteristic features of early maturity—low yield and high quality.

One of the best known of Canadian wheats, namely Red Fife, has been grown as a spring wheat in this country for many years. The yield however, has proved unsatisfactory, from 3 to 4 qr. per acre being the general maximum limit of production, although, in a few districts, yields approaching those of Square-head's Master have been obtained. There are a number of

strains of Red Fife, some more productive than others. One, the Marquis, which has proved the best of the Fifes grown in Manitoba, is now on sale in this country. The Department of Agriculture and Technical Instruction for Ireland have also obtained, by selection, a strain of Fife which gives satisfactory returns in Ireland. The introduction, some few years ago, of Burgoyne's Fife, a cross between Red Fife and Essex Rough Chaff, effected by Professor Biffen of Cambridge, marked a distinct advance on the productive capacity of ordinary Red Fife. While still retaining the fine milling qualities and early maturity of Red Fife, Burgoyne's Fife is a distinctly better yielder, though not equal in this respect to standard varieties of English autumn wheats.

As regards the period required to mature, there is, in reality, no sharp distinction between autumn and spring wheats. In a favourable year, spring-sown autumn wheat will ripen satisfactorily in the earlier parts of England, and it is believed that by repeated growing from spring-sown crops an autumn wheat may be converted into a spring wheat. It is well known in the agricultural practice of late districts that cereals brought from an early district will ripen earlier than the produce of locally-grown seed. Hence if it is desired to sow autumn wheat in spring it is desirable that the seed should be obtained from as early a district as possible and be sown not later than the month of February. The general unreliability of spring-sown autumn wheats, however, has led to their almost total abandonment for spring sowing, and at the present time chief reliance is placed upon certain wheats brought out by Vilmorin of Paris. These, whether sown in autumn or in spring, almost invariably reach maturity a week or two before the standard English wheats. As regards both yield and quality, they are not far short of ordinary autumn wheats. Other varieties of spring wheats, notably "April or Spring Bearded," have long been grown in England, but these older sorts are now rarely met with.

To be successful with spring wheats attention must be paid to a number of points.

Soil.—Any soil on which autumn-sown wheat will thrive will usually grow spring wheat satisfactorily, provided it is possible to obtain a fine, mellow seed-bed which can be made fairly firm below. All cultural operations, therefore, should be directed towards this end, the object being to secure quick, uniform germination and growth, since wheat sown in spring has a comparatively short period of growth. The best results will usually be obtained after a corn or root crop. Drilling is

usually to be preferred to broad-casting. After ploughing, if the furrow is fresh and loosely packed, the Cambridge or ring roller may be run over to consolidate the land, after which the harrows should be freely used so as still further to consolidate the bottom soil while leaving the top inch or two loose and fine. It will usually be found advisable to postpone rolling till the plant is up, for, in addition to further consolidating the soil and smoothing the surface, late rolling will have the effect of promoting tillering, in which spring wheats are deficient.

Manuring.—Unless the soil is highly fertile it will as a rule be advisable to apply some artificial manure, with the two-fold object of encouraging growth and hastening maturity. A dressing of sulphate of ammonia and superphosphate, at the rate of $\frac{3}{4}$ cwt. to 1 cwt. of the former and 2 or 3 cwt. of the latter, per acre, will usually answer the purpose. The manure should be applied before the final harrowing, or superphosphate may be applied when harrowing after sowing and 1 cwt. to $1\frac{1}{2}$ cwt. of nitrate of soda top-dressed in April. If the spring is wet and the young wheat is yellow and backward towards the end of April, nitrate of soda will prove most useful.

Varieties.—In the following table will be found particulars of the yield per acre in bushels (63 lb.) of a number of the best known varieties of spring wheat grown under the auspices of the East Anglian Institute of Agriculture, in 1911, 1912 and 1913:—

Name of Variety.	Centres, 1911.		Centres, 1912.		Centre, 1913.
	Essex. Sown Feb. 23.	Herts. Sown Feb. 15.	Essex. Sown Mar. 27.	Herts. Sown Mar. 28.	Essex. Sown Mar. 11.
Dreadnought ..	58	42½	30½	—	41
Red Marvel ..	53	—	36	41½	35½
Red Admiral ..	—	45	—	—	—
Squarehead's Master ..	52	41½	11	failure.	38
Burgoyne's Fife ..	51	28½	28	34	35½
Sensation ..	47½	40	—	—	—

Dreadnought, Red Marvel, and Sensation are French varieties, named by Mr. C. W. Marster of King's Lynn, who introduced them into this country. The corresponding French names are Hâtif Inversable, Japhet and Bon Fermier. Red Marvel and Red Admiral are also closely akin.

Dreadnought succeeds best when sown not later than the month of February, a fact well shown in the experiments

referred to. Its characteristic feature is relatively short, strong straw, which fits it admirably for sowing on rich land where a weak-strawed variety might be inclined to lodge. The ear is big and compact, and the grain is of medium quality.

Red Marvel is the most generally grown of the French spring wheats. It is longer and weaker in the straw than *Dreadnought*, and is also somewhat liable to "smut," but it may generally be depended upon to yield a satisfactory crop when sown up to the end of March. The ear is rather long and open and the grain is of moderate quality.

Sensation is more suitable for autumn than for spring sowing. Its cultivation both as an autumn and spring wheat has, however, practically ceased in this country except in the Fens. The grain is of rather better quality than that of *Dreadnought*.

Burgoyne's Fife is a white wheat with excellent milling qualities, comparable to those of *Red Fife*. In 1911 a well-known miller valued the grain at 5s. per quarter above that of *Sensation*. The ear is small and the straw extremely fine.

Squarehead's Master is an autumn wheat the characteristics of which are sufficiently well known. It has been shown in the trials above referred to, that in a favourable year such as 1911, *Squarehead's Master* may produce a satisfactory crop when sown as late as the end of February. Sown, however, at the end of March, 1912, this variety proved a failure. The use of *Squarehead's Master* for spring sowing will be attended with some risk.

Early and late Spring Sowing.—As showing the effect of sowing at different dates the following figures are interesting :—

Variety.	Date of sowing, 1911.	Yield per acre.	Natural weight per bushel.	Date of sowing, 1912.	Yield per acre.	Natural weight per bushel.
		Bushels.	lb.		Bushels.	lb.
Red Marvel (Sown in Essex) ..	Feb. 23	53	63	Mar. 27	36	64
" "	Mar. 20	48	61½	April 12	29½	64
" "	April 10	32	61			

In both years the earlier sowing has given distinctly the better results.

A word of explanation is necessary with regard to the extremely satisfactory yields obtained from the spring wheats at the Essex Centre in 1911. The soil on which they were grown

is a fertile "brick earth" which in 1910 grew a crop of oats. After the oats were harvested, dung, at the rate of 7 tons per acre, was ploughed in, and, at seeding time, the following artificials were applied :—¾ cwt. sulphate of ammonia, 2 cwt. superphosphate, and ½ cwt. sulphate of potash per acre. An excellent seed-bed, plenty of plant food and a favourable season all contributed towards what must be regarded as a near approach to the maximum yield possible under ordinary field conditions.

Rate of Sowing.—As already pointed out, spring wheats possess relatively poor tillering powers, and as a consequence have to be sown a little more thickly than autumn wheats. About 3 bushels per acre drilled will, as a rule, be sufficient. If, however, broad-casting is adopted more seed will be required. The earlier the sowing and the better the preparation of the seed-bed and condition of the land the less will be the quantity of seed necessary.

It would appear from the foregoing notes that spring wheat is capable of occupying a distinctly useful place among English farm crops. It will not, as a rule, prove so profitable as autumn-sown wheat, but if through adverse weather conditions autumn sowing has been curtailed, spring wheat will afford a useful means of making good the deficiency. It is a formidable competitor of spring barley and may often be substituted for that crop, as, for example, on strong land after roots. Further, it may be sown with advantage on land on which the oat crop has recently suffered severely from eel-worm ("tulip-root") or frit fly.

Autumn Wheat.—Land which has received 10 loads or more of dung, per acre, for wheat seldom needs further manuring in spring, and the same is generally true

The Manuring of Corn in Spring. where this crop follows a well-manured potato or root crop, or a good clover

root. In view, however, of the exceptionally wet weather prevalent during the past few months, a large amount of leaching of soluble plant food must have occurred, and this, coupled with the inability of plants to establish a deep root-hold in water-logged soil, will place the young wheat crop at a disadvantage when favourable growing weather sets in. A further consideration is the present enhanced price of wheat. There is every likelihood, therefore, that a moderate dressing of artificials this spring will be amply repaid.

The most important manurial element for wheat at this stage is nitrogen, which will, as a rule, be most suitably applied in the form of nitrate of soda. From 1 to 1½ cwt. per acre, according to circumstances, should be given as soon as the risk of severe frost is past. If more than 1 cwt. of nitrate of soda is being applied, it is desirable to give the manure in two dressings at an interval of not less than a fortnight. The later dressing should usually be on by the first week in May in the Eastern Counties and South of England. If nitrate of soda is skilfully used as much as 2 cwt. per acre may often be profitably applied. With a view to hastening maturity and improving the quality of straw and grain about 2 cwt. per acre of superphosphate might be applied any time in the early spring, where this is deemed advisable.

Barley.—After mangolds or other roots which have been liberally manured with dung and artificials, or after turnips which have been folded, further manuring will usually be unnecessary. After a white straw crop, or if in any circumstances manuring is considered desirable, the following artificials should be well mixed and harrowed into the land at seed time :—

$\frac{3}{4}$ cwt. to 1 cwt. sulphate of ammonia or 1 cwt. to 1½ cwt. nitrate of soda 3 cwt. superphosphate	}	per acre.
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Where barley is liable to lodge the nitrogenous manure should be reduced to half the quantity or be omitted altogether. On soils deficient in potash, a good guano, supplying both phosphates and potash, may be substituted for superphosphate.

Oats.—In the later districts where the growing of spring wheat would be attended with risk, and in all districts known to grow oats satisfactorily, farmers would be well advised, under present conditions to devote considerable attention to this crop. After pasture no manure is necessary as a rule, but after most other crops, it will probably pay well to apply some manure unless the land is known to be in a high state of fertility. In most climates $\frac{3}{4}$ to 1 cwt. of sulphate of ammonia mixed with 2 or 3 cwt. of superphosphate and supplied at seed time, will usually give satisfactory results. In late-ripening districts, or on deep productive land, superphosphate may be used, either alone or in combination with a smaller quantity of sulphate of ammonia. On light land, particularly in the drier districts, or if in any circumstances it seems advisable to help a weak plant, a top dressing of 1 to 1½ cwt. per acre of nitrate of soda may take the place of sulphate of ammonia. The application of nitrate

of soda should not be too long delayed after the plant is up, or ripening will be retarded. It should usually be applied when the crop is 3 in. to 5 in. high.

Soot, which is obtained in the combustion of coal and wood, consists chiefly of carbon along with small quantities of nitrogen, sulphur and other substances.

When coal and wood are burnt in fires most of the carbon passes off as carbonic acid gas, but owing to imperfect combustion finely-divided particles of unburnt carbon are deposited in the chimney. Along with the carbon, some phosphates, potash and other mineral substances, also in a fine state of division, are carried off. The nitrogen in the coal and wood is mostly evolved as ammonia, which is partly converted into a salt by combination either with sulphurous acid or hydrochloric acid in the smoke. The salt is found deposited in the soot along with the substances mentioned above.

Composition.—The content of the various substances in the soot varies greatly, and depends upon the draught of the flue, the height of the chimney, the character of the fuel, and the manner of stoking.

Domestic soot is usually the richest, and may contain from 3 to 6 per cent. of nitrogen. Boiler soot, on the other hand, may contain only about 1 per cent., or even less, and in some cases none at all; soot from the Cambridge Rubbish Destructor, analysed at Cambridge, was found to contain no nitrogen.

It may here be stated that soot from the different kinds of coal burnt in dwelling-houses varies widely in composition, but, since parcels from various houses are mixed together for sale, such differences tend to be eliminated. Compared with coal, wood seems to yield a much higher proportion of potash in the soot which also may contain considerable quantities of lime. A sample consisting of flakes of tarry matter from a wood fire, which was analysed at Cambridge, contained 6.4 per cent. of nitrogen. Reddish colour in the soot was not found, of itself, to be an indication of low nitrogen content.

Small quantities of potash are found in certain types of flue dust discarded from iron and other works in various parts of the country. A sample obtained from an ironworks

in the Midlands and examined in the Government Laboratory gave the following analysis :—

	Original sample of Flue Dust.	Water-soluble portion.	
		Percentage on Original Substance.	Percentage on Dry Water-soluble Matter.
	Per cent.	Per cent.	Per cent.
Moisture and hydrated water ..	23.82	—	—
Organic and undetermined matter ..	0.77	—	—
Mineral matter :—			
Siliceous matter ..	19.00	—	—
Soluble silica (SiO ₂) ..	—	1.10	9.36
Copper, lead, tin (oxides) ..	0.10	—	—
Alumina and ferric oxide ..	29.00	—	—
Oxides of zinc and manganese ..	1.65	—	—
Lime (CaO) ..	7.28	1.70	14.47
Magnesia (MgO) ..	4.88	0.29	2.47
Potash (K ₂ O) ..	5.92	2.04	17.30
Soda (Na ₂ O) ..	1.02	1.02	8.68
Phosphoric anhydride (P ₂ O ₅) ..	0.96	—	—
Sulphuric anhydride (SO ₃) ..	3.43	3.43	29.19
Carbonic anhydride (CO ₂) ..	0.09	0.09	0.77
Chlorine ..	2.70	2.70	22.98
Less Cl = O ..	100.62	12.37	105.28
	.62	.62	5.28
	100.00	11.75	100.00

The sample thus contained nearly 6 per cent. of potash, about one-third of which was directly soluble in water. The remainder was soluble in hot dilute hydrochloric acid and would also possess some manurial value. The flue dust would also contain rather more than 7 per cent. of lime; this was not present, however, as free lime or as carbonate, but as calcium sulphate, and would, therefore, not be so valuable as lime in the form of carbonate. No substance directly harmful to plant life was found in the flue dust, and the proportion of water-soluble magnesia was low.

From one ironworks alone three to four truck loads of flue dust are thrown out weekly and it is probable that large quantities of similar material are to be found on waste heaps throughout the country. It is doubtful if the potash could be extracted at such a cost as to make the operation remunerative, but there appears to be no reason why the material should not be used to a limited extent directly on the land in the locality of its production.

Soot sold for agricultural purposes should be free from all admixture of cinders and similar refuse.

Weight.—As regards weight, soot from dwelling houses, analysed at Cambridge, averaged about 1 lb. of nitrogen per bushel; *i.e.*, when the bushel weight was low, the percentage of nitrogen was high and *vice versa* (the bushel weight varied from 9 to 33 lb. except in the case of that from a 40 ft. boiler shaft which weighed 47 lb. per bushel and had a nitrogen content of 23 lb. per bushel). The lightest soots can, therefore, be taken as the richest, and samples should be bought by volume rather than by weight; further, adulteration by the inclusion of cinders, &c., would have less effect upon the volume than upon the weight. A good sample of soot should not weigh more than 28 lb. per bushel.

Value.—Except in the case of samples similar to that analysed at the Government Laboratory, the fertilising value of soot depends almost solely upon its nitrogen content. If 6d. per lb. be taken as the price of readily available nitrogen, a bushel of fresh, light, soot would probably be worth 6d. for its fertilising value alone. When allowed to stand in a loose heap, soot will probably lose some of its nitrogen.

Soot is further valuable in that it makes the soil darker, and thus assists in warming light coloured soils by enabling them to absorb more of the sun's heat. Hall states that on a sunshiny day sufficient of the sun's heat is absorbed to raise the temperature of the soil by about 2 degrees, and that, as radiation at low temperatures is not increased in the same proportion, there is no corresponding loss of heat at night from the sooted land to discount the higher temperature by day. This increased temperature is valuable in forwarding the growth both of the plant itself and of bacteria which render available the reserves of plant food in the soil.

Soot also tends to improve the texture of heavy soils (the sample analysed at the Government Laboratory would be very useful in this direction) and is useful as a deterrent of attacks by slugs and small snails.

Use for Various Crops.—Soot is used specially as a top dressing for wheat and other corn in early spring. These crops are particularly responsive to small applications of active nitrogenous manures in the early months of the year when the oxidation of the nitrogenous residues is slow. The warming of the soil at this season is beneficial and the soot is used at

a time when slugs and snails are doing damage to the young corn. Soot is also used on grass land, on potatoes, for green crops and for market garden crops (when it is also of value as a slug destroyer); flue dust from London rubbish destructors has been used extensively on hop fields in Kent. When strewn as a top dressing either by itself or mixed with sawdust, soot has been recommended for protecting germinating peas.

Application.—Soot may usually be applied at the rate of about 5 cwt. or 20 bushels per acre. Distribution by hand is a disagreeable operation, and it may be well to mix the soot with loam before strewing; it should be applied in calm, showery weather. For general agricultural purposes 3-4 cwt. of superphosphate together with $\frac{3}{4}$ -1 cwt. of sulphate of potash per acre would make a suitable complementary dressing. In view of the present state of the potash trade, however, it will probably be necessary in the absence of dung, to find some other source of potash, *e.g.*,—wood ashes and seaweed (see article in this *Journal* for November, 1914, p. 694, on the Ashes of Hedge Clippings and Trimmings as a Source of Potash, and Leaflet No. 254 on the Use of Seaweed as Manure).

In this *Journal* for December an account was given of the proceedings of the Permanent Committee of the International Institute of Agriculture at Rome at the first two meetings of the session. The third meeting was held on the 1st December, the principal business being the consideration of certain proposals brought forward by the Delegate for France in connection with a report which had been presented at the previous meeting by the Delegate for Great Britain and Ireland on the Third International Congress of Tropical Agriculture, which was held in London last June. In that report the British Delegate had pointed out that in some tropical countries and colonies there appeared to be an impression that the International Institute confined its attention too closely to the interests of agriculture in the temperate regions, and did not pay sufficient regard to tropical agriculture, and had suggested that steps should be taken to bring to the notice of the countries concerned the work already done by the Institute in the interest of tropical agriculture. He had also proposed that the staff of the Institute should study the possibility of increasing the usefulness of the Institute to tropical countries, in the

The International
Institute of
Agriculture in
Relation to
Colonial and
Tropical
Agriculture.

hope that those countries and colonies situated in or near the tropics which have not yet applied for direct representation on the Permanent Committee, might be induced to do so. After some discussion the Permanent Committee unanimously passed a resolution to the following effect:—

The Institute will address all countries, both those which have adhered and those which have not yet adhered to the Institute, reminding them of the International Convention of 1905, pointing out that under it the Institute is bound to devote its attention to all questions relating to agriculture throughout the world, and describing the services already rendered by the Institute to colonial and tropical agriculture, especially by the publication of information on those subjects in the bulletins of the Institute, which are issued in five languages: French, Italian, German, Spanish and English.

It was also resolved to invite the few independent states which have not yet adhered to the Institute to do so now, and to ask the adhering states to arrange for direct representation on the Permanent Committee and the General Assembly of those of their colonies which are not at present so represented, or at least to request them to send officially to the Institute, through their Governments, statistics or reports relating to the crops grown, to their condition and out-turn, to the export and prices of agricultural produce, etc., to be included in the bulletins of the Institute along with the information received from adhering countries.

It was further resolved that the Institute should put itself into communication with the International Association of Colonial and Tropical Agriculture with a view to aiding in carrying out the resolutions passed by the International Congresses of Tropical Agriculture, and especially by the Congress of last year. The staff of the Institute was also instructed to study, still more thoroughly than hitherto, questions connected with colonial and tropical agriculture, to reserve for such questions a still larger portion of the bulletins, and to invite the interested Governments to transmit to the Institute fuller information on those subjects.

In this connection it may be noted, as regards the British Empire, that in addition to Great Britain and Ireland the following Colonies and Dependencies have already given their separate adhesion to the Convention, and thereby secured direct representation on the Permanent Committee:—viz., Canada, Australia, New Zealand, South Africa, India and Mauritius.

THE following Report on the Second Twelve Months Laying Competition at the Harper Adams Agricultural College has been communicated by Mr. W. Brown.

**Laying Competition
at Harper Adams
Agricultural College.**

The results of the competition under review are in many directions an advance on what has been achieved before, and indicate that the information rendered available by former tests has been applied by breeders of utility poultry.

The competition began on 25th October, 1913, and ended on 24th October, 1914. Fifty pens of six 1913 pullets were entered, comprising the following breeds and varieties:—

Breeds.	No. of Pens.	No. of Birds.
White Wyandottes..	24	144
Buff Orpingtons ..	3	18
Buff Rocks ..	3	18
Rhode Island Reds ..	2	12
White Leghorns ..	15	90
Black Leghorns ..	2	12
Croad Langshans ..	1	6
	50	300

For the purpose of comparing results it was unfortunate that each breed was not represented by the same number of entries, and no exact comparison can be made between the results obtained from different breeds.

Another factor which affected the uniformity of the results was the condition which permitted owners to replace any birds that died or were killed during the run of the competition. In all 25 birds died, 12 of which were replaced, including one which was replaced twice. Moreover, 3 birds were returned to their owners before the conclusion of the test, of which 2 were replaced birds. In working out the various tables it was found impossible in all cases to eliminate the records of these birds, hence the statistics are slightly inaccurate.

The land used for the competition was about 4 acres in extent, and consisted of grass laid down in 1912. Roughly speaking, each acre carried 75 head of stock. No artificial shelter was provided and the conditions may be considered normal.

The houses were of the open-fronted type provided with shelters and they proved eminently satisfactory. The initial cost of the plant was considerably greater than would be necessary on a commercial egg farm, being £1 10s. 8d. per bird, after deducting 15 per cent. for depreciation.

The temperature during the competition was normal, but the rainfall was exceptionally low, being 5.39 inches below the average for the past ten years.

The cost of feeding, viz., 7s. 4d. per bird, including grit and oyster shell, may appear somewhat high, but the results in egg production fully justified the expenditure. All foods were purchased; if they had been home produced, as would probably be the case on a commercial plant, substantial saving could have been effected.

Two records were broken in this test. Pen 18, White Wyandottes, produced 492 eggs, or an average of 82 eggs per bird, valued at £3 11s. 5½d., or an average of nearly 11s. 11d. per bird, during the first four periods of 28 days. Bird No. 227, Pen 38, laid 288 eggs, valued at £1 10s. 9d., during the 365 days. These two performances have not previously been equalled and constitute record results in an official test.

The 144 White Wyandottes laid 999 eggs (6.9 per bird) during the first period (October 25th to November 21st), valued at £7 5s. 1¾d. (1s. per bird approximately). The number of eggs increased during each period until the sixth (March 14th to April 10th) when 3,033 eggs were produced (21.1 per bird), valued at £11 10s. 1d. (1s. 7d. per bird). From this time the number decreased gradually and in the thirteenth period (September 26th to October 24th) 1,480 eggs (10.3 per bird) were laid with a value of £9 9s. 3½d. (1s. 3½d. per bird). The period of highest value was the fourth (January 17th to February 13th) when the average was 2s. 1d. per bird. The average yield per bird over the whole year in this section was 188.25 eggs, with a value of 19s. 2½d.

The 90 White Leghorns laid 532 eggs (5.91 per bird) during the first period (October 25th to November 21st) at a value of 10½d. per bird. A steady increase in the egg yield was apparent until a maximum of 1.978 eggs was obtained in the seventh period (April 11th to May 8th) when the average value per bird was 1s. 8d. The egg supply then dropped gradually during each period until the end. During the last period (September 26th to October 24th) 490 eggs were laid (5.44 per bird). The average value was highest in the third period (December 20th to January 16th) when it reached 2s. 2½d. per bird. The average egg yield per bird in this section was 201.43, with a value of £1 0s. 3¾d.

The following particulars are of interest:—

Best and Poorest Pens in White Wyandotte and White Leghorn Sections.

Breed.	Average Egg yield.	Average Value.
		£ s. d.
White Wyandotte, Best Pen ..	223.17	1 4 5½
" " Poorest Pen ..	152.67	0 14 5½
White Leghorn, Best Pen ..	232.2	1 4 4½
" " Poorest Pen ..	152.7	0 14 7½

The heavy breeds were represented by 33 pens (198 birds), and the light breeds by 17 pens (102 birds). It must be recognised that White Leghorns represented 88.2 per cent. of the light breeds, whereas only 72.7 per cent. of the heavy breeds were White Wyandottes. Such an unequal representation influences the results to a considerable extent and should be borne in mind in connection with the following figures:—

Compared Breed, Pen and Bird Averages.

	Total No. of Eggs.	Pen Aver.	Bird Aver.	Total Value.	Pen Value.	Bird Value.
				£ s. d.	£ s. d.	£ s. d.
White Wyandottes, 144 birds	27,108	1,129.5	188.25	138 5 3½	5 15 2½	0 19 2½
Buff Orpingtons, 18 birds ..	2,731	151.72	14 10 1	4 16 8½	0 16 1½	0 16 1½
Buff Rocks, 18 birds	3,484	193.55	17 14 2½	5 18 0½	0 19 8	0 19 8
Rhode Island Reds, 12 birds	1,935	161.25	9 19 0½	4 19 6½	0 16 7	0 16 7
Croad Langshans, 6 birds ..	615	102.5	2 15 4½	2 15 4½	0 9 2½	0 9 2½
White Leghorns, 90 birds ..	18,129	201.43	91 7 5½	6 1 10	1 0 3½	1 0 3½
Black Leghorns, 12 birds ..	2,182	181.8	10 17 0½	5 8 10½	0 18 1½	0 18 1½
Average, 300 birds ..	56,184*	1,123.68	187.28	285 9 3½	5 14 2½	0 19 0½
Heavy Breeds, 198 birds ..	55,873	1,087.06	181.18	183 4 0	5 11 0½	0 18 6
Light Breeds, 102 birds ..	20,311	194.77	109.13	102 5 3½	6 0 3½	1 0 0½
Record of Best Pen No. 6	---	1,339	223.17	..	7 6 7½	1 4 5½
Record of Poorest Pen No. 50	..	615	102.4	..	2 15 4½	0 9 2½

* Including 11 unrecorded eggs.

The eggs were valued at the average price per dozen of the London, Bristol and Wolverhampton Markets during 1911, as set out in the Returns of the Board of Agriculture and Fisheries. The eggs were divided into four grades and valued as follows:—

1st grade eggs, 2 oz. or over, valued at full market price.

2nd grade eggs, 1½ oz. to 2 oz., valued at 10 per cent. less than full market price.

3rd grade eggs, 1¼ oz. to 1½ oz., valued at 25 per cent. less than full market price.

4th grade eggs, under 1¼ oz., not valued.

Owing to the system of grading adopted it was not possible to determine the exact weight of eggs produced. The percentages of different grades of eggs varied somewhat in the different sections, as shown in the following table:—

	1st Grade.	2nd Grade.	3rd Grade.	4th Grade.
White Wyandottes ..	86.68	12.54	0.75	0.03
Buff Orpingtons ..	97.95	2.05	..	..
Buff Rocks ..	96.13	3.87	..	..
Rhode Island Reds ..	97.73	2.27	..	..
Croad Langshans ..	78.69	20.33	0.98	..
White Leghorns ..	91.36	8.01	0.62	0.01
Black Leghorns ..	97.29	2.66	0.05	..
Total ..	90.2014	9.229	0.568	0.0016

In five of the seven breeds the poorest layer produced 100 per cent. 1st grade eggs, whereas the percentage of first grade eggs from the best layer in each breed section varied between 41.1 and 99.18.

In all 56,184 eggs were laid, thus giving an average of 187.28 eggs, valued at 19s. 0½d. per bird. The variation in individual production was very great. The heaviest layer yielded 288 eggs, valued at £1 10s. 9d., the poorest layer only 53 eggs, valued at 4s. 8.6d. One bird failed to lay at all during the test.

The following analysis of laying indicates the variation in the individual records of the birds entered:—

Number of Birds.*

Laying.	No of Birds.	280 and over.	260 to 279.	240 to 259.	220 to 239.	200 to 219.	180 to 199.	160 to 179.	140 to 159.	0 to 139.	Total.
280 eggs and over ..	3	3									3
260 eggs to 279 eggs ..	8	3	8								11
240 eggs to 259 eggs ..	19	3	8	19							30
220 eggs to 239 eggs ..	41	3	8	19	41						71
200 eggs to 219 eggs ..	59	3	8	19	41	59					130
180 eggs to 199 eggs ..	57	3	8	19	41	59	57				187
160 eggs to 179 eggs ..	36	3	8	19	41	59	57	36			223
140 eggs to 159 eggs ..	26	3	8	19	41	59	57	36	26		249
0 eggs to 139 eggs ..	51	3	8	19	41	59	57	36	26	51	300

* Including replaced birds.

Percentage of Birds.*

Laying.	Per-centage of Birds.	280 and over.	260 to 279.	240 to 259.	220 to 239.	200 to 219.	180 to 199.	160 to 179.	140 to 159.	0 to 139.	Total.
280 eggs and over ..	1.00	1.00									1.00
260 eggs to 279 eggs ..	2.67	1.00	2.67								3.67
240 eggs to 259 eggs ..	6.33	1.00	2.67	6.33							10.00
220 eggs to 239 eggs ..	13.67	1.00	2.67	6.33	13.67						23.67
200 eggs to 219 eggs ..	19.67	1.00	2.67	6.33	13.67	19.67					43.34
180 eggs to 199 eggs ..	19.00	1.00	2.67	6.33	13.67	19.67	19.00				62.34
160 eggs to 179 eggs ..	12.00	1.00	2.67	6.33	13.67	19.67	19.00	12.00			74.34
140 eggs to 159 eggs ..	8.67	1.00	2.67	6.33	13.67	19.67	19.00	12.00	8.67		83.01
0 eggs to 139 eggs ..	17.00	1.00	2.67	6.33	13.67	19.67	19.00	12.00	8.67	17.00	100.00

* Including replaced birds.

The above table clearly indicates the success of the competition as a whole. It has been a question for some years whether a strain laying 200 eggs could be produced. The fact that 130 birds out of the 300, or 43.34 per cent., laid 200 eggs and over demonstrates what has been achieved in this direction. The percentages of White Wyandottes and White Leghorns laying 200 eggs and over were 43 and 54 respectively.

The total food consumed was 11 tons 19 cwt. 92½ lb., or 89½ lb. per bird. The cost was £109 19s. 1d., or 7s. 4d. per bird.

The season of heaviest food consumption was from February 1st to April 30th as is shown below:—

	300 Birds.	Per Pen.	Per Bird.
1st Season—Oct. 25th to Jan. 31st	70.5 lb.	1 lb. 6.6 oz.	3.8 oz.
2nd Season—Feb. 1st to Apl. 30th	80.5 lb.	1 lb. 9.8 oz.	4.3 oz.
3rd Season—May 1st to July 31st	72.9 lb.	1 lb. 7.3 oz.	3.9 oz.
4th Season—Aug. 1st to Oct. 24th	70.7 lb.	1 lb. 6.6 oz.	3.8 oz.

The season of increased food consumption coincided with the periods of heaviest egg production. During the sixth period (March 14th to April 10th) the average egg yield was 20.8 eggs per bird.

The amount of food required to produce 1 lb. of eggs (reckoned at minimum weight in each grade) was 3.825 lb.

The results of the special tests with different breeds were:—

	Total No. of Eggs.	Food cost per Egg.	Value per Egg.	Difference per Egg.
300 Birds ..	56,184	0.45	1.22	0.77
198 Heavy Birds ..	35,873	0.47	1.225	0.755
102 Light Birds ..	20,311	0.409	1.208	0.799
144 Wyandottes ..	27,108	0.45	1.224	0.774
90 White Leghorns ..	18,120	0.405	1.21	0.805

It was found that when birds which were already laying were sent to the competition, that the journey, the change of condition, and the change of food all tended to decrease egg production. The best layers have proved to be those that were ready to lay when received. The heaviest layers were those that produced 10-19 eggs during the first period of 28 days, as shown in the following table:—

Egg Production.	No. of Birds.*	Total No. of Eggs.	Average No. of Eggs. per Bird.	No. of Birds laying over 200 Eggs.	Percentage of Birds laying over 200 Eggs.
20 and over during 1st period	29	6,220	211.0	19	65.5
10 to 19 during 1st period	60	12,913	215.2	41	68.33
1 to 9 during 1st period	51	10,156	199.1	30	58.8
20 and over during 2nd period	10	1,998	199.8	4	40.00
10 to 19 during 2nd period	30	5,921	197.37	15	50.00
1 to 9 during 2nd period	21	3,942	187.7	7	33.3
Laid during 3rd period	49	8,263	168.6	13	26.5
Laid after 3rd period	49	6,772	138.1	1	2.04
Never laid at all	1	..	..	..	..
Totals	300	56,184	187.28	130	43.3

*Including replaced birds.

During the thirteen periods of 4 weeks 804 broody hens were handled, of which 767 belonged to the heavy breed class and 37 to the light breed class. Of the latter 16 birds went broody with a total of 37 periods of broodiness. The following are the particulars:—

Bird No.	Pen No.	Breed.	No. of times Broody.	No. of Eggs.	Average No. of Eggs per Bird.
208	35	White Leghorns	1	257	185.1, or 10.3 eggs below the breed average.
213	36	" "	1	133	
216	"	" "	1	135	
239	40	" "	2	184	
243	"	" "	2	237	
244	41	" "	4	232	
246	"	" "	6	190	
250	43	" "	4	171	
272	"	" "	1	152	
273	46	" "	4	213	
276	"	" "	1	132	166.4, or 15.4 eggs below the breed average.
285	48	Black Leghorns	1	135	
286	"	" "	2	206	
287	"	" "	3	151	
290	49	" "	3	139	
293	"	" "	1	201	
Total No. of Birds, 16.			37	2,868	179.25, or 10.88 eggs below the light breed average.

NOTES ON AGRICULTURAL CO-OPERATION.

A GENERAL enquiry recently made by the Board throughout England and Wales has shown that there are in this country 1,080 societies for the co-operative insurance of pigs, generally known as Pig Clubs. These societies are scattered over 28 counties of England, but, so far as has been ascertained, there are none in Wales or in 18 English counties. The counties having the largest number of societies are Lincolnshire with 340, Northamptonshire with 121 and Wiltshire with 102. Fifty-one of these societies were founded before the year 1860, and so have been at work for more than fifty years, the oldest of them, that at Whitwell in Derbyshire, having been founded in 1833; while 232 of them have been started since 1900, so that the movement is still spreading.

Co-operative Pig Insurance Societies in England and Wales.

A few leading statistics have been obtained for 1,027 of these societies. They had altogether 37,848 members, an average of 37 members per society, but one society had 270 members, and another 267, while 36 societies had between 100 and 200 members each, and several had less than 10. They insured among them 63,558 pigs, an average of 62 pigs per society; but one society insured 1,030 pigs, 18 insured more than 300 pigs each, and several insured each less than 20 pigs. As the average number of pigs insured per member was only 1.7, it is evident that the large majority of the members are small men, insuring only one or two pigs each; several societies, however, have an average of more than five pigs per member. All these societies, except one, have a balance to their credit, the sum total of their assets being £32,656, against which there are practically no liabilities, as their accounts are settled quarter by quarter. The average assets per society are £32; forty societies have each more than £100 to their credit as a reserve fund, and one has £385. The total assets of all the societies put together average 10s. per pig insured, and as the compensation paid on pigs that die averages less than 2s. per annum per pig insured, it is clear that the majority of the societies must be in a sound financial position, able to meet any claims that are at all likely to be made on them, even in bad years, without having to call on their members to pay an additional levy to make up any deficiency in the funds.

The Experience of Three Years.—As many of the unregistered societies are in out-of-the-way villages and do not keep very accurate accounts, it is difficult to collect statistics from them. The following figures have, however, been obtained for the last three years for registered and unregistered societies taken together.

Year.	No. of Societies reporting	No. of Members	No. of Pigs insured.	No. on which claims were paid.	Amount paid on claims	Amount received in contributions from Members	Amount of Reserve Fund.
1911 ..	864	32,223	57,551	3,010	5,327	7,836	29,799
1912 ..	747	28,289	48,223	2,516	4,709	6,754	26,173
1913 ..	691	25,776	46,766	1,772	3,722	5,964	24,537
Average	767.	28,763	50,847	2,433	4,586	6,851	26,836

Thus, according to the experience of these three years, the casualty-rate for these societies has been, for an average number of 50,847 pigs insured, 4.8 per cent. per annum, the rates for the different years having been 5.2, 5.2 and 3.8 per cent.: so that in this important respect, the last year was a favourable one. For the three years the average amount paid per pig that died was £1 18s., the average loss on claims per pig insured was 1s. 10d. and the average amount received in contributions per pig insured was 2s. 8d. In each year the contributions much exceeded the losses, and at the end of the year the accumulated savings of these 767 societies averaged £35 per society, or over 10s. per pig insured—nearly six times the average amount paid on claims in a year.

Statistics for 1913.—For the year 1913 taken by itself the following somewhat fuller statistics are available.

	No. of societies reporting.	No. of members.	No. of animals insured.	No. of claims paid.	Amount paid on claims.	Total expenditure.
Unregistered	659	24,170	43,352	1,669	£ 3,468	£ 5,130
Registered ..	32	1,606	3,414	103	254	406
Total ..	691	25,776	46,766	1,772	3,722	5,536

	Amount received in contributions.	Amount received from sale of carcasses.	Total income.	Reserve fund at the end of the year.
Unregistered	£ 5,637	£ 771	£ 7,338	£ 22,431
Registered	327	37	514	2,106
Total ..	5,964	808	7,852	24,537

For this year the casualty-rate for unregistered societies was 30 per cent., while for registered societies it was 30: the total expenditure per pig insured averaged 2s. 4d. for both classes of societies, and the total income per pig insured was for unregistered societies 3s. 5d. and for registered societies 3s. At the end of the year the reserve funds of the unregistered societies equalled over 10s. per pig insured, or four times the total expenditure of the year, and those of the registered societies equalled over 12s. per animal insured, or five times the total expenditure of the year. In both cases the income of the year considerably exceeded the expenditure and the aggregate savings of the year for the 691 societies reporting amounted to £2,316. Both unregistered and registered societies, taken as a whole, are evidently in a sound position. They receive no subsidy from the Government and very little by way of subscriptions from honorary members; one society obtained £21 during the year from the proceeds of a ball given in aid of its funds.

REGISTERED SOCIETIES.—Fuller statistics are available for the registered societies, which work under rules that have been examined by the Registrar and have the force of law, and which have to submit to him properly audited accounts. There seems reason to believe they are, on the whole, better managed than the unregistered societies, as on the average of the last three years their average casualty-rate has been only 4·2 per cent. per annum as compared with 4·8 per cent. for the unregistered societies, and they succeed equally well with a smaller average rate of contributions.

The Casualty-Rate.—These societies all pay insurance claims on pigs which die or have to be slaughtered in consequence of any disease or accident.

Year.	No. of Societies reporting.	No. of pigs insured.	No. on which claims were paid.	Average casualty-rate per cent. per annum.
1911 ..	32	3,570	173	4·8
1912 ..	31	3,066	148	4·8
1913 ..	32	3,414	103	3·0
Average	32	3,350	141	4·2

According to the experience of these three years, a well-managed society in average surroundings may expect an average casualty-rate considerably below 5 per cent. per annum.

Amount payable per Casualty.—Some societies pay on claims the full value of the pig at the time it fell ill: others pay only a fraction of the value, such as three-fourths or seven-eighths. The actual payments have been as follows:—

Year.	No. of pigs insured.	No. that died.	Amount paid on claims.	Receipts from sale of carcasses.	Net loss.	Average net loss	
						Per pig that died.	Per pig insured.
1911..	3,570	173	£ 359	£ 53	£ 306	£ s. 1 15	s. d. 1 9
1912..	3,066	148	331	46	285	1 19	1 10
1913..	3,414	103	254	37	217	2 2	1 3
Average	3,350	141	315	45	270	1 18	1 7

From the experience of these three years it appears that an average society may expect to have to pay on the average a net loss of under £2 per pig that dies and to meet a net loss of well below 2s. per annum per pig insured.

Amount of Premium paid.—The statistics of the last three years have been as follows:—

Year.	No. of pigs insured.	Amount of insurance contributions received.	Average per pig insured.
1911 ..	3,570	£ 351	s. d. 2 0
1912 ..	3,066	239	1 7
1913 ..	3,414	305	1 9
Average ..	3,350	298	1 9

The average insurance contributions equalled 1s. 9d. per pig insured, more than sufficient in themselves to cover the net losses.

Income and Expenditure of Insurance Fund.—The total income for the year 1913 of the insurance funds of these 32 registered societies was £445, made up as follows:—Insurance contributions £305, entrance fees and fines £21, sale of carcasses £37, interest £48, other income £34; and the total expenditure was £343, including £254 paid on claims, £55 paid as dividend to members, and other payments £34; so that during the year they made a saving of £102 and their insurance reserve increased from £1,950 at the beginning of the year to £2,052 at the end.

Management Expenses.—Twenty societies insuring 2,389 pigs report their management expenses for the year 1913 as £63, of which £37 was spent in salaries. The average expenditure on management was therefore 6d. per pig insured, as compared with 9d. and 7½d. in the two previous years. From this it appears that most of these societies are economically managed, the members of committee giving their time and trouble without remuneration, and the secretary and marker being content with quite small salaries.

MODEL RULES.—After studying the systems of working of the most successful of the existing societies, the Board have issued sets of model rules for registered and unregistered rural co-operative pig insurance societies, and have published a pamphlet on the co-operative insurance of pigs, containing those model rules and an explanation of the more important of them. In accordance with the experience summarised above, it has been suggested that if a community of working men and small holders will form a society based upon those rules, with such small modifications as may be required to suit its individual circumstances, will charge to its members insurance contributions of 6d. per quarter per store pig and 2s. per breeding sow or boar, and a management contribution of 3d. per quarter, per pig insured, and will pay compensation on each insured pig that dies, reckoned at four-fifths of its value at the time it fell ill, up to a maximum of £6 in each case, it may expect to find its average casualty-rate less than 5 per cent. per annum, and the average amount payable per casualty less than £2. Such a society, with careful management, should be able not only to pay its way, but gradually to build up a reserve fund, which will ultimately enable it to reduce the rate of insurance contribution charged to its old members; thus following the example of the Kemerton Pig Club, which has succeeded in reducing its average casualty-rate to one per cent. per annum, has accumulated a reserve fund of £180, and now insures the pigs of all its members who are of more than four years' standing, on a total payment of 8d. per pig per annum, while still adding to its reserve fund. Copies of these model rules can be obtained at the price of one penny each from Messrs. Wyman and Sons, Limited, 29, Breems Buildings, Fetter Lane, London, E.C., and copies of the pamphlet may be had free of charge on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W. Existing pig insurance societies will find it useful to study the pamphlet, as they may get from it suggestions, derived from the experience of other societies, for the improvement of their own methods of working.

The Board have also arranged for a system of reinsurance of part of the risks of local co-operative insurance societies with the Agricultural and General Co-operative Insurance Society, Limited, Dacre House, Dacre Street, Westminster, London, S.W. An account of that system will be found in the pamphlet and also in this *Journal* for November, 1913.

OFFICIAL NOTICES AND CIRCULARS.

THE Board have issued a second French edition of their Handbook of British Breeds of Live Stock, the edition in question being a French translation of the second English edition.

Second French Edition of Handbook of British Breeds of Live Stock.

The Handbook was originally prepared for the Brussels and Buenos Aires International Exhibitions of 1910 with the special object of encouraging the export of British live stock. The contents of the first French edition have been extensively revised, attention having been given to various points of practical importance with a view to making the Handbook still more useful; and it is hoped that the edition just issued will prove a valuable guide to owners of live stock in various foreign countries as to the distinguishing characteristics which contribute to the excellence of the various British breeds of live stock. Attention may be drawn in particular to some tables which are given in the Handbook showing the average ages, live weights and daily increases of cattle, sheep and pigs at the Smithfield Shows during the years 1902-11. In the case of dairy cattle, milk yields have been given so far as they could be ascertained.

A statement of the more important shows and places at which animals of each breed can be bought is given, together with an indication as to the average range of prices. This statement further shows the names and addresses of the secretaries of the various breed societies for the convenience of foreign stock owners who may wish to get into communication with any particular society.

This second French edition of the Handbook contains some 157 pages of letterpress and 88 photographs of animals. It may be obtained at the office of the Board of Agriculture and Fisheries, 8, Whitehall Place, London, S.W., price 1s., post free.

In this connection the attention of stock owners in various foreign countries may be further directed to the fact that the Board have established an Official Cattle Testing Station, at which cattle for export may be officially tested for Tuberculosis and be immunised against Red Water, as described in this *Journal*, October, 1914, page 616.

WITH a view to encourage and assist the breeding of horses, the Board of Agriculture and Fisheries have been authorised by the War Office to arrange for the selection in France

Sale of Army Mares for Breeding.

and return to this country of mares which are no longer suitable for use with the Expeditionary Force, but which appear to the Board to be of types suitable for breeding purposes.

The first consignment of these mares, 46 in number, arrived from France on 31st December last. They were kept at the Cattle Testing Station, Pirbright, Surrey, under the care and observation of the Board for about a month, and were then sold by auction on condition that they were not to be exported out of the country. To secure observance of this condition the mares have been branded with a distinctive mark of diamond shape.

The mares were subjected to and passed the mallein test before being sold, and were examined by the Board's veterinary officers to see that they were free from contagious and infectious diseases.

The mares have been disposed of as follows:—

- 14 were sold on 30th January at Leicester Horse Repository by Messrs. Warner, Sheppard, and Wade, and realised an average price of £33.
- 13 were sold on 2nd February at Northallerton by Mr. John Todd and realised an average price of £30.
- 14 were sold on 4th February at the Cheltenham Horse Repository by Messrs. Warner, Sheppard, and Wade, and realised an average price of £32 18s. 6d.

Four of the mares have not yet been sold, and one met with an accident in transit and had to be shot.

From information obtained from the purchasers it appears that practically all the mares have been bought for breeding purposes, and in this connection the attention of breeders generally is drawn to the fact that all Premium Stallions will travel next season at the low service fee of £1.

The Board hope to arrange for further sales in various parts of the country during the next few months.

No outbreak of foot-and-mouth disease has been confirmed in Great Britain since that which occurred at Cople, near Bedford, on the 17th December—referred to in last month's *Journal*.

Foot-and-Mouth Disease.

All the general restrictions on the movement of animals which were imposed by the Board on account of the outbreaks of the disease in Bedfordshire were withdrawn as from the 23rd January.

THE Board desire to warn farmers against making up preparations containing poison in vessels that are used for preparing foods. A case which recently came to the notice of the Board shows the danger attending this practice. In this case six pigs died, and a *post mortem* examination revealed signs of irritant poison. An analysis was made of the stomach contents, as well as of some wash and scrapings from a boiler in which some roots

had been prepared for the pigs on the night previous to their death. The analysis showed the presence of a large quantity of arsenic, and subsequent inquiries elicited the fact that the boiler had been lent to a neighbour who had used it for the purpose of boiling up a preparation containing arsenic for foot rot in sheep. Preparations of this kind, as well as spray fluids for horticultural purposes, should be mixed and contained in vessels which are not subsequently to be used for foods for live stock.

With reference to the article bearing this title in the *Journal* for January, 1915, the Board have been asked to state that the following societies shared in the work, of which particulars were given in the article:—The Surveyors' Institution; The Auctioneers' and Estate Agents' Institute; The Land Agents' Society; The Central Chamber of Agriculture; The National Farmers' Union; and The Central Association of Agricultural and Tenant-Right Valuers.

MISCELLANEOUS NOTES.

THERE has been a remarkable development of the rural telephone system in the United Kingdom during the last three years, upwards of

The Extension of Rural Telephones.

450 exchanges having been opened chiefly in small villages in the most rural parts of the kingdom; the service was carried to 73 new places in 1912, in 1913 the number of new exchanges increased to 140, and in 1914 more than 240 exchanges were opened. This by no means exhausts the number of localities to which the telephone has been extended during these three years, however. The figures given must be increased fourfold to show the number of villages and localities which now enjoy telephone service for the first time. Rural call offices were opened at 115 places in 1912, 408 in 1913, and nearly 800 in 1914, and these figures only include those call offices which imply the extension of the system to a new locality, so that after making allowance for those cases where a call office already existed before the exchange was opened, some 1,700 new localities have been provided with telephone service during the past three years. The rural call offices in many cases afford the inhabitants facilities to speak by means of the trunk wire system over the whole county and in all cases limited trunk facilities at least are given.

No county in fact, in England and Wales is now without the telephone service; villages formerly cut off from the world and in many instances possessing not even a telegraph office and in most cases no railway station are now furnished for use in cases of urgency with the most rapid means of communication extant. (*The Telegraph and Telephone Journal*, January, 1915).

[The attention of farmers and others is directed to Leaflet No. 258, "Rural Party Line Telephones," which may be obtained post free on application. This leaflet points out the great advantage of the telephone to agriculturists and gives particulars as to service and rate of subscription.]

The *Bulletin of Agricultural and Commercial Statistics* for January, 1915, contains estimates of the production of cereal crops in 1914.

Notes on Crop Prospects Abroad.

The countries for which it is possible to give estimates are as follows:—In *Europe*—Prussia, Hungary (proper), Belgium, Denmark, Spain, Great Britain and Ireland, Italy, Luxemburg, Norway, Netherlands, Rumania, Russia in Europe (63 governments), Sweden, Switzerland; in *America*—Canada, United States; in *Asia*—India, Japan; in *Africa*—Algeria (department of Constantine), Tunis.

Wheat.—The total production in the above-mentioned countries is estimated to amount to 342,066,000 qr. in 1914 compared with 375,716,000 qr. in 1913, the decrease being equal to 9 per cent., while the area under production was greater by 1.6 per cent.

Rye.—In the specified countries, excluding Great Britain, India, Japan, Algeria, and Tunis, the estimated production is placed at 172,572,000 qr., against 180,250,000 qr. in 1913, or a decrease of 4.3 per cent. The area sown was smaller by 0.8 per cent.

Barley.—In the above countries, excluding India, the forecast gives the production as 141,059,000 qr. in 1914, or a decrease of 11.4 per cent. compared with the previous year, when the production amounted to 159,223,000 qr. The area planted was smaller by 0.4 per cent.

Oats.—For the same countries as above, but omitting India, the estimated production is 339,613,000 qr. against 387,562,000 qr. in 1913, the decrease amounting to 12.4 per cent., while the area sown was less by 0.6 per cent.

Sowing of Winter Cereals.—The areas estimated to have been sown to wheat in 1914-15, compared with the areas sown during the corresponding period of 1913-14, expressed as percentages, are as follows:—Denmark 103, England and Wales 110, Italy 105, Luxemburg 107, Switzerland 110, Canada 133, United States 111, India 122. The areas sown to rye are:—Denmark 93, Luxemburg 106, Switzerland 110, United States 103. The area sown to barley in Switzerland is 105 per cent. of that sown in 1913-14.

The following information is given respecting crops in the southern hemisphere:—

Wheat.—The estimated production in Argentina, Chile, and Australia in 1914-15 is placed at 30,740,000 qr., against 28,713,000 qr. for the same countries in 1913-14, the increase being equal to 7.1 per cent.

Italy.—The official report of the Minister of Agriculture for the end of January says that wheat and other grain crops, on the whole, look well, but especially in Upper and Central Italy a period of dry weather is required, with a low temperature, to stop over-development and precocious growth, as well as the weed trouble. In some of the low-lying land of the Liguria, Venetia, Tuscany, Umbria and Campania heavy rain has done damage, and prevented a greater extension of the area, especially so in Lazio and in the Abruzzi. It is, however, estimated that the area sown with grain this year is about 740,000 acres greater than in 1914. (*London Grain, Seed and Oil Reporter*, 2nd February.)

According to the latest official statistics the crops of maize, beans and peas in Italy, in 1914, were 12,100,000 qr., 600,000 qr., and 430,000 qr. respectively. (*Broomhall's Corn Trade News*, 22nd January.)

Canada.—A bulletin issued by the Census and Statistics Office at Ottawa, on the 13th January, states that the season proved very unfavourable for the growth of grain. Persistent drought throughout the greater part of the north-west provinces resulted in a yield per acre of the chief cereals which was lower than in any season since 1910; in Ontario and Quebec the conditions were not so unfavourable, whilst in the Maritime provinces a favourable season resulted in good returns. The total production of wheat was 161,280,000 bushels as compared with 231,717,000 bushels in 1913; oats, 313,078,000 bushels, against 404,669,000 bushels; barley, 36,201,000 bushels, against 48,319,000 bushels; rye, 2,016,800 bushels, against 2,300,000 bushels; buckwheat, 8,626,000 bushels, against 8,372,000 bushels; flax, 7,175,200 bushels, against 17,539,000 bushels; and maize, 13,924,000 bushels, against 16,768,000 bushels in 1913.

The Minister of the Interior at Ottawa states that there is an abnormally large acreage of land ready for sowing in the spring, the increase being about 40 per cent.

Argentina.—The spell of wet weather which commenced on 28th December terminated on the 3rd January, since when fine weather has prevailed, and harvesting operations are once more in full swing. From all accounts there does not appear to have been much damage done to

the wheat by the storms, but oats are said to have suffered. It is probable that there will not be any heavy arrivals of cereals at the ports until about the end of January, and in the south in many parts wheat cutting will not commence until about the middle of the month. The heavy rains have caused serious inundations in the far south in the valleys of the Rio Colorado and Rio Negro as well as in parts of the Province of Cordoba, where some of the salt lakes have overflowed. In the province of Mendoza there have been severe hailstorms. (*The Review of the River Plate*, January 8th).

India.—The first General Memorandum on the wheat crop of 1914-15 states that the area sown to the end of November, in all the chief wheat growing areas except Hyderabad and a few other native states, was 28,694,000 acres, an increase of 22 per cent. on the total acreage last year. The returns are, however, not complete as sowing has continued since the date of the reports. The sowing season was very favourable and an increased area has been sown in all the provinces, except Behar and Orissa and Bengal. The present condition and prospects of the crop are generally good; but rain is required in the United Provinces, the Central Provinces, Behar and Orissa, and Bengal.

Japan.—The *Official Gazette* states that the weather conditions were bad after the sowing of the corn crops, and since April severe changes in temperature and constant rains interfered with the growth. In certain districts disease and heavy rains also affected the crops and the yield is considerably less than the first estimate. The total production of barley, rye and wheat was 13,171,092 qr., a decrease of 15 per cent. as compared with 1913, and 3 per cent. below the average of the previous ten years. (*H.M. Commercial Attaché for Japan*.)

Live Stock in Denmark.—The figures from the census of the 15th July, 1914, give the number of horses as 568,240 compared with 535,018 on the same date in 1909, or an increase of 6.2 per cent.; of cattle as 2,462,862 against 2,253,982, an increase of 9.3 per cent.; of sheep as 514,918 against 726,879, a decrease of 29.2 per cent.; and of pigs as 2,496,661 against 1,467,822, an increase of 70.1 per cent. (*Bulletin of Agricultural and Commercial Statistics*, January, 1915.)

ACCORDING to statements in the Board's Monthly Agricultural Report (1st February) the supply of labour was everywhere reported to be scarce, but the work required on the land was generally so small during January that the shortage proved no material hindrance. Everywhere, however, apprehensions were expressed as to the prospects in the busy spring time. The following local summaries give further details regarding agricultural labour in the different districts of England and Wales:—

Northumberland, Durham, Cumberland and Westmorland.—Although little work on the land has been possible lately the supply of labour was often short of requirements, and a decided scarcity later in the year was everywhere anticipated.

Lancashire and Cheshire.—In a few districts labour was sufficient to meet the demands, but it was generally anticipated that there would be a shortage of labour in all parts at the next hirings, and that more would be needed to meet the spring work.

Yorkshire.—Skilled labour was very scarce everywhere, and the larger

farms in particular were seriously short of ploughmen and horsemen. Prospects were considered as very unfavourable, as the work of the farms is now increasing.

Shropshire and Stafford.—Both Shropshire and Stafford seemed to be already suffering from a considerable shortage of labour, and the problem was expected to become more acute in the near future.

Derby, Nottingham, Leicester and Rutland.—Labour was getting very scarce in nearly all districts, Rutland appearing to have suffered least. The shortage of milkmen was very marked in Nottinghamshire.

Lincoln and Norfolk.—In general the labour supply appeared to be just sufficient, but a serious deficiency is feared in the spring. There was already some shortage of horsemen and other skilled labour.

Suffolk, Cambridge and Huntingdon.—With little work on the land possible, the deficiency in the supply of labour, which was general, was not much felt during January in most districts. A serious shortage is, however, anticipated when spring work begins.

Bedford, Northampton, and Warwick.—Farmers were everywhere faced with the difficulty of insufficient labour. The trouble was not acute, but it was anticipated that difficulty will be experienced when the spring sowings begin.

Buckingham, Oxford, and Berkshire.—Labour was becoming increasingly deficient, especially among milkers and stockmen.

Worcester, Hereford and Gloucester.—Labour was everywhere reported to be short, but the wet weather prevented a heavy demand. It was expected that the deficiency will be felt when the busy work of spring seeding and cultivation begins.

Cornwall, Devon and Somerset.—The supply of labour was short, but the deficiency was not acutely felt owing to the unfavourable weather conditions hindering farm work. It was anticipated that with the approach of spring considerable difficulty will be experienced in obtaining men for the work.

Dorset, Wiltshire and Hampshire.—Although little work was possible on the land during January the supply of labour was decidedly short in many districts; some farmers were not able to work their horses in consequence. Prospects for the busy spring period were everywhere considered serious.

Surrey, Kent and Sussex.—Although the supply of labour was generally deficient, the shortage was not much felt during January. It was anticipated, however, that there will be a serious scarcity when the busy spring period arrives.

Essex, Hertford and Middlesex.—Except in one or two districts labour was becoming distinctly scarce, but it is in the spring that the shortage will be most troublesome.

North Wales.—In Anglesey, Carnarvonshire and Flintshire the supply of labour was generally sufficient during the past month, but Denbighshire and Merioneth reported a shortage, the position being worst in east Denbighshire.

Mid-Wales.—There was no serious deficiency of labour except in one district of Radnor and in Montgomeryshire. The prospect for the coming months, when farm work considerably increases, are, however, nowhere bright.

South Wales.—There was a distinct shortage in the supply of labour in some districts, but during January the supply was sufficient for requirements, or nearly so, in most parts of the division. Casual labour was, however, scarce, and farmers were generally expected to be very short of men later in the year.

The Crop Reporters of the Board, in reporting on the agricultural position on 1st February, state that the heavy rains during the first three weeks of January prevented farm work nearly everywhere; but cultivation was generally resumed during the last week of drier weather, except in low-lying districts. Wheat and other winter-sown crops are looking quite well on the drier land; but that sown late, or on wet lands, is everywhere less satisfactory, being often weak as a result of the excessive rainfall.

The prolonged wet weather has been very trying to the ewes, but they appear to have stood the conditions as well as could be expected. In the early districts of Dorset, Hampshire and neighbouring counties, there are reports of some losses among young lambs, many of which are weak, while there appear to have been fewer twins than usual. The few flocks which have lambed elsewhere have yielded rather more satisfactory results, while in the rest of the country prospects are generally regarded as normal.

Live stock have naturally not been suited by the conditions, but are generally satisfactory and healthy, although they have deteriorated somewhat where it has not been possible to give them a sufficiency of dry food. The supply of keep is generally ample or sufficient, except in the eastern and south-eastern districts.

Agricultural Conditions in England and Wales on 1st February.

THE following statement shows that according to the information in the possession of the Board on February 1st, 1915, certain diseases of animals existed in the countries specified:—

- Bulgaria (for the period September 6th—14th).*
Anthrax, Foot-and-Mouth Disease, Glanders, Sheep-pox, Swine Fever.
- Denmark (month of December).*
Anthrax, Foot-and-Mouth Disease (43 outbreaks), Glanders and Farcy, Swine Erysipelas, Swine Fever.
- France (for the period November 22nd—December 5th).*
Foot-and-Mouth Disease, Glanders and Farcy.
- Holland (month of December).*
Anthrax, Foot-and-Mouth Disease (131 outbreaks), Foot-rot, Swine Erysipelas.
- Italy (for the period January 18th—24th).*
Anthrax, Blackleg, Foot-and-Mouth Disease (279 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.
- Norway (month of December).*
Anthrax, Blackleg, Swine Fever.
- Rumania (for the period November 21st—29th).*
Dourine, Foot-and-Mouth Disease (531 animals), Glanders and Farcy, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.
- Russia (month of September).*
Anthrax, Foot-and-Mouth Disease (116,039 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.
- Spain (month of November).*
Anthrax, Blackleg, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Tuberculosis.

Sweden (month of November).

Anthrax, Blackleg.

Switzerland (for the period January 1st—10th).

Anthrax, Blackleg, Foot-and-Mouth Disease (130 "étales" entailing 2,081 animals, of which 37 "étales" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries:—Austria, Belgium, Germany, Hungary, Montenegro, Serbia.

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.
<i>Week ending Jan. 2nd:</i>							
England, N.E. ...	37.7	—0.3	1.01	26	+15	1.3	+0.2
England, E. ...	39.8	+2.3	1.89	48	+38	0.6	—0.7
Midland Counties ...	38.4	+1.0	1.83	46	+33	1.5	+0.4
England, S.E....	42.0	+2.4	2.35	60	+46	1.2	—0.2
England, N.W. ...	39.4	+0.1	1.53	39	+22	1.3	+0.4
England, S.W. ...	41.8	+0.4	2.83	72	+48	1.5	+0.1
English Channel ...	45.7	+0.7	2.22	56	+37	1.5	—0.4
<i>Week ending Jan. 9th:</i>							
England, N.E. ...	38.9	+1.1	1.05	27	+16	0.5	—0.6
England, E. ...	40.1	+2.8	0.81	21	+10	0.8	—0.5
Midland Counties ...	39.5	+2.3	1.36	35	+21	1.0	—0.2
England, S.E....	42.7	+3.6	1.54	39	+25	1.4	0.0
England, N.W. ...	40.4	+1.3	1.37	35	+18	0.9	—0.1
England, S.W. ...	43.4	+2.4	1.67	42	+19	1.9	+0.4
English Channel ...	46.5	+2.0	1.58	40	+20	2.3	+0.3
<i>Week ending Jan. 16th:</i>							
England, N.E. ...	41.6	+3.5	0.67	17	+5	1.5	+0.4
England, E. ...	43.1	+5.8	0.75	19	+9	1.7	+0.3
Midland Counties ...	43.2	+5.8	0.83	21	+9	1.0	—0.2
England, S.E....	44.3	+5.2	0.53	14	+1	1.4	0.0
England, N.W. ...	43.3	+4.0	1.64	42	+26	0.7	—0.4
England S.W. ...	45.2	+4.2	1.25	32	+12	0.6	—0.9
English Channel ...	47.2	+3.0	0.73	19	+1	0.9	—1.1
<i>Week ending Jan. 23rd:</i>							
England, N.E. ...	38.8	—0.1	0.47	12	+2	1.2	—0.2
England, E. ...	37.6	—0.5	1.16	29	+20	1.2	—0.4
Midland Counties ...	38.4	+0.1	0.39	10	—1	1.4	0.0
England, S.E....	38.2	—1.6	0.89	23	+11	2.2	+0.6
England, N.W. ...	39.4	—0.6	0.49	12	—5	2.1	+0.9
England, S.W. ...	39.9	—1.7	0.75	19	—1	1.9	+0.3
English Channel ...	43.2	—1.2	1.07	27	+11	2.0	0.0
<i>Week ending Jan. 30th:</i>							
England, N.E. ...	36.5	—2.9	0.17	4	—5	0.5	—1.2
England, E. ...	36.4	—2.5	0.13	3	—7	0.6	—1.5
Midland Counties ...	35.4	—3.7	0.07	2	—11	1	—1.0
England, S.E....	36.0	—4.3	0.14	3	—10	0.6	—1.2
England, N.W. ...	35.7	—4.6	0.16	4	—15	2.2	+0.8
England, S.W. ...	36.1	—5.8	0.22	6	—16	1.9	+0.1
English Channel ...	38.9	—5.8	0.09	2	—15	2.1	—0.1

* 1 inch = 25.4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	JANUARY.	
	1915.	1914.
Anthrax:—		
Outbreaks	88	98
Animals attacked	100	105
Foot-and-Mouth Disease:—		
Outbreaks	—	—
Animals attacked	—	—
Glanders (including Farcy):—		
Outbreaks	3	9
Animals attacked	5	26
Sheep-Scab:—		
Outbreaks	79	71
Swine Fever:—		
Outbreaks	408	237
Swine Slaughtered as diseased or exposed to infection ...	1,787	1,882

IRELAND.

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

DISEASE.	JANUARY.	
	1915.	1914.
Anthrax:—		
Outbreaks	—	—
Animals attacked	—	—
Foot-and-Mouth Disease:—		
Outbreaks	—	1
Animals attacked	—	19
Glanders (including Farcy):—		
Outbreaks	—	—
Animals attacked	—	—
Parasitic Mange:—		
Outbreaks	5	17
Sheep-Scab:—		
Outbreaks	69	118
Swine Fever:—		
Outbreaks	20	15
Swine Slaughtered as diseased or exposed to infection ...	99	94

Unit Prices of
Artificial Manures.Statement of cost to the purchaser of 1 per
cent. per ton of Nitrogen, Soluble and In-
soluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d.	s. d.	s. d.	s. d.
Nitrogen from:				
Sulphate of Am- } 95%	13 5½	—	13 0	13 6
monia pure ... } 93%	—	—	13 8	13 2
Calcium Cyanamide ...	12 1	—	12 1	11 9½
Nitrate of Soda } 95%	—	—	14 2½	—
pure ... } 90%	14 6½	—	14 4	14 0
Nitrate of Lime ...	15 5	—	13 10	16 3½
Soluble Phosphates from:				
Superphosphate 35%	1 10½	—	2 0	2 0½
" 33%	1 11	—	2 0½	2 0½
" 30%	1 11½	—	2 1½	2 1½
" 26%	2 1	—	2 3	2 3
Dissolved Bones ...	2 10	—	2 8½	2 8
Allowed for Nitrogen	17 2½	—	16 6	16 4½
Allowed for Insol. Phos.	1 11	—	1 10	1 9½
Insoluble Phosphates from:				
Basic Slag ...	1 8	—	1 6½	1 3½
Bone Meal ...	1 7½	—	1 6½	1 6
Allowed for Nitrogen	14 7½	—	14 1	13 7½
Steamed Bone Flour ...	1 4½	—	1 5½	1 6
Allowed for Nitrogen	12 4½	—	12 10	13 4
Potash from:				
Kainit ...	—	—	—	—
Sulphate of Potash ...	—	—	—	—
Muriate of Potash ...	—	—	—	—
Potash Salts ...	—	—	—	—

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the

various sources, at certain ports and Manufacturing Centres, for February, 1915.

Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
—	—	13 3	12 6	—	—
13 8	13 5	13 5	12 1	13 9	14 2½
—	11 9½	—	12 0	11 9½	12 1
—	13 8½	13 10½	—	13 10½	13 6½
—	—	—	15 2	14 4	—
—	—	—	—	15 10	15 6
2 0½	1 11	1 10½	2 0½	2 0½	2 0½
—	1 11½	1 10½	2 1	2 1	2 1
2 1½	1 11½	1 10½	2 1½	2 1½	2 1½
2 3½	2 1½	2 0½	2 3½	2 3½	2 3½
2 10	3 0	2 11½	3 1	3 1	3 1
17 4½	18 1	18 0½	18 8½	18 9½	18 11½
1 11	2 0½	2 0	2 1	2 1	2 1½
—	1 4	1 4½	1 4½	1 8½	1 9½
1 7½	1 7	1 7	1 6½	1 6½	1 9
14 8	14 2	14 5	13 10½	13 10	15 9
1 5½	—	—	1 3	1 5½	1 6½
12 11	—	—	11 2	13 2½	13 8½
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and rebagging the ingredients, bags, and loss of weight.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in January, 1915, and December, 1914.

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

Description.	JANUARY.		DECEMBER.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	10 6	10 1	10 2	9 10
Herefords	10 5	9 4	9 9	9 0
Shorthorns	10 4	9 5	9 9	8 11
Devons	10 6	9 8	10 1	9 0
Welsh Runts	10 2	9 2	9 10	8 10
	per lb.*	per lb.*	per lb.*	per lb.*
Veal Calves	9½	8½	9½	8½
Sheep:—				
Downs	10½	9	10	9
Longwools	9½	8½	9½	8½
Cheviots	10½	9½	10	9½
Blackfaced	10½	9	9½	9
Welsh	9½	8½	9½	8½
Cross-breds	10	9	10	9
Pigs:—	per stone.*	per stone.*	per stone.*	per stone.*
	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	7 11	7 5	7 9	7 3
Porkers	8 5	7 11	8 5	7 11
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk	24 13	20 14	24 19	20 19
—Calvers	23 16	19 14	24 0	20 10
Other Breeds—In Milk	22 16	19 9	22 0	18 14
—Calvers	17 10	16 5	16 10	15 0
Calves for Rearing	2 13	2 2	2 11	2 0
Store Cattle:—				
Shorthorns—Yearlings	12 8	10 10	12 1	10 6
—Two-year-olds	16 10	14 12	16 1	14 0
—Three-year-olds	19 3	17 5	19 1	17 6
Herefords—Two-year-olds	17 10	15 12	16 14	14 18
Devons—Two-year-olds	16 11	14 15	16 5	14 9
Welsh Runts—Two-year-olds	—	—	16 3	14 18
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools	47 6	39 10	44 6	38 5
Store Pigs:—				
8 to 12 weeks old	19 10	15 0	18 5	13 3
12 to 16 weeks old	35 8	26 2	36 1	26 5

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in January, 1915.

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

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.	per cwt. s. d.
BEEF:—						
English	1st	70 0	70 0	—	73 0	70 0
	2nd	65 6	67 6	—	69 0	66 0
Cow and Bull	1st	63 0	65 6	62 6	63 0	61 0
	2nd	56 0	56 0	57 6	58 6	56 0
Irish: Port Killed	1st	67 6	—	69 0	71 0	67 6
	2nd	65 6	66 6	65 6	67 0	63 6
Argentine Frozen—						
Hind Quarters	1st	60 6	60 6	58 6	60 6	58 6
Fore "	1st	55 6	55 6	53 6	54 0	53 6
Argentine Chilled—						
Hind Quarters	1st	68 0	67 0	67 0	69 6	67 6
Fore "	1st	56 0	56 0	55 6	56 0	55 6
Australian Frozen—						
Hind Quarters	1st	58 6	57 6	58 6	60 6	58 6
Fore "	1st	55 0	55 0	53 6	56 0	53 6
VEAL:—						
British	1st	74 6	74 6	87 0	83 0	84 0
	2nd	69 0	70 0	81 6	73 6	79 6
Foreign	1st	—	—	—	87 0	—
MUTTON:—						
Scotch	1st	—	—	84 0	76 6	84 0
	2nd	—	—	78 0	71 6	79 6
English	1st	78 0	79 6	—	73 0	79 6
	2nd	69 0	76 0	—	67 0	74 6
Irish: Port Killed	1st	76 0	—	78 6	—	75 0
	2nd	64 0	—	74 0	—	70 6
Argentine Frozen	1st	51 6	52 0	50 6	50 6	50 6
Australian "	1st	51 0	50 0	48 6	49 6	48 6
New Zealand "	1st	51 6	—	—	52 6	—
LAMB:—						
British	1st	—	—	—	99 0	—
	2nd	—	—	—	90 0	—
New Zealand	1st	63 6	65 6	62 6	62 6	62 6
Australian	1st	60 6	63 0	57 0	61 0	57 6
Argentine	1st	59 0	60 0	58 6	59 6	58 6
PORK:—						
British	1st	73 6	71 0	76 0	71 6	74 0
	2nd	67 0	67 6	70 0	67 0	69 6
Foreign	1st	70 0	—	—	69 0	—

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND in January, 1915.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	16 9	15 9	—	—	17 0	16 0
Irish Creamery—Fresh	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
" Factory ...	—	—	—	—	—	—
Danish ...	—	—	154 0	152 0	154 6	150 6
French ...	—	—	—	—	141 6	136 0
Russian ...	—	—	132 0	128 0	134 6	130 6
Australian ...	144 0	142 0	142 6	140 6	140 6	136 6
New Zealand ...	145 6	143 6	146 0	144 0	142 6	138 6
Argentine ...	144 0	142 0	142 0	140 0	139 6	135 6
CHEESE:—						
British—						
Cheddar ...	86 6	80 6	87 6	82 6	87 6	82 0
Cheshire ...	—	—	120 lb.	120 lb.	120 lb.	120 lb.
	—	—	92 6	87 6	95 6	88 6
Canadian ...	82 6	80 6	per cwt.	per cwt.	per cwt.	per cwt.
	—	—	81 6	79 6	81 0	78 6
BACON:—						
Irish (Green) ...	84 0	79 0	83 0	79 6	85 0	81 0
Canadian (Green sides)	77 6	75 0	76 6	74 0	77 0	74 0
HAMS:—						
York (Dried or Smoked) ...	114 0	112 0	—	—	112 0	105 6
Irish (Dried or Smoked)	—	—	—	—	104 0	96 6
American (Green) (long cut) ...	75 0	71 6	72 6	68 6	73 6	70 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	—	—	—	—	19 7	17 6
Irish ...	18 1	17 1	17 10	16 9	18 3	17 0
Danish ...	21 0	20 0	—	—	19 6	17 6
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII. ...	94 0	82 6	85 0	80 0	92 0	83 0
Langworthy. ...	95 0	80 0	95 0	90 0	102 6	93 6
Up-to-Date ...	91 0	78 6	80 0	76 6	96 0	87 6
HAY:—						
Clover ...	—	—	101 0	75 0	104 6	94 6
Meadow ...	—	—	—	—	94 6	85 6

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 1913, 1914 and 1915.

Weeks ended (in 1915).	WHEAT.			BARLEY.			OATS.		
	1913.	1914.	1915.	1913.	1914.	1915.	1913.	1914.	1915.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan. 2 ...	30 5	31 1	44 4	28 6	26 2	29 10	19 10	18 2	26 6
" 9 ...	30 3	30 11	46 2	28 4	25 11	29 7	19 2	18 4	26 5
" 16 ...	30 5	31 0	48 9	28 6	26 0	30 5	19 4	18 6	27 6
" 23 ...	30 11	30 11	51 6	28 10	26 3	31 3	19 4	18 11	28 10
" 30 ...	31 1	31 1	52 8	28 11	26 6	32 5	20 2	19 1	29 10
Feb. 6 ...	31 0	31 0	53 3	28 10	26 7	33 7	20 1	18 9	30 3
" 13 ...	30 9	31 0	—	29 1	26 7	—	20 2	18 11	—
" 20 ...	30 11	31 0	—	28 8	26 7	—	20 7	18 11	—
" 27 ...	31 0	31 0	—	28 6	26 6	—	20 4	18 11	—
Mar. 6 ...	31 3	31 5	—	28 5	26 2	—	20 0	18 9	—
" 13 ...	31 1	31 6	—	27 11	26 0	—	20 2	18 7	—
" 20 ...	31 1	31 5	—	28 6	25 8	—	19 11	18 6	—
" 27 ...	31 3	31 4	—	27 6	25 7	—	19 7	18 8	—
Apr. 3 ...	31 4	31 6	—	27 0	25 6	—	19 2	18 5	—
" 10 ...	31 3	31 5	—	27 8	26 8	—	19 2	18 4	—
" 17 ...	31 6	31 7	—	26 11	25 4	—	18 10	18 4	—
" 24 ...	31 8	31 9	—	26 7	26 6	—	19 3	18 5	—
May 1 ...	32 2	31 9	—	25 11	26 0	—	19 6	18 5	—
" 8 ...	32 6	32 2	—	25 9	25 6	—	19 6	18 9	—
" 15 ...	32 10	32 7	—	25 4	26 3	—	19 9	18 11	—
" 22 ...	32 10	33 0	—	25 3	25 10	—	19 11	19 0	—
" 29 ...	32 7	33 9	—	26 1	26 1	—	20 1	19 4	—
June 5 ...	32 10	34 0	—	26 2	25 11	—	19 8	19 4	—
" 12 ...	32 8	34 1	—	24 7	24 11	—	20 2	19 8	—
" 19 ...	32 8	34 1	—	23 10	25 10	—	19 8	19 9	—
" 26 ...	32 8	34 3	—	24 3	25 4	—	19 1	20 0	—
July 3 ...	33 1	34 4	—	25 2	24 6	—	21 0	19 9	—
" 10 ...	33 4	34 2	—	25 10	24 9	—	19 4	20 0	—
" 17 ...	33 6	34 1	—	24 9	24 2	—	20 5	19 10	—
" 24 ...	33 10	34 0	—	24 1	24 7	—	20 8	19 9	—
" 31 ...	34 1	34 2	—	24 5	25 9	—	20 3	19 8	—
Aug. 7 ...	34 1	34 9	—	24 9	25 2	—	19 0	19 1	—
" 14 ...	34 3	40 3	—	24 7	29 4	—	18 7	25 1	—
" 21 ...	33 7	38 9	—	26 5	29 10	—	18 8	24 3	—
" 28 ...	32 7	36 2	—	29 0	30 3	—	17 10	23 5	—
Sept. 4 ...	31 11	36 5	—	30 11	30 6	—	17 8	23 9	—
" 11 ...	31 9	37 10	—	31 5	29 11	—	18 0	23 11	—
" 18 ...	31 7	38 3	—	30 9	29 5	—	17 11	23 8	—
" 25 ...	31 6	37 6	—	30 1	29 3	—	17 9	23 3	—
Oct. 2 ...	31 3	37 1	—	29 9	29 1	—	17 10	22 9	—
" 9 ...	31 0	36 8	—	29 1	28 10	—	17 10	22 5	—
" 16 ...	30 11	36 7	—	28 8	28 8	—	17 9	22 4	—
" 23 ...	30 7	37 2	—	28 7	28 7	—	18 0	22 5	—
" 30 ...	30 1	37 10	—	28 2	28 3	—	17 9	23 7	—
Nov. 6 ...	30 0	38 8	—	28 1	28 6	—	17 9	23 7	—
" 13 ...	30 1	39 8	—	27 8	29 0	—	17 11	24 8	—
" 20 ...	30 4	41 0	—	27 5	29 8	—	18 1	25 5	—
" 27 ...	30 9	41 11	—	27 0	30 3	—	18 4	25 8	—
Dec. 4 ...	31 2	42 2	—	26 8	30 2	—	18 4	25 9	—
" 11 ...	31 2	42 1	—	26 5	29 11	—	18 6	25 9	—
" 18 ...	31 2	42 7	—	25 11	29 8	—	18 5	25 9	—
" 25 ...	31 0	43 3	—	25 10	29 9	—	18 4	25 11	—

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.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of January, 1914 and 1915.

	WHEAT.		BARLEY.		OATS.	
	1914.	1915.	1914.	1915.	1914.	1915.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London ...	32 2	51 0	27 6	32 6	20 3	29 11
Norwich ...	30 7	47 6	25 2	30 2	18 2	28 0
Peterborough ...	30 6	49 4	25 8	30 11	18 5	28 7
Lincoln ...	31 4	49 5	26 7	30 3	19 2	27 6
Doncaster ...	31 1	49 1	24 9	30 0	18 4	27 2
Salisbury ...	30 4	48 11	26 3	31 1	19 0	29 0

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SOME FIGURES IN RELATION TO AN EXPERIMENT IN THE FEEDING OF YOUNG PIGS.

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IN the December issue of this *Journal* (p. 789), a summary was given of the results obtained in an experiment carried out with ten Large White Yorkshire pigs, with the object of obtaining information as to the extent to which the ingredients of the food were recoverable in the excreta of the animals at different stages of growth.

All the animals were of practically equal age and were treated exactly alike. Throughout the course of the experiment a careful record of food consumption was kept and each animal was weighed weekly.

The amounts of food supplied were regulated so that at any one meal each animal consumed as nearly as possible the same amount of food. The unconsumed residues left on a few occasions by individual pigs were trifling in amount and insignificant in comparison with the losses unavoidably associated with the feeding habits of the pig. Details are given in the former article of the arrangements adopted for individual feeding by which these losses were reduced to a minimum. At the outset great difficulty was experienced in inducing the pigs to eat in the separate pens, but this was overcome by opening up somewhat the closely boarded partitions at first erected.

The experiment, in addition to fulfilling its primary object, thus furnished useful data illustrative of the degree of variability in the rate of growth of pigs of equal age and closely allied parentage, when subjected to identical conditions of feeding, housing and general treatment.

The pigs were drawn from two litters and were treated as two separate groups. The five pigs of Group A (Nos. 1-5) were all males, whilst Group B consisted at first of four males and one female (No. 9). The unsatisfactory progress made by No. 7 of this group led to his being replaced in the seventh week of the experiment by a female from the same litter. The male pigs of both groups were castrated twelve days before the experiment commenced (June 30), at which time the pigs were roughly 8 weeks old.

The general course of the feeding is indicated in Table I.

TABLE I.
Weekly Ration per Pig.

Week. No.	Period.	Sharps.	Bran.	Pea Meal.	Barley Meal.	Water.	Total Weight of Meal.
		lb.	lb.	lb.	lb.	lb.	lb.
1	June 30-July 7..	?	?	—	—	—	?
2	July 8- " 14..	4.63	0.77	—	—	35	5.40
3	" 15- " 21..	5.07	1.21	—	—	35	6.28
4	" 22- " 28..	6.50	1.54	—	—	42½	8.04
5	" 29-Aug. 4..	7.49	1.54	0.66	—	52½	9.69
6	Aug. 5- " 11..	8.60	1.54	1.43	—	52½	11.57
7	" 12- " 18..	9.26	1.54	2.54	—	52½	13.34
8	" 19- " 25..	9.26	1.54	3.08	—	52½	13.88
9	" 26-Sept. 1..	15.00	3.08	0.44	—	57½	18.52
10	Sept. 2- " 8..	13.23	3.08	5.29	—	70	21.60
11	" 9- " 15..	12.34	3.08	6.17	—	70	21.59
12	" 16- " 22..	15.00	3.08	6.17	—	70	24.25
13	" 23- " 29..	15.43	3.08	6.17	—	70	24.68
14	" 30-Oct. 6..	15.43	3.08	7.50	—	87½	26.01
15	Oct. 7- " 13..	15.43	3.08	7.71	—	87½	26.22
16	" 14- " 20..	17.20	3.08	8.13	—	87½	28.43
17	" 21- " 27..	18.52	3.08	9.26	—	87½	30.86
18	" 28-Nov. 3..	15.87	3.08	9.26	1.98	87½	30.19
19	Nov. 4- " 10..	15.43	3.08	9.26	2.87	87½	30.64
20	" 11- " 17..	15.43	3.08	10.58	3.08	87½	32.17
21	" 18- " 24..	16.53	3.64	11.35	3.08	87½	34.60
22	" 25-Dec. 1..	16.97	3.86	11.57	3.08	87½	35.48
23	Dec. 2- " 8..	18.30	3.86	12.24	4.41	105	38.81
24	" 9- " 15..	18.52	3.86	12.34	4.63	105	39.35

It will be observed that wheat bran and wheat "sharps" were used throughout, whilst pea meal was introduced in the fifth week of the experiment and barley meal was used in the last seven weeks. In addition to the materials included in the table a little precipitated chalk—about 3 oz. per pig weekly—was

given from October 14 to December 1. No milk or dairy waste was used. The total weight of meal consumed weekly rose steadily from about 5.4 lb. to 39.3 lb. per pig, these quantities representing practically the maximum amounts that the least voracious animal could be induced to consume.

The weekly gains in live weight are summarised in Table II., together with an indication of the degree of variability in the records of the individual pigs.

TABLE II.

Week No.	Range of Variation in Individual Weekly Increases of Live Weight.	Average Weekly Increase per Pig.		
		Group A.	Group B.*	All Animals.
	lb.	lb.	lb.	lb. lb.
1	0.1 3.0	1.7	1.7	1.72 ±.17
2	(-)1.4 (+)1.0	(-)0.4	(-)0.7	(-)0.55 ±.10
3	1.4 2.5	1.9	2.1	1.96 ±.09
4	2.6 5.1	3.6	3.6	3.62 ±.19
5	0.8 3.8	2.7	2.9	2.78 ±.19
6	3.8 7.2	5.4	4.7	5.11 ±.26
7	4.0 7.5	5.7	4.8	5.29 ±.23
8	4.5 10.6	6.4	5.7	6.05 ±.39
9	4.1 6.5	5.4	5.1	5.26 ±.18
10	5.3 8.0	6.6	6.1	6.39 ±.18
11	6.4 9.5	8.2	7.6	7.90 ±.17
12	7.0 10.7	8.6	8.2	8.41 ±.29
13	5.1 6.8	5.6	5.8	5.73 ±.10
14	5.3 10.6	6.2	8.0	7.13 ±.40
15	2.3 6.5	4.9	5.1	5.04 ±.30
16	4.0 11.5	9.2	6.8	7.99 ±.49
17	5.8 13.2	9.0	12.1	10.59 ±.49
18	1.9 8.0	5.4	3.9	4.63 ±.45
19	7.2 12.3	9.5	10.5	9.99 ±.37
20	4.5 13.0	7.4	9.2	8.30 ±.50
21	5.5 11.3	7.9	8.2	8.06 ±.34
22	7.4 12.9	10.4	10.9	10.64 ±.38
23	4.1 14.0	12.8	9.0	10.94 ±.62
24	3.8 11.8	7.2	10.6	8.89 ±.56

* 4 pigs only up to and including 7th week (*i.e.*, original No. 7 excluded. See text).

It will be noted that the animals did not make satisfactory progress during the first two or three weeks, there being an actual decrease in weight recorded for the second week in the case of eight pigs. This was due to the difficulty, previously alluded to, of inducing the pigs to eat in separate stalls. The amounts of food consumed during this period were far below the normal requirements of pigs 8-10 weeks old. By the end of the third week, however, the pigs were thoroughly settled.

down and this fact is reflected in the increases subsequently recorded.

Taking the weekly average increases of all animals, these show in the main a steady rise throughout the experiment. An appreciable slackening of the rate of growth is evident in the results for the three weeks, September 23—October 13, and is possibly attributable to inadequacy of the rations fed during that period, the total supply of meal being increased by only 2 lb. weekly per pig. A similar explanation is suggested for the more striking relapse in the rate of growth recorded for the week October 28—November 3. In this week barley meal was introduced into the ration and the supply of sharps reduced, a slight reduction in the total ration being occasioned by the readjustment. Other causes must have contributed, but they could not be identified.

The range of variation in the weekly increases of the individual pigs was very considerable each week, despite the closely allied parentage of the animals and the special efforts made to secure uniformity of treatment. It was, however, appreciably less than is commonly experienced in feeding trials.

TABLE III.

Pig No.	Sex.	Initial Weight. (June 30th).	Final Weight. (Dec. 15th).	Increase in 24 Weeks.
		lb.	lb.	lb.
Group A	1 M	23.4	174.5	151.1
	2 M	26.1	180.7	154.6
	3 M	25.5	169.2	143.7
	4 M	28.0	188.8	160.8
	5 M	24.4	173.0	148.6
Group B	6 M	26.1	188.3	162.2
	7 F*	(27.4)	181.5	(154.1)
	8 M	28.1	185.2	157.1
	9 F	30.6	166.0	135.4
	10 M	24.7	177.5	152.8
Average { Group A ..		25.5 ± .5	177.2 ± 2.3	151.7 ± 1.9
Group B ..		27.4 ± .7	179.7 ± 2.6	152.3 ± 3.0
Average of all ..		26.5 ± .45	178.5 ± 1.7	152.0 ± 1.7

* Animal introduced in 7th week (See text). Initial weight estimated.

The average increases for the whole period (Table III.) were almost identical for the two groups, the individual records of Group A being slightly more uniform than those of Group B. If the records of the male pigs alone be compared,

TABLE IV.
Averages (per Week) for Successive 3-Weekly Periods.

Period (of Table II.).	Food Consumed per 100 lb. Live Wt. per Week.			Albu- minoid Ratio.	Percentage Increase of Live Weight per Week.	Food Consumed to Produce 1 lb. Live Weight increase.			Cost of Food.	
	Total Meal.	Digestible Albu- minoids.	Starch EQUIVA- lent.			Total Meal.	Digestible Albu- minoids.	Starch EQUIVA- lent.	Weekly per Pig.	Per lb. Increase of Live Weight.
I.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Weeks.	lb.	lb.	lb.	1 : 5.1	Per cent.	lb.	lb.	lb.	pence.	pence.
4th-6th ..	26.7	3.25	15.7	1 : 5.1	10.5	2.5	0.31	1.5	7.1	1.8
7th-9th ..	29.3	3.68	17.5	1 : 5.0	10.6	2.8	.35	1.6	11.3	2.0
10th-12th ..	31.2	4.10	19.0	1 : 4.7	10.5	3.0	.39	1.8	16.9	2.2
13th-15th ..	27.8	3.69	17.0	1 : 4.7	6.5	4.3	.57	2.6	19.4	3.3
16th-18th ..	26.0	3.19	16.1	1 : 4.7	6.7	3.9	.47	2.4	22.8	2.9
19th-21st ..	23.3	2.82	14.7	1 : 5.0	6.3	3.7	.45	2.3	25.2	2.9
22nd-24th ..	22.5	2.81	14.2	1 : 5.1	6.0	3.8	.47	2.4	29.4	2.9

it will be seen that there was a difference of only $18\frac{1}{2}$ lb. between the highest and lowest gain recorded, or 12 per cent. of the average gain.

Further data of interest compiled from the records are summarised in Table IV., in which, for the purpose of bringing out the general trend of the changes in the course of the experiment, the averages for consecutive three-weekly periods are used. The results for the first three weeks are excluded for reasons previously stated.

Columns 2 to 4 of Table IV. indicate the relation of the food-consumption to the size of the pig. It will be noted from the weights of meal consumed per 100 lb. live weight, that up to the 12th week (September 16-22), the appetite of the pig increased more rapidly than its size, but this relation was subsequently reversed. The difference between the averages for the 10th-12th week and 13th-15th week periods is exaggerated by the abnormally low gains of live weight recorded in the latter period, to which reference has already been made.

The columns 7 to 9 of Table IV. indicate further the relation between food consumption and live weight increase at different stages of growth. The general validity of the law of diminishing returns is clearly evident both in the ratio of the live weight increase to the total weight of the animal (col. 6) and in the ratio of food consumed to growth produced in each period. Thus, whereas in the early stages, when the pigs were 13 to 15 weeks old, one pound gain in weight was secured for every 2.5 lb. of meal consumed, nearly 4 lb. of meal was required in the final stages, when the pigs were 31 to 33 weeks old. A similar increase is noticeable in the cost of feeding (columns 10 and 11), which rose steadily from 7d. to 29d. per pig weekly, whilst the cost of production per pound live weight increase rose from $1\frac{3}{4}$ d. to practically 3d.

If a comparison be made of the rations used with those suggested in Kellner's Table of Feeding Standards, it will be found that our rations throughout were well above the "standards" in respect of the albuminoid-supply, but were of appreciably lower starch-equivalent. We might have reduced the latter discrepancy, and possibly obtained an even more rapid rate of growth, by introducing barley meal earlier and more liberally into the ration as a substitute for sharps and pea meal, but the requirements of the manurial investigations which formed the main object of the feeding were better served by the rations used.

BRITISH LIVE STOCK AND THE BRAZILIAN MARKET.

NOTABLE features of the world's meat trade in recent years have been the throwing open (if only temporarily) of various European countries to supplies of chilled and frozen meat from Argentina and elsewhere, and the decrease in the exports from the United States. The higher prices which have resulted from the growing demand have led to fresh sources of supply being sought, and enquiry has been especially directed to the possibility of the eventual establishment of an export trade in meat from Brazil, similar to that from Argentina and Uruguay.

The vast plains, especially in the south of Brazil, are said to be eminently adapted to the raising of cattle on a large scale. In the State of Sao Paulo in particular, among the most important areas for live stock breeding are those of Barretos, on the frontier of the States of Matto Grosso and Minas Geraes, where most of the store cattle coming from these two states are fattened before being sent to Sao Paulo and Rio de Janeiro; the Campos of Paranapanema, at present little known, but which are said to have a great future; the district of Faxina in the south, noted for the breeding of horses and mules; Lencoes in the centre of the State, where some sheep raising is carried on; and the Campos of Jordao situated at a high altitude, where many farms are occupied in the raising of Dutch cattle.

Live stock are also required, in some districts, to supply the meat requirements of the country itself. Further, in the State of Sao Paulo at least, there has for some years been a marked tendency towards intensive cultivation of coffee, the staple agricultural product. This change has rendered necessary the use of manures; and the need for farmyard manure in addition to artificials, is leading to changes in the agricultural economy of the country, an ever-increasing importance attaching to the keeping of live stock. Nearly all the planters, even on the richest soils, are erecting sheds for the accommodation of live stock in order to obtain the necessary farmyard manure, and are setting aside part of the plantations for pasture or for the cultivation of fodder crops. While it is true that at present the planters regard stock keeping rather as a necessary evil, it is probable that the time is not far distant when they will find dairying and meat production so

advantageous that they will be led to pay much more attention to this branch of agriculture. The coffee plantations are scattered all over the State.

The official figures* of the number of live stock in Brazil in 1912 are as follows:—Cattle 22,467,000; pigs 11,968,000; sheep 11,801,000; goats 6,886,060; horses 4,955,000; mules 1,681,000.

With regard to the establishment of meat factories, packing establishments have recently been started at Osasco, near Sao Paulo City, with a capacity of 1,000 steers and 1,000 hogs per day, and at Barretos, Sao Paulo, where 450 cattle per day can be killed. A jerked beef factory has been established on the Paraguay river in Matto Grosso. The stock of the Brazil Land, Cattle and Packing Company, which operates in the States of Matto Grosso, Minas Geraes and Parana, is said to consist of 85,000 head besides 150,000 wild cattle; for the purpose of improving the breed this company has recently imported large numbers of pure-bred cattle. On the other hand, His Majesty's Consul for Rio Grande, in his report for 1913 (*F. O. Reports, Ann. Ser.*, No. 5392), stated that "it would seem strange that British capitalists have not turned their attention to this State (Rio Grande) which is essentially a cattle-raising district. The railways, a deeper bar, and a new port having all the necessary equipment in stores and refrigerators for the shipment of cattle and frozen meat, offer every facility to the trade."

Encouragement of Live Stock Breeding.—Among the official measures taken to encourage live stock breeding in Brazil may be mentioned the granting of subsidies to importers of foreign pedigree live stock approximately equal to the cost of carriage from the country of origin (see later). These subsidies are granted both by the Federal Government and by the Governments of Sao Paulo and Rio de Janeiro. According to His Majesty's Consul at Rio de Janeiro there are signs that these grants may be augmented.

To encourage cattle raising prizes are given for dipping tanks constructed for combating red-water, and many have been built in Minas Geraes, Rio Grande do Sul, Bahia and Ceara; a Pasteur institute has been installed in Florianopolis for the preparation of rabies vaccine.

Zootechnic stations have been established by the Federal Government and by the State Governments of Minas Geraes

* These figures are in respect of the States of San Paulo, Rio Grande do Sul, Bahia, Minas Geraes, Espirito Santo, Santa Catharina, Sergipe and Parana.

and Sao Paulo; the European cattle imported either by the Governments or by private importers seem to be taken first to these stations. The posts in the stations are mostly controlled by European veterinary surgeons, and attention is chiefly directed towards rendering the imported cattle immune to red-water. Some animals after becoming immune are sold; others are used for stud purposes, the young stock being sold by auction every year.

Acclimatisation of Live Stock.—Since it is probably in the State of Sao Paulo that the greatest efforts in the direction of stock raising and the testing of the suitability of various foreign breeds have been carried out, some detailed particulars as to the conditions prevailing in this State may be given.

The mean annual temperature of the State is 64° F., with a maximum in summer of 100° F. and a minimum in winter of about 30° F.; the minimum is rarely found, and cold is not often general, but limited to a few places. Imported animals seem to bear the summer heat very well, especially when the precaution (which is general) is taken of housing them during the hottest part of the day. Animals are, however, generally imported in winter and are already more or less acclimatised by the hot season. It seems that cold is more to be feared than heat.

As regards rainfall, the danger of the rainy season (in summer) lies rather in the prevalence of insects than in any harm caused directly by rain. In the dry season (winter) there is a lack of good pasturage. The natural pastures of the country are composed of poor gramineous herbage, but these are farthest from civilisation, the pastures of districts nearer the capital being practically all artificial and apparently well suited to fattening live stock.

Feeding of newly-imported animals presents no difficulties.

Measures against Red-Water.—From the point of view of acclimatisation of cattle the most important disease is certainly red-water; an account of the progress in regard to this disease in Sao Paulo may be given. About ten years ago, of an importation of 315 breeding animals from Europe and Argentina only 7 were found to survive, the rest dying from red-water. It has since been found that the losses among imported animals are much reduced (1) if only young animals (12 to 14 months) are imported, as these have proved to be much more resistant than mature animals; (2) if no pregnant animals are imported, as these abort when attacked and generally succumb; (3) if importation is only undertaken during the

Brazilian winter (May to September), so that animals suffer less from changes of climate; and (4) if immunisation is carried out as soon as possible, either naturally (by the application of a limited number of ticks), or artificially (by subcutaneous injection of virulent blood from an animal recently recovered from an attack of the disease).

The mortality among imported animals was reduced to 33 per cent. in 1908, 13 per cent. in 1909 and to 7 per cent. in 1910. The certainty of acclimatisation of imported animals cannot yet, however, be guaranteed.

It has been established that red-water is present on all the stock-breeding farms in the State of São Paulo, so that immediate immunisation of young breeding stock imported against the disease is imperative if the animals are not to succumb when they reach maturity. In addition to red-water (*Piroplasma bigeminum*), recent research has shown Anaplasmosis (*Anaplasma marginale*) to be prevalent and to be, if anything, more grave than the former.

The work of Sir Stewart Stockman, Professor Nuttall, and Dr. Arnold Theiler having shown excellent results to be obtained from trypan blue, experiments have been carried out in São Paulo, and the results fully confirmed the findings of these investigators. As trypan blue does not destroy all parasites the immunity conferred is of a permanent nature. In the injection of virulent blood previous to the use of trypan blue it is necessary, however, to eliminate all *Anaplasma marginale* parasites.

Sir Stewart Stockman states that animals immunised against red-water have an increased resistibility against anaplasmosis. Dr. Arnold Theiler is of opinion that immunisation with *Anaplasma marginale* var. *centrale* is the best method of conferring resistibility against anaplasmosis.

M. L. Misson, the Director of Animal Industry in São Paulo, comes to the conclusion that it would be much preferable to carry out immunisation of animals against red-water in Europe some time before embarkation.

The immunisation of animals against red-water is undertaken at the Cattle Testing Station of the Board at Pirbright, Surrey, an account of which will be found in Leaflet No. 290. Through the instrumentality of the Chief Veterinary Officer of the Board more than 300 animals have been immunised in the last few years and shipped to various countries, including Brazil, and reports on the animals after landing in infected countries have been highly satisfactory.

Other than red-water the most frequent enzootic diseases in the country are symptomatic anthrax and actinomycosis in cattle; glanders and a trypanosomiasis peculiar to South America in horses; rabies; and vermicular pneumonia in goats. Cattle plague does not exist, and up to the present there has been no case of bacteriological anthrax.

To secure the grants given in respect of imported animals, such animals must, *inter alia*, be submitted to the tuberculin or mallein tests before shipment. The tuberculin test is also undertaken at the Board's Cattle Testing Station.

Native Breeds and the Degree of Success which has attended the Importation of British Breeds. An account of the native breeds of live stock, and of the measure of success which has attended the introduction of British breeds into São Paulo may be of interest.

Importation of European stock for breeding purposes has taken place upon a fairly large scale, both by the Ministry of Agriculture and by private stock breeders with Government aid.

Investigations as to the value of European live stock for crossing with the native breeds appear to have been carried on by the Government of the State of São Paulo since 1907.

On account of the poverty of the Brazilian soils in lime and potash, and the lack of natural fodder during the winter, the indigenous races of animals have a small frame, so that large-limbed breeds are necessary for crossing. One of the principal native breeds of cattle is the Caracu, a good healthy breed of Portuguese origin; it is being steadily improved by the introduction of pedigree stock, and the results of crossing with the native breeds are most gratifying.

The age of cattle has been dealt with (page 1081). Preference is accorded to stallions of about 3 years old; these are most resistant to the climate, and if allowed to serve only a small number of mares the first year (at most twenty) are found to retain the characteristics of their breed. As regards condition, imported animals should be in average condition, and a warning is issued by the Director of Animal Industry of São Paulo against the purchase in Europe of animals prepared for shows by special feeding. Imported stallions seem to be easily acclimatised. The best height for imported stallions is given as "not exceeding 59 in." as the native mares are small; when the native breeds are improved by crossing or selection it is stated that the height limit can be increased to 61 in. The size of cattle for the same reason, should not be too great.

Various recommendations are made by the Director of Animal Industry as to suitable breeds to import into Sao Paulo, based on the results of crossing hitherto achieved. While the only two breeds of pigs recommended are the Berkshire and the Large Black, it is to be regretted that no English breeds of horses* or cattle are given among those which seem at the present time to have the best chances of success. With regard to the importation of sheep, the climate of Sao Paulo places strict limits on sheep raising; further, there seems to be little demand in the country for mutton. In the districts where pasturage and altitude are suitable the Shropshire and Southdown appear to be the most valuable of imported European breeds.

Experiments with pigs have shown the Berkshire to increase greatly the precocity of the native breeds. A native pig, one year old, weighs from 165 to 175 lb.; a first cross with the Berkshire 275 lb., and a pure bred 330 lb. The Large Black has also given good results. It is stated that the Yorkshire, being white, suffers greatly from parasitic diseases, and the Tamworth does not seem to have given good results.

Among numerous Shorthorn bulls imported, a few, which have been able to resist the climate, have produced offspring, by crossing, to which they have transmitted many of their characteristics, increasing the production of meat and milk. The examples of crossing are at the present time too few to permit of an accurate judgment being passed as to their value for improving the native cattle. Similar observations are made as to the Hereford; but the crosses are more numerous, and several breeders who are satisfied with the results so far obtained are continuing their experiments on a larger scale. In particular, the Brazil Land Cattle and Packing Company have decided that the Hereford stock is best suited to local conditions and are credited with the intention of importing large numbers of this breed.

Few experiments have been made with the Devon, although this breed has a marked resistibility to red-water, and has shown itself adaptable to the conditions of live-stock breeding on a larger scale. Crosses with the Red Polled breed have been shown to possess an increased milk production.

The Jersey has been imported for many years. The female progeny obtained by crossing a Jersey bull with a native cow

* In Rio de Janeiro, however, the larger breeds such as Shire, Percherons and Suffolk Punches have ceased to be introduced, but Hackneys and Anglo-Arabs are being used.

have proved excellent milkers, not only as regards yield and quality of milk, but also in respect of duration of lactation. The male progeny are, however, smaller than the native races and are less useful for meat production or as draft animals.

Of all imported breeds at the Central Zootechnical Station of Sao Paulo, the Guernsey has given the best results when kept pure. No animals failed to become acclimatised, and the cows have remained excellent milkers and breeders. As in the case of the pure-bred Jerseys, the loss of pure-bred calves born in the country has unfortunately been high. The Guernsey has not as yet been much used for crossing.

Portuguese and Spanish Editions of the Board's Live Stock Handbook. In spite of the excellence of British breeds of live stock there has been a tendency in the past to import breeding stock from countries other than the United Kingdom, viz., France, Holland, Switzerland and the United States. With the view of making known to breeders of live stock in Brazil and other countries of South America the distinguishing characteristics which contribute to the excellence of British breeds of live stock the Board have issued editions in Portuguese and Spanish of their Handbook of British Breeds of Live Stock.

Attention may be drawn in particular to some tables which are given in the Handbook showing the average ages, live weights and daily increases of cattle, sheep and pigs at the Smithfield Shows during the years 1902-11. In the case of dairy cattle, milk yields have been given so far as they could be ascertained.

A statement of the more important shows and places at which animals of each breed can be bought is given, together with an indication as to the average range of prices. This statement further shows the names and addresses of the secretaries of the various breed societies for the convenience of foreign stock-owners who may wish to get into communication with any particular society.

These Spanish and Portuguese editions of the Handbook contain some 153 pages of letterpress and 88 photographs of animals. In England they may be obtained at the office of the Board of Agriculture and Fisheries, Whitehall Place, London, S.W., price 1s. post free.

Costs of Transport of Live Stock. The following costs of transport from the place of origin to the port of Santos are

given by the Secretary of Agriculture for Sao Paulo. They are made on the basis of transporting 5 or 10 animals of each kind at the same time, so that one whole railway wagon is occupied.

	£	s	d
Bulls and cows	32	8	0
Horses and mares	40	0	0
Asses and donkeys	16	0	0
Goats and sheep	8	0	0

The above includes commission to intermediaries who were found to be a necessity, as they looked after all the arrangements relative to the transport of animals.

Excluding such services the following figures are given:

	Bulls and Cows from Switzerland.			Goats and Sheep from Switzerland.			Horses from France.		
	£	s	d	£	s	d	£	s	d
Railway, food and guard	2	0	0	12	0	0	12	0	0
Insurance	1	12	0	6	8	0	8	0	0
Sea freight	17	11	2	2	18	4	10	10	0
Food on board ship	1	12	0	18	0	0	1	0	0
Guard on board ship	1	1	5	4	0	0	1	4	0
General Charges	3	5	0	1	8	0			
Total	24	0	0	35	0	8	23	14	0

WASTE PRODUCTS OF AGRICULTURAL INTEREST—WOOL AND LEATHER WASTES.

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Shoddy.

CONSIDERABLE quantities of waste products have recently become available at the Yorkshire cloth mills as a result of the present large production of woollen cloth for military purposes. In normal times the amount of the waste material from cloth manufacture can probably all be absorbed by certain sections of the agricultural community, which have long made a practice of dealing with it, but the supplies at present are largely in excess of this amount.

Some of these waste products contain wool, and for this reason possess considerable manurial value, wool having long been known to be a good fertiliser. Many of the early writers on agriculture refer to it, and less than a century ago woollen rags used to be cut up by women on farms near London, and dug or ploughed into the soil. Nowadays, such a course is unnecessary, the vast development of the Yorkshire woollen industry having given the agriculturist a more efficient substitute.

Wool contains about 17 per cent. of nitrogen. Its constituents are more complex than the substances present in meat or fish meals, and it is therefore not so rapidly broken up in the soil, but it decomposes steadily with formation of ammonia, which is subsequently converted into nitrate. In addition, the organic matter has valuable physical effects on the soil, improving the tilth, regularising the water supply, and bringing about other desirable improvements.

During the working up of the wool in the first instance a number of short threads are obtained too small to be picked up by the machine. Some of these fragments find application in other industries, but part of the material is sold at a price which makes it possible for the agriculturist to use it as manure. Similar fragments, too small to be utilised, are obtained during the process of tearing up old clothes and woollen cloth and

making them into new cloth. It is these that are usually known as *Shoddy*.

Where the old material was all wool the resulting shoddy is, of course, practically all wool also, but more usually there is an admixture of cotton. Unfortunately for the farmer, cotton has no fertilising value: it contains no nitrogen, and its decomposition in the soil yields nothing known to be of any use for purposes of plant growth. The value of the shoddy therefore depends on the proportion of wool it contains. This can be estimated roughly by picking out a few fragments and burning them: strands of cotton burn easily with no smell, wool smoulders and gives off a characteristic odour. The analyst adopts a safer course and determines the amount of nitrogen, and on this basis only should shoddy be purchased. Large buyers, who deal with mills handling only pure wool, sometimes consider analysis unnecessary, but the cost is so small that it should never be omitted.

Several grades of shoddy exist: those that are practically pure wool, containing 10 to 15 per cent. of nitrogen, those admixed with more or less cotton, containing 5 to 10 per cent. of nitrogen, and those which are practically all cotton and dirt, containing only 2 to 5 per cent. of nitrogen. The highest grades are largely used by fruit and hop growers in Kent, and by manure merchants as a basis for making compound manures, and hence the ordinary supplies are readily taken up. The middle grades are obtainable in considerably larger quantities: in addition to the 5 to 10 per cent. of nitrogen they often contain a little phosphate and potash, but not sufficient to have much effect on their value. Thus a recent sample was found to contain 0.5 per cent. of potash (K_2O), and 0.4 per cent. of phosphoric acid (P_2O_5), in addition to 5 per cent. of nitrogen. These middle grade shoddies have also long been in use among fruit and hop growers, especially on the lighter soils. Experiments at Rothamsted, however, have shown that they give good results on ordinary farm crops, and that the benefit is not confined to light soils, but is also seen on heavy soils.

Since the decomposition is not completed in the soil during the course of a single season, shoddy is effective for two or three years, although it produces its chief effect on the first crop. This is well seen in the following Table, which shows the results of a series of experiments carried out at Rothamsted on the residual manurial values of shoddy.

TABLE I.—*Manurial Effect of Shoddy, $\frac{1}{2}$ ton per acre. Rothamsted, Little Hoos Field.—Total Produce per acre.*

	Swedes, 1904.	Barley, 1905.	Man- golds, 1906.	Spring Wheat, 1907.	Swedes, 1908.
	Tons.	lb.	Tons.	lb.	Tons.
Unmanured	10.6	2,588	17.7	4,334	15.1
Manured with Shoddy					
Year of application ..	14.7	4,393	24.2	7,495	19.7
1st year after application	..	3,656	23.6	6,231	22.2
2nd	..	..	21.0	4,550	19.1
3rd	..	..	..	4,667	16.3

	Barley, 1909.	Wheat, 1910.	Man- golds, 1911.	Wheat, 1912.	Swedes, 1913.	Barley, 1914.
	lb.	lb.	Tons.	Bush.	Tons.	lb.
Unmanured	3,850	2,561	11.7	24.2	7.9	2,805
Manured with Shoddy						
Year of application ..	4,558	3,461	14.7	28.1	10.7	4,510
1st year after ..	3,969	2,387	14.0	29.8	9.4	2,769
2nd	5,448	2,295	11.6	30.1	7.2	2,439
3rd	4,466	2,560	11.4	26.1	5.6	3,215

For purposes of comparison it is more convenient to express these results as percentages, reckoning the control plot as 100. The figures then become:—

TABLE II.—*Manurial Effect of Shoddy, $\frac{1}{2}$ ton per acre. Rothamsted, Little Hoos Field.—Total Produce per acre (unmanured = 100).*

	Swedes, 1904.	Barley, 1905.	Man- golds, 1906.	Spring Wheat, 1907.	Swedes, 1908.
Unmanured	100	100	100	100	100
Manured with Shoddy—					
Year of application ..	139	169	137	173	130
1st year after application	..	141	133	144	147
2nd	..	..	119	105	126
3rd	..	..	..	108	108

	Barley, 1909.	Wheat, 1910.	Man- golds, 1911.	Wheat, 1912.	Swedes, 1913.	Barley, 1914.
Unmanured	100	100	100	100	100	100
Manured with Shoddy—						
Year of application ..	118	135	126	117	135	161
1st year after ..	104	93	120	123	119	109
2nd	142	90	99	126	91	87
3rd	116	100	99	108	71	115

In these experiments the shoddy was applied at the rate of $\frac{1}{2}$ ton per acre at the time of the last ploughing. The returns were very striking, and were practically identical with those obtained from ordinary dung. Taking the average of all the crops the results are:

	Year of application	Successing year	2nd year after	3rd year after
Control	100	100	100	100
Shoddy, 10 cwt. per acre ..	110	112	109	103
Ordinary dung, 16 tons per acre	111	113	111	105
Cake-fed dung, 16 tons per acre	105	112	111	105
Peruvian guano, 8 cwt. per acre	150	101	95	95
Rapeseed cake, 10 cwt. per acre ..	136	100	100	94

The dressings of shoddy, guano, and rapeseed cake all supplied 50 lb. of nitrogen per acre.

Experiments on the fertilising value of wool have also been made at Gembloux by Grégoire and Hendrich* with very favourable results, the nitrogen proving nearly 90 per cent. as effective as that in sulphate of ammonia.

As shoddy contains nothing soluble it may be put on to the land at any convenient time in the winter. It can, however, go on later, and at Rothamsted it has been used as late as March; the essential point is that it must be applied before the last ploughing as it has to be worked into the land and not used as a top dressing.

Shoddy is one of the cheapest nitrogenous manures on the market; it can normally be obtained at about 4s. or 5s. per unit of nitrogen at the Yorkshire mill, but carriage is rather heavy, so that on farms in the south the total cost may be 7s. or 8s. per unit. Even at this higher price it is distinctly a useful fertiliser. It is doubtful, however, whether the lowest-grade shoddies, containing less than 5 per cent. of nitrogen, can advantageously be used at any distance from the mill, and in any case the cost per unit should be well below that of fish guano.

Being a waste product, and not a definitely manufactured article, shoddy is liable to some variation in composition, but the consignment as delivered should not differ widely from the sample offered at the time of purchase. Shoddy is usually in good mechanical condition, and so finely divided that it can

easily be applied to the land. Some of the other wastes also grouped with shoddy, such as carpet waste, cloth clippings, etc., are not so good in this respect.

Occasionally, samples are offered as having been specially freed from oil, or treated with sulphuric acid to facilitate decomposition in the soil, but there is nothing to show that either treatment is of any advantage to the farmer. There is, therefore, no justification for paying a higher price for such shoddies.

Other varieties of wool waste arise during the cleaning or "fettling" of the raw wool, and may prove to be of manurial value; some are, at any rate, deserving of trial, provided the unit price is not high. One sample, however, recently came to hand for which 14s. per unit was asked for the nitrogen, but there was nothing to show that it was worth as much. Even this, however, is less than is sometimes asked for low-grade manures.

Leather Waste.

Considerable quantities of leather scraps are available in Leicester, Northampton, and the surrounding districts, as waste from the boot-making industry. Like wool, leather is a nitrogen compound, but during the process of manufacture it becomes so resistant that it no longer breaks down in the soil. It has never been found to possess the slightest manurial value.

The soil organisms, however, can attack a very wide range of nitrogen compounds, and it is remarkable that leather should remain outside their scope. It ought not to be beyond the power of modern chemistry to change leather from one of the few nitrogenous substances that soil organisms will not attack to one of the many that they will.

The problem is not a new one, and attempts have already been made to convert waste leather into a fertiliser. Although the problem is not solved, sufficient has been done to show that it is by no means hopeless. At several of the Experiment Stations in the United States treatment of ground leather with sulphuric acid has been found to facilitate decomposition considerably. In Lindsey and Smiths' experiments at the Massachusetts Experiment Station* the availability of the nitrogen was increased so much that it became 60 per cent. as effective as nitrate of soda. Good results were also obtained as a result of this treatment by Jenkins and Street at the Connecticut Experiment Station†, and by Hartwell

* Report, 1894, pp. 285, 321.

† Report, 1911, p. 100.

* Annales de Gembloux, 1911, 21, 395-605.

and Pember at Rhode Island. Roasting has been tried with some success on the Continent. Müntz and Nottin* found that the rate of nitrification of roasted leather was nearly half that of dried blood, and about one quarter that of sulphate of ammonia, and an almost identical result was obtained in a totally different experiment at Gembloux†, where raw ground leather was found to be useless, but roasted ground leather was nearly one quarter as effective as sulphate of ammonia. Thus a case seems to have been made out for further experiments.

It is highly desirable that experiments should be made to discover the best means of converting waste leather into manure. The chemistry of tanning has been so carefully studied at the University of Leeds and elsewhere that it ought not now to be difficult to reverse the process and produce a soft, easily decomposed material. There is evidence from the agricultural side that a valuable manure would result. Soft untanned leather is already used with considerable success in the Evesham district; the scraps obtained from the glove-making industry are found to be of marked value for putting in with young Brussels sprouts, cauliflower plants, etc., yielding valuable products when they decompose, and affording a useful root run until the plant is established.

Unfortunately, some of the dealers have not waited for a process whereby a really useful manure can be produced, but have already ground leather scraps to a fine powder which they have offered to manure merchants for incorporating in compound manures. A sample recently came into the writer's possession containing 7 per cent. of nitrogen, which was offered to the trade at 21s. per ton, i.e., 3s. per unit of nitrogen. Its manurial value was probably nil, but an unscrupulous dealer could easily have incorporated a certain proportion with a compound manure and asked 15s. per unit for it. Fortunately, leather dust can easily be recognised by the analyst because it floats on water and swells up, but it is very regrettable that a substance which apparently might, with skilful investigation, become a legitimate source of profit for the industry as a whole should acquire a bad reputation among agriculturists because it is exploited by a few people for purposes of fraud. The only way of meeting the fraud is to discover some process for converting the waste into manure, and thus benefiting both the leather industry and the farming community.

* Comptes Rendues, 1908, 147, 928-926.

† Annales de Gembloux, 1911, 21, 595-603.



FIG. 1. General View of part of the Lez-les-Bois Cross Bays, showing the stream of water in the foreground; the water from the Cross Bays is running down the other side of the path separating the stream from the bays.

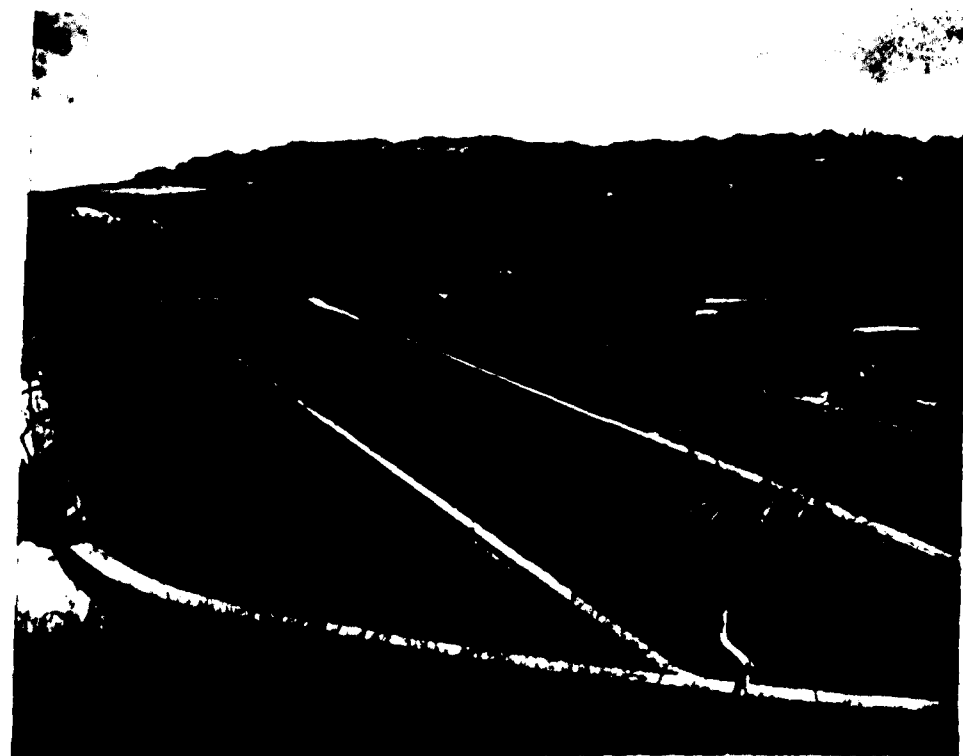


FIG. 2. Another View of the Bays.

THE CULTIVATION OF WATERCRESS.

DURING recent years watercress (*Nasturtium officinale*) has been grown commercially in Great Britain on a very large scale, an area of as much as 25 acres being handled by a single grower. As a salad this plant can scarcely be surpassed; and, in addition, it possesses medicinal properties as a result of its content of sulphur and an aromatic oil, to the presence of the latter of which it owes its peculiar pungent flavour. Iodine, iron, phosphates, and other salts are also present. Properly cultivated in the pure spring water of the chalk strata, it is inviting and palatable.

Watercress comes at a time of the year when other green food is scarce, and for many years it has been in great demand among the mill hands of Lancashire and Yorkshire, the iron workers of the Black Country and in the congested areas in the London district. It is estimated that over 5,000 tons are consumed in this country annually.

The conditions under which the crop is grown on a large scale are in many instances ideal, and it is no exaggeration to say that probably no vegetable to-day is grown under such perfectly hygienic conditions.

Varieties and Water Supply.—Two varieties of watercress are generally grown: (1) the Brown-leaved or Winter Cress, and (2) the Green-leaved or Summer Cress. There are several types of both varieties and large growers have found it desirable to carry out considerable selection when stocking fresh beds, and thus have eventually obtained a stock which comes as near as possible to their ideal of what a perfect cress plant should be.

Large growers at a distance from centres of consumption confine themselves largely to the culture of the Brown-leaved Winter variety; it stands carriage well, whereas the Green-leaved or Summer variety suffers in transit during hot weather if the distance to be covered is considerable.

The Green-leaved or Summer variety is grown, therefore, to the greatest extent by the growers who are near the large centres of population and where the distance to be travelled between the beds and the market is short.

The Green variety is often grown where the source of the water supply is a brook or river, and in very hot summers such supply is liable to shrink in volume and become contaminated with sewage, etc. This fact, along with the evidence of the medical faculty, has tended to prejudice consumers against

the Green variety. Great improvement has, however, been made in the hygiene of the culture of this variety.

On the other hand, the Brown Cress, which is the staple product in winter, spring and early summer, is in most cases grown by the aid of water obtained from artesian borings. One large grower has as many as 74 borings to a depth of from 50 to 150 feet (see photograph, Fig. 8, showing the water bubbling up through the artesian borings).

The water from the artesian borings is at a fairly constant temperature of about 52° F., any variation from this standard being very slight. It will be evident, even to those unacquainted with the general principles of watercress culture, that with this temperature of the water the cress grower is independent of climatic conditions and that growth can go on all through the winter and spring. To be free from the danger of frost the borings must be equally distributed over the cultivated area.

Locality. The situation of the beds must depend on the availability of water from the chalk strata by means of boring, and this being of the first importance very large growers exist to-day in some rather remote district. Their produce is conveyed several miles by motors to the nearest station.

In the case of small growers who cannot afford this means of conveyance, proximity to a station is essential.

Formation of Beds. A bottom of chalk, lightly pulverised, is the best foundation for a bed, but clean gravel is also very suitable. Some growers use a little soil in the form of a medium gravelly loam, but some of the largest and most successful growers use no soil.

The beds are of no definite shape, this depending upon the configuration of the ground. Those in the shape of a parallelogram are probably the most convenient.

A slight slope is necessary to keep up a gentle circulation of the spring water, and the water after traversing the beds is led away into a ditch or stream. In some districts the water is dammed up in frosty weather in order to submerge the plants and thus protect them. Where, however, the supply of water from artesian borings is adequate no such process is adopted.

The beds are usually thoroughly cleaned out every two years, all weeds, lime, etc., being removed and the bed relevelled.

The cost of formation of a watercress bed may amount to as much as £100 per acre; the rent of beds varies from £15 to £30 per acre per annum.

Propagation and Planting. Amongst large growers of Brown Cress the planting is usually done during June, July and

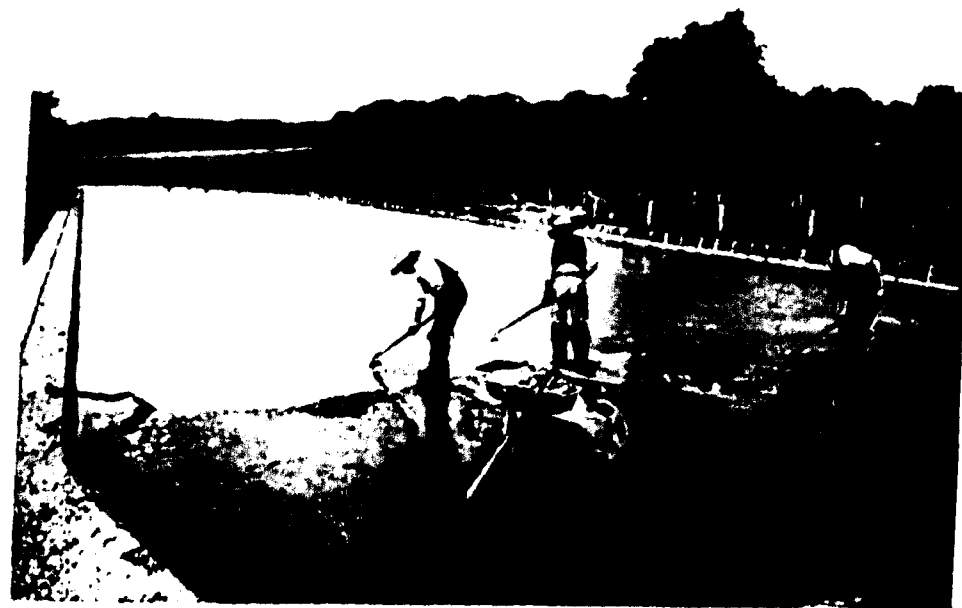


FIG. 3. Re-levelling a bed prior to the planting, after water has been cleared.



FIG. 4. Planting Cuttings after the preparation of the bed. This surface contains no mud, but is simply the sandy gravel overlying chalk.

August; in the case of Green Cress it may be done later and may extend into October.

The leading shoots are pinched out of the plants and portions 6-8 inches in length immediately behind the growing point, which has been removed, are selected. These are placed in quantity in the newly cleaned beds in a depth of from 3-4 inches of water. The replanting is usually carried out every two years.

A few stones are sometimes used to steady the plants and keep them in position.

Growers who use soil sometimes insert the ends of the cuttings into the bottom; but as has been already stated many very large growers use no soil (*see* Fig. 4).

Gathering.—The cress is gathered by men furnished with water-tight boots. These boots are a considerable source of outlay to the grower, costing about £3 10s. per pair.

The employment of two men per acre right through the season is necessary in the case of large commercial beds; a skilled workman will cut 200 dozen bunches per day.

The tying is done by boys and women and the usual rate of pay is $\frac{1}{4}$ d. per dozen bunches. Good hands will make from 15s. to 18s. per week.

When the first cutting is commenced only the most forward shoots are selected; later the cress is cut straight ahead, all shoots being taken.

The thinning process is illustrated in Fig. 6.

Marketing.—The bulk of the cress is sent by passenger train packed in light "chips" containing 7 lb. and 14 lb. A 14-lb. chip holds 6 dozen bunches, and 576 bunches usually weigh 1 cwt. When bought in quantity 14-lb. chips can be obtained for about 36s. per gross.

The price per cwt. is usually about 10s. 10d.—*i.e.*, equal to about £11 per ton. From one establishment alone 411 tons were sent out last season.

The bunches before packing are washed in pure spring water and the chips are again dipped after packing.

Owing to the facts that watercress is heavy as compared with other green produce and also that great quantities are sent to market by passenger train, the carriage reduces the profit very considerably. Some idea of the extent to which the cost of carriage reduces the profit is afforded by the following example of the charges on a consignment despatched from Dorset:—

	£	s.	d.
Gross amount realised in the market for a consignment of 118½ cwt.	95	14	2—i.e., 1½d. per lb.
Railway charges:			
Carriage paid by sender	20	3	11
Carriage paid by salesman	13	9	
Carriage paid by salesman for re- turned empties	3	4	4
	24	2	0

Net amount realised for consignment by
grower 71 12 0—i.e., 1½d. per lb.

The railway charges thus worked out at about ½d. per lb. This is exclusive of the cost of conveyance to the station, a distance of several miles.

A piece of ice is sometimes placed in the centre of the crates when cress is being dispatched from a considerable distance in summer. This applies more particularly to the Green variety as many of the large Brown Cress growers do not carry on a summer trade, especially where the distance from the markets is great.

Enemies.—Although the watercress grower seldom suffers from wholesale devastation by insects, he is by no means immune to their ravages. Where water is introduced from a stream the fresh water shrimp often does considerable damage by devouring the young rootlets. Where water is obtained by artesian borings from the chalk this pest is seldom troublesome.

Water beetles are often found in great quantity in cress beds, but it has not been clearly proved that they do much harm.

In beds surrounded by woodwork the Caddis Worms are often present in large numbers and are a source of trouble to the grower. In cases of severe attack, the only remedy which is effective in checking the pest is clearing out the cress and replanting after thorough cleaning of the margins and bottom of the beds. If the beds can be left dry for a week or two before planting, the worms are carried away by the first flooding, as they readily rise to the surface and remain floating.

Where the beds are surrounded by quantities of cruciferous weeds, Flea Beetles sometimes prove troublesome; but where good culture prevails this is seldom the case.



FIG. 5.—A crop of Brown Spring Watercress.



FIG. 6.—Men gathering by thinning.

No fungoid diseases seem to give trouble. A peculiar spotting on the leaves in spring, resembling a rust, is attributed by some growers to the effects of very bright sunshine following a gentle shower of rain. It is thought that the drops of water act as foci for the rays and cause burning.

Weeds.—There are several aquatic and semi-aquatic plants which sometimes give trouble, such as the Lesser Duckweed (*Lemna minor*) and other species of the genus, Frogbit, Marshwort (*Apium nodiflorum*), Water Starwort (*Callitriche verna*), and Brooklime. The great safeguards are care at the time of planting and persistent removal of stray plants as they appear.

Analysis of Water.—As evidence of the purity of the water in which much of our market cress is grown, the following Report by a well known analyst is appended :—

REPORT OF THE ANALYSIS OF TWO SAMPLES OF WATER FROM
THE BEDS OF A LARGE GROWER AND LABELLED NOS. 1
AND 2.

One sample was taken from the top and higher level of a cress bed and the other from the exit or lower level.

	1.	2.
	Grains per gallon.	
Solids (dissolved mineral matter) ..	8.5	9.0
Chlorine " " ..	1.7	1.7
Nitrites " " ..	0.0	0.0
Nitrates " " ..	0.0	0.0
Iron " " ..	faint trace	faint trace
Lead or copper " " ..	0.0	0.0
Oxygen absorbed in 15 min. at 212 ft.	0.0	0.0
	parts per million	
Free Ammonia	00.1	00.1
Albuminoid Ammonia	00.2	00.2
Colour as seen through a 2-ft. tube..	colourless	colourless

Opinion—Both the samples are excellent waters, quite free from organic contamination, and the best I have examined for some time.

(Sgd.) J. COMYNS LEACH, M.D., B.Sc., Lond.,
D.P.H. Camb. & Lond., F.I.C., &c.,
County Analyst.

28th October, 1914.

In the report of the Medical Officer to the London County Council for the year 1913, in which are embodied reports by Dr. Frank Clowes (the Council's Chemist) and Dr. A. C. Houston on Watercress and Watercress Beds in the neighbourhood of London, the following occurs :—

“ It is quite clear from the Inspector's inquiries and from Dr. Houston's results that cress of the best quality can be grown under conditions to which, from a public health point of view,

no exception can be taken ; that there is under existing circumstances no material risk in consuming the watercress supplied from the majority of the beds sending watercress to London."

If the watercress is thoroughly cleansed in pure water before eating, there would appear to be little risk from the use of that grown under present conditions. The principal requirement is to ensure that the cress shall be grown in water which is free from risk of contamination, preferably water from a deep source—a spring or artesian well. It should not be grown in water which is liable to fouling by surface water, or drainage from land which is manured by privy or ashpit refuse, by sewage or house drainage, by the contents of any privy, cesspool, or water closet escaping into it, or by matters from any knacker's yard, slaughterhouse, or premises on which any offensive business or trade is conducted. The water also should not be mixed with any liquids escaping from fold or farm yards or pigsties, nor liable to contamination by cattle, in the act of drinking it or otherwise. Growers of watercress will be well advised to ask for the guidance of the local Medical Officer of Health as to whether the conditions under which the cress is grown obviate all risk of contamination.

In order to avoid risks of contamination by human agency it is desirable that watercress beds should not be near urban centres. If they are so situate, they should be enclosed by a fence or otherwise. The beds should be properly cleansed, and all decaying vegetation removed from time to time. The persons gathering the cress should be supervised, to ensure that they are not suffering from any infectious illness whilst handling it. Care should also be taken that, if the cress is washed after gathering, this should be effected with pure water. The cress should, further, be properly protected from accidental contamination while in transit to the consumer.

SEED TESTING FOR FARMERS.

It is upwards of forty years since seed testing as at present understood was established in Denmark and Saxony, and the importance of a definite and analytical examination of seeds, to ascertain from every point of view whether they are good for sowing, is now recognised in every civilised country, the Governments of almost all of which support official Seed Control Stations.*

* Various terms used in this article are briefly explained at p. 1109 and might with advantage be read at the outset.

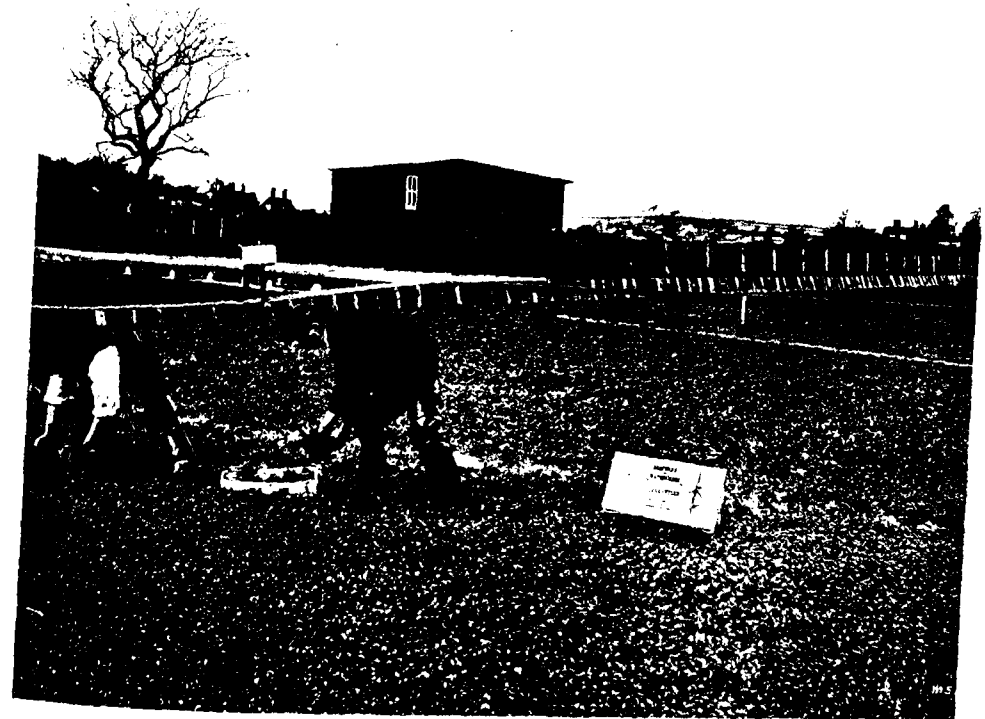


FIG. 7.—Cutting Watercress and putting in non-returnable Packages.

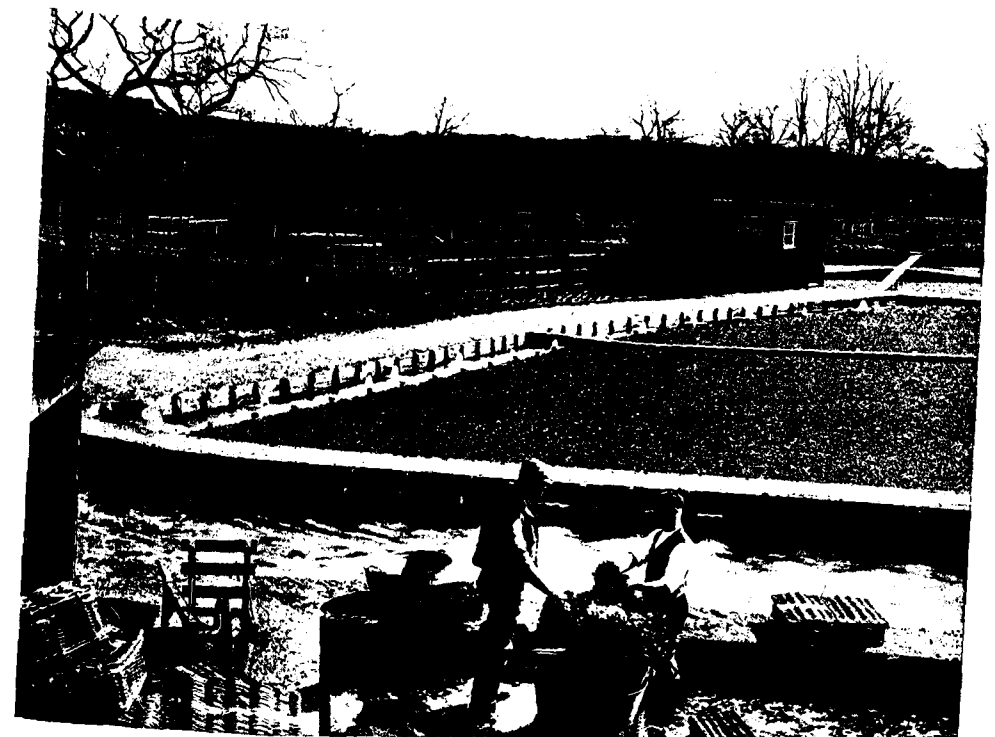


FIG. 8.—Method of Handling and Packing the Cress. (Note the artesian wells at the top of the beds.)

The Importance of Seed Testing.

The following facts may help to convince English farmers that it is worth their while to take the utmost pains to ensure that their seeds are good.

1. The amount spent on seeds in this country (cereals, pulse, roots, rape, vetches, lucerne, sainfoin, clovers, and grasses) amounts to millions of pounds sterling annually, the value of the seeds named, sown in Great Britain in 1914, being estimated at nearly £7,000,000 (the average of four estimates).

2. Increased crops are proved to result from the use of seed of improved quality, having regard to purity, and power of germination.

3. The success of a given crop may depend entirely on the seed sown.

4. Seeds are perhaps more variable in quality than any other goods the farmer has to purchase. The *Purity* of seed varies according to the manner of growth, method of harvesting, and cleaning operations. The *Germinating Power* varies with the climate and exposure to weather during the period of growth—especially at the time of harvesting—as well as with the mode of harvesting and storing (either in the rick or after threshing). Old or dead seeds are sometimes mixed with fresh seed of the same species in order to increase profits.

5. Seed testing or seed analysis reveals the presence (or absence) of weed seeds, which have an enormous capacity for damage when sown broadcast over the farm in impure seeds. It has been estimated that about 16½ million pounds sterling per annum is lost by farmers in Great Britain in growing (and getting rid of) weeds, a large proportion of which are sown with agricultural seeds.

Examples of Low-quality Seeds.

Three samples of perennial red clover which were bought at 1s., 10d. and 9d. per lb., respectively, were examined, with the following result* :—

Sample.	Price per lb.	Per cent. of good seeds.	Per cent. of inferior seeds.	Per cent. of weed seeds.	No. of good seeds per lb.	No. of good seeds for 1d.
No. 1	s. d. 1 0	97·1	1·7	1·2	213,620	17,801
" 2	0 10	78·6	13·4	8·0	172,920	17,292
" 3	0 9	60·3	28·1	11·6	132,660	14,740

If the whole of the seeds sown amounted to 10,000,000 per acre, and if all were equally impure, sample No. 1 would provide nearly 25 weed seeds per square yard, while No. 3 would

* *Journal*, October, 1912, p. 529.

SWISS SEED CONTROL STATION, ZÜRICH.
Table showing the Maximum, Minimum, and Average Purity and Germination of Seeds tested in 1912-13, and the Average Purity and Germination of Seeds tested from 1876-1913.

SPECIES.	Average per cent. of		Maximum per cent. of		Minimum per cent. of		Average, 1876-1913.	
	Purity.	Germination.	Purity.	Germination.	Purity.	Germination.	Purity.	Germination.
Red Clover	94.1	89	99.6	99	64.2	39	96.1	90
White Clover	93.6	86	99.3	98	66.5	48	94.7	82
Alsiike	93.4	84	99.4	96	44.1	34	95.3	85
Lucerne	94.6	86	99.4	98	91.6	70	96.7	90
Sainfoin	96.3	76	99.8	95	86.3	17	97.6	75
Crimson Clover	95.5	90	98.2	96	94.0	78	95.7	88
Hop Clover	98.1	79	99.7	93	55.0	32	90.4	76
Perennial Rye-grass	96.6	83	99.9	97	68.3	0	95.9	82
Italian Rye-grass	95.7	83	99.9	99	35.2	21	95.4	81
Timothy	97.8	95	99.8	99	51.3	44	97.8	93
Crested Dogtail	95.5	78	99.8	97	39.0	16	92.4	78
Forrtail	74.5	83	96.4	97	19.8	42	74.1	70
Meadow Fescue	92.1	92	99.6	99	30.1	8	94.2	84
Red Fescue	91.8	62	97.4	97	67.1	0	83.8	63
Sheep's Fescue	72.8	82	98.1	96	15.7	11	75.6	76
Smooth-stalked Meadow-grass	81.7	74	98.2	93	54.3	11	84.1	68
Rough-stalked Meadow-grass	82.1	89	96.2	97	49.2	33	88.1	77
Cocksfoot	78.2	90	96.6	99	15.4	39	77.5	84
Golden Oat-grass	73.6	76	90.8	90	14.1	50	71.0	64
White Mustard	98.9	94	99.3	99	98.3	88	95.8	83
Linseed	97.8	90	99.8	97	88.0	76	97.9	87
Turnip	—	—	—	—	—	—	97.3	87
Swede	—	—	—	—	—	—	98.6	88
Mangold	—	—	—	—	—	—	97.8	124

provide no less than 240 weed seeds per square yard. The results of the examination for purity of samples No. 1 and No. 3 are graphically shown in Fig. 1.*

Similar quantities were found in examinations of alsike, white clover, and mixtures of seeds for temporary pastures.

The variability of different samples of seeds of the same species in regard to purity and power of germination is shown by the Table on p. 1100, giving the maximum, minimum and average purity and germination of seeds tested at the Swiss Seed Control Station in the year 1912-13, and the average purity and germination ascertained in the years 1876-1913.

3. In the course of the sowing season of 1912 an enquiry conducted by the Board resulted in the examination of 208 samples of seeds, 168 of which were purchased by one of the Board's Inspectors in seventy-seven centres, while 40 were sent in by farmers. Some of the results may be given as follows:—

SAMPLES.	REMARKS.
56 (sold as) English or Welsh Red Clover.	Average real value,† 67.34 per cent. 30 [samples contained dodder—20 in considerable quantity; 8 contained both Chilian and European dodder.
31 White Dutch Clover	Average real value, 50.6 per cent. 18 samples contained dodder.
29 Alsike	Average real value, 54.45 per cent. 19 samples contained dodder.
10 Sainfoin	Average purity, over 99 per cent.; average real value, 45.8 per cent.
37 Italian Rye-grass	Average real value, 79.24 per cent.
23 Perennial Rye-grass	Average real value, 72.5 per cent.

The average "real value" in almost all cases was low.

A similar examination in the sowing season of 1913 showed:—

SAMPLES.	REMARKS.
42 (sold as) English or Welsh Red Clover.	Average real value,† 58.1 per cent. 28 samples contained dodder, viz., 12 European dodder, 12 both European and Chilian dodders, and 4 Chilian dodder.
30 White Dutch Clover	Average real value, 61.3 per cent. 8 samples contained dodder.
21 Alsike	Average real value, 58 per cent. 8 samples contained European dodder.
29 Sainfoin	Average purity, 98.5 per cent.; average real value, 35.5 per cent.
24 Italian Rye-grass	Average real value, 72.5 per cent.
23 Perennial Rye-grass	Average real value, 71.8 per cent.

* Reproduced from an article by Mr. W. Borlase in this *Journal*, October, 1912, p. 529.

† For explanation of "real value," see p. 1109.

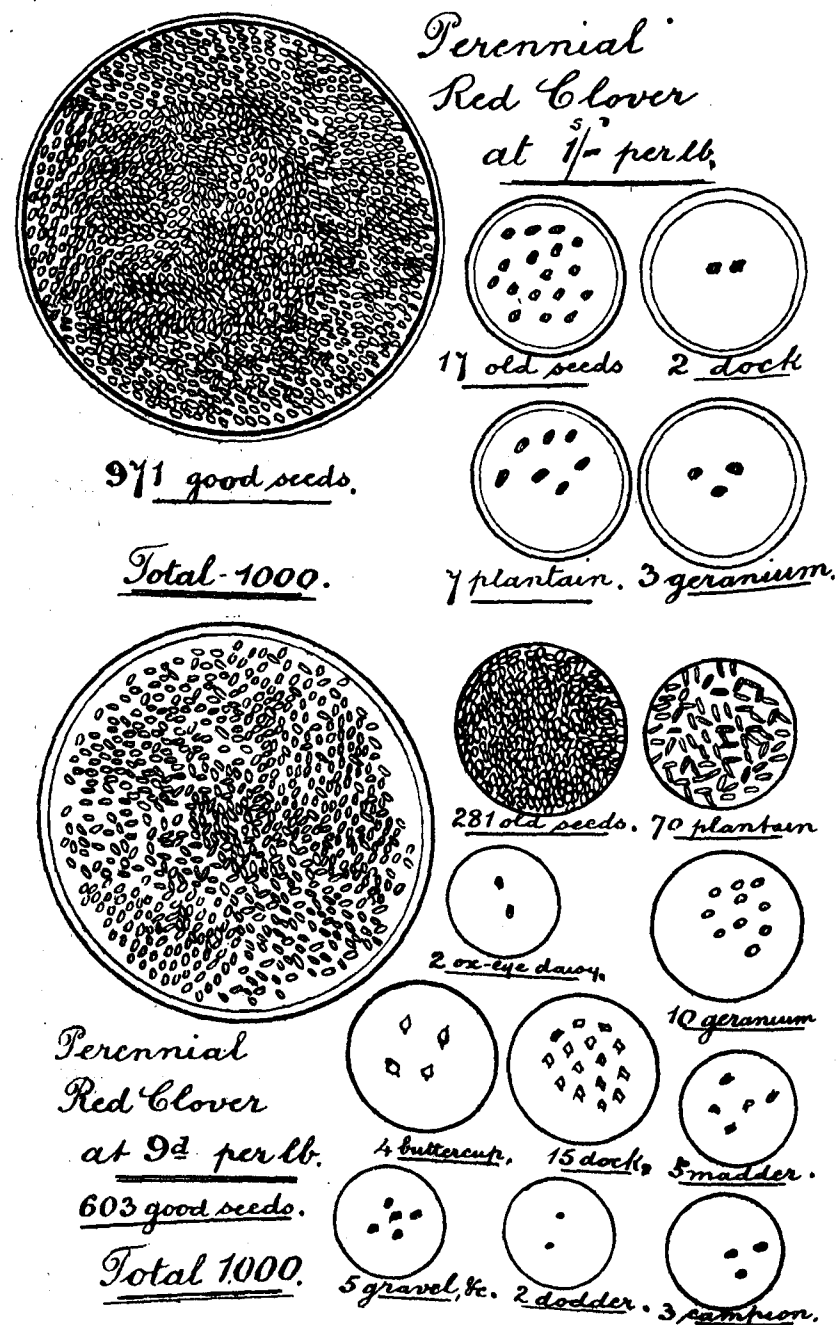


FIG. 1.—Good seeds and weed seeds found in samples of red clover: above, at 1s. per lb.; below, at 9d. per lb. (see pp. 1099 and 1101).

Examination of samples in 1914 showed the following results, among others (see also p. 1131):—

SAMPLES.	REMARKS.
30 (sold as) English Red Clover	Average real value, 55.9 per cent. About $\frac{1}{4}$ contained dodder.
43 White Dutch Clover	Average real value, 56.9 per cent. About $\frac{1}{4}$ contained dodder.
25 Alsike	Average real value, 62.48 per cent. About $\frac{1}{4}$ contained dodder.
24 English Cow-grass	Average real value, 72.67 per cent.
20 Cocksfoot	Average real value, 63.13 per cent.
13 Meadow Foxtail	Average real value, 51.37 per cent.

4. A clover sample offered for sale as white clover was submitted to the Board, and examination showed it to be an annual and comparatively worthless species (*Trifolium parviflorum*). This species appears to have been offered many times for white clover.

5. Information as to the presence of weed seeds is of the utmost importance. The following table shows the approximate numbers of some common weed seeds which are contained in $\frac{1}{100}$ th part of 1 lb., and which might accordingly be found in 1 lb. of any seed containing 1 per cent. of any one of them as an impurity (*Journal*, January, 1915, p. 832):—

Species of Weed Seed.	No. of Seeds.
Creeping Buttercup (<i>Ranunculus repens</i> , L.)	2,900
Red Field Poppy (<i>Papaver Rhæas</i> , L.)	40,000
Charlock (<i>Sinapis arvensis</i> , L.)	1,980
Shepherd's Purse (<i>Capsella Bursa-pastoris</i> , Moench)	45,000
Field Pansy (<i>Viola tricolor</i> , L.)	6,700
White Campion (<i>Lychnis vespertina</i> , Sibth.)	3,500
Chickweed (<i>Stellaria media</i> , Cyrill.)	12,000
Mouse-ear Chickweed (<i>Cerastium vulgatum</i> , L.)	36,000
Dove's-foot Geranium (<i>Geranium molle</i> , L.)	4,500
Cut-leaved Geranium (<i>G. dissectum</i> , L.)	1,900
Wild Carrot (<i>Daucus Carota</i> , L.)	4,400
Field Madder (<i>Sherardia arvensis</i> , L.)	2,500
Ox-eye Daisy (<i>Chrysanthemum Leucanthemum</i> , L.)	11,000
Stinking Mayweed (<i>Anthemis Cotula</i> , L.)	12,800
Scentless Mayweed (<i>Matricaria inodora</i> , L.)	11,600
Wild Chamomile (<i>Matricaria Chamomilla</i> , L.)	79,000
Groundsel (<i>Senecio vulgaris</i> , L.)	21,800
European Clover Dodder (<i>Cuscuta Trifolii</i> , Bab.)	18,000
Chilian Dodder (<i>Cuscuta racemosa</i> , Mart.)	7,300
Self-heal (<i>Prunella vulgaris</i> , L.)	6,800
Rib-grass (<i>Plantago lanceolata</i> , L.)	3,000
Hoary Plantain (<i>P. media</i> , L.)	8,500
Goosefoot or Fat-hen (<i>Chenopodium album</i> , L.)	6,600
Curled Dock (<i>Rumex crispus</i> , L.)	3,200

Species of Weed Seed.	No. of Seeds.
Sheep's Sorrel (<i>R. Acetosella</i> , L.)	10,500
Yorkshire Fog (<i>Holcus lanatus</i> , L.) (in glumes) ..	8,900
Yorkshire Fog (<i>Holcus lanatus</i> , L.) (without glumes)	12,700
Wavy Hairgrass (<i>Aira flexuosa</i> , L.)	8,400
Tufted Hairgrass (<i>A. caespitosa</i> , L.)	25,500

Thus, if a red clover sample contains 1 per cent. by weight of European clover dodder each pound of this so-called "red clover" seed will contain 18,000 seeds of dodder: if 16 lb. of red clover were sown per acre, this would mean 60 dodder seeds per square yard over the whole area sown. Similarly, 1 per cent. by weight of rib-grass seeds in 16 lb. of red clover would represent 10 seeds per square yard over the whole area.

Further, in the case of many weed seeds "one per cent. by weight" really represents a much higher percentage by number of seeds.* Thus:—

One per cent. by weight of the following weed seeds:	Represents the percentages by number given below:			
	In Red Clover.	In Alsike or White Clover.	In Rye Grasses.	In Meadow Foxtail.
Creeping Buttercup	—	—	1.2	0.6
Red Field Poppy	17.3	5.5	—	—
Shepherd's Purse	19.8	6.2	—	—
Field Pansy	3.0	—	—	—
White Campion	1.5	—	—	—
Chickweed	5.2	1.6	—	—
Mouse-ear Chickweed	—	5.0	—	—
Wild Carrot	1.9	—	—	—
Field Madder	1.1	—	—	—
Ox-eye Daisy	4.8	1.5	—	—
Stinking Mayweed	5.5	1.7	—	—
Scentless Mayweed	5.0	1.6	—	—
European Clover Dodder	7.6	2.4	—	—
Chilian Dodder	3.2	—	—	—
Self-heal	2.9	0.9	—	—
Rib-grass	1.5	—	—	—
Hoary Plantain	3.7	1.2	—	—
Goosefoot or Fat-hen	2.8	0.9	—	—
Curled Dock	1.4	—	—	—
Sheep's Sorrel	4.6	1.5	4.4	2.2
Yorkshire Fog (in glumes)	—	—	3.6	1.8
Yorkshire Fog (without glumes)	—	—	—	—
Tufted Hairgrass	—	—	5.1	2.5
				5.0

Thus, if one-hundredth part of the weight of so-called red clover seed is really poppy seed, 17 per cent., or 1 in 6, of the seed sown will be poppy.

If the buyer realises what the presence of 1 per cent. of a given weed seed really indicates, there will be little fear of his using still more inferior samples containing 5 per cent., 10 per cent. or more of weed seeds. At the present time such inferior seeds are used more frequently than is generally supposed.

* *Journal*, January 1915, p. 833.

Losses due to Low-quality Seed.

In the case of the so-called red clover mentioned on p. 1099 the seed at 1s. per lb. supplied 17,800 clover seeds for 1d., while that at 9d. supplied only 14,740 clover seeds for 1d., representing a shortage of 36,720 seeds on every shillingsworth of the lower quality as compared with the higher. A further source of loss in connection with the cheaper sample would consist in the large amount of weed seeds present, as these would undoubtedly injure the crop and cause expense in destroying them—probably over several years.

Again, five samples of red clover seeds* showed the following purity and germinating capacity, and hence their real value was as shown in the third column:—

No.	Purity (per cent.).	Germinating capacity (per cent.).	Real Value (per cent.).
1	82	69	56.6
2	80	72	57.6
3	90	62	55.8
4	92	81	74.5
5	82	85	69.7

The buyer should expect a red clover of 98 per cent. purity and 95 to 98 per cent. germination, or a real value of 93.1 to 96.0 per cent. If a real value of only 90 per cent. were expected, the loss between a sample of that value and the five quoted (presuming the prices are the same) would be as follows:—

No.	Loss in lb. per cent.	i.e. Loss on £5 worth of seed.
		£ s. d.
1	90-56.6=33.4 lb.	1 13 5
2	90-57.6=32.4 "	1 12 5
3	90-55.8=34.2 "	1 14 2
4	90-74.5=15.5 "	15 6
5	90-69.7=20.3 "	1 0 3½

The loss caused by the inclusion of useless seeds, weed seeds and rubbish in Nos. 1, 4 and 5 of these clover samples on purchasing 100 lb. is graphically shown in Fig. 2 (p. 1106).

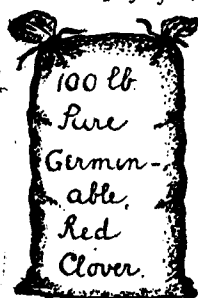
Another source of loss may arise in the sowing of an insufficient amount of good seed, when the sample is of poor quality. For example, in the case of the three clover samples mentioned on p. 1099, 6¼ lb. of the seed at 1s. per lb., costing 6s. 3d., will produce more clover plants than 10 lb. of the seed at 9d., costing 7s. 6d. That is to say, it would

* Annual Report of the Intelligence Division of the Board for 1905.

directly save the farmer 1s. 3d. to buy $6\frac{1}{4}$ lb. of the former instead of 10 lb. of the latter, and the $6\frac{1}{4}$ lb. would cover as much ground with an equal number of good seeds as the cheaper sample, while it would not introduce such a large quantity of weed seeds.

The possible loss due to the introduction of weed seeds cannot readily be estimated in money, but 5 or 10 per cent. of weed seeds must be paid for, and in the purchase of 100 lb. of clover seed at 1s. per lb. they would cost 5s. or 10s. Weed seeds also reduce the yield of the crop sown by occupying a considerable portion of the ground, while they cost money for cleaning.

What the
Farmer pays for.



What the Farmer gets.



Sample No. 1.

Sample No. 2.

Sample No. 3.

FIG. 2.—Showing the losses in purchasing samples 1, 4 and 5 of seeds referred to above (p. 1105).

Low-grade clovers are likely to contain the seeds of dodder,* a parasitic weed which attaches itself to the growing clover and lives on its juices, often spreading rapidly and killing large areas of the clover crop.

Finally, seeds may be the means of introducing insect and fungus pests, the presence of which may be revealed during the process of seed-examination by the expert.

What Pure, Good Seed means.

A good sample of seed should fulfil several conditions, and farmers should be careful to purchase on this basis:—

1. It should be "true to name" or of the correct species.
2. It should be as "pure," or free from impurities, as modern knowledge and machinery can make it.

* See Leaflet No. 180.

3. It should be "heavy," dry, fresh and vigorous, with a high power of germination or growth. In clovers the percentage of "hard seeds" should be low.

4. It should be of stated origin, *i.e.*, British or from a specified country or locality.

5. It should be free from injurious insects and fungi.

How Farmers may Purchase Good Seeds.

What steps can the farmer take to guard against sowing bad seed or seed of low quality?

1. The seed merchant should be asked for a guarantee (*a*) as to purity and germinating capacity, and (*b*) as to the weed seeds present, making the latter point an important part of the contract to purchase.

2. The farmer should purchase his seeds subject to the right of return if, on analysis by a recognised agricultural botanist, the seeds do not come up to the guaranteed standard. Farmers should deal only with firms who are prepared to adopt this arrangement.

3. The farmer should be prepared to pay a fair price for the seed he requires: if he insists on a low price he is practically insisting on low quality. The examples given above show that the seed of highest cost is probably the best, considering the number of good seeds for 1d. only, quite apart from the introduction of weed seeds.

Seed merchants should receive the hearty encouragement of farmers to supply only seeds of the very highest quality at a fair price. If they give proper support, farmers may expect good results. At the same time farmers need not pay an excessive price for their seeds.

4. Farmers should submit samples of the seeds they purchase, "under guarantee and subject to analysis," to a competent agricultural botanist at one of the Agricultural Colleges or to a County Agricultural Organiser, as indicated in the list on pp. 1108 and 1109, and only accept the bulk on his recommendation to do so. Instructions as to sampling, labelling, etc., should first be asked for from the expert concerned.

5. In the case of seed mixtures for rotation grasses and permanent pasture, farmers should purchase the ingredients separately and mix them themselves, so more effectually ensuring that they get the species and quantities required.

6. Farmers in the same counties or districts might do well to co-operate, both in the purchase and examination of the seeds they require.

7. Finally, in sowing seeds of their own harvesting—cereals or other seeds—farmers will be well advised to be extremely careful that such seeds are thoroughly cleaned. They might well be examined by an expert as though purchased from a seed merchant. *Sweepings from the hay-loft, from hay-carts and similar sources should on no account be used for pastures.*

It must here be emphasised that a seed analysis or examination should contain a statement as to the *Purity*, the *Germinating Capacity*, and the *amount and nature* of the *Impurities*—particularly noting *Weed Seeds*. The *Speed of Germination* is also desirable, since (other things being equal) if a sample germinates 90 per cent. in five days it is far better than a sample which germinates 90 per cent. in ten days. Though the purity and germination may be satisfactory it may be necessary to refuse the seed solely on account of the presence of weed seeds, which are always useless and may, if sown, cause continual difficulty and loss. Indeed, it is no exaggeration to say that there is no greater folly in farming than the sowing of seeds which are unlikely to produce a fine crop.

Agricultural Colleges to which Farmers should apply for Advice as to Examination of Seeds.

- I. *Armstrong College*, Newcastle-on-Tyne.
(Professor of Agriculture—D. A. Gilchrist, M.Sc.)
Cumberland. Durham.
Northumberland. Westmorland.
- II. *The University*, Leeds.
(Professor of Agriculture—R. S. Seton, B.Sc.)
Yorkshire.
- III. *Midland Agricultural and Dairy College*, Kingston, Derby.
(Principal—W. Goodwin, M.Sc., Ph.D.)
Derby. Leicester.
Lincoln (Lindsey). Nottingham.
Rutland.
- IV. *University of Cambridge, Agricultural Department*.
(Secretary, Board of Agricultural Studies, Alderman R. H. Adie, M.A.)
Bedford. Cambridge.
Essex. Hertford.
Huntingdon. Isle of Ely.
Lincoln (Kesteven). Norfolk.
Northampton. Soke of Peterborough.
East Suffolk. West Suffolk.

- V. *South-Eastern Agricultural College*, Wye, Kent.
(Principal—M. J. R. Dunstan, M.A.)
East Sussex. West Sussex.
Kent. Surrey.
- VI. *University College*, Reading.
(Dean of the Faculty of Agriculture and Horticulture—
R. V. O. Hart-Synnot, D.S.O., B.Sc.)
Berkshire. Buckingham.
Dorset. Hampshire.
Isle of Wight. Middlesex.
Oxford.
- VII. *Seale-Hayne Agricultural College*, Newton Abbot.
(Principal—B. N. Wale, B.Sc.)
Cornwall. Devon.
- VIII. *University of Bristol*.
(Professor of Agricultural Biology—B. T. P. Barker, M.A.)
Gloucester. Hereford.
Somerset. Wiltshire.
Worcester.
- IX. *Harper Adams Agricultural College*, Newport, Salop.
(Principal—P. Hedworth Foulkes, B.Sc.)
Shropshire. Stafford.
Warwick.
- X. *University College of Wales*, Aberystwyth.
(Professor of Agriculture—C. Bryner Jones, M.Sc.)
Brecon. Cardigan.
Carmarthen. Pembroke.
Radnor. Glamorgan.
Monmouth. Montgomery.
Merioneth.
- XI. *University College of North Wales*, Bangor.
(Professor of Agriculture—R. G. White, M.Sc.)
Anglesey. Denbigh.
Carnarvon. Flint.

Residents in the following counties should also consult the respective County Agricultural Organisers:—

County.	County Agricultural Organiser or other Agricultural Expert.
Somerset ..	J. H. Burton, M.Sc., Agricultural Education Office, 5, Graham Road, Weston-super-Mare:
Cornwall ..	Wm. Borlase, N.D.A., c/o. Secretary for Techni- cal Education, Gwealhellis, Helston.
Hereford ..	John Porter, B.Sc., Shire Hall, Hereford.
Devonshire ..	F. V. Dutton, B.Sc., County Education Offices, The Castle, Exeter.

Explanation of Terms used in this Article.

Dryness of Seed.—Seeds which are well dried indicate that they have been well harvested and stored.

Germinating Capacity.—This means the number of seeds per hundred of the pure seeds true to name which will sprout

under favourable conditions. *Energy or Speed of Germination* is the percentage of the pure seeds which will sprout in a given time.

Hard Seeds.—Clover and lucerne seeds may contain a proportion of seeds which do not germinate quickly because the seed-coat does not readily permit the entrance of water. These seeds are called "hard seeds." They may germinate after lying a considerable time in the soil.

Moisture Content.—The degree of dryness being important (see *Dryness of Seed*), the amount of moisture present is often determined in seed control work.

Old Seed.—This is seed which is of such an age that it may be dead or will only show enfeebled germinating power. On occasion it is treated in various ways and used to mix with good seeds in order to reap an unjustified profit.

Origin of Seed.—This term means a statement as to the source of the seed—the district or country in which it was grown—e.g., *English* red clover, *French* lucerne, *Provence* lucerne, *Chilian* red clover, *Dutch* dogtail, *New Zealand* cocksfoot, *Danish* hard fescue, *American* timothy, *Canadian* alsike.

Purity.—This term indicates the amount or percentage of pure seed true to the species concerned, present in a sample after all other seeds (including weed seeds), chaff, dust, stones, etc., have been removed. All the latter are included in the *Impurity*.

Real Value.—Theoretically the real or true or cultural value of a sample of seeds is the percentage of the *pure* seeds present which will germinate; it is obtained by multiplying the purity by the germinating capacity and dividing by 100. Thus if the purity is 95 per cent., and the germinating capacity is 90 per cent., the true value is $\frac{95 \times 90}{100} = 85.5$ per cent.

Practically, however, the cultural value must also depend on the seeds which are present other than those ordered.

Species.—The seed should be of the kind or *species* ordered—"true to name." The species may in general be readily determined, but variety can usually only be determined by growing the crop from the seed.

Weight.—The weight of seeds is important, the heaviest samples of a species usually being the best; hence the weight per 1,000 seeds is often determined.

NOTE.—Other articles on Seed Testing, published in this *Journal* recently, are as follows:—

The Study of Agricultural Seeds.—W. Borlase, October, 1912, p. 529.

The Control of Agricultural Seeds in Switzerland.—J. Long, December, 1912, p. 726.

Seed Analyses: Their Interpretation and Use.—S. F. Armstrong, January, 1913, p. 827.

Seed Testing.—W. M. Findlay, July, 1913, p. 301.

Seed Control Stations on the Continent.—*Journal Supplement*, August, 1914.

The Improvement in the Standard of Quality of Agricultural Seed in Ireland.—October, 1914, p. 585.

These articles have been fully utilised in preparing the foregoing statement.

PRESENT COMPARATIVE VALUES OF FEEDING STUFFS.

THE following notes on feeding stuffs have been prepared at the request of the Board by the School of Agriculture, Cambridge University. The values are based on the approximate prices of the various feeding stuffs at London, Liverpool, Hull and Bristol at the beginning of March.

The high prices of feeding stuffs, and the difficulties of transport, caused by disturbances due to the War, entail a very considerable amount of study on the part of the "feeder," who, looking for the most profitable results, wishes to fulfil the duty of increasing the national food-supply.

Food Constituents.—The skill of the chemist has enabled him to arrange all food constituents in groups, among which the following are very important: (1) Flesh-formers (called albuminoids or protein); (2) Carbohydrates (material used as fuel in the animal's body); and (3) Oil or Fat (a material which adds greatly to the value of milk and meat as human food, when stored as reserve concentrated fuel in the tissues of the "finished" animal). It should be fully realised that whereas fat can replace carbohydrates and carbohydrates can replace fat, neither the one nor the other nor both together can replace flesh-formers. Hence the importance of paying attention to the first column in the table on p. 1114. Here, under the title "Nutritive ratio," is stated the relative proportion of flesh-formers to fuel and fat. For instance, in the case of soy bean cake each 1 lb. of flesh-former is combined with $1\frac{1}{10}$ lb. (1:1.1) of fuel and fat (the fat being reduced to its full fuel value),

whereas in the case of palm-nut cake 1 lb. of flesh former is combined with 4 lb. (1:4) of fuel and fat. This nutritive ratio should always be kept in mind when examining the cost of a feeding stuff.

Food Units.—For the purposes of comparing the value of one food with another chemists have sought to reduce everything digestible to one common factor, so that foods may be compared with one another. The chemist would be the last person to claim that this valuation is complete, and the matter is still being very closely investigated by scientific workers. Nevertheless, the results so far obtained are much too valuable to be ignored. A feeder may feel quite safe in allowing himself to be largely guided by them, provided always he pays attention to the following matters incidental to their *practical* worth.

Wholesomeness.—Occasionally the food unit value of a food is ruined by the presence of some poison, but this is of very rare occurrence. At the same time, when circumstances suggest the desirability of using some feeding stuff that is new to the market it is undoubtedly desirable to bear the point in mind.

Apart altogether from the presence of poisonous properties, experience suggests that stock thrive better on certain foods than on others. Linseed cake, oats and bran immediately suggest themselves to the mind as foods which are believed to be perfectly wholesome. The skill of the feeder must decide how much he ought to pay for the quality of wholesomeness. For instance, if the table on p. 1114 be consulted the food unit of oats will be found to vary in cost from 2s. 11½d. to 3s. 4½d., whereas that of maize germ meal lies between 1s. 9d. and 1s. 11d. The difference in the nutritive ratio is very slight, so that unless experience shows in no uncertain way that oats, in their effect on the health of the feeding beast, are quite different from maize germ meal, the former is a very much dearer food at present prices.

Prejudice.—In studying food unit values the feeder will do well to watch for any accidental cause that may have led to feeders disliking some particular foodstuff. For instance, decorticated cotton cake is disliked by many because, before knowledge about nutritive ratios was as common as it is now, it was fed in far too large quantities. Again, if maize be substituted for beans the result will be likely to be bad, whereas a mixture of maize and decorticated cotton cake would probably be successful in replacing beans as a fattening food.

Palatableness.—It is clear that stock exhibit preference in regard to food, but this preference should not be allowed to become too costly. The unrelished food should be given at the beginning rather than at the end of the feeding period. Its palatability can be increased by skilful mixing, by the addition of some little condimental food, and even by adding a little common salt.

Change of Feeding Stuffs.—Much of the prejudice which exists against the wholesomeness, the palatability, etc., of certain foods, is due to neglect of the elementary rule that all change in feeding stock should be gradual. This precaution is all the more important if foods differing greatly in their nutritive ratio are being substituted one for the other.

Convenience.—No practical feeder can neglect the matter of convenience, which is still more important when labour is short. Generally speaking, cake is more convenient to feed than meal, but experience of the special circumstances existing in each case must decide how much should be allowed for it in the cost of a feeding stuff.

Appearance.—Probably the pleasing appearance of a food is sometimes paid for. This indeed seems to be the case when the prices of the two wheat brans given in the table are compared. "broad" bran costing from 1s. 11½d. to 2s. 1½d. per food unit as against 1s. 8d. to 1s. 10¾d. for simple bran. Many practical men, who observe things for themselves, refuse to pay the extra money, however much more pleasing may be the appearance of the one compared with the other.

Markets.—The study of the table on p. 1114 shows that locality may have a great effect on the cost of each food unit fed. For instance, oats cost 2s. 11½d. at Hull and 3s. 4½d. at Bristol. If it may be contended that such a difference may be due to the special quality of a sample from the one or other locality, it can hardly be maintained that (see table) peas from Liverpool at 3s. 0¼d. per food unit are as good value as peas from Hull at 2s. 3½d.

Remarks on Use of Feeding Stuffs.

The chief points in the feeding of the foodstuffs dealt with in the table are given below, and should be read in conjunction with the Special Leaflets Nos. 8, 16, 19 and 20 already issued by the Board. It is assumed that the usual allowance of roots and bulky fodder is fed.

Table of Feeding Stuffs, showing Nutritive Ratio, Food Units, Price per Ton and Price per Food Unit.

Feeding Stuff.	Reckoned from digestible nutrients.		Approximate price per ton at the beginning of March.				Approximate price per Food Unit.			
	Nutritive Ratio.	Food Units.	London.	Liverpool.	Hull.	Bristol.	London.	Liverpool.	Hull.	Bristol.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Soy Bean Cake ..	1:17	122.3	9 15 0	9 5 0	9 0 0	9 0 0	1 6 1	1 6 1	1 5 1	1 5 1
Decorticated Cotton Cake ..	1:13	130.3	11 5 0	10 5 0	10 5 0	10 5 0	1 10	1 11	1 11	1 11
Indian Linseed Cake ..	1:19	123.1	11 10 0	11 15 0	11 5 0	11 10 0	1 11	1 11	1 11	1 11
English Linseed Cake ..	1:20	120.1	6 11 6	6 10 0	6 15 0	6 15 0	1 10	1 11	1 11	1 11
Bombay Cotton Cake ..	1:24	65.3	7 17 6	7 5 0	7 0 0	7 0 0	1 8 1	1 7 1	1 7 1	1 7 1
Egyptian Cotton Cake ..	1:20	71.9	7 0 0	6 10 0	6 10 0	6 10 0	1 9	1 9	1 9	1 9
Coconut Cake ..	1:38	102.6	7 0 0	6 10 0	6 10 0	6 10 0	1 8 1	1 7 1	1 7 1	1 7 1
Palm-nut Kernel Cake ..	1:40	83.5	9 13 8	10 14 8	10 4 6	9 3 2	1 11	2 2 0	2 0 1	1 10 10
English Beans ..	1:26	99.5	10 14 4	10 14 8	10 14 8	9 15 10	2 2	2 2 1	2 2 1	1 11 1
Chinese Beans ..	1:26	101.2	12 17 9	14 14 0	11 2 3	—	2 7 1	3 0 1	2 3 1	—
English Maple Peas ..	1:32	97.2	12 0 0	15 8 0	—	—	2 8 1	3 2	—	—
English Dun Peas ..	1:32	97.2	14 13 4	15 8 0	—	—	3 0	3 2	—	—
Calcutta White Peas ..	1:23	97.5	9 6 8	9 19 2	—	—	1 10	1 11	1 10	1 10
American Maize ..	1:11	93.8	8 12 8	8 12 8	8 12 8	8 12 8	2 1	2 1	2 1	2 0 1
Argentine Maize ..	1:11	94.2	9 5 0	9 10 0	9 10 0	8 17 6	1 4 1	1 4 1	1 6 1	—
Maize Meal ..	1:13	86.4	8 5 0	—	—	—	1 4 1	—	—	—
Maize Gluten Feed ..	1:33	121.6	8 10 0	8 15 0	9 10 0	—	1 9	1 9	1 11	—
Maize Germ Meal ..	1:84	99.2	10 12 9	9 6 8	9 5 0	9 7 6	2 6 1	2 3	2 2 1	2 5 10
English Feeding Barley ..	1:78	83.0	12 0 0	11 8 2	11 3 4	11 3 4	3 2	3 1	3 1	3 4 1
English Oats ..	1:79	75.4	6 0 0	6 5 0	6 5 0	6 5 0	1 8 1	1 9 1	1 7	1 9 1
Malt Culms ..	1:36	69.9	7 2 6	—	—	—	1 8 1	—	—	—
Brewers' Grains (dry) ..	1:34	84.5	7 0 0	—	—	—	1 8 1	—	—	—
Brewers' Grains (wet) ..	1:34	21.1	7 0 0	—	—	—	1 8 1	—	—	—
Rice Meal ..	1:10.3	78.7	7 10 0	7 10 0	6 7 6	—	1 9 1	1 10 1	1 7 1	—
Wheat Middlings ..	1:5.3	93.5	7 7 6	7 10 0	8 10 0	—	1 7 1	1 8 1	1 11 1	1 11
Wheat Sharps ..	1:5.3	86.3	6 10 0	7 5 0	7 5 0	7 5 0	1 8 1	1 10 1	1 11 1	1 11
Wheat Bran ..	1:5.3	77.5	7 15 0	7 15 0	7 15 0	7 15 0	1 8 1	1 11 1	2 1 1	1 11 1
Wheat Bran (broad) ..	1:4.7	79.9	—	—	—	—	—	—	—	—

Soy Bean Cake.—Nutritive value, 1:1.1. Cost per food unit, 1s. 6d.

The soy bean and its products are highly esteemed in the East for both man and beast. Owing to their comparatively recent introduction to this country, their practical value is not fully known. The cake is rich in protein, but possesses *distinctly* laxative, not to say scouring, properties. It should, therefore, be fed with great discretion, and it is suggested that it should never exceed one-fourth of the concentrated ration. At present prices it is a very cheap foodstuff, and should form an efficient substitute for part of the linseed cake in a ration. It can be mixed without danger with maize gluten feeds and a combination of bean and rice meal. It is usually fed in combination with common cotton cake. Further information is given in Special Leaflet No. 8.

Decorticated Cotton Cake.—Nutritive value, 1:1.3. Price per food unit, 1s. 7d.

This is the cheapest of the cakes in common use, probably because its use was abused when it was first introduced. It is a valuable feeding stuff, but should be fed with discretion, and should never exceed one-half the concentrated part of the ration. It goes well with maize (2 decorticated cotton cake, 4 maize), barley meal (2 decorticated cotton cake, 4 barley meal), maize germ meal, and a mixture of rice meal and bean meal (1 decorticated cotton cake, 1 bean meal, 2 rice meal).

Linseed Cake.—Nutritive ratio, 1:2. Price per food unit, 2s.

This is held to be the most wholesome of all the cakes, and is especially esteemed for finishing fattening cattle. It may be mixed with anything so long as the mixture used does not lead to scouring. It is generally used in conjunction with cotton cake, bean meal, or a mixture of cotton cake and bean meal.

Common Cotton Cake.—Nutritive ratio, 1:2. Price per food unit, 1s. 10d. to 2s. 1d.

Both Egyptian and Bombay cotton cakes are in common use, being often mixed with more laxative concentrated foods owing to the binding properties they are known to possess. The Bombay cotton cake is apt to contain a lot of fibre, and is, therefore, dangerous for calves and lambs. Generally speaking, cotton cake is a better food for mature animals than for young growing stock. At present prices per ton Egyptian is cheaper than Bombay for feeding purposes.

Coconut Cake.—Nutritive ratio, 1:3.8. Price per food unit, 1s. 7d.

This cake is of comparatively recent introduction into this country. Per food unit it is a comparatively cheap food, and is esteemed on the Continent for dairy feeding, and may be fed in quantities up to 3 to 4 lb. a day, being damped before use. At present prices it might be used as a substitute for more expensive foods in the concentrated rations for dairy cows, and should certainly be given further trial for feeding for meat production. Further information is given in Special Leaflets Nos. 8 and 20.

Palm-nut Kernel Cake.—Nutritive ratio, 1:4. Price per food unit, 1s. 7d. to 1s. 9½d.

This food is dearer per unit on some markets than coconut cake. It is very similar to coconut cake, and may be substituted for it.

English Beans.—Nutritive ratio, 1:2.6. Price per food unit, 1s. 10d. to 2s. 2½d.

Per food unit beans are much cheaper than the cereal grains, and may be fed to advantage in conjunction with any laxative concentrated food. Beans should be used with discretion as they are very binding. With linseed cake they form a very popular finishing ration.

English Peas.—Nutritive ratio, 1:3.2. Price per food unit, 2s. 3½d. to 3s. 2d.

Peas may be used for all purposes for which beans are fed, and have similar feeding properties. At the present ruling prices, peas are dear per food unit, and on this account should not be fed if beans are available.

Calcutta Peas.—Nutritive ratio, 1:2.3. Price per food unit, 3s. to 3s. 2d.

These peas differ from English peas chiefly in having a higher protein content. Compared with English peas, they are dearer per unit, and their use is inadvisable in the present state of the market.

Maize.—Nutritive ratio, 1:11. Price per food unit, 1s. 11d.

Maize, crushed or in the form of meal, is useful for all kinds of stock when fed in conjunction with concentrated cakes. At present prices it is dear, costing as much per food unit as linseed cake. Having a wide nutritive ratio it is valuable for giving mixed with concentrated cakes. Allowing for the cost of crushing, the meal is as cheap per food unit as the whole maize.

Maize Gluten Feed.—Nutritive ratio, 1:3.3. Price per food unit, 1s. 5d.

This food, a by-product of maize, though having a different nutritive ratio, is very cheap per food unit, and (although there is still much to learn as to its feeding value in this country) it should prove a useful substitute for part of the concentrates, since it is fairly rich in oil and protein. In the few cases in which it has been used extensively in England it has given very good results, being fed up to 5 lb. daily. It has been used in the United States with excellent results for dairy cattle and fattening stock, and is always used in conjunction with a light material such as wheat bran.

Maize Germ Meal.—Nutritive ratio, 1:8.4. Price per food unit, 1s. 9d. to 1s. 11d.

This, another by-product of maize, though differing in its nutritive ratio, is cheaper per unit, though containing more oil and protein, than maize meal. It should be worth a trial in many cases.

English feeding Barley and Oats.—The use of these foods as feeding stuffs is strongly deprecated at the present time, as their price per unit is out of all proportion to their feeding value. (For substitutes for oats for farm horses, see Special Leaflet No. 19.)

Malt Culms.—Nutritive ratio, 1:3.6. Price per food unit, 1s. 8½d. to 1s. 9½d.

Malt culms form a brewery by-product, and are used extensively for stock in districts where they are readily obtained. They have a great reputation for feeding to fattening lambs, and at the present price per unit form a valuable and cheap food for general purposes.

Dried Brewer's Grains.—Nutritive ratio, 1:3.4. Price per food unit, 1s. 7d. to 1s. 8½d.

Many experiments, at home and abroad, have established the value of this food for farm stock. It is a good feed for dairy cows, and is particularly useful for suckling ewes and growing lambs. It is quite wholesome and should be given a trial whenever it can be bought cheaply. At present prices it is a cheap food. (See also Special Leaflets Nos. 8 and 19.)

Wet Brewer's Grains.—Nutritive ratio, 1:3.4. Price per food unit, 1s. 2½d.

This food is the cheapest per food unit included in the table, and is largely used for feeding dairy cows. It is very palatable, and the low cost of the food is due to the fact that

the difficulties of carriage restrict the consumption of the grains to certain localities, and to the fact that it varies very much in composition. Where available, wet grains should be used, but special care must be taken that they are delivered fresh, and that no more are given to the animals than can be consumed without causing scour. Over-feeding, especially after storage, leads to fermentation and consequent digestive disturbances. Where cleanliness and supervision of feeding are exercised, this feeding stuff is very economical for the production of milk. It is largely used in Holland for fattening old cows for beef.

Rice Meal.—Nutritive ratio, 1:10.3. Price per food unit, 1s. 7½d. to 1s. 10½d.

Rice meal is very variable in quality, but where the analysis is good it is a cheap feeding stuff at present prices. It is particularly valuable for mixing with beans, with decorticated cotton cake, or with soy bean cake. A good mixture of English beans and rice meal can be made. It should not be used with common cotton cake. The best rice meal also forms the basis of many "calf meals," and mixed with bean meal and sharps forms a good food for fattening pigs. (Further information is given in Special Leaflet No. 16.)

"Middlings."—Nutritive ratio, 1:5.3. Price per food unit, 1s. 7¼d.

Middlings is much used for dairy stock, being a wholesome and palatable feeding-stuff. It is also much used for growing pigs and suckling sows. It is, however, not much used for fattening, and it would seem that present prices suggest a much more extensive use. More especially is this the case if substituted for barley meal in the production of pork and bacon. Middlings often gives very good results when fed to young animals being rapidly fattened off at an early age as beef or mutton.

Sharps.—Nutritive ratio, 1:5.3. Price per food unit, 1s. 8½d. to 1s. 11¾d.

Sharps are so much like middlings that the food unit price may well be left to decide which of these two should be fed.

Bran.—Nutritive ratio, 1:5.3. Price per food unit, 1s. 10d.

Except that bran is said to "scour" young pigs, and that it may be made very laxative by feeding as a warm "mash," the same remarks apply as to sharps. At present prices

the feeding of broad bran seems to be extravagant. (More detailed information concerning these by-products is given in Special Leaflet No. 8.)

The prices given per ton in the table on p. 1114 represent for the most part the price *ex mill*, and do not allow for customs of credit, carriage, etc. In some cases the prices given include sacks. Since, however, these affect to a similar extent all the foodstuffs given, the usefulness of the table is not affected, and the relative comparative values given still hold, although the price per food unit is low in every case.

The figures given in the table are the prices ruling *ex mill* at the beginning of March, but the computation of feeding stuffs whose market value has risen since then can be easily obtained by dividing the price per ton by the number of food units given in the table against the foodstuff under consideration.

Leaflets* dealing with different rations and the compounding of rations have been published by the Board. With these leaflets, and applying the prices given in the table on p. 1114, the farmer is in a position to compound the rations as cheaply as the circumstances of his farm will permit. It must always be the case that the bulk of the home-grown fodder, as well as the roots, will govern to a very considerable extent the relative value of any concentrated bought feeding-stuff.

NOTE.—Rations for the use of farmers, based on the principles outlined in this article, will be suggested in this *Journal* in the coming months, commencing with the April issue.

* No. 74. The Composition and Properties of Concentrated Feeding Stuffs.
No. 79. Rations for Farm Stock.

SUGGESTIONS TO ALLOTMENT HOLDERS FOR GENERAL CROPPING DURING THE SPRING AND SUMMER MONTHS.

THE following suggestions and recommendations have been prepared for the use of those who hold small areas of land, such as allotments and gardens, and who may wish to increase their supplies of vegetables during the coming season.

(1) *Vegetables which may be Sown or Planted during March.*

In this connection it should be borne in mind that a friable surface (a fine tilth) and a dry seed bed go a long way towards ensuring strong and even germination. By deferring operations for a week or ten days when the land is in a wet state, conditions of soil and weather are often secured which enable the crop to make up rapidly for the late start.

The following crops may most suitably be sown :—

*Potatoes	Early varieties.	Leeks	..	All varieties.
Beans	.. Broad.	Parsnips	..	"
Peas	.. Early and mid-season varieties.	Lettuce	..	Early varieties.
Spinach	.. Early varieties.	Radish	..	"
Turnips	.. "	Cabbage	..	All varieties (sown).
Onions	.. All varieties.	Cauliflower	..	" "
Carrots	.. Early varieties.	Kale	..	" "
		Parsley	..	" "

(2) *Vegetables which may be Sown or Planted during April and the first half of May.*

Potatoes	.. Main crop and late varieties.	Cabbage	..	Main crop varieties.
Beans	.. Kidney and Runner.	Beet	..	All varieties.
Peas	.. Late varieties.	Spinach Beet	..	"
Cauliflower	.. Early and main crop varieties (transplanted).	Carrots	..	Main crop varieties.
		Turnips	..	"
		Brussels	{	Early cropping varieties.
		Sprouts	{	"

(3) *Vegetables which may be Sown or Planted during the latter half of May and during June.*

Successional sowings of turnips, radishes, lettuces, spinach and peas may be made, allowing a period of from fourteen to twenty-one days to elapse between the sowings.

Kale, broccoli, cabbage and cauliflower (late varieties), Brussels sprouts, savoys and leeks may be planted on ground as it becomes vacant.

Celery may be planted in May and early June, according to the locality.

* See also Special Leaflet No. 18 (*Potato Growing in Allotments*).

Particulars for the Planting and Sowing of the Various Crops.

1. *Potatoes*.—The land should be thoroughly dug and forked during the winter and worked into a friable condition. The common distance to plant for first-early varieties is 4 in. in depth, 12 in. between the sets, and about 20 in. between the rows. For mid-season and late varieties the sets may be 15 in. apart with 24 to 30 in. between the rows. For further information see Special Leaflet 18 (*Potato Growing in Allotments*).

2. *Broad Beans*.—Broad beans should be planted $3\frac{1}{2}$ to 4 in. deep, with 18 to 24 in. between the drills, and 4 in. between the seeds.

Kidney Beans.—Planting should be about 2 in. deep, 2 to 4 in. apart in the drill, and 18 to 27 in. apart between the rows. One pound of seed will plant 150 to 200 ft. of drill.

3. *Peas*.—Peas may best be sown in a flat drill from 2 to 3 in. in depth according to soil—in stiff soil shallow, and in light soil deep. Dwarf varieties should be sown in rows 18 in. to 2 ft. apart, and tall varieties further apart according to height.

Early peas require 1 lb. of seed to 70 ft. of drill, and late varieties 1 lb. to 85 ft. of drill.

4. *Turnips*.—One ounce of seed may be sown to 200 ft. of drill, $\frac{1}{2}$ in. deep. The drills should be 12 in. apart. The plants should be thinned to 5 to 9 in. apart, according to variety.

5. *Carrots*.—One ounce of seed will be required for 300 ft. of drill. The drills should be $\frac{3}{4}$ in. to 1 in. in depth, and 12 in. apart. The young plants may be thinned out gradually to 5, 6, or 8 in. apart, according to season and variety.

6. *Onions*.—One ounce of seed is needed for 200 ft. of drill. The drills should be 1 in. deep, and 9 to 12 in. apart. Autumn-sown varieties need not be thinned if for salading purposes, but they may be transplanted to the above distances and grown on for bulbing purposes.

7. *Lettuce*.—Lettuce seed may be sown at the rate of $\frac{1}{4}$ oz. to 160 ft. of drill, the drills being $\frac{1}{4}$ in. deep, and 9 to 12 in. apart. The plants may be thinned or transplanted 6 to 8 in. apart, according to variety.

8. *Radish*.—One ounce of seed is sufficient for 75 ft. of drill, and the drills should be 1 in. in depth and 6 to 9 in. apart.

9. *Spinach*.—One ounce of seed is required for 65 ft. of drill, and the rows may be about 1 in. deep, and from 12 to 15 in. apart.

10. *Parsley*.—For summer use parsley should be sown in March in drills $\frac{3}{4}$ in. in depth, and at the rate of $\frac{1}{4}$ oz. of seed to

90 ft. of drill. If more than one drill is required the drills should be 10 to 14 in. apart.

11. *Spinach Beet*.—This may be sown as for round spinach, but should be thinned to 8 or 10 in. apart in the rows.

12. *Early Cabbage*.—Strong young plants should be planted in rows, leaving 15 in. between the plants and 18 in. between the rows. Very dwarf varieties, however, succeed if only 12 in. are left between the plants and 15 in. between the rows. Strong-growing late varieties require 18 in. between the plants and 27 in. between the rows. The plants must be earthed up with the hoe as they get larger.

13. *Cauliflowers*.—Early dwarf varieties should be planted from 12 to 15 in. between the plants and 18 in. between the rows; mid-season varieties, 18 in. between the plants and 27 in. between the rows; and late varieties on very rich soil may be given 3 in. more each way. The plants should be earthed up as in the case of cabbage.

14. *Broccoli*.—Strong young plants should be planted in rows, leaving 18 in. between the plants and 27 in. between the rows. The crop should be earthed up as in the case of cabbage.

15. *Borecole* or *Kale*.—Plant in rows as in the case of broccoli.

16. *Leeks*.—Leeks may be sown in drills as in the case of onions. They may be thinned out or transplanted, leaving 4 to 6 in. between the plants and 12 to 15 in. between the rows.

17. *Celery*.—A double row may be planted, 9 in. apart every way, in a trench 9 in. in depth. A liberal dressing of well decayed rich manure should be dug into the bottom. The soil should be heaped on the sides and used for blanching purposes later. The plants are usually earthed up three times during the season.

Information as to the application of fertilisers to these crops will be found in Leaflet 106 (*Fertilisers for Market Garden Crops*).

General Cultivation.

The soil between the crops should be frequently stirred by means of a small cultivator or a Dutch hoe.

Heavy soils have a tendency to cake and harden and may require slacking with a digging fork once or twice during the season. It is very important that the surface soil should be kept in a fine loose state (a good tilth) right through the season. By this method moisture is conserved and weeds are destroyed.

Liquid manure may be given to all crops with advantage during the season of growth, but especially to the cabbage and onion families. Watering in dry weather is an advantage, but should not be resorted to unless it can be kept up until favourable climatic conditions recur.

Inter-cropping may often be practised with advantage, such as planting Brussels sprouts or some other member of the cabbage family between the rows of early potatoes, or, if the whole crop is not wanted immediately, alternate plants of the potatoes may be taken at the time of lifting and some member of the cabbage family may be planted between the remaining potatoes. A second crop will thus be coming on while the potato plants still occupying the soil continue growth.

NOTE.—Leaflets describing many of the common insect and fungus pests may be obtained on application to the Board, who are also prepared to give advice as to treatment in cases of special difficulty.

LARCH KILLED BY LONGICORN BEETLE.

B. B. OSMASTON,

Adviser in Forestry, Oxford.

WHILE inspecting a larch wood at Maer (North Staffordshire) in November, 1913, the writer noticed certain trees, in the pole stage, about 18 in. in girth, which appeared to be dying as the result of an insect attack. The attack was not general, but was confined to a few trees near the exposed edge of the plantation. The bark of the affected trees was riddled with holes, slightly elliptical and about 3 mm. across. On removing a piece of the bark of an attacked tree a few larvæ were obtained which were subsequently identified by Mr. E. R. Speyer, Lecturer in Entomology, as *Tetropium gabrieli*, var. *Crawshayi*.

About the same time a similar attack, due to the same beetle, was observed in a larch pole wood near Alderbourne Manor, Berkshire. Here, again, the attack was rather sporadic in nature.

Subsequently, in June, 1914, a report was received from Abbots Leigh (Haywards Heath, Sussex) of larch trees being killed and the timber damaged by an insect. A visit to the

woods in question disclosed two centres of attack about $\frac{1}{2}$ -mile apart, in each of which a few trees were either dying or dead, apparently as the result of the attack of the same beetle. One fair-sized larch tree, 4 ft. in girth, had been killed outright, and the bark was riddled from the butt upwards by woodpeckers (*Picus viridis*), which had made such a systematic and successful search for the larvæ that it was with some difficulty that a dozen or so of the larvæ and pupæ and a few specimens of the perfect insect were secured. These proved, on examination, to be the same beetle.

The galleries of the larvæ are mainly excavated in the bast and cambium, but the larvæ also usually penetrate the wood before pupation, and Mr. Leigh Pemberton, the owner of the Abbots Leigh wood, stated that a few trees sold last year were reported as being seriously damaged by such borings.

The beetle is dull black, about $\frac{1}{2}$ -in. in length, and the antennæ are about two-thirds the length of the body and abdomen.

A very complete description and life-history of this beetle has been published* by Rev. G. A. Crawshay, M.A., from which the following notes have been made:—

The beetle, which has up to date been reported from several parts of England, belongs to a *variety* of the type, with black elytra and black femora, and may be styled *Tetropium Crawshayi*. It attacks the European larch exclusively in the wild state, though in confinement it is capable of living on species of *Pinus* and *Picea*.

Life Cycle.—The eggs are laid in June in small batches of one to six under the plates of, or in crevices in, the bark, and as many as 100 eggs are laid by a single individual. The larvæ hatch out in a fortnight or so, and devour the soft bast and cambium, grazing also the sapwood. They feed during June, July and August, thus destroying the vital juices and rapidly killing a sickly tree.

When full fed towards the end of August, the larva either excavates a pupa cell under the surface of the outer bark or burrows into the wood and pupates there.

The normal burrow of *Tetropium* runs into the wood horizontally for about 1 to $2\frac{1}{2}$ in., with generally a curve to right or left, or sinuating. It then takes a sharp turn downwards, never upwards, for a distance of 1 to $2\frac{1}{2}$ in. The larva lies in the pupa cell from about the middle of September to the beginning of April, when it pupates. The pupal stage lasts

about a month, the mature beetle finally emerging early in May.

Thus the life cycle of this insect normally extends over one year. This life cycle may, however, be shortened by high temperature to three months (May to August, and, in fact, four successive generations have actually been produced in 16 months (May of one year to August of the following year, inclusive).

Damage.—Mr. Crawshay says "it is quite certain that the species cannot injure healthy trees—when it does lay on such trees the newly-hatched larva must inevitably be smothered in its minute burrow by the flow of sap on eating into the surface of the tender bark.

"I have only found the larvæ in failing trees.

"From a commercial point of view the species injures the wood to a certain extent, but considerably less than *Crioccephalus* and *Sirex* which feed in the wood itself, excavating it more deeply, and to a much greater extent.

"In timber yards this species is propagated to a large extent, the beetles emerging and laying in adjacent timber felled in the current year. Many perish in conversion, but many more are carried away in posts and slabs to emerge later in new districts and so the pest is disseminated.

"A large percentage of larvæ remain in the timber yard in uncut logs till the summer when the perfect insects emerge and lay their eggs freely on the fresh incoming timber.

"Larch canker, larch aphid and unsuitable environment, in multiplying the number of sickly trees, lend themselves to the propagation of this insect."

The writer has little to add to Mr. Crawshay's observations. Mr. Crawshay is, no doubt, correct in saying that healthy larch trees are not attacked. As, however, so much of our larch crop is now sickly or diseased, it is of importance that this insect should not be allowed to spread its ravages unchecked.

Affected trees should be felled and converted without delay, the slabs being burnt. In this way few beetles will survive to spread the pest.

Trees which are attacked may usually be first recognised by the excavations made by the green woodpecker in searching for the larvæ of the beetle.

Judging from personal observations, the writer believes that the green woodpecker will prove our strongest and most effective ally in the suppression and extermination of this beetle.

* Transactions of the Entomological Society, 1907, pp. 183-212.

In the issue of this *Journal* for May, 1914 (page 135), an account was given of an experiment made by Professor Jakob Eriksson of the Experimental Station at Stockholm, in which evidence was produced that wart disease of potatoes can be eradicated by the application to infected soil of a solution of commercial formaldehyde and water (1 in 100). Professor Eriksson suggested that further experiments should be conducted in England to test his conclusions, advising that in very badly infected soil the solution should be of a 2 or 3 per cent. strength. Experiments were accordingly made on land at Bardon Hill, near Leicester, which is known to have been infected for ten years.

The area selected was 130 sq. yd., 100 sq. yd. being set apart for treatment with a 1 per cent. solution of formaldehyde, while 30 sq. yd. were left untreated as a check. On 7th April 2 gal. of commercial formaldehyde were mixed with 198 gal. of water and applied to the former plot, 2 gal. of the liquid being poured over each square yard by means of a watering can to secure uniformity of treatment. The soil was forked over on 18th April, and on the 20th April potatoes were planted 6 in. deep, in rows 30 in. apart and 15 in. apart in the row. Eight rows of "Up-to-Date" and seven rows of "King Edward VII."—two well-known susceptible varieties—were planted. Two other varieties of an unknown kind were also planted. The "check plot" ran the whole length of the area treated with formaldehyde, so that every line of potatoes passed through the treated and untreated plots.

The weather was very favourable for planting during the whole of the time. The plants received a severe check from frost in May, but by the end of June had fully recovered. No disease was visible at that time, but when the plants were examined on the 6th August it was not possible to find a single plant that was not badly infected with wart disease both in the stem and tubers. No difference in the amount or intensity of the disease could be discerned between those planted on either plot, and the unnamed varieties were as badly diseased as "Up-to-Date" and "King Edward VII." In some cases the potatoes had begun to deliquesce, showing an advanced stage of the disease. The only potato that was not attacked was a chance self-set plant of the variety "Abundance," a well-known resistant type.

Another experiment was made on the same lines in Lancashire. On a small area of badly infected land nine plots were laid out, each 12 sq. yd. in size. Six rows of potatoes of the varieties "Up-to-Date" and "Epicure" were planted on each. The plots were treated as follows:—

1. Untreated.
2. One per cent. formaldehyde solution.
3. One per cent. formalin solution.
4. Untreated.
5. 0.1 per cent. of mercuric chloride.
6. Ten cwt. sulphate of potash per acre.
7. Untreated.
8. Private treatment, unspecified.
9. Five drills of "Iron Duke" potato for test.

The "Up-to-Date" potatoes grew and flourished, but the "Epicures" were rather weak.

The results when the potatoes were lifted were as follows:—

			34.8	per cent. diseased.
1. Epicure	..	..	45.3	" "
Up-to-Date	..	..	26.3	" "
2. Epicure	..	..	38.1	" "
Up-to-Date	..	..	27.1	" "
3. Epicure	..	..	46.1	" "
Up-to-Date	..	..	26.1	" "
4. Epicure	..	..	43.4	" "
Up-to-Date	..	..	24.4	" "
5. Epicure	..	..	62.2	" "
Up-to-Date	..	..	33.9	" "
6. Epicure	..	..	36.4	" "
Up-to-Date	..	..	21.7	" "
7. Epicure	..	..	37.5	" "
Up-to-Date	..	..	32.6	" "
8. Epicure	..	..	48.4	" "
Up-to-Date	..	..		" "
9. The Iron Duke variety was badly diseased and no record of the number of diseased tubers was kept.				

There was very little difference between any of the plots in the weight of the crop. Mercuric chloride seems to have increased the amount of disease. The results of these experiments are wholly unfavourable to the use of formaldehyde as a preventive of wart disease.

Experiments of another character were tried on some infected land near Sutton Coldfield. The investigator in this case, a gardener with considerable scientific attainments, had already made some trials in 1913, with which he was highly satisfied. Three plots of 60 sq. yd. in extent were taken, and one treated with 14 lb. of superphosphate, a second treated with 7 lb. of superphosphate mixed with 7 lb. of soot, and the third left untreated. The resultant disease was "very little," "very slight" on the first plot, "little," "slight" on the second, and "much," "general" on the third. On inspection,

however, it was found that certain conditions, such as the extent to which the soil had been worked, and consequently put in a drier and more aerated state, were not equal in all the plots, and it was decided to repeat the experiment in 1914. Twelve plots of 40 sq. yd. each over which the disease was evenly distributed in 1913 were accordingly taken and treated as follows:—

Three plots with 3 lb. copper sulphate applied early in February.

Three plots with 10 lb. superphosphate.

Three plots with 6 lb. kainit.

Three plots left untreated.

The three plots in each case were planted with (a) King Edward VII., (b) Duke of York, (c) Up-to-Date.

The plots were visited again on the 22nd August, when it was found that most of the tubers had been lifted. Sound and diseased tubers had been carefully separated, but there was very little difference between the results obtained on any of the plots. There was a considerable amount of disease on the haulm in each case, and the crop, which was a very poor one, was affected in every case, the variation ranging from 10 to 50 per cent. On this occasion at any rate there was no evidence of any beneficial result from kainit or superphosphate.

Further experiments were made at Warley in Worcestershire on a number of allotments known to be affected with wart disease. In this case the soil was treated with (a) kainit and (b) salt. Some delay occurred in applying the treatment, and as the weather was very dry for the next few weeks the test was not absolutely satisfactory. The result showed, however, that while disease varied on the different plots, in no case was freedom from disease achieved. As may be supposed, the crop was very poor where salt was used.

THE following methods of control are suggested in the case of infestation of grain by weevils in place of the advice given in the Board's Leaflet No. 206 (*Grain Weevils*).

(1) Fumigation with bisulphide of carbon is a satisfactory method of treating infested grain, though it is specially adapted to small quantities and is most successful when the temperature is not too low (50° F. and over). The grain should be put in a bin or air-tight receptacle, and the bisulphide poured into a shallow vessel or on to a folded cloth placed on the top of the grain. From 1 lb.—5 lb. of carbon bisulphide are recommended as the quantity necessary to

treat 1,000 cubic feet of space, but it has been found in some cases that the smaller quantities have failed to kill all the beetles, and it is therefore preferable to use the fumigant at the rate of 5 lb. per 1,000 cubic feet of space. The receptacle should be kept closed for 24—36 hours; it should then be opened and the contents thoroughly aired. The grain will not retain either the poisonous qualities or the bad smell of the bisulphide, nor will its powers of germination be impaired. When fumigating the operator should avoid breathing the fumes, and on no account should a flame, a lighted pipe, cigarette, or even a live electric wire be brought near, since a violent explosion may be caused.

(2) Carbon bisulphide has also been recommended for treating stores and mills. The amount originally suggested for this purpose was 1 lb. to every 1,000 cubic feet of space, but it is better to allow 5 lb., whilst it must also be noted that certain experiments in America have given rise to the statement that as much as 20 lb. per 1,000 cubic feet may be required. Fumigation at a low temperature is said to be unsatisfactory and this probably explains the wide variation in advice which has been given.

(3) Fumigation is sometimes carried out with hydrocyanic acid gas instead of carbon bisulphide. In this case 1 oz. sodium cyanide ("130 per cent."), 2 oz. sulphuric acid, specific gravity 1.83, and 4 oz. water should be allowed for each 100 cubic feet of space. The gas is excessively poisonous and must be used with the greatest caution. Further notes on the subject will be found in Leaflet No. 188, but fumigation at low temperatures should be avoided.

(4) Owing to the difficulties in using carbon bisulphide or hydrocyanic acid gas in mills and granaries, treatment by heat is often preferred in America. A temperature of 118°—120° F. is said to be sufficient to kill the weevils, and this temperature can often be obtained in summer by means of the heating apparatus already in the mill. It has been found that a moist atmosphere, caused by leaks in steam pipes, makes it more difficult to obtain the necessary temperature. The time required for the treatment naturally varies with the contents and nature of the building and the sources of heat available. Periods of 16—24 hours seem to be usual in America, though special radiators are sometimes installed for the purpose of obtaining great heat.

(5) For cargoes in ships, thorough ventilation should be practised, this keeping down the temperature and ensuring dryness of the grain.

THE following note on experiments conducted in Bucks to minimise the loss of fruit due to frost, was communicated to the Board by Mr. Philip Mann, Horticultural Instructor for Buckinghamshire.

**Losses of Fruit
Due to Frost.**

During the last 30 years, the acreage under fruit cultivation in England has been considerably increased. The chief problem confronting growers, after pruning, spraying and manuring their orchards, is the annual fight against the May frosts. These have caused great loss of fruit, especially in low-lying areas. Very interesting experiments carried out in Mr. W. J. Rodwell's Prune Damson orchard, near Aylesbury, have proved that the frost may be successfully combated by spraying the trees late in the spring, just before the buds begin to expand, with winter wash, and by using Colorado stoves. The orchard was divided into three sections as follows:—

Division I.—This area, consisting of $2\frac{1}{2}$ acres, was not sprayed, and the Colorado stoves were not used, the result being that the fruit was very thin and undersized, and the trees made poor, stunted growth, and were seriously crippled by the aphids. This pest caused the leaves to curl and dry, checking the development of the fruit buds for the next year's growth.

Division II.—Five acres were sprayed, but stoves were not used to protect the blooms from May frosts. As a result, there was only a quarter of a crop of fruit, and the fruits were not so large as where the stoves were used.

Division III.—This area of five acres was sprayed at the end of February, and on May 27th, when the frost did so much damage to fruit crops generally, the Colorado stoves were filled with coal and lighted when the thermometer registered 32° F. In the area where the stoves were used the thermometer was not allowed to fall below 28° F. The temperature in the area which was not influenced by the stoves was 18° to 20° F., whilst 14° F. of frost were registered in the village adjoining the orchard, so that the stoves caused a rise in temperature of 10° F. The thermometer was placed about $3\frac{1}{2}$ ft. above the ground. Four tons of coal were consumed in the three nights, value £4, which saved a crop of fruit valued at £300 by the grower. The loss of fruit in the above area was estimated at only 5 per cent., compared with between 60 to 90 per cent. outside the area. The heat kept off the frost, consequently there was a very heavy crop—so heavy that the branches had to be supported. The Prune Damsons were nearly as large as small Victoria Plums. It is estimated that

six trees standing on eight poles of land, bore a ton of fruit, worth £12. The grower remarked that where the trees had been sprayed and the stoves used, the fruit was of better quality and realized 2s. per sieve more in the open markets. All trees were manured in exactly the same manner.

Comparison of Results.—By comparing the crops in the three divisions, it will readily be seen how advantageous to the grower are the spraying and the use of Colorado stoves. The number of Colorado stoves used on the 5 acres was 200, and they were evenly distributed over the area at about 12 yards apart every way.

The Colorado stoves cost 1s. 9d. each, or a total cost of £17 10s. for the 200. The Colorado stoves, with careful storage, can be made to last from 10 to 15 years, and hence the annual outlay should only be reckoned at $\frac{1}{10}$ th of the purchase price. This would mean that for 5 acres the capital expense would be £1 15s. The following statement gives full data:—

		£	s.	d.
For 5 acres	Colorado Stoves	1	15	0
	Fuel	4	0	0
	Setting	6	0	0
	Lighting and attending	5	0	0
	Spraying	11	0	0
Total		£17	6	0

The combined cost of spraying and protecting with Colorado stoves therefore amounted to £3 10s. per acre. This sum was very amply covered by the price obtained for the crop, which sold at £12 to £15 per ton, despite the slump in prices due to the War. Indeed, after debiting the whole initial expense of the Colorado stoves to last season's account, the returns left a very handsome balance in favour of the treatment.

The stoves are suitable for the protection of vegetable crops, in addition to fruit. The fuel used may be coal, which is preferable, but slack coal, sawdust, or shavings mixed with tar have also been used in the stoves.

It is advantageous, also, to instal a frost predictor, by means of which the grower is warned of the fall in the temperature.

THE enquiries as to the character of agricultural seeds sold to farmers and market gardeners which were carried on in 1912 and 1913, were continued during 1914.

**Quality of Farm
Seeds.**

The area dealt with comprised the three Ridings of Yorkshire, and the number of samples submitted to the School of Agriculture, Cambridge University, by the Board's Inspectors was 190.

Thirty of the samples consisted of seeds sold as English red clover, 43 of seeds sold as white Dutch clover, 2 as wild white clover, 25 alsike, 24 English cow-grass, 2 Italian rye-grass, 1 perennial rye-grass, 1 rough-stalked meadow-grass, 1 wood meadow-grass, 20 cocksfoot, 13 meadow foxtail, 1 crested dogtail, 1 Canadian timothy, 1 sheep's fescue, 1 meadow fescue, 1 hard fescue, 1 tall fescue, and 22 mangold.

The number of samples tested at Cambridge was 173. Dodder was found to be prevalent in the clover samples, about half the red clovers and about one-third of the alsikes and white clovers containing appreciable quantities. This result is very unsatisfactory. It was also found that 7 samples of red clover and 2 of alsike were of seeds that had been oiled.

The average real value of the clover seeds (as calculated by the formula* in use at Cambridge University) was, for red clover, 55.9 per cent., white clover, 56.9 per cent., and alsike 62.48 per cent. Out of a total of 95 samples of clover seeds tested only one gave a real value of over 90 per cent.

The real value figures for the samples of cowgrass (9 of which also contained dodder) averaged 72.67 per cent. The average real value for the samples of cocksfoot was 63.13 per cent., and for the samples of meadow foxtail 51.37 per cent. The samples of mangold seeds gave an average germination of 116.68 per cent., the highest being 165 per cent. and the lowest 49 per cent.

THE following report on the Egg-laying Competition at Sedlescombe has been communicated to the Board by Mr. J. N. Leigh.

Egg-Laying Competitions and the Sedlescombe Test.

The Egg-laying Competitions which are now held annually in this country were originated by the Utility Poultry Club in 1897, when the very modest number of twenty-eight birds competed in a short contest extending over sixteen weeks only.

Since then they have steadily increased in importance and popularity and during the last year no less than four competitions were held in the United Kingdom, involving the individual testing of over 1,200 birds throughout the full period of twelve months. In our Australian Colonies and Canada, in the United States of America and elsewhere, they have become firmly established, and the granting of State aid has made it possible to conduct them upon a large and elaborate scale.

The primary object of these competitions has been to ascertain the best laying strains in our various breeds of poultry, and to emphasise the importance of strain in egg production. They have provided interesting and instructive object lessons in housing, feeding and general management. In this respect they are greatly appreciated by

*The formula for ascertaining the Real Value is—
Percentage Purity × Percentage Germination.

the large numbers of poultry keepers and others who have been enabled to visit them, many of the visitors having travelled long distances, paying regular and frequent visits to watch the progress and note the results.

There is a further and particular effect, the benefits of which have not always been estimated at their full value, and that is in the improvement brought about in the methods of poultry keeping in the more immediate locality.

This is in reality a very noticeable result, supplying a strong argument in favour of peripatetic contests as means of instruction and demonstration of approved methods of poultry culture. There are, of course, arguments in favour of the establishment of permanent competition sites, but the demonstration value is certainly enhanced by the conduct of the tests at a succession of suitably placed centres.

The Sedlescombe Competition.—In the Utility Poultry Club's twelve-months' laying competition held at Sedlescombe, and which terminated on the 10th October last, a test was made of the egg production of birds of the same strain and breed kept on different systems: (1) the small flock system, and (2) the large flock or so-called "semi-intensive" system.

The competition was for that purpose divided into two sections, comprising thirty-one pens of four birds each (124 birds in each section), and to ensure a fair and accurate test each competitor was required to enter a pen of the same breed and strain in both sections. The general conditions as to floor space, area of grass runs per bird and other details were, as far as possible, equalised. The breeds represented were:—White Leghorns, 11 pens; White Wyandottes, 11 pens; Buff Orpingtons and White Orpingtons, 2 pens each; Buff Plymouth Rocks, 2 pens; Black Leghorns, 1 pen; Rhode Island Reds, 1 pen; and Red Sussex, 1 pen.

The method of scoring adopted for the purpose of awarding prizes was by the value of the eggs laid, calculated upon the weekly average prices of the markets of London, Bristol and Wolverhampton, as set out in the returns of the Board of Agriculture and Fisheries. All eggs were weighed, and those scaling 2 oz. and over were termed 1st grade; those weighing 1½ oz. and under 2 oz., 2nd grade; and those of 1½ oz. and under 1½ oz., 3rd grade. The deductions of 10 per cent. and 25 per cent. were made from current market prices on all 2nd and 3rd grade eggs respectively. No eggs under 1½ oz. were scored.

As the object of a competition should be to improve the size as well as the number of eggs produced, a minimum of 1½ oz. appears far too low, the minimum should be raised to 1¾ oz. After the first two or three months the deduction for want of size on 2nd grade eggs should be increased to 20 per cent.

It is very doubtful whether the market price, which is governed by supply and demand, and is greatly influenced by foreign competition, is a desirable basis for making the awards. The true standard of merit of a bird's performance is the number and weight of eggs laid.

A description of the houses used and the general arrangements of the pens appeared in this *Journal* for February, 1914, p. 1000, but it may be stated briefly, that the small flock section was divided up into sixteen flocks accommodated in eight double houses, measuring 12 ft. by 8 ft., and provided with duplicate grass runs for alternate use. The semi-intensive or large flock section was housed in one large scratching shed, measuring 40 ft. by 20 ft., and also provided with duplicate grass runs.

The total area of grass run given to each section was 1 acre, or 39 sq. yds. per bird, and the house provided a floor space of 6 sq. ft. per bird. In the design of the houses special attention was paid to the provision of abundant light and air and to the prevention of draught.

The feeding was the same in both sections, and the system adopted was as follows:—*Morning*—grain (scattered in the litter, with which the houses were bedded down) consisting of wheat and oats (usually in equal proportions) with the addition of a small quantity of a mixture of dari, buckwheat and kibbled peas and maize. *Mid-day*—wet mash of bran, sharps and Sussex ground oats with about 5 per cent. in weight of either fish or meat meal; to this was added a quantity of boiled vegetables, green stuffs and roots, and steamed clover chaff. *Evening*—grain as in the morning, but usually scattered broad-cast on the grass runs; only fed in the houses during very wet weather. No fixed rules were followed in the quantity, preparation, and proportions of the several foods used, these being varied from time to time as deemed advisable, having regard to the weather, condition of the birds and other considerations. The feeding was generous and of a bulky nature, as it must necessarily be to secure good results, and every endeavour was made to ensure the birds retiring to roost with full crops.

The weather conditions throughout the test were, on the whole, favourable to egg production, except that the runs were badly "burnt" during the long drought. In the summer months the supply of young grass was much curtailed in consequence.

The following is a comparative summary of the results obtained in the two sections:—

	Small flock Section.	Large flock Section.
Total number of eggs laid	23,317	21,302
Average per bird	188	171.8
Highest score per pen of 4 birds ..	951	898
Average per bird in best pen	237.7	224.5
Highest individual bird record	277	253
Percentage of 1st grade eggs	87.5	85.2

	Small flock Section.	Large flock Section.
Total realised by sale of eggs	£ s. d. 140 2 6	£ s. d. 127 13 10
Average price per dozen	1 5½	1 5½
Total profit over cost of feeding ..	87 14 1	75 5 5
Average value of eggs laid per bird ..	1 2 7	1 0 7
Average cost of feeding per bird	8 5.4	8 5.4
Average profit per bird	14 1.6	12 1.6

These figures show that very satisfactory results were obtained in both sections, those in the small flock section being especially good, and new records were set up for pen score—951, an average of 237.7 per bird, and also in the general flock average—188 eggs per bird.

The feeding cost of 8s. 5.4d. per bird is undoubtedly high, but this must be so when production is heavy. It was, to some extent, increased

in this instance by the war prices paid during the last nine or ten weeks of the test. It should also be pointed out that all foods were the very best of their respective kinds, bought in comparatively small quantities relative to the size of the flock and in order to ensure freshness.

On the other hand, the return per bird over and above the cost of feeding, which after all is the important point, was exceptionally high, being 14s. 1.6d. in the small flocks, and 12s. 1.6d. in the large. The comparatively high average price (1s. 5.4d. per doz.) received for the eggs was due primarily to the guarantee of freshness and, in part, to the high prices ruling throughout the last few weeks (2s. and 2s. 3d. per doz.) on account of war conditions.

The following table gives the egg production of the various breeds competing, and their averages* :—

SMALL FLOCK SECTION.

No. of pens.	No. of birds.	Breeds.	Total eggs laid.	Average per pen.	Average per bird.
11	44	White Leghorns	8,892	808.3	202
1	4	Black Leghorns	691	691	172.7
11	44	White Wyandottes	8,058	732.5	183
2	8	Buff Orpingtons	1,339	669.5	167.2
2	8	White Orpingtons	1,312	656	164
2	8	Buff Rocks	1,510	755	188.7
1	4	Rhode Island Reds	778	778	194.5
1	4	Red Sussex	621	621	155.2
12	48	All Light Breeds	9,583	798.5	199.6
19	76	All Heavy Breeds	13,618	716.8	179.2

LARGE FLOCK SECTION.

No. of pens.	No. of birds.	Breeds.	Total eggs laid.	Average per pen.	Average per bird.
11	44	White Leghorns	8,039	730.8	182.5
1	4	Black Leghorns	736	736	184
11	44	White Wyandottes	7,547	686	171.5
2	8	Buff Orpingtons	1,252	626	156.5
2	8	White Orpingtons	1,319	659.5	164.8
2	8	Buff Rocks	1,184	592	148
1	4	Rhode Island Reds	634	634	158.5
1	4	Red Sussex	408	408	102
12	48	All Light Breeds	8,775	731.2	182.8
19	76	All Heavy Breeds	12,344	649.7	162.4

Large and Small Flocks.—The results generally show a decided advantage in favour of small flocks.

Without assigning any special or general reason for this, there appear to be several contributory causes more or less affecting the result, some of which may or may not be encountered.

*In the small flock section, 202 eggs per bird is a remarkably fine average. It is also a significant fact, as pointing to the accuracy of the test, that the difference in the two sections in the averages per bird of the Light and Heavy Breeds taken separately is precisely the same as between the total flocks, viz., seventeen eggs per bird.

The chief of these, and the most difficult to contend against, is the difficulty of controlling infectious diseases in the case of large flocks. This was experienced in the Sedlescombe test, and doubtless accounts to a considerable extent for the disparity in the egg yield.

Roup was imported at the outset, and although both sections were affected the trouble in the small flocks was easily controlled and effectually stamped out within a very short time. In the large flock section it spread rapidly and a large proportion of the birds became affected. It was quite two months before it finally disappeared.

Then the matter of feeding has its influence. When dealing with small numbers it is possible to study to a great extent the varying conditions and requirements of the individual birds, and to regulate the feeding accordingly, but with large flocks all must necessarily be treated alike.

Seventeen deaths (6.8 per cent.) occurred during the test—eight in the small flocks and nine in the large. Of these eleven were due to troubles of the reproductive organs.

In comparing the general health and condition of the birds it was impossible to overlook the fact that those in the small flocks were more alert and brighter in face and comb, whilst there was too great a tendency on the part of the birds in the large house to remain inside even on days most favourable to foraging in the open.

Those in the small flocks, on the other hand, were usually to be found outside even in the roughest weather, without any adverse effect upon production.

At no period of the test, with the exception of the first three days, did production in the large flock exceed that of the small. The latter showed distinct superiority even in bad weather when it might reasonably be expected that the extra comfort of a large roomy house would have given an advantage to its occupants.

In a similar test carried out concurrently at Burnley by the Northern Utility Poultry Society these results were, in the main, confirmed, though the disparity in production was considerably less, but that may fairly be attributed to the absence of any outbreak of infectious disease.

From the economic standpoint large flocks have some advantage both in regard to the original outlay on plant and also in the subsequent labour charges, but the saving effected would certainly not be sufficient to compensate for such a disparity in egg production as that shown in the test, a difference of 2s. per bird.

The result of the test may, therefore, be regarded as justifying the conclusion that laying hens, like other kinds of live stock, give better results if kept in small flocks than when large numbers are dealt with.

Broodiness and Egg Production.—In addition to the competition proper and the test of systems, a subordinate observation was made with the purpose of discovering how far it might be possible to throw any light on the question of broodiness and its effect upon egg production.

It was observed that a moderate and even excessive amount of broodiness had less effect upon egg production than is generally supposed to be the case. In the small flock section and in the combined totals, birds showing none of the natural incubating instinct gave smaller results than those that did. In the semi-intensive section this was not the case.

The only pen amongst the heavy breeds showing no sign of broodiness was a pen of White Wyandottes in the small flock section, and this was at the very bottom of the list.

It is, of course, evident that a great deal depends upon the promptness with which the inclination to broodiness is dealt with, and the method of treatment adopted. It is probable that the new type of broody house used in connection with this test influenced the general result.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

Soil Solutions and the Mineral Constituents of the Soil (*Jour. Agric. Sci., Vol. VI., Part 3; A. D. Hall, M.A., W. E. Breckley, D.Sc., L. M. Underwood, B.Sc.*).—Solutions were made by extracting the soil from certain of the Rothamsted plots on which wheat and barley had been grown for 60 years and upwards. Wheat and barley were grown in these solutions, which were renewed fortnightly. The soil solutions contained phosphoric acid and potash of the same order as that in the natural drainage water from the same plots.

The comparative growth in the solutions was closely parallel to the growth of the crop on the plots in the field, and corresponded to the composition of the solutions as regards phosphoric acid and potash. Growth in the soil solutions from imperfectly manured plots was brought up to the level of that in the solutions from completely manured plots on making up their deficiencies in phosphoric acid and potash by the addition of suitable salts.

Wheat grew as well as barley in the solutions of the wheat soils, and *vice versa*. In a similar set of solutions from the same soils the growth of buckwheat, white lupins and sunflowers corresponded with that of wheat and barley. Boiling effected no alteration in the nutritive value of the soil solutions.

From the data obtained the following conclusions were reached:—

The composition of a natural soil solution as regards phosphoric acid and potash is not constant, but varies in accord with the composition of the soil from which it is taken, and the previous manuring of the soil.

Within wide limits the rate of growth of a plant varies with the concentration of the nutritive solution, irrespective of the total amount of plant food available.

When other conditions, such as the supply of nitrogen, water and air, are equal, the growth of the crop will be determined by the concentration of the soil solution in phosphoric acid and potash which, in its turn, is determined by the amount of these substances in the soil, their state of combination, and the fertiliser supplied.

On normal cultivated soils the growth of crops like wheat and barley, even when repeated for 60 years in succession, does not leave behind in the soil specific toxic substances which have an injurious effect upon the growth of the same or other plants in the soil.

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

Investigation into Soil Temperature (*Michigan Agric. Coll. Expt. Sta.; Tech. Bull. No. 17*).—The different types of soil investigated were gravel, sand, loam, clay and peat. The specific heat of these soils in a dry condition did not differ very materially. The moisture content of the different soils in their natural condition varied very greatly, and since water has such a high specific heat it made a very great difference in their final specific heat.

Gravel was found to possess the highest heat-transmitting power, followed in order by sand, clay, loam and peat respectively. Under field conditions solar radiation tended to travel with greater rapidity and facility vertically than horizontally. Contrary to general belief it was shown that colour had no effect on radiation, although it influenced absorption. A dry surface or mulch reduced the radiation.

When the influence of colour and other factors was removed it was found that all these soils cooled and froze about the same time in the upper six inches, but in the spring they thawed and warmed up at different rates; gravel and sand thawed first, followed by clay one day later, loam two days later, and peat ten days later. The temperature of the first two soils rose very rapidly after thawing, while that of the others rose very slowly; when the lower depths of the latter soils had thawed, however, their temperature rose also quite rapidly, and finally reached the same degree of magnitude as in the former or lighter soils. The rate of thawing was found to vary with the amount of organic matter present.

The different meteorological elements present and the conditions of cultivation were two further factors shown to influence soil temperature.

Salt solutions made the soil considerably warmer during the day. Different kinds of farmyard manure raised the temperature—horse manure most, cow manure next, and sheep manure the least.

FIELD CROPS.

Varieties of Potatoes (*Univ. Coll. of N. Wales, Dept. of Agric., Bull. II., 1914*).—In 1914, tests were made of eight varieties of potatoes at six centres, on soils ranging from a gravelly loam to a heavy loam on clay subsoil. Dung and artificials were applied to the crop in the rows, in varying proportions at the different centres. The average yields per acre of marketable potatoes were as follows:—Arran Chief, 12 tons 3 cwt. (av. of 6 centres); Up-to-Date, 11 tons 6 cwt. (5 centres); New Champion, 10 tons 16½ cwt. (6 centres); President, 10 tons 2½ cwt. (4 centres); Northern Star, 10 tons 2 cwt. (6 centres), Golden Wonder, 8 tons 7½ cwt. (6 centres). King Edward and Evergood, which were only tested at 2 centres, gave average yields per acre of 13 tons 12½ cwt. and 12 tons 17½ cwt., respectively. It is pointed out that owing to the dry summer of 1914 little disease was present, and in a year more favourable to disease the more resistant varieties, such as President, Northern Star and Golden Wonder, would doubtless have occupied relatively higher places.

In a further test carried out at the College farm, the early varieties, Eclipse and Epicure, gave average yields per acre of marketable potatoes of 12 tons 5½ cwt. and 11 tons 7 cwt., respectively; while the second early varieties, Royal Kidney and Tíree, yielded 12 tons 17½ cwt. and 9 tons 16½ cwt., respectively.

Varieties of Oats (*Univ. Coll. of N. Wales, Bangor, Dept. of Agric., Bull. I., 1914*).—In 1914 ten varieties of oats were tested at the College farm on a gravelly loam of fair depth which had previously been under grass for a considerable number of years. In the case of every variety two plots, each of $\frac{1}{10}$ acre, were laid out, and on the whole the results from the two sets of plots agreed very well. The yields of grain per acre in bushels and the estimated market values per 315 lb. of the different varieties placed in order of yield were as follows:—Record, 93½, 22s. 6d.; Black Mogul, 89, 20s. 9d.; Leader, 86½, 22s.; Goldfinder, 85½, 21s.; Victory, 82, 23s.; Bountiful, 80, 22s.; Abundance, 79½, 23s. 6d.; White Cluster, 77½, 22s. 9d.; Black Tartarian, 71½, 21s.; Golden Rain, 62, 20s. 6d. All the black varieties appeared to have ripened too quickly owing to the dry weather.

The yields of straw and chaff per acre were:—Black Mogul, 3 tons 0 cwt. 96 lb.; Record, 2 tons 17 cwt. 40 lb.; Goldfinder, 2 tons 16 cwt.; Golden Rain, 2 tons 15 cwt. 80 lb.; Abundance, 2 tons 14 cwt. 72 lb.; Black Tartarian, 2 tons 14 cwt. 16 lb.; Leader, 2 tons 13 cwt. 64 lb.; Bountiful, 2 tons 13 cwt. 56 lb.; Victory, 2 tons 12 cwt. 32 lb.; White Cluster, 2 tons 9 cwt.

The Chemical Composition of Wheat (*Washington Agric. Expt. Sta. Bull. No. 111*).—The influence both of environment and breeding on the chemical composition of wheat was examined.

With regard to various environmental factors the conclusions were reached (1) that the composition of the soil has very little influence upon the composition of the crop grown upon it; (2) that the moisture supply is a very potent factor in determining the composition of the wheat grown in any given locality or season; (3) that the exclusion of direct sunlight causes an increase in the proportion of mineral and nitrogenous matter and a decrease in the proportion of carbohydrates; (4) that the longer the growing season the smaller the proportion of protein in the grain (whether the season is prolonged by earlier seeding or later harvesting); and that the determining cause is the length of the period during which the kernel of the grain is being formed and not the whole period during which growth is taking place. The smaller proportion of protein in autumn-sown wheat is explained by the fact that it matures earlier than spring wheat and has consequently a longer period for kernel formation; and (5) that the composition of the seed grain has no effect whatever upon the composition of the resultant crop and that change of seed has no effect so far as composition of the grain is concerned.

The results of the selection work at the station are taken as proving that high or low nitrogen content is not a property of wheat which can be "fixed" by selection, i.e., the chemical composition of wheat is not a hereditary character but is entirely a matter of environmental influence.

Influence of Potash on Rape (*New Zealand Journal of Agriculture, Oct., 1914*).—Two one-acre plots were sown with rape, both receiving 2 cwt. superphosphate, while one received ½ cwt. sulphate of potash in addition. About three months later 19 lambs were turned on to each plot for a fortnight. During this period the gain per lamb on the plot receiving potash was 7.74 lb. and on the plot receiving no potash 4.42 lb. The value of the total gain, at 3d. per lb., was £1 16s. 9d. from the plot receiving potash and £1 1s. 0d. from the plot receiving no potash. Later in the year the potash plot carried double the number

of stock that the no-potash plot supported. After grazing down the second time the plots were closed; during the winter it was found that the potash plot made vigorous growth while the plants on the no-potash plot appeared weakly and were running to seed.

A similar experiment was carried out in the following year, 59 sheep in all being used. The gain per head from the potash plot was 8.17 lb. and that from the no-potash plot 6.03 lb. during the fortnight. The value of the total gain was £6 os. 6d. from the potash plot and £4 9s. 0d. from the no-potash plot.

DAIRYING.

Cost of Food in the Production of Milk (*Kent and Surrey Co. Councils, S.E. Agric. College, Wye; G. H. Garrad, N.D.A.*).—This investigation was begun in 1908, and reports on the previous results obtained were published in 1910 and 1913. The third report, published recently, deals with the period from May 1st, 1913, to May 1st, 1914. The year was divided into a winter and a summer period of 26 weeks each. In reckoning the cost of feeding, the following values per ton were placed on the home-grown produce:—mangolds and swedes, 10s.; turnips, 8s.; hay, 60s.; oat straw, 40s.; barley straw, 25s.; chat potatoes, 20s.

The average results per cow for the summer period from May 1st to November 1st, 1913, on 17 farms, comprising 592 Shorthorn cows, were: daily milk yield, 2.3 gals.; cost of food per day, 5.45d.; cost of food per gal. of milk, 2.37d. In addition, a herd of 22 Guernseys and another of 18 Jerseys were included in the tests, their average results per head being, respectively: daily milk yield, 1.99 and 1.57 gals.; cost of food per day, 4.35d. and 7.75d.; cost of food per gal. of milk, 2.18d. and 4.93d. Taking the average of all the herds it was calculated that the cost of the foods consumed during the whole summer period per cow was £4 1s. 6d., composed as follows:—(1) Outdoor feeding: grazing, £1 16s. 4d.; green crops, 3s. 10d. (2) Indoor feeding: concentrated foods, £1 11s. 8d.; roots, 4s. 4d.; fodder, 2s. 1d.; wet grains, 3s. 3d.

The average results per cow for the winter period from November 1st, 1913, to May 1st, 1914, on 18 farms comprising 632 Shorthorn cows were: daily milk yield 2.26 gals.; cost of food per day 12.12d.; cost of food per gal. of milk 5.36d. The corresponding figures per cow for the above Guernsey and Jersey herds were, respectively: daily milk yield 1.6 and 1.35 gals.; cost of food per day 12.57d. and 9.23d.; cost of food per gal. of milk 7.87d. and 6.84d. The average cost for all the herds of the food consumed during the winter period per cow was £9 os. 6d., composed as follows:—Roots, £2 2s. 11d.; fodder, £2 16s. 10d.; wet grains, 7s. 7d.; concentrated foods, £3 13s. 2d.

As regards the milk yields of the cows, it was found that 600 gallon cows were the commonest, constituting 25 per cent. of the total, while 65 per cent. of the cows yielded between 500 and 800 gals. per head during the year. The two extremes were a third-calf cow, which gave 1,238 gals. in 49 weeks, and a fourth-calf cow, which gave 279 gals. in 36 weeks; if milk be valued at 8d. per gal., the milk yields from these cows were worth £41 5s. 4d. and £9 6s., respectively, a difference of £31 19s. 4d. on the year. An average cow cost about £13 a year for food alone (see above), so that, valuing the milk at 8d. per gal., cows giving less than 400 gals. per annum were not paying for their keep. In this investigation 2 per cent. of the cows with completed records gave less than this amount of milk. The average yield per

cow over all the herds was 681 gals., the best herd producing an average of 756 gals., and the worst herd 604 gals.

WEEDS AND PLANT PESTS.

Silver-leaf Disease (*Univ. Coll., Reading, Faculty of Agric and Hort., Bulls. 23 and 24; J. M. Hector, B.Sc.*).—Owing to the prevalence of Silver-leaf disease (*Stereum purpureum*) in Berkshire, Hampshire and Middlesex, especially the last-named county, an investigation was recently carried out in a large number of infected orchards. It was estimated that in Middlesex at least 10 per cent. of the plum trees were attacked by the fungus. The disease was also seen on the following trees and shrubs:—Greengage, damson, peach, nectarine, gooseberry, red currant, cherry, cherry-laurel, lilac and elder. No attack on pear trees was observed. It is interesting to note that in every case where orchards planted with standard plum and apple trees were interplanted with gooseberries found to be infected with American gooseberry mildew, Silver-leaf disease was also present. Of the varieties of plums noted, Victorias appeared to be most liable to attack by the fungus, Czars were also very susceptible, Monarchs, Pond's Seedlings, Prince of Wales and Emperors were rather less susceptible, while Early Prolifics appeared to be the least susceptible of all.

It is stated that there is every reason to believe that the disease is usually spread by air-borne spores. This view appeared to be supported by the irregular distribution of the fungus and by the rapidity with which scions of re-grafted trees developed the disease. In one case about 40 Monarchs had been re-grafted with Victorias. So far as could be ascertained both trees and grafts were previously free from Silver-leaf; nevertheless, quite 60 per cent. of the trees contracted the disease apparently through the wood exposed by the grafting process.

It is emphasised that Silver-leaf attacks trees through wounded surfaces, and a number of ways in which trees may suffer damage and thus afford entry for the fungus spores are discussed. At present no effective treatment has been discovered, but the spread of the disease may be to a large extent arrested by the prompt removal and burning of all dead wood before the fructifications of the fungus develop.

The Addition of Soft Soap to Lead Arsenate for Spraying Purposes (*Jour. S.E. Agric. Coll., Wye, 1913; D. R. Edwardes-Ker*).—

As the result of enquiries received at the College, an investigation was recently carried out with regard to the advisability of mixing soft soap with lead arsenate for spraying. It appeared that when a 1 per cent. soap solution was added to lead arsenate, as sold commercially, there was no appreciable increase in the amount of soluble arsenic in the spray, i.e., arsenic in a form capable of causing injury to foliage by scorching. This was also the case when the home-made spray, consisting of a solution of lead acetate added to a solution of sodium arsenate, each being prepared with half the usual quantity of water, was made up to volume by the addition of an equal quantity of a 1 per cent. soap solution. When the lead acetate and sodium arsenate solutions were made up with a 1 per cent. soap solution entirely in place of water, a considerable increase in the amount of soluble arsenic occurred and, in addition, the precipitate obtained was very curdy and sticky, rendering the mixture quite unsuitable for spraying.

Eradication of Wild Oats (*Agric. Gazette of Canada, November, 1914*).—The following method of suppressing wild oats is stated to have met with considerable success on a badly infested field of 40 acres:—The land was lightly ploughed and harrowed in the autumn of 1913. The

wild oats were permitted to grow until the first week in June, 1914, when the field was ploughed to a depth of about 5 in. and harrowed immediately. Barley was then sown at the rate of $1\frac{1}{2}$ to 3 bushels per acre. When the barley was harvested there were only about 3 stooks in the field which showed wild oats.

POULTRY.

Poultry Feeding Experiments (*W. of Scotland Agric. Coll., Bull. 64; Miss. A. Kinross, N.D.D.*).—This bulletin contains an account of the following experiments which have been carried out recently:—

(1) Seven pullets were fed for a year on a daily ration per bird consisting during the six winter months of 1 oz. of a mash composed of bran, oatmeal and potatoes in the morning, 1 oz. of a mixture of 2 parts Indian corn and 1 part oats at noon, and 2 oz. of a mixture of 2 parts oats and 1 part Indian corn in the evening; during the six summer months the total daily winter quantity of 4 oz. was reduced to 3 oz. The bran was scalded and the potatoes, previously cooked, were then added to the bran along with the oatmeal, the whole being made into a crumbly mass. Green vegetable food was also supplied when necessary. The number of eggs laid during the year was 1,143, the value amounting to £6 3s. 11d. The total cost of the food consumed was £1 17s. 2d., the profit over the cost of food thus amounting to £4 6s. 9d. or 12s. 4½d. per hen.

(2) In this experiment 182 pullets and 70 second season hens were fed for a year on a daily ration consisting of 1 oz. of a mash composed of bran, oatmeal, thirds and meat in the morning, 1 oz. of equal parts of oats and Indian corn at noon, and 2 oz. of a mixture of 7 parts wheat and 3 parts oats in the evening. Green vegetable food was also supplied. The number of eggs laid during the year was 38,458 of a total value of £220 6s. 6d. The total cost of food of the 70 hens was £21 10s. 2½d., and of the 182 pullets £62 15s. 0½d., or a total of £84 5s. 3d., thus giving a gross profit of £136 1s. 3d., or 10s. 9½d. per hen.

(3) Two tests of the cost of fattening birds for 3 weeks were made, 6 birds being fed in each case. In the first trial the food consumed was as follows:—10½ lb. oatmeal, 10½ lb. Indian meal, 5½ lb. fish meal and 11½ lb. oats. The total cost of the food per bird was 7½d. At the commencement of the period the 6 birds weighed 28½ lb., and at the end 41½ lb., or an average gain per bird of 2 lb. 3½ oz. In the second trial 19 lb. oatmeal and 19 lb. Indian meal were consumed at a cost per bird of 7½d. The total weight of the 6 birds at the start was 27½ lb., and after fattening they weighed 39½ lb., the average gain per bird for 3 weeks thus being 2 lb.

(4) This experiment was designed to find out the cost of rearing chickens from birth until 16 weeks old, and also to test the comparative costs of rearing chickens by the hen and by means of a brooder. Fifty-five Rhode Island Red chickens hatched on 17th February, 1913, were reared to 8 weeks old in brooders. The total quantity of food consumed was 112½ lb. at a cost of 12s. 11d., or 2½d. per chicken. The cost of the paraffin burned during 6 weeks averaged ½d. per bird. The total cost of rearing was thus 3½d. per chicken for the 8 weeks. Twelve Rhode Island Red chickens were hatched on 22nd February, and reared by a hen to an age of 7 weeks. The total amount of food consumed, including the feeding of the hen, was 26 lb. 9 oz. at a cost of 3s. 9d., or an average of 3½d. per chick for the period.

The two lots of chickens were then reared together, making a total of 67 birds. The amount of food consumed during the next period of 4 weeks was 276½ lb. at a total cost of 23s. 11½d. or 4½d. per bird. During this period 3 chickens died.

During the final 4 weeks of the test, the birds consumed 411½ lb. of food at a cost of 36s. 10½d. or 7d. per chicken. The cost of feeding over the whole period was thus about 1s. 2½d. per chicken, but it would have been slightly higher if the chickens reared by the hen in the first period of the test had been fed for the full 8 weeks.

Some Factors Influencing the Bacterial Content and Keeping Quality of Eggs (*Kansas Agric. Expt. Sta., Bull. 201*).—The annual losses due to eggs being spoiled in the United States are estimated at over nine million £ sterling. This investigation dealt with the bacterial contents and keeping quality of fresh eggs produced under various conditions. The following is a summary of the conclusions reached:—

(1) Almost all the eggs containing bacteria were infected in the yolk, while very few of them showed bacteria in the white. Very few of the bacteria in eggs grow at blood temperature, while they grow abundantly at room temperature, a point which is of interest because of its bearing on the hatching quality of eggs.

(2) The number of infected eggs increased slightly with the age of the fowl.

(3) Eggs from different hens varied widely in bacterial content and keeping quality; eggs from the same hens varied similarly at different times and without apparent cause.

(4) Shutting up the fowls increased the number of infected eggs.

(5) Feeding wet mash increased the number of infected eggs appreciably; this was due to bacteria growing at blood temperature.

(6) Mating the hens did not increase infection of the eggs, a fact that suggests that the large number of fertile eggs spoiled results from the development of the embryo, which appears to increase the susceptibility of the egg.

(7) Increase in infection does not necessarily mean decrease in keeping quality, because it is the qualitative rather than the quantitative bacterial content that determines keeping quality; so that such of the foregoing statements as relate to bacterial content only are not necessarily reliable for keeping quality.

(8) Summer eggs contained more bacteria than spring or autumn eggs.

(9) The ratio of coagulable to uncoagulable nitrogen did not reveal any appreciable influence of the factors investigated upon the keeping quality of the eggs examined.

(10) No eggs with green coloured albumen were laid by a number of hens whose food consisted chiefly of lucerne, nor could any green pigment forming bacteria be detected in such eggs.

FORESTRY.

The Artificial Production of Vigorous Trees (*Journal Dept. Agric. and Tech. Instr. for Ireland, Vol. XV., No. 1; Augustine Henry, M.A., F.L.S., M.R.I.A.*).—An account is given of experiments on the artificial hybridisation of trees carried out by the author and others, with a summary of the facts upon which the experimental work is based (see also *Gardeners' Chronicle*, Vol. LVI., pp. 1, 46, 66, containing an article on "The Black Poplars" by the same writer).

The writer considers that by the propagation of vigorous crosses of timber trees the prospects of economic afforestation in Great Britain and Ireland would be greatly improved. Details are given of hybrid seedlings of Poplar, Ash, and Alder, which present special features of interest, together with a list of crosses of various species made in 1909-1914. The paper contains practical hints upon the manipulation of flower-bearing twigs in crossing experiments.

NOTES ON AGRICULTURAL CO-OPERATION.

In the *Journal* for January, 1914, a note was published dealing with the statistics of Agricultural Co-operative Credit Societies for 1912.

Co-operative Credit Societies in 1913.*

At the end of that year there were 46 registered societies in England and Wales, but only 30 of these could be treated as working societies, the test of work being the granting of loans, or the receipt of deposits, or both. For one of the societies, Well Hill, in Kent, the figures were not then available.

While one of the non-working societies has ceased to exist in 1913, eight new societies were started in 1913 as compared with six in 1912. The total number of societies at the end of 1913 was 53, but some of these are not doing business, and if this is continued may have to be dissolved. Of the new societies two are in Hampshire and one in each of the counties of Gloucester, Dorset, Oxford, Bedford, Surrey and Lincoln. North of the Humber the movement is represented by a single society in Yorkshire which was founded in 1911, and which did no business in 1912 or 1913.

Confining attention to working societies, the figures for 1912 and 1913 compare as follows:—

Year.	Working Societies.	Members.	Loans granted during year.		Deposits received.	Profits to end of year.
			No.	Amount.		
1912 ..	30	723	197	£ 2,025	£ 332	£ 297
1913 ..	30	796	165	1,832	521	323

So far as can be ascertained, 27 societies made loans to their members in 1913 and 9 of these also obtained deposits. Three societies received deposits, but made no loans. One of these, Cadoxton, in South Wales, is shown as having obtained £240. This is a credit society connected with a small-holdings society at the same place, which has recently acquired some land, and it seems not unlikely that the amount deposited is largely intended to meet the amount payable as compensation to the outgoing tenant. The total deposits held by village banks at the close of 1913 amounted to £1,225, which is 55 per cent. of the total outstanding loans, £2,221. The usual rates of interest paid on deposits are 3 and 4 per cent. It is an undoubted weakness that so few societies succeed in attracting deposits. For bank overdrafts 4 and 4½ per cent. are the common rates. If a village society borrows at either of these rates it would be prudent to charge 6 per cent. on loans to members, but most societies adopt 5 per cent. This results in very petty annual profits, if any, and failure to build up a proper reserve.

The progress of the co-operative credit movement is very slow. The reluctance of the villager to let his neighbours know that he owes money is an undoubted obstacle. The practical difficulty of obtaining capital has hitherto been another. Notwithstanding the arrangement made between the Board and the leading joint-stock banks, it is not

*Contributed by the Agricultural Organisation Society.

always easy to get power to overdraw unless repayment is guaranteed by some individual member or members. There is at least one case in which a village bank has been financed by a gift of money and another where a landowner has made a loan to a society without interest. Help of this kind is not free from objection, and the best way to aid a society is to make a small deposit and take the usual interest.

All existing societies are registered under the Friendly Societies Act, and the liability of the members is unlimited. There are alternative rules under this Act and also under the Industrial and Provident Societies Act for societies with limited liability. It may be doubted whether the nature of the liability has much effect one way or the other on the popularity of small rural societies. At present co-operative purchase appeals more to the cultivator of a small holding or allotment than do facilities for borrowing. Village banks when once started have perhaps in the past been left too much to themselves, and, while outside interference in details is likely to do harm, arrangements are being made by which it is hoped that it will be possible to assist with advice more regularly and systematically. (See Table. pp. 1146 and 1147).

This Society was founded at Coveney in Cambridgeshire in 1884, and was registered in 1891 as a Cattle Insurance Society under the Friendly Societies Act. It was established "to provide by voluntary subscriptions for making good any loss that the members may sustain by the death of their cattle or stock,"

and one of its rules lays down that "All stock that may die from accident, malicious injury, or any cause whatever, shall be paid for the same as if the stock had died a natural death, except it be through the wilful neglect of the owner."

Constitution of the Society.—The Society insures horses, mares, foals young horses, cows, calves, bullocks, and young stock. It consists at present of 24 members, all of whom reside in the parish of Coveney or close to its borders, within a radius of about two miles of the registered office. All of them, except one labourer, are engaged in farming land, and about 15 of them are of the status of small holders. The society has three trustees, is managed by a committee consisting of the treasurer and four members, who are elected annually, and has a secretary, who receives a salary of £1 10s. per annum. All of these officials are farmers, except that one of the trustees is the sub-post-master and the treasurer is an inn-keeper.

Payment of Entrance Fee and Premiums.—A new member is admitted by the vote of the majority of the members present at any meeting, and pays 1s. entrance fee and 6d. in the £ on the value of the animals entered at that time. The Society meets once a quarter, and each member is required to pay his contribution at the quarterly meeting at the rate of 1½d. in the £ per quarter on the value of the stock he enters. For brood mares, however, 2½d. in the £ is paid. A member is not required to insure the whole of his stock; he may insure any animals he pleases and keep other animals uninsured. No mark is placed on an insured animal, but as the members of the Society all live within a short distance of one another, there is practically no difficulty in identifying an insured animal. Each animal offered for insurance is inspected by the committee to see that it is sound, but not valued by them at that time, the owner being allowed to place his own valuation on the animal and to pay his insurance contribution according to the value he himself has named. When the animal falls

AGRICULTURAL CREDIT SOCIETIES REGISTERED UNDER THE FRIENDLY SOCIETIES ACT (WITH THE SPECIAL AUTHORITY OF H.M. TREASURY).—General Statement for the Year 1913.

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ill or dies, the committee inspect it again and estimate its value at what they think it was worth before it fell ill, and the owner is paid compensation at 17s. 6d. in the £, (that is seven-eighths) of his own valuation or of the committee's valuation, whichever is less. The committee's valuation is final and is practically never disputed.

Age of Insured Animals.—There is no limit as to the age from which or up to which a calf or cow can be insured. If a cow is insured, compensation is paid for the calf if it lives for 48 hours and then dies, but the calf must be separately paid for on the next club night. If a member buys a calf not already insured, he can give ten days' notice and have the calf insured on the next club night, however young it be.

No horse above the age of seven is accepted for insurance for the first time, but once a horse has been insured it remains insured up to any age. If a brood mare is insured, the insurance covers her foal also (even if it does not live for 48 hours, provided it is born after the 1st January), until the midsummer club night, when the foal has to be entered and paid for separately. If a member purchases a new foal, it can be insured on the next club night on 10 days' notice, however young it be. The difference in the treatment of calves and foals is partly due to the fact that a cow pays as insurance contributions per quarter only 1½d. in the £, whereas a brood mare pays 2½d. in the £. The extra 1d. per £ charged on a brood mare begins at the midsummer quarter and continues for three quarters thereafter, whether the mare be in foal or not. An owner can alter the valuation of any animal at any quarter, and sometimes a member raises his valuation of a mare for the quarter in which she is going to foal and reduces it again after foaling. Many members insure their animals at less than their full value, partly in order to avoid disputes as to valuation and partly in order to have a lower insurance contribution to pay.

Income and Expenditure of the Society during recent Years.—During the last eleven years the number of members has fallen from 27 to 24, and the number of cattle insured has risen from 37 to 75, and of horses from 45 to 50. On the average of the eleven years the number of animals insured has been about two cattle and two horses per member, but one member insures as many as eight horses and thirty cattle. The average number of animals insured was 108, of which 53 were cattle and 55 were horses. The average number of deaths among the insured animals was 3·5 per annum, which gives an average death rate of 3·1 per cent. per annum. The average amount paid on claims was £8 1s. per animal that died and 5s. 2d. per animal insured; but as the club received an average of 11s. per carcass, its net loss was £7 10s. per animal that died or 4s. 10d. per animal insured. The amount received in insurance contributions averaged 8s. per animal insured and was much more than sufficient to cover the net losses. The average expenditure and income for the last eleven years have been as follows:—

<i>Expenditure—</i>				£	s.	d.
Paid on claims	..	..	..	27	17	9
Expenses of management	..	..	..	2	8	6
Total expenditure	..	..	..	£30	6	3
<i>Income—</i>				£	s.	d.
Insurance contributions	..	..	..	43	8	5
Entrance fees	..	..	..		1	10
Interest	..	..	..	5	16	9
Sale of carcasses	..	..	..	1	16	3
Total income	..	..	..	51	3	3

Thus the Society has on the average saved nearly £21 a year, and its Reserve Fund has during these eleven years increased from £136 to £365, of which at the end of last year £321 were deposited in the Savings Bank. It is obvious, therefore, that it is in a flourishing financial condition and, as its Reserve Fund now amounts to £2 18s. per animal insured, which equals more than ten times the average loss of the last eleven years, there is now very little risk that the members will ever have to suffer under the rule which lays down that "In case any loss should occur and there should not be funds enough to meet the demand, the Society to pay at next quarter night, so far as the money will go, so that all may be equal at the end." Unlike most other societies, this club has no rule requiring the members to pay an extra levy in order to make up losses in case of a deficiency.

Experience with regard to Cattle and Horses compared.—It is interesting to compare the experiences of this Society as regards cattle and horses. The average death-rate among cattle has been 2·8 per cent. per annum, whereas among horses it has been 3·6 per cent. The cattle are all paid for at the rate of 1½d. per £ per quarter, that is 2½ per cent. per annum, and as the owner receives, if the animal dies, only seven-eighths of the valuation on which he pays, this rate corresponds very exactly with the actual average experience of the Society. For a brood mare 2½d. per £ per quarter is paid, that is, about 4 per cent. per annum, while other horses pay 1½d. or 2½ per cent. Of the 49 horses insured last July, 23 were insured as brood mares at 2½d. per £ per quarter and 26 at the lower rate of 1½d. per £ per quarter. Broadly speaking, the result of this plan of charging an extra 1d. per £ per quarter on brood mares is that the insurance contributions for all horses taken together correspond fairly well with the average experience of the Society, so that it makes the rate of insurance of horses fair as compared with the rate of insurance on cattle.

Taking all the horses together the average value at which a horse was insured was £21, the average for brood mares being £25 and for other horses £17. The highest value at which a horse was insured was £35, although some of them are actually worth £40 or more. Practically all of the horses are engaged in ordinary farm work.

It is interesting to note that while the average value at which a horse was insured was £21 on which at seven-eighths £18 8s. would be payable in case of death, the actual amount paid on the average for the eleven years was only £11 2s., which means that the death-rate was higher among the less valuable animals, that is, the foals and the old horses, than among the more valuable, that is, the horses in the prime of life. This accounts for the fact that although the rate of premium charged by the Society corresponds fairly closely with the actual average death-rate per cent., yet the actual payments on losses have been much less than the premium income and the Society's Reserve Fund has increased rapidly.

OFFICIAL NOTICES AND CIRCULARS.

THE International Institute of Agriculture has now been at work for five years, and sufficient time has therefore elapsed for it to be possible to judge of the value of the results which have been attained. The earlier years of the Institute's existence were necessarily beset with many obstacles. The ambitious nature of the problems which it attempted to solve, and the absence of any existing institution of a similar type, made the work of organisation one of unusual difficulty. It speaks well for the future of the Institute that most of these obstacles have now been successfully surmounted, and there is little doubt but that its work in the interests of international agriculture, as time goes on, will become of far-reaching importance. Unfortunately, the work of the Institute is not as widely known in this country as it should be, and it is hoped that a pamphlet recently published by the Institute, entitled "The International Institute of Agriculture—Its Organisation—Its Work—Its Results," will help towards a better realisation of its efforts. This pamphlet describes briefly the origin, organisation, and work of the Institute, and the principal results obtained since its formation. It is well illustrated with photographs of the imposing building in which the Institute is housed.

Copies of the pamphlet may be obtained, free on application, from the Office of the Board.

THE International Institute of Agriculture has just published, in French, the second International Year-book of Agricultural Statistics (*Annuaire international de statistique agricole* 1911 et 1912). It is the intention of the Institute to issue this volume every two years. The first Year-book appeared in 1912, and related to the decennial period 1901-1910. The present volume is a collection of statistical tables systematically grouped giving the following particulars for the countries throughout practically the whole of the civilised world in the decennial period 1903-1912:—(1) Total area and population; (2) area and production of the principal crops; (3) numbers of live stock; (4) importation and exportation of agricultural produce; (5) consumption and prices of agricultural produce.

The figures for all countries are expressed in the same measures and grouped into concise and intelligible tables so as to enable the reader to form an opinion of the evolution of agriculture either in individual countries or in practically the whole world.

The Year-book may be obtained from the Board of Agriculture and Fisheries, Whitehall Place, London, S.W., price 4s. post free.

The attention of readers of this *Journal* is drawn to Leaflet No. 257, which gives some account of the work, aims, and publications of the International Institute of Agriculture. With regard to the Institute's publications, these are on sale at the Office of the Board, and particulars as to prices will be found in the Leaflet, copies of which may be obtained free on application.

THE purpose of the Board's Special Leaflets was explained in the note in the *Journal* for September, 1914, p. 566, and a list of those issued was given at the time, and again in the *Journal* for October, 1914, p. 658, November, 1914, p. 755, and December, 1914, p. 852. The following further Special Leaflets have

since been prepared:—

- Special Leaflet No. 11.—Poultry Houses and Appliances for Allotment Holders, Cottagers, and Others.
 " " 18.—Potato Growing on Allotments and Small Gardens.
 " " 20.—Coconut Cake and Palmnut Kernel Cake.
 " " 21.—The Manufacture of Charcoal.
 " " 22.—The Growing of Spring Wheat.
 " " 23.—The Manuring of Corn in Spring.

MISCELLANEOUS NOTES.

FULL particulars as to the work which the Board is carrying out with a view to encouraging and improving the light horse breeding industry have been given in this *Journal* from time to time, and it is only necessary here to recall the fact that the main heads of the Board's scheme are: (1) The subsidising of stallions to travel at low fees; (2) the provision of brood mares for farmers at a small rental, and (3) the elimination of unsound stallions. Details of the progress accomplished in each of these three directions are given in the recently issued report of the Board on the "Administration of the Grant for the Encouragement and Improvement of the Light Horse-Breeding Industry for 1913-14." [Cd. 7818, price 3d.]

SERVICE SEASON, 1913.—From the returns received it appears that 1,785 foals were bred from 3,068 mares served by King's Premium Stallions during the service season of 1913, giving an average foal-getting percentage of 58.18 per stallion. The average amount paid by the Board for a King's Premium was £251, and the maximum £264 15s. These payments, with the service fee of £2, payable by a mare owner, bring the average earnings of a King's Premium Stallion up to £352, and the maximum to £420. An additional payment of 100 guineas was made in respect of 10 stallions to which the Super-premiums were awarded.

In addition to the Super-Premiums and King's Premiums to which the foregoing figures relate, Board's Premiums were awarded to 25 stallions recommended by County Committees, and of the mares served by them an average of 48 per cent. proved to be in foal. The average payment by the Board in respect of each of these Premiums was £113, and the maximum £151. With the addition of the service fee of £1, chargeable to the owner of a mare, the average earnings of a Board's Premium stallion was £156, and the maximum £216.

SERVICE SEASON 1914—*Super-Premiums and King's Premiums*.—The number of Premiums awarded at the Show of Thoroughbred Stallions was increased to 50 as compared with 44 in 1913, and the number of entries also showed a slight increase, being 119 as compared with 114 in 1913. The stallions paraded showed a distinct improvement in quality over those exhibited in 1913. The number of mares served by the 50 stallions was 3,820, giving the satisfactory average of 76 mares per stallion.

Board's Premiums.—The Board's Premiums were increased in number from 25 to 28; 23 of the stallions were Thoroughbreds, 3 Hunter Sires, 1 Yorkshire Coach, and 1 Cleveland Bay. The number of mares served was 1,756, an average of 63 per stallion.

Pony Stallions.—With the object of encouraging the use of high class pony sires for the service of pony mares not exceeding 14.2 hands the Board, on the recommendation of the National Pony Society, awarded 6 Premiums of the approximate value of £75 to Riding Pony Stallions selected at the Society's Show held on 13th March, 1914. As was to be expected during the first year's operations the number of mares served was comparatively few, averaging only 32 per stallion. This is not satisfactory, but it is hoped that by a re-arrangement of the districts and better advertisement of the routes to be travelled, more mares of the height and type required will be forthcoming. The Board regard the action they have taken in the matter as an experiment, and if the owners of the stallions and mares concerned do not take active steps to make it a success the award of the Premiums will not be continued.

Premiums to Welsh Cob, Fell, and Mountain, and Moorland Ponies.—Premiums of the average value of £50 were given to 10 Welsh Cob Stallions, these stallions being required to serve 25 mares of the old Welsh type, the nomination in the case of these mares being awarded free. Five premiums of the average value of £40 (increased from £30) were awarded to Fell Pony Stallions, and 38 of the value of £5 to Mountain and Moorland Ponies.

Free Nomination for Mares.—Practically all the free nominations are issued in respect of mares belonging to tenant farmers and small-holders; to a King's Premium Stallion the value is £2, and to a Board's Premium Stallion £1. During the year, of a total of 1,250 free nominations issued to King's Premium Stallions (*i.e.*, 25 per stallion), 1,127 were taken up; and of a total of 700 issued to Board's Premium horses 547 were used.

Purchase of Brood Mares.—The shortage of good brood mares of hunter type was the reason for the introduction of the brood mare scheme in 1911. Since its inception grants amounting approximately to £33,000 have been made to 38 County Committees and 740 mares have been purchased at an average cost of £40 and leased out to custodians.

Registration of Stallions.—The object which the Board have in view is the elimination of unsound stallions, the use of which has done and is doing so much harm to the horse-breeding industry of the country. At present registration is voluntary, but the time may not be far distant when action will be taken to make it illegal to travel an unsound stallion. It can be made unprofitable to do so now, if mare owners would only refuse to use a stallion which has not been registered for the current year, but unfortunately many mare owners only consider the amount of the fee and not the soundness of the stallion.

The increasing support given to the registration scheme is evidence that a certificate has a commercial value. This is most satisfactory, and it is hoped that mare owners will do their share to increase this value by refusing to use any stallion that is not registered.

Of the 1,220 stallions registered in 1913-14, 636 were Shires, 200 Thoroughbreds, 170 Ponies, 88 Hackneys, 44 Suffolk Punches, 59 Clydesdales, 10 Hunters, 6 Yorkshire Coach Horses, 4 Cleveland Bays, and 3 American Trotters.

Of the 106 rejected in 1913-14, 65 were Shires, 24 Thoroughbreds, 4 Ponies, 6 Hackneys, 4 Suffolk Punches, 1 Clydesdale, and 2 Yorkshire Coach Horses.

That the Board's scheme has revived an interest in light horse-breeding is generally admitted, and that it is tending to improve the

quality of the stock bred is undoubted, but as improvement in the standard of the horses bred is necessarily a slow process, it must not be expected that the good results will be apparent for some years to come. The Board are not without hope, however, that if sufficient funds are placed at their disposal they will be able, with the assistance of the Breed Societies and persons interested, to extend and develop their scheme to secure the objects in view.

THE *Bulletin of Agricultural and Commercial Statistics* for February, 1915, contains estimates of the production of cereals crops in 1914.

Notes on Crop Prospects Abroad.

The countries for which it is possible to give estimates are as follows:—In *Europe*—Prussia, Hungary (proper), Belgium, Bulgaria, Denmark, Spain, Great Britain and Ireland, Italy, Luxemburg, Norway, Netherlands, Rumania, Russia in Europe (53 governments), Sweden, Switzerland; in *America*—Canada, United States; in *Asia*—India, Japan, Russia in Asia (10 governments); in *Africa*—Algeria (department of Constantine), Egypt, Tunis.

Wheat.—The total production in the above-mentioned countries is estimated at 360,047,000 qr. in 1914, compared with 400,478,000 qr. in 1913, or a decrease of 10.1 per cent.

Rye.—For the same countries as above, but omitting Great Britain, India, Japan, Algeria, Egypt, and Tunis, the production is placed at 160,494,000 qr., or a decrease of 8.6 per cent. compared with the previous year, when the production amounted to 175,522,000 qr.

Barley.—In the specified countries, excluding India, the forecast gives the production as 134,214,000 qr. in 1914, against 160,321,000 qr. in 1913, or a reduction of 16.3 per cent.

Oats.—In the above countries, omitting India and Egypt, the estimated production is given as 344,559,000 qr. in 1914; compared with 392,735,000 qr. in 1913, the decrease amounting to 12.3 per cent.

Sowing of Winter Cereals.—The areas estimated to have been sown to wheat in 1914-15, compared with the areas sown during the corresponding period of 1913-14, expressed as percentages, are as follows:—Denmark 103, Great Britain 110, Italy 105, Luxemburg 107, Switzerland 110, Canada 133, United States 111, India 122, Japan 99. The areas sown to rye are: Denmark 93, Luxemburg 106, Switzerland 110, United States 103. The areas sown to barley are: Switzerland 105, Japan 102.

The following information is given respecting crops in the southern hemisphere:—

Wheat.—The estimated production in Argentina, Chile, Australia, and New Zealand in 1914-15 is placed at 31,321,000 qr., against 29,457,000 qr. in 1913-14, or an increase of 6.3 per cent.

Argentina.—The preliminary estimate places the production of rye at 216,000 qr. in 1914-15, against 390,000 qr. in 1913-14, a decrease of 44.7 per cent., and of oats at 9,091,000 qr., against 5,227,000 qr., or an increase of 73.9 per cent.

Russia.—According to a report of the Central Statistical Committee, the condition of the crops at the beginning of winter was as follows:—In three governments the condition was slightly below average; in eighteen governments, average; in thirty-five governments, slightly above average; in sixteen governments, considerably above average; in one government, nearly good; and in one government, very good. (*London Grain, Seed and Oil Reporter*, 15th February.)

Rumania.—According to official returns 4,811,000 acres of wheat were sown by the 1st December last, this area being $7\frac{1}{2}$ per cent. less than that of the previous year. As sowing continued during December it is thought that some 4,950,000 acres are now under this crop, as compared with 5,213,000 acres in the previous year. A little spring wheat is usually sown, but never very much. The acreage under winter rye, barley and rapeseed has decreased by 25 to 30 per cent. (*Broomhall's Corn Trade News*, 24th February.)

United States.—The Bureau of Statistics of the Department of Agriculture estimates that the following quantities of grain were still in farmers' hands in the United States on the 1st March (stocks on the same date in 1914 in brackets):—Wheat 152,903,000 bushels (151,809,000 bushels); maize, 910,894,000 bushels (868,692,000 bushels); oats, 379,369,000 bushels (419,476,000 bushels); and barley, 42,889,000 bushels (44,126,000 bushels). (*The London Grain, Seed and Oil Reporter*, 8th March.)

India.—According to the second General Memorandum on the wheat crop, published on 6th March, the area under wheat in India is 32,028,000 acres, an increase of 23 per cent. as compared with last year. Crop conditions and prospects are very favourable, except in Bihar, Orissa and Bengal, where, however, wheat crops are not of much importance. (*Broomhall's Corn Trade News*, 8th March.)

Argentina.—The Minister of Agriculture issued on the 27th February an estimate of the area and production of maize in the Republic in the season 1914-15. The total acreage is given at 10,480,000 acres, an increase of 150,000 acres as compared with the previous season, and the production is estimated at 39,523,000 quarters against 38,180,000 qr. last year. (*Broomhall's Corn Trade News*, 1st March.)

The *Review of the River Plate* of February 5th states that during the previous week considerable progress was made with the harvest in good weather. Some damage was done to the grain crops during January, and the export surplus of wheat is now estimated at 3,200,000 tons, and of oats at 600,000 tons. Linseed does not appear to have suffered. Maize is making very satisfactory progress, but in the Province of Cordoba damage has been caused by locusts, although this will have little effect on the total crop of the country.

ACCORDING to statements in the Board's Monthly Agricultural Report (March 1st) the supply of labour was scarce everywhere, but the very wet weather, by stopping field work, prevented the shortage being seriously felt. Wages rose generally, and at the February hirings in the north men very generally secured an advance of a couple of shillings per week as compared with last year.

The following local summaries give further details regarding agricultural labour in the different districts of England and Wales:—
Northumberland, Durham, Cumberland, and Westmorland.—At the hirings which were taking place in north Northumberland at the date of the report, men were difficult to obtain, and wages showed a rise of 2s. per week; in the south of the county the hirings had not started, but prospects were not considered bright. Although a shortage in the supply of labour was expected to be keenly felt in Durham, when a beginning could be made with spring work, the supply at the time was nearly sufficient for requirements. In Cumberland and Westmorland the supply was very short in most districts, and wages were 10 to 15 per cent. higher than a year ago.

Lancashire and Cheshire.—There was a general deficiency in the supply of labour, and it was anticipated that with the increased work required in the spring the shortage will be badly felt.

Yorkshire.—The supply of labour was very deficient, in spite of a rise of 2s. to 3s. a week in wages. Skilled labourers, particularly horsemen, were very scarce.

Shropshire and Stafford.—In spite of increases of wages the supply of labour was distinctly short throughout the district.

Derby, Nottingham, Leicester and Rutland.—Although in some districts the supply of labour during February was sufficient for requirements, a distinct scarcity, especially of skilled men, was making itself felt, and spring work will probably be delayed. Higher wages than usual were being paid.

Lincoln and Norfolk.—Although up to the date of the report farmers had generally been able to get all the work that was possible done, men were scarce, and, with finer weather, a sufficient supply of labour, more particularly horsemen, will not be at hand. Wages were higher than usual in most districts.

Suffolk, Cambridge and Huntingdon.—Labour was short everywhere, but as little work could be done owing to the bad weather, the shortage was not much felt up to the date of the report. Wages were increased by 1s. or 2s. a week in many districts.

Bedford, Northampton and Warwick.—There was a general scarcity of farm workers throughout this division, only about four-fifths of the usual supply being available, and wages were about 1s. to 2s. a week above the normal in most districts.

Buckingham, Oxford, and Berkshire.—There was a distinct shortage throughout the district, particularly of skilled labour. It was anticipated that the effects will be more severely felt when the weather improves. Wages generally rose.

Worcester, Hereford, and Gloucester.—A deficiency in the supply of labour was general, and there were no prospects of immediate improvement. In north-west Hereford and north-east Gloucester, however, the shortage was not serious. Reports of advances in wages were received from Worcester and Gloucester, and in some cases increases of 1s. to 2s. per week were being made.

Cornwall, Devon, and Somerset.—The supply of labour was short throughout this division, except in north Cornwall where it was reported to be fairly good, and in east Devon where the shortage was not felt. It is anticipated that when weather conditions improve sufficiently to allow spring sowing to be proceeded with the deficiency will be serious.

Dorset, Wiltshire, and Hampshire.—Throughout the division the scarcity of labour, particularly of carters, was being increasingly felt, and the position promised to be worse later. In Dorset, wages increased by about 2s. per week, but good men were very difficult to get.

Surry, Kent, and Sussex.—The supply of labour was generally deficient and the outlook was often considered serious, as there was a great scarcity of capable men. Sufficient horsemen and milkers in particular could not be got, and in the south-east of Kent there was difficulty in getting enough hands for threshing. Higher wages than usual were generally being paid.

Essex, Hertford, and Middlesex.—Labour was very short, but the shortage was not very acutely felt, as farm work was almost at a standstill during the month. Wages were increased in many places.

North Wales.—There was a shortage in some districts, and it was anticipated that a serious deficiency will make itself felt when spring cultivation can be begun in earnest.

Mid Wales.—In Montgomery and the north of Radnorshire the supply of labour was deficient and the outlook was far from promising. Elsewhere a scarcity of men was not felt to any extent, but later on a deficiency was expected. In the south of Cardiganshire ploughmen were very scarce.

South Wales.—The shortage of labour was expected to be severely felt when the weather improves. In some districts wages have advanced.

THE Crop Reporters of the Board, in reporting on agricultural conditions in England and Wales during February, state that wheat on light soils and where sown in good time, is generally looking well and healthy, in spite of the very wet weather. The later sown wheat, however, and that on heavy or low lying ground, has suffered from the excessive rainfall, and is in some instances turning yellow. Oats and beans have stood the conditions better than wheat, and look well everywhere.

Very little work has been done in the fields in most parts of the country during February, and spring sowing has scarcely begun. The area intended for spring wheat is reported to be larger than last year, and the average of oats will also be increased, a second corn crop being often grown instead of roots.

Lambing is in full swing in the southern counties, and the flocks in early districts have generally given an average crop of lambs. The condition, both of ewes and lambs, is, however, hardly so satisfactory as usual, owing to the very trying weather, and in some districts there has been a rather heavy mortality. The condition of ewes in other districts is only fairly good—they have naturally done best where given plenty of dry food—but lambing prospects are generally considered normal.

Live stock generally have not made much progress during the month, but they have not, in most places, lost condition.

Prevalence of Animal Diseases on the Continent.

THE following statement shows that according to the information in the possession of the Board on March 1st, 1915, certain diseases of animals existed in the countries specified:—

Denmark (month of December).

Anthrax, Foot-and-Mouth Disease (43 outbreaks), Glanders and Farcy, Swine Erysipelas, Swine Fever.

France (for the period January 17th—February 6th).

Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox.

Holland (month of January).

Anthrax, Foot-and-Mouth Disease (110 outbreaks), Foot-rot, Swine Erysipelas.

Italy (for the period February 8th—14th).

Anthrax, Blackleg, Foot-and-Mouth Disease (247 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Norway (month of January).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period December 29th—January 6th).

Foot-and-Mouth Disease (122 animals), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Fever.

Russia (month of October).

Anthrax, Foot-and-Mouth Disease (77,009 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of November).

Anthrax, Blackleg, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Tuberculosis.

Sweden (month of January).

Anthrax, Blackleg, Foot-and-Mouth Disease (9 outbreaks).

Switzerland (for the period February 1st—7th).

Anthrax, Blackleg, Foot-and-Mouth Disease (176 "étables" entailing 2,333 animals, of which 19 "étables" were declared infected during the period), Glanders and Farcy, Swine Fever.

No further returns have been received in respect of the following countries:—Austria, Belgium, Bulgaria, Germany, Hungary, Montenegro, Serbia.

The Weather in England during February.

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 Feb. 6th:							
England, N.E. ...	42.2	+3.0	0.68	17	+8	5	1.0
England, E. ...	41.9	+3.0	0.56	14	+4	5	1.6
Midland Counties ...	42.7	+3.6	0.91	23	+10	5	1.0
England, S.E. ...	43.6	+3.2	1.12	29	+16	5	1.6
England, N.W. ...	43.6	+3.6	1.47	37	+19	7	1.2
England, S.W. ...	43.3	+1.7	1.49	38	+17	7	1.4
English Channel ...	45.6	+1.2	1.13	29	+12	6	1.9
Week ending Feb. 13th:							
England, N.E. ...	37.9	—0.8	1.07	27	+17	5	1.5
England, E. ...	39.1	+0.7	0.86	22	+13	5	2.2
Midland Counties ...	37.7	—0.9	1.18	30	+18	5	2.2
England, S.E. ...	40.5	+0.5	1.83	46	+33	6	2.7
England, N.W. ...	38.9	—0.7	0.87	22	+6	4	2.4
England, S.W. ...	40.3	—0.9	2.33	59	+40	6	2.2
English Channel ...	43.0	—1.0	2.22	56	+40	7	3.2
Week ending Feb. 20th:							
England, N.E. ...	39.5	+1.1	0.65	16	+7	5	2.6
England, E. ...	40.4	+2.2	0.93	24	+15	6	2.0
Midland Counties ...	39.7	+1.3	0.96	24	+13	5	2.5
England, S.E. ...	41.5	+1.8	1.30	33	+21	5	2.5
England, N.W. ...	40.0	+0.7	0.82	21	+7	5	3.1
England S.W. ...	41.3	+0.3	1.72	44	+26	5	2.8
English Channel ...	44.2	+0.3	1.57	40	+24	6	3.2
Week ending Feb. 27th:							
England, N.E. ...	36.1	—2.4	0.30	8	0	4	4.2
England, E. ...	37.2	—1.2	0.41	10	+2	5	3.3
Midland Counties ...	35.9	—2.6	0.41	10	0	4	4.5
England, S.E. ...	37.6	—2.2	0.46	12	+1	3	4.6
England, N.W. ...	36.9	—2.5	0.87	22	+9	4	4.0
England, S.W. ...	37.0	—4.0	0.63	16	—1	5	4.7
English Channel ...	40.7	—3.3	0.34	9	—6	4	5.3

* 1 inch = 25.4 millimetres.

Unit Prices of
Artificial Manures.Statement of cost to the purchaser of 1 per
cent. per ton of Nitrogen, Soluble and In-
soluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d.	s. d.	s. d.	s. d.
Nitrogen from:				
Sulphate of Am- 95%	14 5	—	14 0	14 3
monia pure ... 93%	—	—	—	13 11
Calcium Cyanamide ...	12 9	—	12 5	11 9½
Nitrate of Soda } 95%	—	—	14 10	15 2
pure ... } 90%	16 2½	—	15 0	15 0
Nitrate of Lime ...	—	—	12 5	15 3½
Soluble Phosphates from:				
Superphosphate 35%	2 1	—	2 1	2 2½
" 33%	2 1½	—	2 2	2 2½
" 30%	2 2½	—	2 3	2 3½
" 26%	2 4½	—	2 4½	2 6
Dissolved Bones ...	3 1½	—	2 8	3 1
Allowed for Nitrogen	18 4½	—	15 7½	17 9½
Allowed for Insol. Phos.	1 9	—	1 6	1 8
Insoluble Phosphates (Citric Soluble) from:				
Basic Slag ...	1 9½	—	1 8½	—
Insoluble Phosphates from:				
Basic Slag ...	—	—	1 4½	1 3½
Bone Meal ...	1 7	—	1 6	1 5
Allowed for Nitrogen	16 6	—	15 9	14 10½
Steamed Bone Flour ...	1 6	—	1 5½	1 6½
Allowed for Nitrogen	15 10½	—	15 4	16 4
Potash from:				
Kainit ...	—	—	—	—
Sulphate of Potash ...	—	—	—	—
Muriate of Potash ...	—	—	—	—
Potash Salts ...	—	—	—	—

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the

various sources, at certain ports and Manufacturing Centres, for March, 1915.

Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
14 7½	—	14 6	13 10½	—	—
—	14 8	14 8	—	14 6	15 2½
—	11 9½	—	12 3	—	12 4½
—	14 6	14 8	—	15 2	14 8
15 8	—	—	15 10	15 7	15 2
—	—	—	—	16 0	15 6
2 2½	2 2	2 1	2 3	2 3	2 3
—	2 2	2 1	2 4	2 4	2 4
2 3½	2 2½	2 1½	2 4½	2 4½	2 4½
2 6	2 5	2 3½	2 7	2 7	2 7
3 1½	3 4	3 4	3 5½	3 6	3 6½
18 4½	19 8	19 6	20 4½	20 7½	20 10
1 9	1 10½	1 10	1 11½	1 11½	2 0
—	1 6½	—	—	2 0	—
1 10½	1 4	—	1 4½	1 6½	—
19 6	1 6½	1 6½	1 5	1 5	1 8
—	16 2½	16 5	14 10½	14 10	17 8
—	—	—	1 3	1 5	1 8
—	—	—	13 3½	15 1	17 4
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and rebagging the ingredients, bags, and loss of weight.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked
or Slaughtered.

GREAT BRITAIN.

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

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	67	69	155	167
Animals attacked	75	75	175	180
Foot-and-Mouth Disease:—				
Outbreaks	—	5	—	5
Animals attacked	—	31	—	31
Glanders (including Farcy):—				
Outbreaks	4	10	7	19
Animals attacked	6	21	11	47
Sheep-Scab:—				
Outbreaks	28	45	107	116
Swine Fever:—				
Outbreaks	284	250	692	487
Swine Slaughtered as diseased or exposed to infection ...	1,055	2,633	2,842	4,515

IRELAND.

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

DISEASE.	FEBRUARY.		TWO MONTHS ENDED FEBRUARY.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Foot-and-Mouth Disease:—				
Outbreaks	—	1	—	2
Animals attacked	—	9	—	28
Glanders (including Farcy):—				
Outbreaks	—	—	—	—
Animals attacked	—	—	—	—
Parasitic Mange:—				
Outbreaks	5	8	10	25
Sheep-Scab:—				
Outbreaks	62	100	131	218
Swine Fever:—				
Outbreaks	19	19	39	34
Swine Slaughtered as diseased or exposed to infection ...	149	130	248	224

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and WALES
in February and January, 1915.

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

Description.	FEBRUARY.		JANUARY.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle:—	s. d.	s. d.	s. d.	s. d.
Polled Scots	10 9	10 5	10 6	10 1
Herefords	10 8	9 10	10 5	9 4
Shorthorns	10 7	9 9	10 4	9 5
Devons	10 8	9 9	10 6	9 8
Welsh Runts	10 6	9 4	10 2	9 2
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	10	9½	9½	8½
Sheep:—				
Downs	10½	9½	10½	9½
Longwools	10½	9	10½	9½
Cheviots	11	10	10½	9½
Blackfaced	10½	9½	10½	9½
Welsh	10½	9½	10	9
Cross-breds	10½	9½	10	9
	per stone.*	per stone.*	per stone.*	per stone.*
	s. d.	s. d.	s. d.	s. d.
Pigs:—				
Bacon Pigs	8 5	7 11	7 11	7 5
Porkers	8 10	8 4	8 5	7 11
LEAN STOCK:—	per head.	per head.	per head.	per head.
	£ s.	£ s.	£ s.	£ s.
Milking Cows:—				
Shorthorns—In Milk ...	24 18	20 15	24 13	20 14
—Calvers	23 5	19 12	23 16	19 14
Other Breeds—In Milk ...	23 9	19 8	22 16	19 9
—Calvers	18 0	16 0	17 10	16 5
Calves for Rearing	2 15	2 3	2 13	2 2
Store Cattle:—				
Shorthorns—Yearlings ...	12 13	10 16	12 8	10 10
—Two-year-olds... ..	16 15	14 17	16 10	14 12
—Three-year-olds	20 15	18 0	19 3	17 5
Herefords—Two-year-olds... ..	19 17	17 12	17 10	15 12
Devons— "	17 2	15 4	16 11	14 15
Welsh Runts— "	17 10	15 5	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	49 9	44 5	47 6	39 10
Store Pigs:—				
8 to 12 weeks old	20 3	15 7	19 10	15 0
12 to 16 weeks old	35 5	26 4	35 8	26 2

* Estimated carcass weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in February, 1915.

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

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
BEEF:—		s. d.	s. d.	s. d.	s. d.	s. d.
English	1st	72 0	71 0	—	74 0	71 6
	2nd	67 6	68 0	—	70 0	68 0
Cow and Bull	1st	64 0	67 0	65 6	64 6	64 6
	2nd	57 0	59 6	60 6	60 0	59 0
Irish: Port Killed	1st	69 0	—	70 0	72 0	69 6
	2nd	65 6	67 6	65 6	68 0	66 6
Argentine Frozen— Hind Quarters	1st	61 0	60 6	59 6	62 0	59 6
Fore "	1st	57 6	57 0	56 0	57 0	56 0
Argentine Chilled— Hind Quarters	1st	70 6	70 6	70 6	71 6	70 6
Fore "	1st	59 6	59 6	60 6	60 0	60 6
Australian Frozen— Hind Quarters	1st	60 0	60 0	59 0	62 0	59 0
Fore "	1st	57 0	57 0	56 0	57 0	56 0
VEAL:—						
British	1st	77 6	77 0	90 6	78 0	87 6
	2nd	71 6	71 6	81 6	69 0	81 6
Foreign	1st	—	—	—	82 0	—
MUTTON:—						
Scotch	1st	—	—	87 6	84 6	90 0
	2nd	—	—	79 6	77 0	85 6
English	1st	78 6	81 6	—	77 0	85 6
	2nd	70 0	77 0	—	71 0	81 6
Irish: Port Killed	1st	77 0	—	81 6	—	81 6
	2nd	63 0	—	73 0	—	77 0
Argentine Frozen	1st	52 6	53 0	52 0	53 0	52 0
Australian "	1st	50 6	51 0	50 0	51 6	50 0
New Zealand "	1st	52 6	—	—	54 6	—
LAMB:—						
British	1st	102 6	—	—	103 0	—
	2nd	98 0	—	—	95 0	—
New Zealand	1st	69 6	67 6	67 6	69 6	67 6
Australian	1st	62 0	62 0	61 0	62 6	61 0
Argentine	1st	62 0	62 6	62 6	63 0	62 6
PORK:—						
British	1st	75 0	70 0	75 0	75 0	74 6
	2nd	69 0	67 0	67 6	70 6	70 0
Foreign	1st	—	—	—	73 6	—

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at
certain MARKETS in ENGLAND in February, 1915.

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

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BUTTER:—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British	17 3	16 3	—	—	16 6	15 6
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery—Fresh	—	—	—	—	—	—
Factory	—	—	141 0	139 0	143 6	139 6
Danish	—	—	—	—	141 6	137 6
French	—	—	—	—	—	—
Russian	—	—	—	—	—	—
Australian	139 6	137 6	138 0	136 0	138 0	134 0
New Zealand	141 6	139 6	140 0	138 0	140 0	136 0
Argentine	139 6	137 6	138 6	136 6	138 6	134 6
CHEESE:—						
British—						
Cheddar	91 6	85 6	91 6	88 0	94 6	89 6
	—	—	120 lb.	120 lb.	120 lb.	120 lb.
Cheshire	—	—	98 6	94 0	100 0	94 0
	—	—	per cwt.	per cwt.	per cwt.	per cwt.
Canadian	89 6	88 0	89 0	88 0	90 6	88 0
BACON:—						
Irish (Green)	84 0	80 0	82 6	78 0	84 6	80 0
Canadian (Green sides)	75 6	73 0	74 6	70 0	76 0	72 6
HAMS:—						
York (Dried or						
Smoked)	114 0	112 0	—	—	115 0	109 6
Irish (Dried or Smoked)	—	—	—	—	112 0	105 0
American (Green)						
(long cut)	71 0	68 0	68 6	65 6	71 0	67 0
EGGS:—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British	—	—	—	—	16 10	15 2
Irish	14 8	14 1	14 8	13 11	15 1	14 1
Danish	—	—	—	—	16 1	14 1
POTATOES:—	per ton.	per ton.	per ton.	per ton.	per ton.	per ton.
Edward VII.	105 0	93 6	85 0	—	102 6	91 6
Langworthy	96 0	82 6	100 0	95 0	111 0	101 0
Up-to-Date	103 0	90 0	85 0	80 0	107 0	99 0
HAY:—						
Clover	—	—	100 0	80 0	104 6	95 6
Meadow	—	—	—	—	95 6	86 6

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 1913, 1914 and 1915.

Weeks ended (in 1915).	WHEAT.			BARLEY.			OATS.		
	1913.	1914.	1915.	1913.	1914.	1915.	1913.	1914.	1915.
Jan. 2...	s. d. 30 5	s. d. 31 1	s. d. 44 4	s. d. 28 6	s. d. 26 2	s. d. 29 10	s. d. 19 10	s. d. 18 2	s. d. 26 6
" 9...	30 3	30 11	46 2	28 4	25 11	29 7	19 2	18 4	26 5
" 16...	30 5	31 0	48 9	28 6	26 0	30 5	19 4	18 6	27 6
" 23...	30 11	30 11	51 6	28 10	26 3	31 3	19 4	18 11	28 10
" 30...	31 1	31 1	52 8	28 11	26 6	32 5	20 2	19 1	29 10
Feb. 6...	31 0	31 0	53 3	28 10	26 7	33 7	20 1	18 9	30 3
" 13...	30 9	31 0	54 8	29 1	26 7	34 7	20 2	18 11	31 1
" 20...	30 11	31 0	56 0	28 8	26 7	34 11	20 4	18 11	31 8
" 27...	31 0	31 0	56 0	28 6	26 6	35 3	20 4	18 11	31 5
Mar. 6...	31 3	31 5	55 11	28 5	26 2	34 6	20 0	18 9	31 8
" 13...	31 1	31 6		27 11	26 0		20 2	18 7	
" 20...	31 1	31 5		28 6	25 8		19 11	18 6	
" 27...	31 3	31 4		27 6	25 7		19 7	18 8	
Apl. 3...	31 4	31 6		27 0	25 6		19 2	18 5	
" 10...	31 3	31 5		27 8	26 8		19 2	18 4	
" 17...	31 6	31 7		26 11	25 4		18 10	18 4	
" 24...	31 8	31 9		26 7	26 6		19 3	18 5	
May 1...	32 2	31 9		25 11	26 0		19 6	18 5	
" 8...	32 6	32 2		25 9	25 6		19 6	18 9	
" 15...	32 10	32 7		25 4	26 3		19 9	18 11	
" 22...	32 10	33 0		25 3	25 10		19 11	19 0	
" 29...	32 7	33 9		26 1	26 1		20 1	19 4	
June 5...	32 10	34 0		26 2	25 11		19 8	19 4	
" 12...	32 8	34 1		24 7	24 11		20 2	19 8	
" 19...	32 8	34 1		23 10	25 10		19 8	19 9	
" 26...	32 8	34 3		24 3	25 4		19 1	20 0	
July 3...	33 1	34 4		25 2	24 6		21 0	19 9	
" 10...	33 4	34 2		25 10	24 9		19 4	20 0	
" 17...	33 6	34 1		24 9	24 2		20 5	19 10	
" 24...	33 10	34 0		24 1	24 7		20 8	19 9	
" 31...	34 1	34 2		24 5	25 9		20 3	19 8	
Aug. 7...	34 1	34 9		24 9	25 2		19 0	19 1	
" 14...	34 3	40 3		24 7	29 4		18 7	25 1	
" 21...	33 7	38 9		26 5	29 10		18 8	24 3	
" 28...	32 7	36 2		29 0	30 3		17 10	23 5	
Sept. 4...	31 11	36 5		30 11	30 6		17 8	23 9	
" 11...	31 9	37 10		31 5	29 11		18 0	23 11	
" 18...	31 7	38 3		30 9	29 5		17 11	23 8	
" 25...	31 6	37 6		30 1	29 3		17 9	23 3	
Oct. 2...	31 3	37 1		29 9	29 1		17 10	22 9	
" 9...	31 0	36 8		29 1	28 10		17 9	22 5	
" 16...	30 11	36 7		28 8	28 8		18 0	22 5	
" 23...	30 7	37 2		28 7	28 7		17 9	22 4	
" 30...	30 1	37 10		28 2	28 3		17 9	23 7	
Nov. 6...	30 0	38 8		28 1	28 6		17 9	23 7	
" 13...	30 1	39 8		27 8	29 0		17 11	24 8	
" 20...	30 4	41 0		27 5	29 8		18 1	25 5	
" 27...	30 9	41 11		27 0	30 3		18 4	25 8	
Dec. 4...	31 2	42 2		26 8	30 2		18 4	25 9	
" 11...	31 2	42 1		26 5	29 11		18 6	25 9	
" 18...	31 2	42 7		25 11	29 8		18 5	25 9	
" 25...	31 0	43 3		25 10	29 9		18 4	25 11	

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.

AVERAGE PRICES of **British Wheat, Barley, and Oats** at certain Markets during the Month of February, 1914 and 1915.

	WHEAT.		BARLEY.		OATS.	
	1914.	1915.	1914.	1915.	1914.	1915.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London...	32 2	57 1	26 8	35 0	20 1	32 7
Norwich...	30 8	54 3	26 0	34 8	18 11	31 7
Peterborough...	30 4	55 1	25 11	35 1	18 7	31 2
Lincoln...	31 1	55 0	27 1	34 10	19 5	30 9
Doncaster...	31 2	53 10	26 9	33 4	19 2	29 8
Salisbury...	30 3	54 0	25 4	35 3	19 0	33 4

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Supplement

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SEED CONTROL STATIONS

ON THE CONTINENT.



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- No. 12.—REPORT ON THE POSSIBILITY OF
REVIVING THE FLAX INDUSTRY IN
GREAT BRITAIN JAN., 1914

IN view of the interest which has recently been shown in the question of Seed Testing the Board felt that it would serve a useful purpose if an inquiry were made into the working of Seed Control Stations in certain European countries. They therefore instructed Mr. H. C. Long, one of their officers, to visit nine of the more celebrated and representative Stations, viz., at Copenhagen, Hamburg, Berlin, Breslau, Munich, Budapest, Vienna, Zürich, and Wageningen. The following pages give some account of these Stations, the work they do, and the success which has attended their efforts to improve the general quality of seeds sold in their respective countries.

The Board desire to acknowledge their indebtedness to the Directors and other officers of the several Seed Control Stations for their courtesy in facilitating the preparation of this Report, and in explaining the working of their Stations to the Board's representative. With the exception of Figs. 1, 2, 3, 4, 6, 17, 18 and 20, the Board are also indebted to the Directors for permission to use the illustrations accompanying this Report.

BOARD OF AGRICULTURE AND FISHERIES.

August, 1914.

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THE GOVERNMENT SEED CONTROL STATION AT COPENHAGEN.

IN the year 1869 Professor Fr. Nobbe, the distinguished author of the "Handbuch der Samenkunde," opened a seed control station at Tharand in Saxony, and shortly afterwards, in 1871, Mr. E. Möller Holst, an agricultural expert and editor of the first agricultural journal, initiated a system of control for seeds in Denmark.* Holst originally published his scheme in 1869, and it is stated that this led to the opening of the control station at Tharand, where Nobbe proved the success of the system. For the first few years from 1871, Holst did not cover his expenses in the Copenhagen office, and when a fuller examination of seeds proved necessary he sought the aid of the Danish Royal Agricultural Society, and received a yearly grant of £55, increased later to £110. After Holst's death (1889) the seed station was taken over by the State (1891) and is now a department of the Ministry of Agriculture. The object of the station is to inform farmers, seed merchants, and seed breeders as to the quality of the seeds they have to use or to sell.

A Seed Control Commission, of which Professor T. Westermann is chairman, has been appointed to advise the Ministry of Agriculture, and consists of two representatives of agricultural science, two farmers and two seed merchants, the last being elected by the Merchants' Association.

Cost.

A sum of £3,100 was voted for the erection of a suitable building in 1906, and since that year the cost of the control to the State has averaged about £360 per annum. The expenses of the Control in 1911-12 were £1,900, of which £1,826 were covered by fees paid for seed analyses, so that the cost to the

* See also Foreign Office Reports, Ann. Ser., No. 4089.

FINANCIAL ASPECT OF DANISH SEED CONTROL.

1st April, 1911, to 31st March, 1912.

RECEIPTS.		EXPENSES.	
£	d.	£	d.
<i>Complete Analyses.</i>			
284 at 7 kr.; 7 at 5 kr.; 425 at 4½ kr.; 1,211 at 3½ kr.; 173 at 3 kr.; 24 at 2½ kr.; 325 at 2 kr.	522	Salaries of Staff	1,346
<i>Germination and Weight Tests.</i>	236	Repairs to Building	53
150 at 5 kr.; 685 at 2½ kr.; 96 at 4 kr.; 17 at 3 kr.; 515 at 2 kr.; 216 at 1½ kr.	122	Fuel, cleaning, &c.	120
<i>Purity Tests.</i>	5	Purchases and renewal of apparatus	86
235 at 3 kr.; 8 at 2 kr.; 978 at 1½ kr.; 14 at 1 kr.	8	Miscellaneous expenses—Paper, printing, lighting, telephone	262
<i>Weight Tests.</i>	3	Meetings of the Seed Control Commission	14
31 Dodder tests at 3 kr.	19	Daily expenses and travelling expenses of the Director	19
32 at 1½ kr.; 127 at 0.75 kr.	12		
38 tests of "genuineness" at 1-4 kr.	8.3		
343 water content tests at 1 kr.	36		
104 urgent analyses	2		
Other tests	5		
Receipts from 4,827 tests made in finance year 1910-11	2		
Compensation for summonses in connection with tests	3		
Ditto outlay on telegrams, &c.	5		
Sale of collections of seeds and testing bags	3		
Apprenticeship premiums from 1 pupil	19		
Interest on investments	74		
Drawn from State Funds..	£1,900		£1,900



FIG. 1.—State Seed Control Station, Copenhagen.



FIG. 2.—Laboratory for Purity Examinations, State Seed Control Station, Copenhagen.

The Building.

The Seed Control Station itself is a substantial building (Fig. 1) erected in 1907, in a quiet road adjoining the Royal Agricultural and Veterinary School. It contains a large, well-lighted room for purity tests (Fig. 2), in which a number of the lady assistants conduct examinations for genuineness, purity, origin, weight, moisture content, etc.; a second large room for germination tests (Figs. 3 and 4), with a small greenhouse attached; a smaller room for special examinations; and other rooms for the Director, Office Staff, and storage.

From the time when Möller Holst first commenced work, tests have been made with great accuracy, and this applies also to the taking of samples.

Staff.

The staff consists of the Director (Mr. K. Dorph-Petersen), three permanent chief assistants, six permanent lady assistants, twenty lady assistants paid by the hour, and a custodian.

The analytical work is chiefly done by lady workers, who, as at Hamburg, Wageningen and Zürich, appear to execute their duties with an ability, deftness and thoroughness which perhaps few men would be able to emulate.

Regulations.

There are no laws governing the sale of seeds in Denmark, but the analyses of seed are carried out in accordance with regulations issued by the Ministry of Agriculture on July 6th, 1912. The regulations include the methods of ascertaining genuineness, place of origin, purity, weight, vitality and germinating power which are described below (p. 14).

"Control" Firms.

The leading seed merchants now sell only "controlled" seeds, which, however, cost rather more than seeds not so controlled. The "control" firms make a contract with the Station, and bind themselves to give the Station the names of all persons to whom they sell guaranteed seeds. The Station may then obtain a sample from the purchaser and so control what has been sold to him. In addition to the samples submitted by seed merchants, a number of "consulenten," who are young men trained at the Agricultural College, and attached to the agricultural societies, are asked to buy samples from dealers and send them for analysis. The Station, however, has

10 SEED CONTROL STATIONS ON THE CONTINENT.

no power to prosecute those who sell inferior seeds : any remedy lies only in a civil action under the common law. It is stated that the official "control" of seeds has done much good, and that but little inferior seed is now sold in Denmark.

Samples Examined.

As regards the number of samples examined yearly, it may be said that the Seed Station was only used to a small extent in its early years, but when seedsmen started selling seeds guaranteed as regards purity and germination, and farmers found that the purchase of such seeds resulted in far higher yields, the seed control was more utilised. When the control was started, the common kinds of clover and grass seeds on the market contained generally only about 35 per cent. of pure germinating seeds, but there has since been a great improvement. At the death of Holst in 1889, the number of analyses was about 1,500 annually, and the clovers and grasses showed a purity of about 80 per cent. and remained at about the same figure until 1902. About the beginning of the new century, however, much energy was displayed in improving the cultivation of farm crops, including clovers, grasses and roots for seed, and since 1903 there has been a great increase in the number of samples examined by the Station : in the year 1st July, 1911, to 30th June, 1912, 11,458 samples were examined. Of these, 5,786 samples were sent by seed merchants, 2,192 by seed breeders (or their Associations), 3,191 by other agriculturists (or their Associations), while 289 investigations were carried out for other purposes.

The samples sent in by seed merchants were from the following countries :—

	Districts or Places.	No. of Senders.	No. of Samples.
Denmark	73	174	5,309
Sweden	9	11	413
Finland	1	1	2
Great Britain	2	2	22
Germany	6	8	38
Austria	1	1	2
	92	197	5,786

The 5,383 samples sent in by seed breeders and other agriculturists were distributed geographically as follows :—



FIG. 3.—A Section of the Laboratory for Germination Tests, State Seed Control Station, Copenhagen.



FIG. 4.—A Section of the Laboratory for Germination Tests, State Seed Control Station, Copenhagen, showing Jacobsen's germinators.

GOVERNMENT SEED CONTROL STATION AT COPENHAGEN. II

Country.	No. of Senders.	No. of Samples.
Denmark	1,482	5,239
N. Schleswig-Holstein	20	126
Sweden	4	5
Norway	1	2
Russia	1	11
	1,508	5,383

Appendix II. shows the countries for which analyses of different species of seeds were made, as far as these were given.

The 11,458 samples were examined as follows :—

5,145 complete analyses (average for 1901-11 = 4,362).	55 for dodder.
2,226 for purity.	18 „ origin.
71 „ weight of seed.	309 „ water content.
3,609 „ germination.	25 „ various purposes.

The samples may be grouped thus :—

479 cereals.	533 mixtures of seeds.
4,817 grasses.	230 industrial plants.
2,110 leguminous plants.	254 forest seeds.
3,008 fodder and root plants.	27 wild plants.

The species of seeds examined and the number of samples of each were :—

Cereals.

204	Oat (<i>Avena sativa</i>).
111	Barley, two rowed (<i>Hordeum distichum</i>).
46	Barley, six rowed (<i>Hordeum vulgare</i>).
49	Rye (<i>Secale cereale</i>).
62	Wheat (<i>Triticum vulgare</i>).
7	Maize (<i>Zea mays</i>).

479 Leguminous Plants.

925	Red clover (<i>T. pratense</i>).
181	White clover (<i>T. repens</i>).
268	Alsike clover (<i>T. hybridum</i>).
3	Crimson clover (<i>T. incarnatum</i>).
1	<i>T. striatum</i> .
1	Hop-clover, Hop trefoil (<i>T. procumbens</i>).
200	Black medick (<i>Medicago lupulina</i>).
101	Lucerne (<i>M. sativa</i>).
95	Kidney vetch (<i>Anthyllis vulneraria</i>).
183	Bird's-foot trefoil (<i>Lotus corniculatus</i>).
1	Marsh bird's-foot trefoil (<i>Lotus uliginosus</i>).
8	Serradella (<i>Ornithopus sativus</i>).
1	White melilot (<i>Melilotus albus</i>).
48	Peas (<i>Pisum</i> sp.).
6	Field bean (<i>Faba vulgaris</i>).
31	Vetch (<i>Vicia sativa</i>).
25	Yellow lupin (<i>Lupinus luteus</i>).
8	<i>Lupinus angustifolius</i> .
9	<i>Cicer arietinum</i> .
14	<i>Lathyrus sativus</i> .
1	<i>Raphanus olieferus</i> (a Crucifer).

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Grasses.

- 320 Timothy (*Phleum pratense*).
- 311 Common rye-grass (*Lolium perenne*).
- 406 Italian rye-grass (*Lolium italicum*).
- 931 Meadow fescue (*Festuca pratensis*).
- 39 Hard fescue (*Festuca duriuscula*).
- 3 Red fescue (*Festuca rubra*).
- 1 Tall fescue var. (*Festuca arundinacea*).
- 270 Field brome-grass (*Bromus arvensis*).
- 7 Soft brome-grass (*Bromus mollis*).
- 15 Awnless brome-grass (*Schedonorus (Bromus) inermis*).
- 248 Tall oat-grass (*Avena elatior*).
- 1,918 Cocksfoot (*Dactylis glomerata*).
- 113 Foxtail (*Alopecurus pratensis*).
- 49 Yorkshire fog (*Holcus lanatus*).
- 22 Fiorin, Marsh bent-grass (*Agrostis alba*).
- 110 Rough-stalked meadow-grass (*Poa trivialis*).
- 23 Smooth-stalked meadow-grass (*Poa pratensis*).
- 4 *Poa compressa*.
- 10 *Poa* sp.
- 10 Dogstail (*Cynosurus cristatus*).
- 2 Sweet Vernal grass (*Anthoxanthum odoratum*).
- 2 *Calamagrostis arenaria*.
- 3 Barley-grass (*Hordeum arenarium*).

4,817

Fodder Plants.

- 2,122 Beet (*Beta vulgaris*).
- 221 Carrot (*Daucus Carota*).
- 396 White turnip (*Brassica campestris rapifera*).
- 256 Swede (*B. Napus rapifera*).
- 9 Buckwheat (*Fagopyrum esculentum argenteum*).
- 2 Spurrey (*Spergula* sp.).
- 2 White Mustard (*Brassica alba*).

3,008

- 533 Analyses of mixtures of seeds.
- 230 Industrial plants.
- 254 Forest seeds.
- 27 Wild plants.

In the season 1912-13, 14,213 samples were tested, and of these some 6,800 were sent by farmers and 6,900 by seedsmen; 2,400 samples were to control guarantees given for purity, germinating capacity, etc. The 14,213 samples consisted of:—

Grass seeds	..	..	..	..	6,066
Clover and other leguminous seeds	..	..	..	..	2,629
Root, etc., seeds	..	..	..	..	3,627
Cereal grain	..	..	..	..	783
Seeds mixtures	..	..	..	..	493
Garden and industrial plant seeds	..	..	..	..	340
Forest seeds	..	..	..	..	252
Wild plants	..	..	..	..	23

Total .. 14,213

GOVERNMENT SEED CONTROL STATION AT COPENHAGEN. 13

The seed trade has of late years so much developed in Denmark that the area devoted to the production of seeds for sale was four times as large in 1912 as five years previously, and Denmark, instead of importing, now exports cocksfoot, meadow fescue, field brome, meadow grass and root seeds.

A table showing the average purity and germinating capacity of certain species of seeds examined at Copenhagen during the years 1902-12, and the averages for the year 1911-12, with other data in each case, is given in Appendix I. (p. 62).

As regards the column "germination of pure seeds" the second figure given refers to "hard" seeds. As the proportion of hard seeds is greater in the last month of the year than at the beginning the figures given are for the analyses from March to June alone. The following are the figures for the whole year: *Trifolium pratense*, 9.7 per cent.; *T. repens*, 15.3 per cent.; *T. hybridum*, 7.2 per cent.; *Medicago lupulina*, 3.0 per cent.; *M. sativa*, 11.7 per cent.; *Anthyllis vulneraria*, 12.0 per cent.; *Lotus corniculatus*, 18.3 per cent.

It is of interest to compare the 1911-12 analyses with those of 1902-12 (+ indicates more weeds, greater purity or higher germinating capacity; — indicates less weeds, less purity, or smaller germinating capacity, as the case may be).

	Weeds.	Purity.	Germination.
<i>Trifolium pratense</i> ..	+ 0.14	— 0.1	— 0.3
" <i>repens</i> ..	+ 0.46	— 2.6	— 0.9
" <i>hybridum</i> ..	+ 0.14	— 1.0	— 0.8
<i>Medicago lupulina</i> ..	+ 0.07	— 0.2	— 0.3
" <i>sativa</i> ..	— 0.11	+ 0.5	+ 0.3
<i>Anthyllis vulneraria</i> ..	— 0.33	+ 0.9	+ 0.6
<i>Lotus corniculatus</i> ..	— 0.21	+ 0.3	— 2.3
<i>Phleum pratense</i> ..	+ 0.12	— 0.5	+ 1.6
<i>Lolium perenne</i> ..	+ 0.02	— 0.5	+ 2.8
" <i>italicum</i> ..	— 0.05	— 1.7	+ 2.1
<i>Festuca pratensis</i> ..	+ 0.26	— 7.3	+ 0.5
" <i>duriuscula</i> ..	— 0.11	— 1.1	— 4.5
<i>Bromus arvensis</i> ..	+ 0.08	— 0.3	+ 2.3
<i>Avena eliator</i> ..	+ 0.06	— 0.9	+ 0.8
<i>Dactylis glomerata</i> ..	+ 0.01	— 1.4	+ 1.2
<i>Alopecurus pratensis</i> ..	— 0.55	— 6.1	+ 2.2
<i>Poa trivialis</i> ..	+ 0.02	— 3.5	+ 1.1
<i>Poa pratensis</i> ..	+ 0.50	— 4.0	+ 3.4
<i>Beta vulgaris</i> ..	0	— 0.9	— 5.6
<i>Daucus Carota</i> ..	+ 0.72	— 4.8	— 3.7
<i>B. campestris rapifera</i> ..	+ 0.04	— 1.9	— 0.1
<i>B. Napus rapifera</i> ..	+ 0.10	— 0.2	+ 0.8

Particulars of the best samples examined in the year 1911-12 are given in Appendix III. and results of analyses of uncontrolled seeds in Appendix IV. (p. 65).

Tests of Stated Guarantee—Controlled Seeds.

The number of after analyses for control purposes in 1911-12 of samples of stated guarantee were 1,272; 1,120 were complete analyses, the other 152 (all root crops) were for germinating capacity alone. No guarantees were given as to points investigated in the case of 372 tests. Of 811 test samples composed of 20 species examined for purity 59 (or 7.3 per cent.) were under guarantee (allowing a latitude of 2 per cent.). The latitude for germination is 3 per cent. for guarantee over 95 per cent.; 4 per cent. for guaranteed germination between 90 and 95 per cent.; and 5 per cent. for guaranteed germination under 90 per cent. Of 900 samples composed of 24 species examined for germinating capacity 29 were under the guarantee, with latitude (or 3.2 per cent.).

For example, of 148 samples of red clover examined for purity 7 were 2-3 per cent. below the guarantee and 3 were 3-5 per cent. below the guarantee. Of 41 samples of white clover no less than 17 were below the guarantee of purity and 1 below the guarantee of germination. On the other hand, of 30 samples of lucerne and 52 samples of timothy none was below the guarantee of either purity or germinating capacity.

Points to be determined by Seed Analysis and Methods of Examination.

The examinations of seeds include the determination of:—

- (a) *Genuineness and Place or Origin*, 250 to 500 grammes being tested for foreign admixtures;
- (b) *Purity*;
- (c) *Weight of 1,000 Fresh Seeds*, and *Moisture Content*;
- (d) *Germinating Capacity and Energy of Germination*.

Purity.—As regards purity two average lots of at least 1,000 seeds are weighed from the sample and examined very closely, being divided into (1) Pure seed; (2) Sand, dirt, chaff, waste material, etc.; (3) Seeds of non-desired cultivated plants; and (4) Weed seeds. As a rule the difference as regards purity between the two lots is scarcely over $\frac{1}{2}$ per cent.; if it is over 2 per cent. a third lot is examined. Specially noxious weed seeds are named and given in numbers per kilogramme: thus, in clover and grass seeds *Matricaria inodora*, *Anthemis arvensis*, *Chrysanthemum segetum*, *Chrysanthemum leucanthemum*, *Cuscuta* sp., *Daucus Carota*, and *Ranunculus repens*; are specified; and in cereals *Agrostemma Githago*, *Bromus secalinus*, *Raphanus Raphanistrum* and *Centaurea Cyanus*, are specified. For specially harmful seeds two lots of at least

10,000 seeds each are examined. A diaphanoscope, especially constructed by the Danish Seed Control in 1910, is used in determining the purity of the more difficult grass seeds, and is now a part of the apparatus of a number of other stations on the Continent.

Moisture Content and Weight.—The moisture content and dry weight of seeds may be determined when the seeds have been sent in a closed air-tight vessel. In ascertaining the weight of fresh seeds six lots of 100 each are weighed and averaged. The dry weight and water content are found by drying 1 to 2½ grammes of the seed for 5 hours at 100° C.

Germination of Pure Seeds.—Vitality and energy of germination are ascertained by germinating six lots of 100 of the pure seeds, clover, grass, and similar seeds being germinated in a Jacobsen's apparatus, cereal grains in damp sand, and *Beta* species in damp blotting paper. In the Jacobsen's apparatus (Fig. 4), the seeds lie on filter paper kept at an even degree of moisture under small glass bell covers having a hole at the top, and are kept at a temperature of between ca. 17° and 25° C. (*Medicago lupulina*, 17°-20°), highest at about 2 p.m. and lowest at night.

Seeds of *Beta* and of forest trees are wrapped in damp blotting paper, placed in glass jars, and kept at a similar temperature. Cereals are placed in salt-glazed earthen vessels in moist sand, and kept at a temperature of 15° to 18° C. To guard against fungus diseases, the cereals and seeds in the Jacobsen's apparatus are so arranged that they do not touch one another. In the case of clovers and related seeds, the germination test is finished after 10 days; with most grasses after 15 days, and with slowly germinating grasses and most forest seeds after 20 to 30 days. At the end of about one-third of the germination period, the number of germinated seeds is noted, and taken as the *Energy of Germination*, and the sender is informed. If the sender so desires, a purity test of one lot and a germination test of 300 seeds only, is sent, but the results have no value in connection with a guarantee.

In stating germinating capacity an allowance is made in regard to "hard seeds." A form of certificate for a complete analysis of seeds is shown in Appendix V. (p. 66). The allowances for latitude in the control of seeds, and the fees charged for the examination of seeds are given below:—

Trade in Seeds: Allowances for Latitude.

For *Purity*: 2 per cent. when the guarantee is at least 85 per cent.; 3 per cent. when the guarantee is under 85 per cent.

For Germination of Pure Seeds: 3 per cent. when the guarantee is at least 95 per cent.; 4 per cent. when the guarantee is from 90-94.9 (inclusive); 5 per cent. when the guarantee is from 80-89.9 per cent.; and 6 per cent. when the guarantee is under 80 per cent.

True Value of Seeds (= pure germinating seeds): 4 per cent. when the guarantee is 90 per cent. or over; 5 per cent. when the guarantee is under 90 per cent.

Weight of Seed: 6 per cent. for clover and seeds of similar leguminous plants, and 10 per cent. for grass seeds.

Weeds: 0.3 per cent. when the maximum content guaranteed is under 1 per cent.; 0.4 per cent. when the guarantee is from 1 to 2 per cent.; and 0.5 per cent. when the guarantee is above 2 per cent.

Moisture Content: 1 per cent.

Allowances for Compensation.

Purity: The amount of compensation in ore per kilogramme =

$$\frac{\text{Liability to compensation (per cent.)} \times \text{price in ore per kilog.}}{\text{Guaranteed purity.}}$$

Example: Guaranteed purity, 90 per cent.; purity actually found, 80 per cent.; price 90 ore per kilog; compensation =

$$\frac{(90-80) \times 90}{90} = 10 \text{ ore per kilog.}$$

In the case of certain seeds—*Dactylis glomerata*, *Festuca duriuscula*, *Avena elatior*, *Holcus lanatus*, *Poa pratensis*, *P. trivialis*, and *Alopecurus pratensis* (also *Festuca pratensis*), *Lolium perenne*, *L. italicum*, and *Bromus arvensis*—a germination higher than that guaranteed (but not greater than the amount of impurities in the samples) can be set off against a defective purity provided that the samples tested do not contain more weeds than the average figure for the ten years seed control for the particular kind of seed.

Germination: Allowance in ore per kilogramme =

$$\frac{\text{Liability to compensation (per cent.)} \times \text{price in ore per kilog.}}{\text{Guaranteed germination.}}$$

Example: Guaranteed germination of pure seed, 85 per cent.; germination actually found, 76.5 per cent.; price 80 ore per kilog.

$$\text{Allowance} = \frac{(85-76.5) \times 80}{85} = 8 \text{ ore per kilog.}$$

GOVERNMENT SEED CONTROL STATION AT COPENHAGEN. 17

A higher purity than guaranteed may be allowed towards balancing a correspondingly lower germination (see also *hard seeds*).

Energy of Germination: As for *germination*.

Hard Seeds: Provided that the guarantee for clover seeds specifies percentage of germination and percentage of hard seeds, the hard seeds shall count as one-third of the value of germinating seeds (in absence of any stipulation at sale as to proportional value of hard seeds).

Example: Guaranteed 92 per cent. germination + 6 per cent. hard seeds: actually found 85 per cent. germination + 13 per cent. hard seeds: price 150 ore per kilog.

$$\text{Allowance} = \frac{[(92 + \frac{6}{3}) - (85 + \frac{13}{3})] \times 150}{94} = 7.5 \text{ ore per kilog.}$$

Weight of Seeds: For every per cent. of liability to compensation payment of $\frac{1}{2}$ per cent. of price of goods.

Example: Guaranteed weight of 1,000 seeds, 1.9 grammes. Found 1.71 grammes. Price 80 ore per kilog.

$$\text{Liability to compensation} = 100 - \frac{1.71 \times 100}{1.9} = 10 \text{ per cent.}$$

$$\text{Compensation is therefore} = \frac{\frac{1}{2} \times 80}{100} \times 10 = 4 \text{ ore per kilog.}$$

Weeds: For the "liability to compensation—difference" reckoned in percentage of goods, pay 15 per cent. of the price for every per cent. of harmful weeds. Harmless weeds to reckon as impurities.

Example: Guaranteed max. 0.2 per cent.; found 0.6 per cent. Price 75 ore per kilog. Allowance = $(0.6 - 0.2) \times 15 = 6$ per cent. of price = 4.5 ore per kilog.

Where it is guaranteed that the seeds do not contain any kind of noxious weed seeds above the given maximum, the sample may contain up to 200 weed seeds per kilog. over and above this maximum without any compensation having to be paid. Above this, the allowance is 2 per cent. of the price per kilog. for every 200 weed seeds which the seeds contain above the guaranteed maximum (but must not amount to more than 25 per cent. of the price).

Example: Guaranteed maximum of 500 seeds of noxious weeds per kilog.; actually found 1,240. Price 50 ore per kilog.

$$\text{Allowance} = \frac{(1,240-500) \times 2}{200} = 7.4 \text{ per cent. of price, or } 3.7 \text{ ore per kilog.}$$

Where it is guaranteed that the goods are absolutely free from dangerous weeds, the presence of over 20 seeds of noxious weeds per kilog. justifies the purchaser in refusing the consignment.

In sending in samples ($\frac{1}{8}$ to $\frac{1}{2}$ kilog.) the test desired (complete, purity, germination) must be stated, and an intimation made as to whether guarantee or indicative analysis is wanted.

Urgent analyses may be carried out, taking precedence in point of time before all ordinary analyses; the charge for such urgent analyses is double the ordinary tariff. The general tariff is as follows:—

Tariff for Seed Analyses.

Kind of Test.	Guarantee Test.	Indicatory Test.
	<i>s. d.</i>	<i>s. d.</i>
Genuineness	1s. 1d.—5s. 7d.	—
Weight of 1,000 seeds	1 9	11
Purity of seed—cereals, legumes, roots and other large seeds	2 3	1 2
Purity of seed—other kinds	3 6	1 9
No. of dodder seeds per kilog.	3 6	—
Germination—cereals and legumes	3 6	1 9
„ and weight of seed—roots	5 7	2 9
„ other seeds	4 6	2 3
Complete analysis of cereals, legumes	5 6	2 9
„ „ other seeds	7 9	3 11

THE GOVERNMENT SEED CONTROL STATION, HAMBURG.

Seed control in Hamburg was inaugurated about 23 years ago, and has since that time developed to a remarkable extent, so that at the present day the amount of testing at the Control Station may be said to represent an extensive trade. A very beautiful new building for the Institute for Applied Botany, standing in the Botanic Garden, was completed in 1907, and includes extensive laboratories for the Seed Control, which forms a separate department of the Institute, the latter including also the Botanical Economic Museum, the Station for investigation of plant diseases, and the laboratory for the investigation of commercial products. A plan of two floors of the Botanical Institute is shown in Fig. 7, and photographs in Figs. 5, 6 and 8, Fig. 8 being the large room devoted to purity investigations. So enormously has the work of the Seed Control Station grown in recent years that an extension of the building to more than twice its original size is now nearing completion.

Cost.

The grant for the whole Institute for the year 1914 is £7,291, of which £3,000 are for seed control and £1,500 for the investigation of plant diseases. The income from the fees, etc., for work done is paid into the Government Account. The income from seed control more than suffices to cover the actual expenditure. For example, the receipts for seed analysis in 1913-14 were £4,819, and the receipts for investigations of plant diseases were £2,012.

Regulations.

There is no special legislation regulating the seed trade, which simply comes under the common law for fraud; and while there is an increasing tendency to sue for fraud, fraud in relation to seeds is decreasing, and the wholesale merchants are themselves increasingly asking for guarantees as to purity and germinating capacity. The Control Station endeavours to favour neither farmer nor merchant, but to hold an even balance between the two.

Staff.

The staff consists of a Director (Professor Dr. A. Voigt), a chief assistant for plant diseases, a chief assistant for the investigation of commercial products, an assistant phytopathologist, an assistant chemist, three general assistants, a curator, a caretaker, three men servants, two clerks, and thirty-six lady assistants for seed-testing.

Points determined by Analysis.

Examinations of seeds are made to determine identity, origin, purity, germinating capacity, percentage of dodder weight of 1,000 seeds, volume weight, and moisture content. In conducting the tests every effort is made to ensure the greatest accuracy and the fairest results. The germination tests are made in a variety of ways, and the different species are studied individually in order that the most satisfactory decisions may be arrived at, and the most natural conditions of germination be ensured. For example, it has been found that grass seeds in general germinate best under varying conditions, and for this reason, the windows are opened at night to cool the germinating room more or less naturally. It may be pointed out that

It may be pointed out that large quantities of barley are examined, principally for purity for feeding purposes, though many samples are examined for germinating capacity for seed purposes.

In compiling the results any possibility of bias on the part of the Station is effectively obviated by the fact that two officers from the Statistical Department do this work at the Station in the evenings.

Samples Examined.

The numbers of samples of seeds and feeding stuffs examined in the past five years have been as follows:—

1909-10	20,085	samples sent by 527 persons.
1910-11	35,198	" " 553 "
1911-12	40,525	" " 703 "
1912-13	37,390	" " 751 "
	28,489	" " 917 "

Of these the number of seed samples have been :—

Year	Number of seed samples	have been :—
1908-09		19,593 samples.
1909-10		34,748 "
1910-11		39,907 "
1911-12		35,330 "
1912-13		27,063 "

These samples in the five years consisted of the species shown in the table on p. 22.

It will be observed that on the whole there is an upward tendency in the number of samples in each group of seeds, but that the vast majority of samples consist of cereals, the principal of which is barley, the samples of barley for the four years ending 1911-12 being 14,167, 27,019, 28,642 and 26,007 respectively (figures for 1912-13 are not available).

Of the other groups of seeds the highest figures are shown by the red clover, lucerne, white clover, Alsike, Timothy,

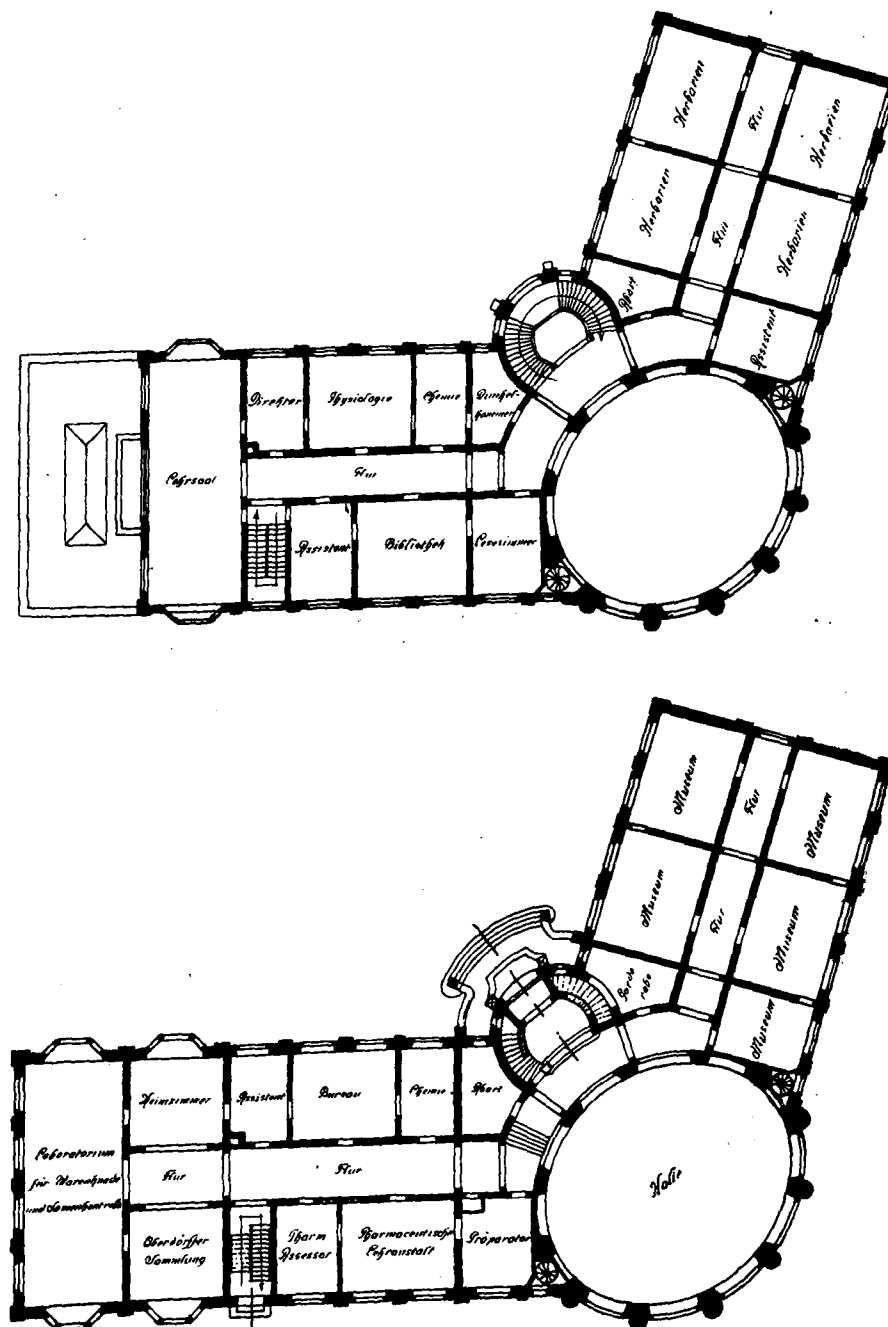


FIG. 7.—Plan of first floor (above) and ground floor (below) of the State Institute for Applied Botany and Seed Control Station, Hamburg.

Species Examined in the Five Years, 1908-13.

Species.	1908-9.	1909-10.	1910-11.	1911-12.	1912-13.
Clovers	3,494	3,995	4,733	4,341	4,918
Grasses	839	918	1,352	1,554	1,219
Perennial Fodder Plants ..	1	5	4	9	9
Annual Fodder Plants ..	82	85	187	306	230
Pulse Seeds	25	51	93	199	167
Cereals	14,505	28,895	32,828	28,125	19,667
Roots and Vegetables ..	429	405	290	319	267
Oil Seeds, etc.	207	340	397	462	539
Ornamental Plants	—	1	3	4	14
Forest Seeds	11	53	20	11	33
Totals	19,593	34,748	39,907	35,330	27,063

serradella, oats, wheat and rye, though many other species number over 100 samples in the year. In 1911-12 the principal samples were:—

Red Clover	2,421 samples	<i>Festuca pratensis</i>	116 samples.
White Clover	490 "	<i>Florin (Agrostis alba</i>	
Alsike	378 "	<i>Schrä.)</i>	
<i>Anthyllis vulneraria</i> ..	112 "	Serradella	87 "
Lucerne	603 "	Barley	245 "
<i>Medicago lupulina</i> ..	135 "	Oats	26,007 "
English Rye-grass	132 "	Wheat	670 "
Italian Rye-grass	75 "	Rye	472 "
Cocksfoot	162 "	<i>Beta vulgaris</i>	868 "
Timothy	363 "	Carrot	127 "
<i>Poa pratensis</i>	99 "	Linseed	74 "
			108 "

The samples sent in for analysis are from many countries, and are submitted by seed merchants, associations, farmers and others. The number of samples of seeds submitted from different countries in the year 1911-12, together with the numbers of firms, etc., sending the samples, are shown in the following table (Hamburg being given separately):—

Country of Origin.	No. of Samples.	No. of Firms, Societies, Farmers, etc.
Hamburg	26,133*	253
Prussia	7,008†	345
German States	1,623‡	111
Austria-Hungary	307	13
Denmark	205§	13
France	3	1
Holland	6	3
Belgium	3	4
Luxemburg	4	1
England	8	3
Sweden	5	2
Russia	21	2
Total	35,326**	751

* 21,895 samples of Barley.

† 1,168 samples of Barley.

‡ 2,790 samples of Barley.

§ 136 samples of Barley.

** Apparently omitting 4 samples of ornamental plants included above.



FIG. 5.—State Institute for Applied Botany and Seed Control Station, Hamburg, from Jungiusstrasse.



FIG. 6.—State Institute for Applied Botany and Seed Control Station, Hamburg, from the Botanic Garden.

The character of the examinations made is shown by the following statement relative to the 35,330 samples of seeds received in 1911-12 :—

Identity	190 examinations.
Origin	204 "
Purity	30,944* "
Germination	3,022 "
Dodder	4,217 "
Weight	42 "
Moisture content	24 "
Total	38,643

It may be noted that the number of examinations for dodder exceeds the number for germination, showing that considerable importance is attached to the presence or absence of this parasitic weed. The samples of certain species of seeds examined for dodder in 1911-12 yielded the following results :—

Species.	No. of samples.	No. containing dodder.	Percentage containing dodder.
Red Clover	2,229	1,492	67
White Clover	422	128	30
Alsike	333	80	24
Lucerne	547	204	37
Crimson Clover	21	—	—
Timothy	328	144	44

Large numbers of the samples, however, contained so little dodder that they were within the latitude allowed (1 grain in 100 grammes or 50 grammes according to species). Thus, of the species named the following samples were free from dodder or within the limits allowed :—

—	Samples free from dodder. Per cent.	Samples within limits of 1 grain in 100 grammes or 50 grammes. Per cent.	= Together. Per cent.
Red Clover	33	38	71
White Clover	70	13	83
Alsike	76	10	86
Lucerne	63	25	88
Timothy	56	14	70

* Barley, 25,968.

On the basis of an agreement between the German, Dutch, Belgian, Danish and Swedish merchants on the one hand and the Russian merchants on the other, 25,869 purity tests of barley were made in 1911-12. The average results, compared with two previous years, were as follows :—

	1911-12. Per cent.	1910-11. Per cent.	1909-10. Per cent.
Pure Barley	94.75	95.18	94.68
Chaff, sand, etc. ..	2.63	2.16	2.66
Oats, including Wild Oats ..	2.04	2.05	2.17
Wheat and Rye	0.58	0.61	0.49

These figures show that the botanical composition of such "barley" is fairly uniform.

The average purity and germinating capacity of the principal classes of seeds examined in 1911-12, compared with the averages for the years 1891-1912, are given in Appendix VI. (p. 67).

The results of examinations are notified to the senders of samples by a variety of certificates, which vary somewhat according to the species of seeds under consideration. In general they are printed in German, English and French, as shown in the three examples in Appendix VII. (p. 68). The first of these is a certificate for a preliminary report, the second for a report on red clover and the third for a report on French rye-grass (tall oat-grass), and all are identical with the originals.

THE GOVERNMENT SEED CONTROL STATION AT WAGENINGEN, HOLLAND.

Until 1894, the control of seeds in Holland was carried on only by establishments specially equipped to conduct chemical analyses, and it was felt necessary to have a staff well acquainted with seed control, specially trained and working in an independent institution.

In view of the increase in the demand for seed control, the Government decided to create at the Wageningen Agricultural Station a separate department devoted exclusively to the control of seeds, and under the direction of an assistant as Divisional Chief. This department developed to such an extent that the Government next founded a State Seed Control Station independent of the Wageningen Agricultural Station; and it was opened on 1st October, 1898. It nevertheless soon became necessary to enlarge the Seed Station, and in order to have an establishment adequate for their requirements the Government finally erected a new building which was also to serve as an agricultural station. In 1915 the building will be entirely reserved for seed control (Figs. 9 and 10).

Since the beginning of 1906, the Seed Control Station has also been entrusted with the botanical and microscopic examination of feeding stuffs for live stock, in order to determine their degree of purity, and this is regarded as very important work.

In November, 1908, two adjoining houses were rented for the use of the microscopical section, and this left more space for the control of seeds; this space is now, however, insufficient.

Objects of the Station.

Article 2 of the rules respecting agricultural stations, brought into force by a Royal decree of 22nd April, 1892 (*Staatsblad* No. 93), defines the objects of the Seed Control Station as follows :—

1. To make analyses of seeds, and later on of animal feeding stuffs. The analyses shall be made either at the request of the Government, or of private institutions, or of individuals;
2. The conducting of cultural experiments;
3. The carrying out of scientific researches of wider type connected with agriculture; and

4. Finally, to provide agriculturists with information concerning the general use of seeds wherever the need for scientific advice exists, and to help the cultivator to the greatest possible extent.

There are no actual State regulations as to the sale of seeds, which may be sold as in England without a guarantee. Farmers are encouraged, however, to ask for a guarantee, and hence many seedsmen contract for the quality of their seeds, and are given certificates of purity and germinating capacity.

Staff.

The staff of the Station is composed of :—

A Director (Dr. F. F. Bruijning), who is placed at the head of the Station, and is entirely responsible for its direction.

A Divisional Chief, who, under the Director, is in charge of the microscopical section.

Two principal assistants.

One assistant.

Two lady assistants.

One principal lady analyst.

Twelve lady analysts.

Four apprenticed lady analysts.

One secretary-accountant, in charge of the administration, and four clerks.

One amanuensis-porter, two other amanuenses, and three servants charged with the care of the establishment and the garden.

The hours of work are 8.30 a.m. to 12 p.m. and 1.30 to 5 p.m. In 6½ "summer" months there is no duty on Wednesday and Saturday afternoons, but in the 5½ "winter" months (1st November to 15th April) work continues daily, and in exceptional circumstances from 7 to 8.30 p.m.

Development of Activities.

Some idea of the development in the activities of the Control Station will be obtained from the following figures, showing the total number of samples examined during the last twelve years (from 1st July to 30th June in each case) :—

1902-3 = 1,414	1908-9 = 2,324
1903-4 = 1,580	1909-10 = 2,234
1904-5 = 1,578	1910-11 = 2,262
1905-6 = 1,558	1911-12 = 2,154
1906-7 = 1,775	1912-13 = 2,712
1907-8 = 1,902	1913-14 = 3,411

The Station was started for the assistance of farmers, who use it extensively, but seedsmen also make use of it widely



FIG. 8.—Laboratory for the Study of Commercial Products and Seed Examinations, State Institute for Applied Botany and Seed Control Station, Hamburg.



FIG. 9.—State Seed Control Station (from the western side), Wageningen.

to control their seeds. It is stated that the seeds at present sold are markedly better than formerly.

The number of samples of the different classes of seeds examined at the Station, and the number of determinations made in 1913-14 were as follows:—

Seeds.	Samples.	Determinations.
Grains and cereal seeds (oats, wheat, barley, rye, maize, etc.)	134	152
Clover seeds	1,125	2,454
Grass seeds	933	1,859
Tree seeds	18	20
Other seeds (sugar-beet, mustard, carraway, etc.)	1,159	1,727
Other investigations not connected with seeds	42	108

The number of samples of red clover examined for dodder was 401. In 58 cases a positive result was obtained, while in 35 cases ripe dodder seeds were found.

Of the total number of samples examined, viz. 3,411, the number sent in by farmers was 1,201 and by seedsmen 2,210.

The work is heaviest in winter. In January 420 samples were examined, in February 550, and in March 442, whereas in June the number was only 32.

Cost of the Station.

All the expenses of the Station are defrayed by the Government. These expenses were, for example, in 1913: Staff, £2,540; materials, £700. The receipts were much smaller, since the Government's object is not to make a profit, but to help agriculturists as much as possible. For this reason the charges made for the examination of samples are very moderate.

Charges for Analyses.

The fee for a quantitative analysis is 1s. 8d., and for a qualitative analysis 10d.; for purity 1s. 8d.; for germinating capacity 1s. 8d.; or for both of these 3s. 4d.

The botanical examination of samples of animal feeding stuffs is a part of the whole examination (chemical and botanical) and hence some of the samples forwarded to the various agricultural stations are sent on to the Seed Control Station. The fees for these examinations, however, are received by the agricultural stations.

A form of Report on a seed analysis is shown in Appendix VIII. (p. 71).

RULES FOR ANALYSES.

The rules observed by the Station in making analyses are contained in a pamphlet entitled "Methoden van onderzoek aan het Rijksproefstation voor Zaadcontrole voor het jaar 1912 voor het onderzoek van Zaaizaden." This pamphlet comprises the rules for :—

- A. Determinations of purity.
- B. " " the weight of a litre.
- C. " " the content of water.
- D. " " the total weight.
- E. " " germinating capacity.
- F. True value of the sample.

A. *The Purity Test, with Methods followed.*

In the germination tests four lots of 200 seeds each are usually tested when the Wageningen method is employed, or four lots of 100 each by the Danish system of glass covers (see p. 15). For cereals, however, four lots of 150 seeds each are tested.

(a) *The Determination of Purity and the Examination of Impurities in General.*—This is usually done by sorting out an exactly-weighed quantity of the seed into :—

- (1) Sound seeds ;
- (2) Harmless impurities (seeds of other cultivated plants, husks, fruit and plant residues, sand, dust, small stones, etc.) ; and
- (3) Harmful impurities (weed seeds, seeds of parasitic plants, sclerotia, etc.).

This quantity is taken from the sample in such a way that its characteristics correspond as closely as possible with those of the sample. The sample is first mixed very carefully by means of zinc boxes and special spatulæ. Quantities, as small as possible, are then taken from different parts of the sample until sufficient seed has been collected for the analysis of purity. A sample is thus obtained which must be of the following weight :—

200	grammes for	<i>Lupinus, Pisum</i> and <i>Zea</i> .
50	"	<i>Vicia</i> species and different cereals.
20	"	<i>Linum usitatissimum</i> and seeds of trees similar in size to cereal grains.
15	"	<i>Phalaris canariensis</i> , etc.
10	"	<i>Trifolium pratense, Trifolium incarnatum, Ornithopus sativus, Medicago sativa, Medicago lupulina, Brassica Napus, Allium, Pinus sylvestris</i> , etc.



FIG. 10.—A corner of the Laboratory for Germination Tests, State Seed Control Station, Wageningen.

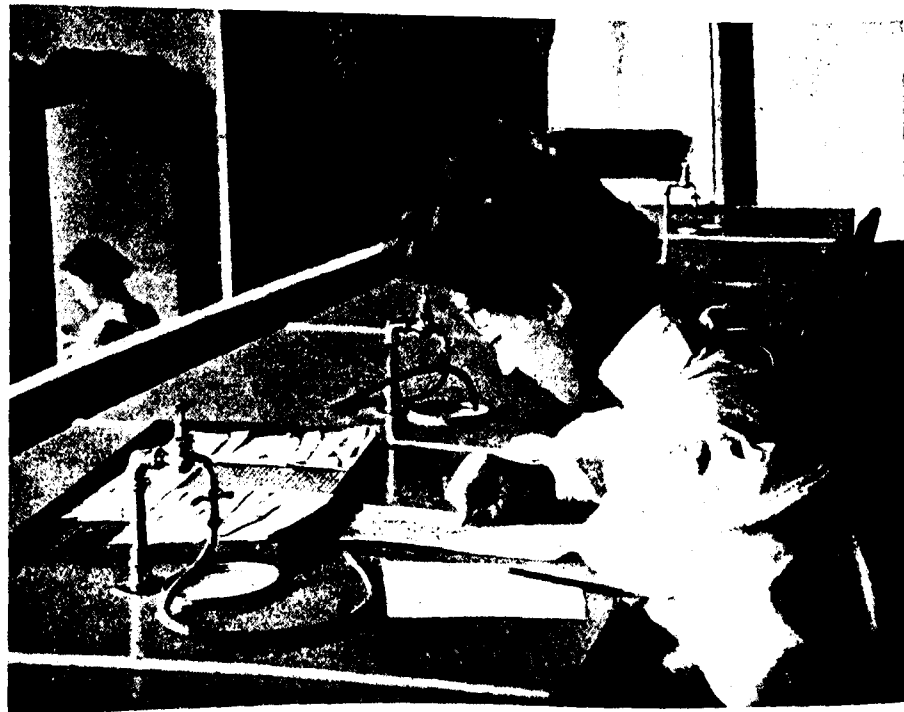


FIG. 11.—Examining Germinated Seeds, State Seed Control Station, Wageningen.

5 grammes for *Trifolium repens*, *Trifolium hybridum*, *Phleum pratense*, *Lolium perenne*, *Lolium italicum*, *Arrhenatherum elatior*, *Festuca pratensis*, *Festuca elatior*, *Spergula arvensis*, *Lotus villosus*, *Lotus corniculatus*, *Carum carvi*, *Anthyllis vulneraria*, *Melilotus coerulea*, etc.
 2 " *Cynosurus cristatus*, *Alopecurus pratensis*, *Dactylis glomerata*, *Festuca ovina*, *Festuca rubra*, *Festuca duriuscula*, *Daucus Carota*, etc.
 4 times $\frac{1}{2}$ gramme for *Anthoxanthum odoratum*.
 0.5 gramme for *Agrostis stolonifera*, *Poa* sp., *Avena flavescens*, *Aira flexuosa*, etc.

Where there are many impurities in the sample the quantities taken are smaller than those given above.

Each purity test must be made with at least two samples, and the results of the two analyses are considered to agree when the difference between them does not exceed 2 per cent. in the case of very small seeds and 1 per cent. in the case of other seeds.

By pure seeds are understood all those belonging to the guaranteed species, which are sound or so slightly damaged that it is probable that they have not lost their germinating capacity.

By harmless impurities are understood :—

- (1) All pure seeds which have been broken or damaged in such a way as to have lost their germinating capacity ;
- (2) Seeds of other cultivated plants ;
- (3) Residues of seeds and fruits, husks, sand, dust, small stones, and any other harmless material.

Harmful impurities are :—

- (1) Weed seeds, and seeds of parasitic plants ;
- (2) Conveyors of plant diseases, such as *Sclerotia*, *Tylenchus*, &c.
- (3) Insects, larvæ or eggs of insects. Nevertheless the "seeds" of *Alopecurus pratensis* which contain larvæ of *Oligotrophus alopecuri* are provisionally included in harmless impurities.

When the purity analysis is completed, the pure seeds, the harmless impurities and the harmful impurities are weighed exactly. There should not be any considerable loss of material, and if the total weight of the pure seeds and impurities differs by more than 2 per cent. from the original weight of the sample, the test must be repeated. In the case of very small seeds the allowance for loss of weight may be doubled. The loss is divided proportionally between the pure seeds and the harmless and harmful impurities.

Moreover, to prevent, as far as possible, any error resulting from loss of moisture during the analysis, it is necessary to expose to the air for an hour or more those seeds which are not sufficiently dry.

The examination of husked seeds can be made by ordinary light. As a table, slabs of very finely polished black marble-glass may be used. On the contrary, in the case of seeds in husks it is necessary to separate the empty glumes from the full, and this can be most easily done if the seeds are lighted from beneath. The caryopsis is easily visible in the case of good seeds, while sterile seeds are nearly transparent. Small tables are used, in which is let a sheet of glass, beneath which is placed a reflecting mirror and condenser, capable of moving in all directions. In this way light is reflected through the glass on which are placed the seeds to be examined. Each table is separated from the next by a wooden partition, and by drawing a curtain daylight can be excluded.

(b) *Special Tests for Purity* :—

(1) *Examination of Holcus lanatus (with husk) and of Anthoxanthum odoratum*.—A quantity of 2 grammes is divided into four equal parts. Each part (consisting of $\frac{1}{2}$ gramme) is examined by a separate assistant, the ordinary method being at first employed (bare caryopses are counted as pure "seeds"), and the "seed" afterwards examined by means of lighting from below, empty glumes being counted as harmless impurities. The full "seeds," together with the caryopses which from the outset have formed part of the "seed," are classed as pure seed. In order to get a better control in this examination, if the caryopses are full, the seeds are husked, so that at the end of each test the following must be weighed :—

1. Harmful impurities.
3. Harmless impurities.
3. Bare caryopses.
4. Seeds, full at the start, but husked during the test.

Nos. 3 and 4 are classed as pure seed.

The average of the four determinations is taken in ascertaining the percentage of purity.

In testing the germination, only the bare caryopses are taken.

(2) *Examination of the Seeds of Beta vulgaris for Purity*.—Two samples are taken, each of at least 25 grammes. They are sifted on a suitable apparatus, being shaken rapidly to and fro.

The fruits which remain on the sieve and contain at least one seed are considered as pure. The stalks are removed and put with the other impurities.



FIG. 12.—Types of Germination Apparatus, Wageningen.

(3) *Examination of Red Clover and of American Red Clover.*—For the determination of origin the sample must weigh at least 500 grammes. Search is made in a sample of 25 grammes for the characteristic seeds, which are then classified, and from their species and the general character of the sample the origin is determined. This test is always made four times for each sample.

(4) *Examination for Dodder.*—The determination of dodder has undergone a great change during the last few years. Formerly attempts were made to separate dodder seeds from clover samples by winnowing, but now a fairly large sample is examined, each grain being observed, and the dodder seeds separated out. It is advisable to cut the dodder seeds in two in order to make sure of the correctness of the selection by revealing the rolled-up and spiral embryo. Neglect of this precaution increases the risk of errors. A good magnifying-glass is indispensable for this operation.

The seeds of *Cuscuta racemosa* and those of other species of dodder which are of corresponding size, are reported as large seeded dodder without naming the species.

In the case of Red Clover, Lucerne, and clover seeds of similar size, 50 grammes of seed are examined for dodder. The number of dodder seeds and the quantity of seed examined are reported. When it is found that 50 grammes of seed contain 3 grains of dodder the test is concluded, and it is reported that the clover contains more than 2 seeds of dodder per 50 grammes of seed. Since each test is made twice, at least 100 grammes of seed are necessary, or at least 150 grammes when in addition to being tested for dodder, the clover is to be tested for purity or germination.

In the case of White Clover, Swedish Clover, and other species of similar size, and in the case of *Phleum pratense*, 25 grammes of seed are examined after the sand has been removed with the aid of a sieve (with mesh of 0.5 mm.). If two dodder seeds are found it is unnecessary to continue the examination. The sample of seed for this test must weigh at least 50 grammes, or at least 100 grammes when a purity or germination test is also required.

In the case of linseed the sample of *Linum usitatissimum* examined for dodder must weigh 150 grammes. If 4 seeds of dodder are discovered the test is concluded. The dodder which is found in linseed is *C. epilinum* Weihe.

(5) *Determination of other Specified Impurities.*— Fifty grammes of red clover seed and other seeds of the same size, and 25 grammes of white clover and other similar seeds are examined grain by grain.

The seeds of varieties of wild *Brassica*, which resemble those of wild mustard, are considered as wild mustard (*Sinapis arvensis*).

B.—Test of the Weight of 1 Litre.

This test is made by means of a 1 litre or a $\frac{1}{4}$ litre measure, which is provided with a movable weight standardised at Berlin. The weight of 1 litre or of $\frac{1}{4}$ litre is determined from the average of four tests.

C.—Test for Moisture.

Ten grammes are dried at a temperature of 105° C., until a fixed weight is obtained. The loss per cent. of weight is then taken as the content of water.

D.—Determination of Actual Weight.

This can be done with seed dried by exposure to the air. A quantity of seed, consisting of 2,000 grammes when their size is equal to or smaller than that of red clover or lucerne, is weighed. The number of seeds is counted and the weight of 1,000 is calculated after the seeds have been dried at a temperature of 105° C. to a constant weight.

In the case of larger seeds, a weight of 1,000 grammes dried by exposure to the air is determined in the same way. The weight of 1,000 dry seeds is calculated from the weight of 1,000 seeds air-dried after the content of moisture has been determined (as in C.).

E.—Determination of Germinating Capacity and Energy of Germination.

1. *General Test.*—Germinating capacity and energy of germination are determined by means of pure seed previously separated in the purity test. The results of the analyses, therefore, refer exclusively to pure seed. For the determination of germinating capacity and energy of germination a small quantity of seed is used, differing according to species and method. The number of seeds requisite is specified in a table in "Methoden van onderzoek aan het Rijksproefstation voor Zaadcontrole voor het jaar, 1912," pp. 14-21.

In the table referred to are also given the name of the method followed and the number of days in which the germinating capacity, energy of germination and maximum germinating capacity can be determined.

All results, such as germinating capacity, energy of germination, hardness, and maximum germinating capacity, are obtained by means of four tests commenced at the same time. When any two of the four sets differ in germinating energy by more than 10 per cent., a fresh series of tests is begun.

The figures obtained for the different values are given to the nearest unit, so that 0.5 per cent. or over is taken as 1 per cent., while less than 0.5 per cent. is disregarded.

The methods followed differ according to the species to be tested. Many large seeds and most seeds of trees are soaked for at least six hours before being put on blotting paper, though this is not done in the case of some large seeds, e.g., oats.

The following methods are given as examples:—

(1) "*W*" Method.

The seeds germinate on blotting paper at a temperature of 18-20° C.

(2) "*W*¹" Method.

The seeds are germinated on blotting paper, the temperature being changed during germination; for 18 hours it is kept at 18-20° C., and for 6 hours at 29-30° C.

(3) "*W*¹¹" Method.

The seeds are germinated on blotting paper, the temperature being 29-30° C.

(4) "*P*" Method.

The germinating beds consist of unglazed porcelain dishes and the temperatures as in methods 1-3 are used. The methods are known as *P*, *W*¹*P*, and *W*¹¹*P*.

(5) "*Z*" Method.

The germinating beds consist of sterilised sand of a special humidity. Before sterilisation the sand is sifted in sieve No. 40, and only the sand which passes through is used. The temperatures employed are as in methods 1-3. These methods are *WZ*, *W*¹*Z*, and *W*¹¹*Z*.

(6) *Jacobsen* ("*K*") Method.

Blotting paper is used, the temperature being 26° C.

(7) "*LP*" Method.

The germination beds are the same as in method 4, but the germination is conducted in daylight.

(8) "*O*" Method.

The germination beds consist of flat, perforated, zinc boxes, lined with blotting paper. The temperatures are the same as in methods 1-3. These methods are *WO*, *W*¹*O*, and *W*¹¹*O*.

Some species are scarcely affected by the method followed, but others are very much affected.

The germinating seeds are regularly inspected, those that have germinated being removed at each inspection and the numbers noted (Fig. 11).

When the energy of germination is required, this energy is calculated on the day when the majority of the seeds of the species in question have germinated.

In the case of tests for germinating capacity and energy of germination, at each inspection the number of seeds that have not germinated is verified and noted.

At the end of the test the number of germinated seeds per cent. is taken as the germinating capacity.

In the case of large seeds, those with hard seed-coats are noted, the seed-coats are cut, and after four days the *maximum* germinating capacity is verified.

Hard seeds of small species, such as red clover, are not tested for germinating capacity, and the percentage only of such hard seeds is noted in the certificate.

Nearly all the tests are made in thermostats of which the station has three types:—

(1) Four thermostats designed by E. Schribaux (made by E. Admet and Sons, Paris). These have glass doors and the temperature in them is intermittent.

(2) One of Vienna make, having a fixed temperature.

(3) Two made to order, having a fixed temperature.

The "K" method (only) is carried out on special tables provided with a basin of water in which are dipped lengths of wool which provide water for the blotting paper on which the seeds germinate. The water is kept at a constant temperature by gas jets under the table.

In the "L P" method the seeds are placed in front of a window to get as much sunlight as possible. The idea, however, has always been to carry out the tests as far as possible independently of the sun, which is so often covered by clouds and is therefore too inconstant. The principle is adopted of testing the various plants in regard to difference of temperature during germination, and light is considered of secondary importance.

When the days fixed for the determination of germinating capacity and energy of germination fall on a Sunday or holiday, the determination is usually made on the day following, while on the preceding day an extra inspection is made.

2. *Determination of the Germinating Capacity of Beets.*—In the case of beets another point must be considered, the fruits which are used as "seed" generally containing two or three or more seeds. Since January, 1909, however, these fruits have been considered as one seed in determining their germination. Previous to that date, the German custom of taking as the germinating capacity the number of seeds which germinated from 100 fruits was followed. It is considered, however, that it is much more economical to use "seed"

(or fruits), a large percentage of which contain *one* fertile seed, than fruits, a small percentage of which contain two or three or more fertile seeds.

At present, the percentage of fertile fruits which possess at least one sound seed is taken as the germinating capacity.

The pure seed which has passed the test is weighed and counted, and from the figures thus obtained is calculated the average weight of 100 fruits. Four samples are taken, the number of fruits in each case being 100, to make sure of securing a fair average. The four samples are weighed, and if the difference between the weight of 100 fruits of one of these samples and the average weight of 100 fruits is more than 10 per cent., the test is repeated.

The four samples of 100 fruits are first soaked in pure water for four hours, when the water is changed and they are soaked for three more hours. After this they are placed to germinate in zinc boxes (method W¹O).

Beet-seeds are very susceptible to temperature, and are therefore placed at the bottom of the thermostats, where the temperature is most constant. At each inspection the fruits in which at least one sound seed has germinated are removed.

F. *True Value of the Sample.*

The intrinsic or true value of seeds is estimated at Wageningen rather differently from the usual method, three times the noxious impurities being deducted. That is, where P = purity, G = germination, and H = harmful contents (weed seeds and other noxious impurities), the true value is

$$\text{taken as } \frac{P \times G}{100} - 3 H.$$

Since 1911, most sales have been carried out according to the "Algemeene Handelsvoorwaarden, geldende bij koop en verkoop van Zaaizaden" (A.H.V.Z.) (general commercial conditions, applying to the purchase and sale of seeds). In these conditions are detailed exactly the points which buyer and seller should observe when the transaction is contracted according to the A.H.V.Z.

When the two parties differ they must submit the difference to the State Seed Control Station, but the right to demand a fresh examination of the seed is accorded to them. This demand for a fresh test must be made to the President of the College of the Agricultural Stations in the Netherlands*

* Actually Mr. F. F. Bruijning, Director of the Seed Control Station.

within three weeks of the date of the analysis report. The average of the two results is to be accepted by the two parties, that is, when the difference between the two results is not too great to establish an average. The cost of this fresh examination (appeal) is three times that of the first test, and is equal to the cost of those examinations for which urgency is requested. A test of this sort takes precedence over any that may be asked for at the same time.

In order to prevent misunderstandings, special cards are distributed for urgent examinations, and these can be obtained free at the State Seed Control Station. The A.H.V.Z. affords room for statements concerning the date of purchase and date of supplying, method of taking sample, record of the number and weight furnished, packing material, claims, guarantee, requirements as to quality*, demand for a fresh test, charges for the test, payments for damages, disputes, rules for arbitration, etc.

There are no legislative measures against frauds or adulteration of seeds in Holland.

The average purity and germinating capacity of samples of seeds examined at Wageningen in the past three years are shown in Appendix IX. (p. 72).

Thanks to the regular control of seeds in Holland adulteration is becoming rarer, and is not now of frequent occurrence.

* These requirements as to quality stipulate:—

(1) That all the seeds supplied shall be of the species indicated on the application for examination;

(2) That the cultural value of certain seeds must not be less than the minimum cultural value of these seeds as defined in a publication issued twice a year by the Director of the Seed Control Station, which is actually as follows:—

Minimum Cultural Value.			
<i>Medicago lupulina</i> ..	80 per cent.	<i>Cynosurus cristatus</i> ..	80 per cent.
<i>sativa</i> ..	85 "	<i>Dactylis glomerata</i> ..	71 "
<i>Trifolium pratense</i> ..	85 "	<i>Lolium perenne</i> ..	77 "
(indigenous) ..	80 "	<i>L. italicum</i> ..	71 "
" ..	85 "	<i>L. italicum</i> var. ..	72 "
<i>Trifolium repens</i> ..	80 "	<i>Westerwoldicum</i> ..	65 "
" ..	80 "	<i>Arrhenatherum elatius</i> ..	50 "
<i>Linum usitatissimum</i> ..	80 "	<i>Alopecurus pratensis</i> ..	86 "
<i>Phleum pratense</i> ..	85 "	<i>Hordeum</i> ..	75 "
<i>Poa trivialis</i> ..	71 "	<i>Avena</i> ..	86 "
" ..	55 "	<i>Secale cereale</i> ..	86 "
<i>Festuca pratensis</i> ..	85 "	<i>Triticum</i> ..	86 "
<i>Agrostis stolonifera</i> ..	75 "	<i>Vicia sativa</i> ..	75 "

(3) That the seeds of *Medicago lupulina*, L., *M. sativa*, L., *Trifolium pratense*, L., *T. repens*, L., *T. hybridum*, L., *Linum usitatissimum*, L., and *Phleum pratense*, L., are free from dodder; and

(4) That the seed sold as indigenous *Trifolium pratense* is free from American seeds.



FIG. 13.—A section of the Laboratory for Purity Examinations, State Seed Control Station, Zürich (in the chemical buildings, Technical High School).



FIG. 14.—A section of the Laboratory for Purity Examinations, State Seed Control Station, Zürich (in the chemical buildings, Technical High School).

THE SWISS SEED CONTROL STATION AT ZÜRICH.

The Government Seed Control Station at Zürich was established in the year 1875, and an annual report has been issued since 1877.

The Station.

The work of the Station has for many years been conducted in a number of rooms in the chemical buildings of the Technical High School, but the growth of the work, and the fact that the accommodation is needed for the chemical department, has led to the erection of a large new building at the experimental fields at Oerlikon near Zürich. Photographs of the rooms hitherto devoted to seed testing are shown in Figs. 13 to 16, and of the new building (incomplete) in Figs. 17 and 18. The new building has been specially designed to include everything that will facilitate and render accurate the work to be done, and includes a large photographic studio, and a lean-to glasshouse for germination tests. The rooms total 25, as well as 5 rooms in the glasshouse and 3 storerooms.

Staff.

The staff consists of the Director (Dr. F. G. Stebler), three assistants, and 17 or 18 lady assistants in winter or nine in summer, three of the ladies being in the office. The establishment also employs four gardeners, one man-servant, and in the summer two labourers for the experimental fields.

Cost.

The cost of the Station in 1912-13 was £3,252, composed of £1,943 for salaries, £215 office expenses, £93 furniture, apparatus books, periodicals, etc., £997 working expenses, and £4 sundry expenses. These figures do not include the cost of the new building.

The receipts amounted to £1,624, £1,520 being received for analyses and £104 sundry receipts, from collections, sale of seeds, etc. Control fees, about £80 paid to the central administration at Berne, are not included. The excess of expenses over receipts is mainly caused by the experimental work of the Station.

Objects.

The objects of the Station are :—(1) The supervision or control of the seed trade ; (2) Testing of forage and other agricultural plants ; (3) Protection of plants against diseases and enemies of agricultural crops ; and (4) The improvement of agricultural crops (selection of cereals).

Samples Examined.

In regard to the control of seeds, the number of samples examined yearly has steadily increased since 1877, as shown by the following figures (the year being from July 1st to June 30th):—

Year.	No. of Samples.	Year.	No. of Samples.
1877-8	885	1895-6	6,956
1878-9	1,056	1896-7	7,285
1879-80	1,358	1897-8	8,495
1880-1	1,465	1898-9	8,473
1881-2	1,792	1899-1900	9,272
1882-3	1,809	1900-1	10,257
1883-4	1,883	1901-2	9,686
1884-5	1,877	1902-3	10,274
1885-6	2,328	1903-4	10,166
1886-7	2,847	1904-5	10,050
1887-8	3,158	1905-6	9,480
1888-9	4,030	1906-7	9,960
1889-90	4,613	1907-8	10,335
1890-1	4,869	1908-9	11,045
1891-2	5,579	1909-10	11,844
1892-3	5,976	1910-11	11,606
1893-4	6,061	1911-12	12,055
1894-5	6,877	1912-13	12,702

Analyses of seeds are divided into two classes: (a) Control analyses; and (b) Ordinary analyses. The former are made in connection with so-called "control" firms or persons, who make a definite agreement with the Station for the examination and control of the seeds sold by them, and who are compelled by the agreement to guarantee their seeds to the purchaser, who can submit a sample of his consignment to the Station for free analysis and report. The "control" firms at the present time (Swiss seed merchants only) number 61. *Ordinary analyses* are made for any person who cares to send samples. The Station makes with such persons special contracts, by which they have the right of a reduction in the fees payable. At the present time 202 seed merchants have made such contracts, 34 being Swiss and 168 foreign (34 British). The regulations governing seed analysis and control are given in Appendix X. (page 73).

The control of seeds has had an excellent effect in improving the general quality of the seeds sold in Switzerland, and of the samples sent in by purchasers for the free "after analysis" (*Nachuntersuchung*), the number not up to the guarantee has shown a steady decrease since 1877. For example, in the years shown below the yearly percentages of samples not conforming to the guarantee were:—

1878-83	..	..	..	29	per cent.
1883-88	..	..	..	22	"
1888-93	..	..	..	14	"
1893-98	..	..	..	11	"
1898-1903	..	..	..	9	"
1903-08	..	..	..	9	"
1908-13	..	..	..	10	"

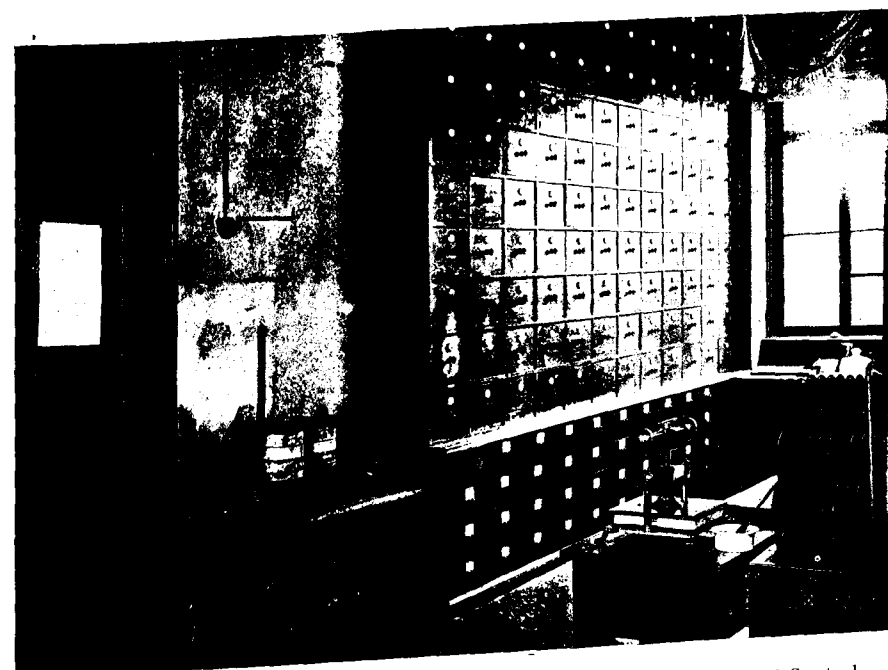


FIG. 15.—Clover Dodder Machine, and Boxes for storing Seeds, State Seed Control Station, Zürich (in the chemical buildings, Technical High School).



FIG. 16.—Room for cleaning Porous Germination Cells, State Seed Control Station, Zürich (in the chemical buildings, Technical High School).

The 12,702 samples examined in 1912-13 consisted of 199 species, composed as follows:—

16 Clovers	3,087 samples.
45 Grasses	6,073 ..
4 Perennial fodder plants	57 ..
8 Annual	59 ..
8 Pulse	125 ..
7 Cereals	139 ..
31 Roots and vegetables	561 ..
54 Forest trees	2,490 ..
26 Various	111 ..
199 species	12,702 samples.

Of the total number of samples, 72.1 per cent. consisted of clovers and grasses, and 19.6 per cent. of forest seeds.

The activities of the Station as a whole are shown by the following figures for the years 1910-11, 1911-12, and 1912-13:—

	1910-11.	1911-12.	1912-13.
Seed Samples	11,844 ..	12,055 ..	12,702 ..
Fodder-growing experiments	220 ..	247 ..	188 ..
Comparative trials in the experimental fields	47 ..	48 ..	49 ..
Individual cultures in the experimental fields	797 ..	887 ..	305 ..
Foreign experiments	57 ..	65 ..	70 ..
Cereal-breeding experiments	37 ..	42 ..	45 ..
Collections of Plants given away	135 ..	48 ..	129 ..
Collections of Seeds given away	45 ..	41 ..	52 ..
Reports on Field Cultivation	322 ..	288 ..	254 ..
Reports on Plant Protection	61 ..	64 ..	72 ..
Officers of the Station.. .. .	4 ..	4 ..	4 ..
Permanent Assistants	10 ..	11 ..	11 ..
Auxiliary Assistants.. .. .	9 ..	9 ..	11 ..
Correspondence sent out	16,995 ..	16,528 ..	18,059 ..
Receipts (at 25 fr. to the £)	£1,264 10s.	£1,509 5s.	£1,624 ..

The number of individual examinations of the 12,702 samples was 31,509, these consisting of:—

Identity	9,179
Purity	8,866
Germination	11,056
For dodder	2,102
For burnet	85
Weight per hectolitre, weight per 1,000 seeds, and moisture content	181
Various	40

The average purity and germinating capacity of various species of seeds for the year 1911-12 and the years 1876-1912, together with the average true value of the samples, are given in Appendix XI. (p. 80).

The number of samples examined in ascertaining the averages given has usually been considerable—the lowest figure for 1911-12 being six samples (for white mustard) and the highest, 1,366 samples (for red clover); while as regards the years 1876-1912 the lowest figure was 72 samples (for true value of mangolds) and the highest 24,704 samples (for estimating purity of red clover).

It must be pointed out that the figures given in the foregoing table are averages, and do not represent the quality that the farmer should demand when purchasing—he should endeavour to secure seeds as much above the average and as near the maximum quality as possible. The maximum and minimum figures for the species included in the table for the year 1911-12 (p. 80) are shown in Appendix XII. (p. 81).

THE GOVERNMENT SEED CONTROL STATION AT BUDAPEST.

Seed testing was conducted for the public in Hungary so long ago as 1871, at the Agricultural School at Debreczen, and in 1878 a special laboratory was opened at the Agricultural Academy at Magyar-Ovár. A considerable amount of seed analysis was done until the Budapest Station was inaugurated in 1884. Since that time various changes have taken place, three further stations have been opened (at Kassa, Keszthely and Kolozsvár). The work at Debreczen, Keszthely and Magyar-Ovár has now been discontinued. There are at the present day, therefore, three seed-testing stations in Hungary, of which that at Budapest is the chief. With the exception of the Station at Budapest, which is independent, the Seed Stations are attached to the Agricultural Academies. Forest seeds are tested at the Central Forest Experiment Station at Selmeczbánya.

The Building.

Since the year 1901 the Budapest Seed Control Station has been housed in a fine building at the corner of two streets,* the building being detached and devoted solely to seed-testing. A plan of the two floors is given in Fig. 19, and the building is illustrated in Fig. 20. The whole building is simply but well fitted, comfortable, well suited to the work, and supplied with everything calculated to ensure accurate and sound results. Cleaning rooms, work and store rooms, etc., are situated in the basement.

Object of the Station.

The Control Station is especially intended to exercise control over the seed trade, to protect the interests of purchasers in

* The address is Kis Rókus-utca 15, Budapest.

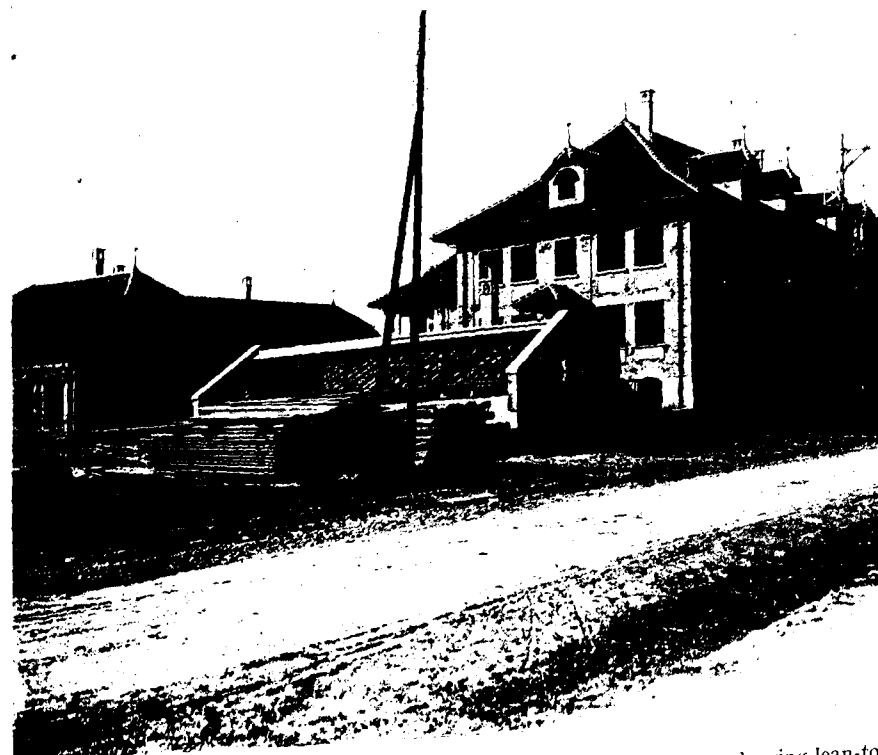


FIG. 17.—New State Seed Control Station, Zürich, in course of building, showing lean-to Germination Room, with glass roof, and Cereal Seed-Selection Store-house on left.



FIG. 18.—Another view of Fig. 17.

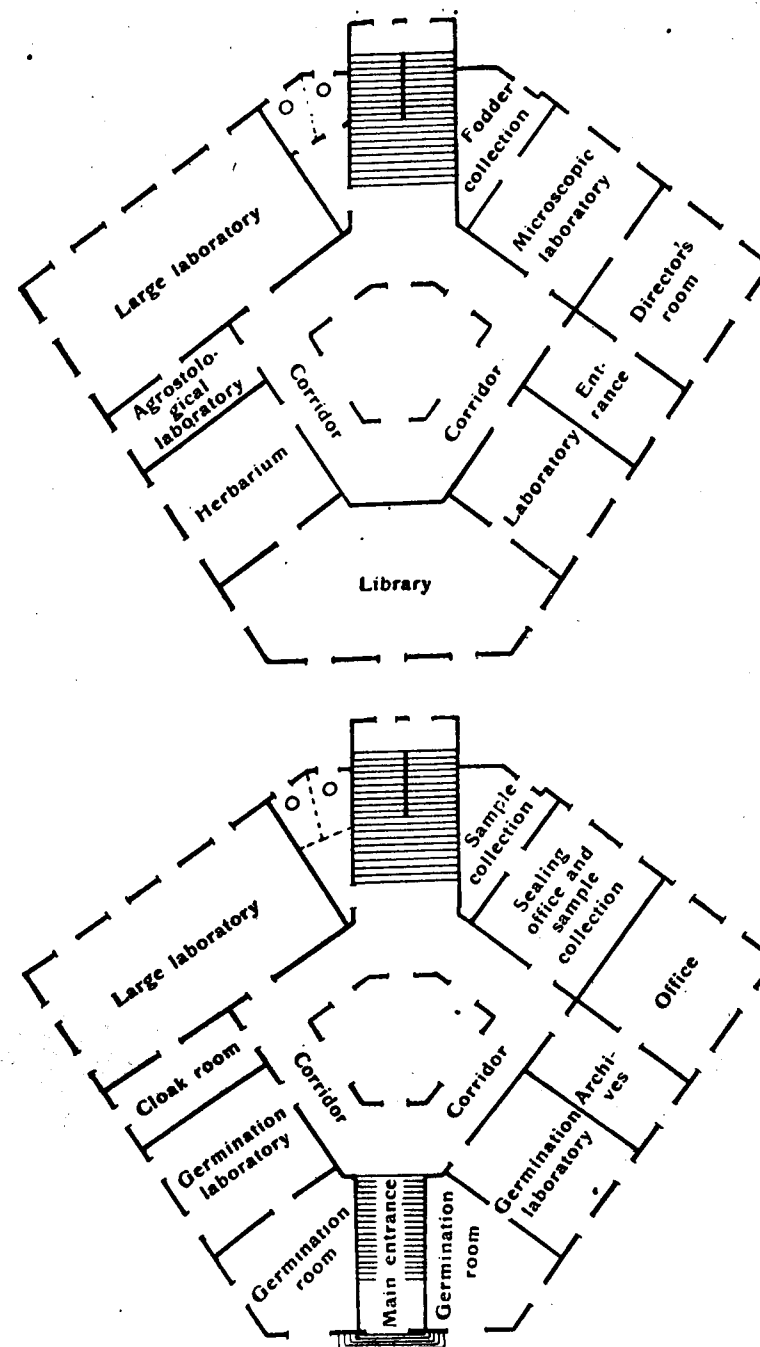


FIG. 19.—Plan of Royal Seed Control Station, Budapest.
First floor above, ground floor below.

relation to fraud, to conduct experiments in relation to seeds, to "analyse" seeds submitted for examination, and, in general, to endeavour to bring about the sale of purer seeds of better type and quality.

Staff.

The permanent staff consists of a Director (Dr. Arpad de Degen), 11 assistant officers, 5 messengers, and 2 laboratory men. The staff is increased in winter.

State Contribution and Income.

The State gives a yearly sum of £666 and, in addition, pays the salaries as follows:—

The Director	£512.
5 Principal Assistants at	£150-£175.
4 Assistants at	£90-£121.
2 Assistants at	£60-£90
5 Messengers, etc., at	£38-£75.

The cost of maintenance apart from salaries, is about £583 per annum. About £1,250 are received in payment for seed analyses, etc.

Work done by the Station.

In relation to seed testing the Station determines identity, origin (when possible), purity, germinating capacity, absolute weight, volume weight and moisture. In addition, it advises on various points in regard to sugar-beet seeds and barley, feeding stuffs and hay, seed mixtures and the improvement of grass land, and in general gives expert advice and opinion in regard to agricultural botany. In the spring samples of seeds are taken by the Station in the open market, and the civil authorities are informed when a seedsman is selling bad or adulterated seeds. If the seed is very bad it may be confiscated and the seedsman fined. The Station does not officially publish the names of such seedsmen. The Seed Control has had the effect of improving the quality of seed sold, seedsmen selling on the result of the Station's analyses.

As an instance of the work done by the Station it may be said that it has been discovered that Russian poppy seed always contains a considerable quantity of poisonous Henbane seeds.* (Poppy seed is extensively used for cakes, etc., and the presence of the seeds of Henbane is a serious matter, as they are poisonous).

* *Zeitschrift für Nahrungs und Genussmittel*, 1910, Vol. 19, No. 12.

Fees for Seed Testing.

Seeds are examined free for farmers in so far as identity, origin, purity, dodder and germinating capacity are concerned, but for other examinations and examinations for seedsmen small charges are made. These fees are as follows:—

	s.	d.
1. Determination of species, sub-species and variety	0	10
2. Determination of origin	0	10
3. Purity analysis and estimation of foreign substances	1	8
4. Presence of dodder and quantity per kilogramme	0	10
5. Germination test	1	8
6. Weight per litre	0	10
7. Percentage of moisture	1	8
8. Absolute weight (= wgt. of 1,000 grains)	0	10
9. Examination of barley for brewing (germination, purity, percentage of starch, weight per litre, and absolute weight)	5	0
10. Complete examination of sugar-beet seed (germination, moisture, purity, number of germs in a kilogramme of seeds)	6	8
11. Complete botanical analysis of a mixture of seeds, with percentage contents, is calculated as follows:—		
(a) For separating the constituents	1	8
(b) For determining each constituent, extra	0	10

Seedsmen and industrial concerns which may send large numbers of samples for analysis obtain the benefit of reduced fees, 100 or more ordinary examinations being conducted at 5d. each, while 100 sugar-beet examinations cost £25, 50 cost £14 3s. 4d., or 25 cost £7 10s.

Equipment of the Station.

The Station is equipped with a special library (about 5,700 volumes), collections of feeding stuffs, materials of different types used for purposes of adulteration, a large herbarium, and an exceptionally fine collection of seeds, amounting to about 10,000 species. In addition there is a variety of analytical scales, measures, optical instruments, and thermostats or germinating cabinets, etc.

For germinating purposes Zürich thermostats and porous porcelain germinators are used, while for beet-seeds Weinzierl's modified Vienna thermostat is used, and for conifers Jacobsen's germinators. The two germinating rooms are so arranged that each can be utilised as a complete thermostat, i.e., can be accurately regulated in regard to temperature and humidity, while ventilation is provided by an electric appliance.

Official Sealing of Trade Seeds.

A practice which is held to have good results consists in the examination of clovers and lucerne for dodder in the warehouse of the merchant having the seed for sale. The sacks or bags

of seed are carefully and stringently examined by an official of the Station, and if they pass the test are duly sealed with string and the lead seal of the Station, a certificate being attached stating that a sample taken from the sack was found free from dodder. Any quantity of seed is examined, and even small bags are sealed in this way.

Insufficiently cleaned seed, mixtures of new and old seed, and American clover or Turkestan lucerne seeds—even free from dodder—cannot be sealed.

The fee for the examination for dodder on behalf of seedsmen is mentioned above (p. 43), but in the case of sealing, there is an additional charge of *rd.* for sealing each sack or part of a sack. In cases where this work is desired outside towns where Seed Control Stations exist the travelling expenses and a charge for the officer's attendance must also be paid.

A number of regulations are made to ensure that the sealing of sacks cannot be abused.

The Station will also seal sacks after the seed has been examined for purity and germinating capacity, but only when an average sample shows at least the following percentages for purity and germinating capacity:—*

Species.	Purity.	Germinating Capacity.	Species.	Purity.	Germinating Capacity.
<i>Alopecurus pratensis</i>	75	65	<i>Onobrychis sativa</i> ..	93	75
<i>Avena elatior</i> ..	70	70	<i>Phleum pratense</i> ..	95	90
" <i>flavescens</i> ..	65	60	<i>Poa pratensis</i> ..	85	65
<i>Brassica</i> sp.	97	85	" <i>trivialis</i> ..	85	70
<i>Cynosurus cristatus</i> ..	90	75	<i>Poterium Sanguis-</i>		
<i>Dactylis glomerata</i> ..	75	75	<i>orba</i> ..	80	85
<i>Festuca pratensis</i> ..	90	80	<i>Trifolium hybridum</i>	94	80
" <i>ovina</i> ..	75	70	<i>Trifolium incarna-</i>		
" <i>rubra</i> ..	75	60	<i>tum</i> ..	94	85
<i>Lolium italicum</i> ..	90	78	<i>Trifolium pratense</i>	95	90
" <i>perenne</i> ..	93	80	" <i>repens</i> ..	94	90
<i>Lotus corniculatus</i> ..	92	65			

Legislation.

Two Acts (Rural Police Act XII. of 1894, and Act XLVI. of 1895) relate among other things to seeds. The former imposes a penalty up to 200 crowns (£8 6s. 8*d.*) on any person who offers for sale any clover or lucerne seed which is not absolutely free from dodder. The effect of this law has been that seedsmen prefer to sell seeds which have been examined and "sealed" by the Station.

* The Table only shows the percentages for certain species of seeds, but other species are also provided for.



FIG. 20.—Royal Seed Control Station, Budapest.



FIG. 21.—Imperial Royal Seed Control Station, and Experiment Station for Agricultural Botany, Vienna.

The second Act (XLVI. of 1895) among other things, imposes penalties to the extent of two months imprisonment and a fine of 600 crowns (£25) for certain offences—for adulterating or selling adulterated agricultural products, or a fine of £25 for selling agricultural products under a false designation. Quantities of seeds above 10 kilogrammes (22 lb.) may only be sold on a declaration by the seller as to their real name, variety and origin (when a special quality is attached to it), the percentage of purity and germinating capacity. The taking of samples for control is provided for by this Act. If the examination by the Station shows a difference in purity or germinating capacity of more than 5 per cent. below the declared figures the merchant is liable to a penalty. If the examination shows a lower purity but higher germinating capacity or *vice versa*, then their product divided by 100 (*i.e.*, the "true value") may show a lower percentage of value not exceeding 5 per cent., or in the case of grass seeds 10 per cent.; if the difference is lower than these limits the merchant is liable to a penalty. The opinion of the Station may be submitted to a council of experts for revision.

The two Acts have resulted in much increasing the work of the Seed Stations.

General Results.

The total number of examinations made at the Budapest Station have in recent years been as follows:—

Year	1903-4.	1904-5.	1905-6.	1906-7.	1907-8.
Number ..	43,691	57,832	41,814	45,728	43,797
Year	1908-9.	1909-10.	1910-11.	1911-12.	1912-13.
Number ..	52,491	43,488	47,654	51,913	42,749

Of these examinations almost all were in relation to seeds, and the following numbers were made respectively for farmers, merchants, and institutions:—

Year	1903-4.	1904-5.	1905-6.	1906-7.	1907-8.
Farmers ..	389	351	336	450	294
Merchants ..	39,529	52,857	34,173	37,862	36,619
Institutions ..	184	264	117	174	323
Together ..	40,102	53,472	34,626	38,486	37,236

Year ..	1908-9.	1909-10.	1910-11.	1911-12.	1912-13.
Farmers ..	328	553	411	369	718
Merchants ..	43,226	29,124	36,745	41,505	34,762
Institutions ..	877	682	680	912	1,069
Together ..	44,431	30,359	37,836	42,786	36,549

The numbers of examinations for official sealing of bags of seeds were :—

Year ..	1903-4.	1904-5.	1905-6.	1906-7.	1907-8.
Number Sealed ..	34,851	46,127	31,060	34,073	33,213
Not sealed ..	20,444	31,905	20,991	25,513	24,847
	14,407	14,162	10,069	8,560	8,306

Year ..	1908-9.	1909-10.	1910-11.	1911-12.	1912-13.
Number Sealed ..	40,757	25,980	33,642	39,157	32,239
Not sealed ..	28,677	17,316	21,283	27,468	23,391
	12,080	8,664	12,359	11,689	8,848

As the table on p. 47 will show, the vast majority of the examinations made are for dodder, which is considered of very great importance in Hungary.

In regard to the presence of dodder the following species of seeds were examined :—*Trifolium pratense*, *T. incarnatum*, *T. repens*, *T. hybridum*, *Medicago sativa* and *M. lupulina*, *Anthyllis vulneraria*, *Phleum pratense*, *Linum usitatissimum*, *Lotus corniculatus*, *Bromus commutatus*, *Lolium perenne*, *Cannabis sativa*, and various mixtures of seeds. The total samples of all these species examined and the percentages containing dodder were as follows :—*

	1903-4.	1904-5.	1905-6.	1906-7.	1907-8.
Number of samples ..	36,964	49,033	34,937	38,780	37,220
Percentage containing dodder	43.96	33.87	39.44	30.95	31.32

	1908-9.	1909-10.	1910-11.	1911-12.	1912-13.
Number of samples ..	44,628	33,917	39,597	42,831	33,330
Percentage containing dodder.	34.28	46.82	45.04	35.75	29.13

* In individual years certain of these species were not examined.

Examinations made ..	1903-4.	1904-5.	1905-6.	1906-7.	1907-8.	1908-9.	1909-10.	1910-11.	1911-12.	1912-13.
For Dodder ..	No. 36,964	No. 49,033	No. 34,937	No. 38,780	No. 37,220	No. 44,628	No. 33,917	No. 40,175	No. 43,638	No. 35,283
Germination ..	5,810	7,481	5,679	5,599	5,377	5,344	4,486	4,930	4,492	4,632
Germination per kilogramme ..	7	8	7	20	19	7	2	4	3	5
Energy of germination ..	4	6	—	64	—	—	59	3	3	2
Purity ..	491	846	801	585	576	1,084	1,639	925	1,258	1,082
Identity ..	212	275	281	218	98	748	2,679	26	51	20
Origin ..	28	46	13	1	2	54	164	60	32	23
Water content ..	7	8	7	3	3	4	3	3	3	5
Weight per 1,000 seeds ..	5	6	2	—	3	7	10	3	3	178
Volume weight ..	3	8	6	107	74	182	223	3	763	176
Analysis of Seed ..	7	49	34	4	—	60	1	6	3	29
Grass seed mixtures ..	6	5	—	—	—	3	—	—	—	2
Total Seed Examinations ..	43,544	57,771	41,772	45,471	43,372	52,121	43,183	46,141	50,755	41,437
Fodders, Plants, Hay, etc. ..	147	61	42	257	425	370	305	1,513	1,158	1,312
Grand Total ..	43,691	57,832	41,814	45,728	43,797	52,491	43,488	47,654	51,913	42,749

48 SEED CONTROL STATIONS ON THE CONTINENT.

By far the greatest number of samples examined consisted of *Trifolium pratense* and *Medicago sativa*.

Nearly 300 species of seeds have been examined annually for purity or germinating capacity, or both, and data as to the more important of these are shown in the table, in Appendix XIII. (p.82), the number of samples given being for the seven years 1903-10.

THE IMPERIAL AND ROYAL SEED CONTROL STATION IN VIENNA.

The Seed Control Station in Vienna was founded in 1881 by the Imperial and Royal Agricultural Society of Vienna, and while it started with quite modest aims it has now, after 33 years, developed into a great Experiment Station for agricultural botany, claimed to be the largest Station of its kind. For the first five years (till 1886) the Station was situated in one room in a private house, and merely examined the more important seeds of commerce. It was then transferred to the premises of the Imperial and Royal Agricultural Society, and, developing rapidly, was in 1895 taken over by the State, and moved to the offices of the Ministry of Agriculture. Finally, since 1905 it has occupied a fine building specially built on an acre of land presented by the Emperor, so that small cultivation experiments may now be conducted.

There is a large laboratory for purity examinations, a second devoted to beet seed investigations, and a large germination room, in addition to chemical, botanical and micro-bacteriological laboratories, and various offices. The Station building is illustrated in Figs. 21, 22, and 23.

In 1907 a small branch station was opened in connection with the Agricultural Exchange in Vienna, and purchasers in the Exchange can submit samples offered for sale for an examination on the spot, and so obtain useful information before completing a purchase.

Staff.

The staff of the Station consists of a Director (Professor Dr. Th. Ritter v. Weinzierl), 3 inspectors, 4 assistants and 1 sub-assistant, occasionally an inspector for moor culture, 1 agrostologist (*Wiesenbaumeister*), 1 office clerk (*Kanzleioffiziant*), 1 lady clerk, 5 lady assistant clerks, 6 laboratory men servants, and 2 men servants who are also gardeners.



FIG. 22.—Analytical Laboratory, Imperial Royal Seed Control Station, Vienna.



FIG. 23.—General Laboratory for Germination Tests, showing Germinators, Imperial Royal Seed Control Station, Vienna.

Income and Expenditure

The preliminary ordinary expenditure in 1912 was £5,042 and the receipts £1,375.

Objects.

The objects at which this Station has zealously aimed have been not only the extension and perfection of scientific methods of investigation of the different seeds traded in, and the organisation of seed control proper, but also investigation and experimentation; begun soon after the inception of the Station, in the provinces of agricultural seeds, cultivation of fodder plants, and later of seed breeding, together with various field trials on the agricultural value of widely advertised trade seeds sent in for analysis. By its present sphere of activity as an independent agricultural and botanical experiment station the Station has served as a model in the foundation of analogous stations both in Austria and elsewhere.

The condition of seed control in Austria, and of the experimental work related thereto, finds expression through the dispositions and activity of the Vienna Seed Control Station.

The Station's present sphere of activity includes the determination of the actual value of different trade seeds, and secondly, determination of identity, origin, content of clover dodder, purity (in weight per cent.), germinating capacity, and water content (in the case of seeds, fruits and tubers); the investigation of seeds of sugar beet and turnips for impurities, germinating capacity, number per gramme, etc. Cereals are tested for weight per hectolitre, absolute weight, percentage (by weight) of broken, rusted or ergoted grain, or grain otherwise damaged. Further work of the Station in this direction has regard to the testing of grain made into bread with regard to the baking quality of the meal; complete analysis of brewing barley for water content, purity, hectolitre-weight, absolute weight, content of damaged grain, germinating capacity, germinating energy, etc., and the investigation of concentrated feeding stuffs (bran, meal, oilcakes, etc.) with respect to the determination of genuineness and possible adulteration, etc. Finally, the Station undertakes the identification of cultivated plants, and weeds, as well as the investigation of plant diseases; it carries out botanical analyses of hay, and investigates plants and parts of plants which are of importance on account of their value for breeding.

Among the duties which fall to the Station in its capacity

as an experimental station for agricultural botany the following may be cited :—

(1) The improvement of fodder crops by carrying out field trials with these crops, foundation of fodder crop stations, growing and breeding seeds of fodder plants, Alpine fodder crop experiments.

(2) The promotion of seed breeding and seed cultivation in the case of corn, flax, turnips, sugar beet, potatoes, maize and fodder plants, as well as plant breeding in general—(a) by means of experiments in the improvement of native varieties—the propagation of new varieties on the one hand, and the maintenance of the productivity of tried imported kinds on the other hand—and (b) by the diffusion of the results of these scientific practical experiments by publications, lectures, and the laying out of demonstration fields.

(3) The formation of organisations for promoting the production of agricultural plants, especially for seed growing and breeding on small holdings (peasant properties) or through agricultural corporations.

(4) The promotion of the scientific principles of cultivation, especially by scientific investigation as regards seeds, and, in the case of the most important cultivated plants, as regards the production of plant forms.

For the purpose of conducting small breeding experiments, growing new varieties of seeds of doubtful origin, etc., a garden of 50 plots, together making 0.827 acre, is available, and in winter a glass house is used.

Samples Examined.

The number of analyses of seeds, etc., made yearly for the public has risen from 122 in the first year (1881) to over 29,000 in 1912.

The numbers of analyses each fifth year from 1881 to 1906 and for the year 1912 have been as follows :—

Year. (1)	Samples. (2)	Sealed Sacks. (3)	Separate Analyses. (4)	Total Examinations. (3 and 4).
1881	82	—	122	122
1886	800	1,458	1,045	2,503
1891	2,530	5,600	4,201	9,801
1896	4,182	8,361	10,418	18,779
1901	8,024	11,356	15,882	27,238
1906	11,490	10,913	19,012	29,925
1912	9,899	13,468	15,732	29,200

It may be mentioned that the total number of examinations rose to the maximum in 1904, when it was 36,927.

In 1912 the examinations made were composed as follows :—

	No. of Samples.	No. of Analyses.
Clovers	5,686	6,826
Grasses	2,077	3,508
Beet	629	2,055
Cereals	921	2,602
Linseed	25	59
Poppy seed	105	107
Forest seeds	37	59
Various	373	470
Foodstuffs (meals, cakes, etc.)	42	42
Hay samples	4	4
Totals	9,899	15,732

In addition a large number of samples were examined (chiefly for dodder) in the warehouses and sealed with the lead seal of the Station, as follows :—

	No.
Red Clover	8,033
Other "Clovers"	437
Lucerne	4,098
Timothy	508
Various (Grasses, etc.)	392
Separate examinations as above	13,468
Total analyses	15,732
	29,200

"Control" Firms.

In 1912 39 firms had made contracts with the Station for the control of their seeds, while there were seven subscribers of a different type.

Of 877 samples sent for "after analysis" or "after control" (samples of seed supplied to farmers under guarantee, and submitted to the Station) 772 samples conformed to the guarantee and 105 samples (or 11.9 per cent., compared with 19.2 per cent. in 1911) did not conform to the guarantee.

At the request of the senders 6,356 samples were examined for dodder, and 1,763 samples (or 27.7 per cent.) contained dodder. The figures given in the table on p. 52 relate to the five most numerous species.

Lead Sealing of Seeds.

Since 1882 the Station has undertaken the official examination of samples for purity in warehouses, and the practice has also been followed at Munich (pp. 53-56) and Budapest (p. 43). Samples are drawn from sacks or bags of seeds, and approved lots are sealed with an official lead seal as a guarantee that they do not contain dodder. Only those samples

are eligible for sealing which are "dodder free"—that is, the drawn sample of which does not contain a single grain of dodder—and which appear to the eye to have been cleaned with the best machinery and to be of high germinating capacity; and, as regards red clover and lucerne, which also are not of

Dodder Found in certain Species of Clover.

	Number of Samples. 1912.	Number containing Dodder.			
		In 1912.		10-year Average 1902-11.	
		No.	Per cent.	No.	Per cent.
Red Clover	3,506	1,272	36.3		32.9
Alsike	348	62	17.8		15.0
White Clover	172	32	18.6		15.2
Lucerne	1,306	287	21.9		16.1
Timothy	787	99	12.6		3.2

American origin or mixed with American seed. The lead seal secures in place a label having the same number as the certificate, and bears on one side the month and year, and on the other the Austrian Eagle and the words "K.k. Samen-Kontroll Station in Wien."

Charges for Analysis.

There is a rather considerable list of charges made for the various examinations made by the Station, and all cannot be given here. The following charges, however, may be given as more or less typical:—

Genuineness	s. d.
Origin	1 8
For Dodder	1 8
Moisture Content	1 3
Purity—(a) Grasses	0 8
(b) Clovers, Timothy	2 1
Germinating capacity	0 8
Composition of Seeds Mixtures	1 8
Certifying and Sealing a sack	3 4
Urgent examinations—double fees.	0 10

Genuineness or origin may also be determined by a cultivation experiment, in which case the charge is 8s. 4d. Control firms may, under certain conditions, be allowed a reduction of 40 to 50 per cent. of the normal fees; and members of the Imperial and Royal Agricultural Society of Vienna are allowed a reduction of 25 per cent. of the normal fees. Farmers and certain others who desire to send a large number of samples in the year and agree to contribute not less than £4 3s. 4d. secure a reduction of 50 per cent.

Methods of Control.

Definite instructions and rules for the control of seeds in Austria have been drawn up by an expert Commission for seed control with the Director of the Station as president.

Forms of Certificate.

Forms of report as to results for purity of leguminous seeds and of germinating capacity of leguminous and grass seeds are given in Appendix XIV., and also a form of certificate of results of analyses of seeds (pp. 83-86).

Results as to Purity and Germinating Capacity.

The average purity and germinating capacity of certain species of seeds in 1912 are given in Appendix XV., together with average values over ten years, and the limit values which ensure the 5 per cent. latitude allowance (p. 87).

SEED CONTROL IN MUNICH.

Seed control work in Munich is carried out by a department of the Royal Institute for Agricultural Botany, which was founded in 1902, and receives an annual State grant of £4,889, whilst other sources of income add about £500.

Staff.

The staff of the *Institute* consists of a Director (Professor Dr. L. Hiltner), five assessors, six assistants, one voluntary assistant, one secretary, one head gardener, one agriculturist, two gardeners, three clerks, eight lady clerks and laboratory assistants, and four men servants.

Seed Control is under the direction of a departmental head, with six assistants for technical and literary work. In the busiest season assistance is given by other departments of the Institute.

Work Done.

Seeds are examined for genuineness, purity, germinating capacity, origin, dodder, weight, moisture content, artificial treatment of seed, etc., and also for insect and fungus pests—indeed, to ascertain all that there is to be known about seeds. Special attention is devoted to the presence of *Fusarium* on cereal grains. The examination and lead sealing of sacks of seeds in warehouses is extensively carried out, but differs from

the Budapest Station in taking account also of impurities other than dodder.

The growth of seed control work has been rapid, as is shown by the following figures of samples received :—

1903 ..	976 samples.	1909 ..	2,866 samples.
1904 ..	1,021 "	1910 ..	3,750 "
1905 ..	1,340 "	1911 ..	4,326 "
1906 ..	1,486 "	1912 ..	5,504 "
1907 ..	2,166 "	1913 ..	6,508 "
1908 ..	2,902 "		

In 1911, 1912 and 1913 the samples of seeds have been made up as follows :—

	1911.	1912.	1913.
Clovers			
Serradella, Sainfoin, Lupines, Peas, Beans, and Vetches	1,354	1,420	1,573
Grass seeds	153	152	142
Cereals, including Maize	359	341	366
Linseed, Mustard, Beet and other agricultural seeds	1,808	2,607	3,661
Forest seeds	160	210	118
Vegetable seeds	44	69	14
Weed seeds, and various	105	175	102
Total	343	530	532
	<u>4,326</u>	<u>5,504</u>	<u>6,508</u>

The samples are sent by merchants, agricultural societies, and individual farmers, and it is of interest to note the proportions submitted by the different classes :—

	Merchants.	Farmers and Agricultural Societies.	Taken for the information of the Institute.
1903			
1904	176	664	136
1905	237	489	295
1906	237	766	337
1907	247	933	306
1908	327	1,133	706
1909	664	1,307	931
1910	845	1,237	784
1911	873	1,374	1,503
1912	1,138	1,851	1,337
1913	1,492	2,588	1,424
	1,620	3,639	1,249

It will be observed that the number of samples submitted by merchants is much lower than the number submitted by farmers and societies. Owing to the action of agricultural societies in sending in samples, it is probable that most agricultural seeds sold in Bavaria are "controlled" by the Station.

Besides the samples noted above, lead sealing of samples has been extensively practised in recent years, though at first

mistrusted by seedsmen. In the season 1912-13 the following numbers of sacks were examined and sealed :—

Red Clover	..	..	8,829 sacks.
Other "Clovers"	..	..	253 "
Lucerne	..	..	210 "
Grass Seeds	..	..	1,185 "
Serradella	..	..	4 "
Total	..	..	<u>10,481</u> "

These represented a value of about £105,900.

Cost of Analyses.

For an examination of a sample of seeds for any one of the following the charge is 2s. :—(1) genuineness ; (2) origin ; (3) purity ; (4) clover and flax dodder ; (5) content of barren fruits, &c., of grasses ; (6) germinating capacity ; (7) healthiness, freedom from fungus or animal parasites, and power of withstanding soil organisms ; (8) absolute weight ; (9) hectolitre weight ; (10) specific weight ; (11) ratio between husk and kernel (barley and oats) ; (12) gluten value (barley and wheat) ; (13) moisture content ; or (14) artificial "improvement" of seeds by colouring, oiling or sulphuring.

When an examination is made for more than one of these items, 2s. is charged for the first and 1s. for each further item. For example, an examination of a red clover sample for origin, purity, dodder content, and germinating capacity would cost 5s. The highest fee chargeable for a complete analysis of any species of seed is 6s. This sum is also charged for a botanical analysis of seeds mixtures, a report on separate constituents of which, for purity, germination, &c., is separately charged.

Half fees are charged to Bavarian farmers and agricultural societies, who are expected to give full particulars as to the source and price of the seed and the guarantee given with it. The Station is prepared to make contracts with agricultural societies to conduct full analyses for their members, the societies contributing a yearly sum to the Station. This is done in the case of so many societies that it may almost be said that seed testing is done free for Bavarian farmers individually. Contracts are also made with seedsmen.

Correct Description of Seeds as regards Origin.

The question of the source of seed is of considerable importance, seed of a given species from one country being commonly much superior as compared with that from another country. In the case of red clover, 1,054 samples were examined for origin in the year 1912-13, and the following table shows the number of samples stated to be from different

countries and those the origin of which was correctly described :—

Country.	No. of Samples, 1912-13.	Of these were		
		Correctly described.	Incorrectly described.	Not described.
Bavaria, Franconia ..	23	23	—	—
Silesia	16	16	—	—
Other parts of Germany ..	16	15	—	1
Austria, Styria, Bohemia and Moravia ..	267	187	—	80
Galicia, Hungary, Rumania and Transylvania ..	134	88	2	44
Russia	186	94	38	54
France	107	27	59	21
North France	23	22	1	—
Mid or South France ..	18	—	9	9
Italy	24	4	17	3
"South European" ..	114	—	51	63
England	5	1	1	3
South America	1	—	—	1
Mixtures of E. with W. European seed ..	35	5	20	10
Mixtures of Mid with S. European seed ..	85	—	53	32
Total	1,054	482	251	321

This table shows that large numbers of samples of red clover seeds are falsely described as regards origin.

Lead Sealing.

As noted above, seeds may be examined for lead sealing for other impurities besides dodder, and the total number of sacks examined in 1912-13 was 10,481.

A sample can only be lead-sealed when it can be certified as in all important respects suitable for sowing—thus, in the case of clovers, not only freedom from dodder, but origin, purity and germinating capacity must be considered.

The label attached by lead and string to the bags examined and approved is about 7 inches long by 3 inches wide, composed of thick card, and on one side bears the Royal Arms, with the following statement (in German) :—

Royal Bavarian Institute for Agricultural Botany, Munich.

SEALING STATION, No.

SEAL No.

This label is only a proof of the fact that the Institute has accepted the seeds for 'sealing' if this space has been covered with the sealed adhesive label giving the results of the analysis.

On the reverse side is the following statement :—

The seal and string must be unbroken, and the seal number on the adhesive label must correspond with the seal number at the head of the present tag.

The guarantee that seed has been cleaned from dodder is held to be fulfilled when the results of one or more analyses disclose either no ripe dodder seeds at all or only single accidental seeds.

With regard to the hard or fresh seeds, and those not germinating within the period of the test, an undetermined percentage of these will germinate in isolated cases according to length of time, kind of soil, etc.

It is urged that, in spite of this 'sealing,' a sample should be taken, before seeding, in the presence of a witness, sealed in a paper bag, and kept in dry, unheated storage for further analysis in case of need.

The form of adhesive sealed label as to examination for lead sealing referred to is shown by the following example :—

SEALING PLACE 2.

SEAL No. 230.

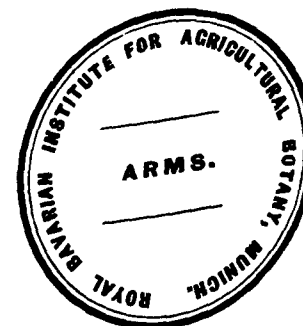
"Austrian Red Clover."

Results of Analysis of an average Sample....
The Seed has been cleaned from Dodder.

Purity	97.6%
Foreign harmless matter ..	1.9%
Weed Seeds	0.5%
Total	100.0%

Germination in 14 days ..	89%
Hard or fresh seeds	5%
Germinable seeds	94%
Non-germinable seeds.. ..	6%
Total	100%

*There is no doubt about the correctness of the particulars as to origin.
Munich, 17th April, 1913.*



THE SEED CONTROL STATION AT BRESLAU.*

The Experiment Station for Agricultural Botany and Seed Control at Breslau was opened in 1875 as an institute of the Landw. Verein, Breslau, and since 1905 has been under the management of the Chamber of Agriculture for the Province of Silesia. It receives, however, a State grant of £75 per annum. The staff consists of a Director (Dr. W. Grosser), a Botanist, a Lady Assistant for seed control (chiefly for germination tests), and three Assistants who conduct purity tests and undertake the secretarial duties.

Cost of the Station.

The expenditure of the Station for the five years ending 1910 was:—1910, £1,004; 1909, £741; 1908, £690; 1907, £670; and 1906, £668.

The receipts in the same years were £1,018, £873, £690, £670, and £668.

Work done by the Station.

There are no State laws relative to seeds, and the regulations are simply those of the Agricultural Experiment Stations (*Landwirtschaftliche Versuchs-Stationen*). Samples are not taken in the open market, and are sent in to a large extent by seedsmen; many samples, however, are sent in by farmers direct and through the Chamber of Agriculture. The charges are about 2s. 6d. per sample on the average, and individually as follows:—

	I. General Fees.	II. Reduced Fees.†	III. Fees for Members of the Agricultural Union.‡
	s. d.	s. d.	s. d.
Purity (Giving impurities per cent., including dodder).			
(a) Sainfoin, grasses, clovers, lucerne, linseed, serradella ..	4 0	3 0	1 6
(b) Seeds other than (a) ..	3 0	2 0	1 0
Germination.			
(a) Beta species ..	5 0	4 0	2 0
(b) Sainfoin, grasses, clovers, linseed, serradella ..	4 0	3 0	1 6
(c) Other seeds ..	3 0	2 0	1 0

* Agrikultur-botanische Versuchs- und Samen-Kontrollstation der Landwirtschaftskammer für die Provinz Schlesien zu Breslau.

† For seedsmen who undertake to sell their seeds with a guarantee as to purity and germination, and as to genuineness and freedom from dodder and to take back seeds which are shown by subsequent analysis of the Station to be below a minimum value.

‡ For farming members of the Agricultural Union of Breslau.

	I. General Fees.	II. Reduced Fees.†	III. Fees for Members of the Agricultural Union.‡
	s. d.	s. d.	s. d.
True Value.			
(a) Beta species according to the Magdeburg normals, and of grasses according to weight method (number of seedlings from 1 gramme of the sample and percentage of germinating seeds) ..	7 0	5 0	2 6
(b) Sainfoin, grasses (by numerical method) clovers, lucerne, linseed, serradella ..	6 0	4 0	2 0
(c) Other seeds ..	5 0	3 0	1 6
Fusarium (Presence of <i>Fusarium</i> on cereals, tests with Hiltner cells).			
(a) <i>Fusarium</i> test only ..	5 0	3 0	1 6
(b) If with another test ..	3 0	2 0	1 0
Dodder.			
In quantities of 50 grammes of white or alsike clover, or 100 grammes of red clover and other large seeded species of clover ..	3 0	2 0	1 0
Weeds (Examination for other weeds).			
(a) For weed seeds only ..	3 0	2 0	1 0
(b) If with another test ..	2 0	1 0	0 6
Origin.			
(a) Origin only ..	6 0	4 0	2 0
(b) If with another test ..	3 0	2 0	1 0
Moisture (Of Beta species, etc.).			
(a) Moisture only ..	3 0	2 0	1 0
(b) If with another test ..	2 0	1 0	0 6
Weight.			
(a) Weight only ..	3 0	2 0	1 0
(b) If with another test ..	2 0	1 0	0 6
Colour.			
(a) For artificial colouring only ..	3 0	2 0	1 0
(b) If with another test ..	2 0	1 0	0 6
Identification.			
So far as it can be determined without field trials ..	2 0	1 0	0 6
Investigations by the hour ..	3 0	2 0	1 0

It may be noted that for the year ending March 31st, 1913, 74 firms had made contracts to guarantee their seeds in regard to purity, germinating capacity, and freedom from dodder, for control purposes, after the manner of the Zürich Station (p. 38).

At present over 5,000 samples are received per annum, the number having risen steadily. The numbers of samples received yearly for the past 10 years have been as follows (the years being to March 31st of the following years):—

	Grass.	Clovers.	Other Seeds.	Total.
1904	216	2,948	621	3,785
1905	225	2,742	598	3,565
1906	250	3,227	570	4,047
1907	238	3,452	683	4,373
1908	249	3,425*	536	4,210
1909	302	3,369	963	4,634
1910	367	3,439	1,257	5,063
1911	584	3,964*	893	5,441
1912	410	4,001*	941	5,352
1913	330	3,618	1,384	5,332

* Including *Medicago*.

†, ‡ See footnotes previous page.

It may be noted that the samples are chiefly clovers. Owing to the control of seeds by the Station it is stated that there has been an improvement in the general quality of seeds sold.

In making germination tests four lots of 100 seeds are usually taken, but in the case of large seeds four lots of 50 seeds, and in the case of beet three lots of 100 fruits.

Small allowances are made as a working latitude in regard to purity, germinating capacity and percentage of dodder, and these may be given as follows:—

(a) For *Purity*.—1 per cent. for all species when the purity is 97–100 per cent.; 2 per cent. for all species when the purity is 90–96.9 per cent.; and 3 per cent. when the purity is below 90 per cent.

(b) *Dodder*.—In general, seeds guaranteed as free from dodder are allowed to be so described if they contain not more than 1 grain of dodder in the sample examined.*

(c) *Germinating Capacity*.—When the germinating capacity lies

between Per cent.	or between Per cent.	the latitude is Per cent.
99.9–95	0.1–5	4.2
94.9–90	5.1–10	5.7
89.9–85	10.1–15	6.8
84.9–80	15.1–20	7.7
79.9–75	20.1–25	8.3
74.9–70	25.1–30	8.8
69.9–65	30.1–35	9.1
64.9–60	35.1–40	9.4
59.9–55	40.1–45	9.4
54.9–50	45.1–50	9.6

The results obtained in regard to the purity and germinating capacity of certain seeds during the year ending March 31st, 1913, are as shown in the following table:—

Species.	No. of Sam- ples.	Purity, Per cent.			Ger. Cap., Per cent.		
		Max.	Min.	Aver.	Max.	Min.	Aver.
Red Clover ..	2,751	99.5	45.0	95.8	97.0	41.0	85.8
Alsike ..	538	99.3	84.4	95.1	96.0	59.0	84.8
White Clover ..	169	97.3	76.5	92.4	95.0	76.0	87.0
Lucerne ..	115	99.2	94.6	97.8	98.0	81.0	91.5
Timothy ..	165	99.6	76.0	94.1	99.0	86.0	95.1
English Rye- grass ..	57	99.4	79.6	94.5	99.0	47.0	87.0
Italian Rye- grass ..	45	98.6	91.2	93.0	98.0	69.0	82.0
Crested Dogstail ..	18	99.5	95.0	97.6	97.0	66.0	88.0
Cocksfoot ..	20	92.8	68.8	81.0	97.0	79.0	91.0
Linseed ..	55	99.7	86.9	98.2	100	56.0	91.0

A general form of Certificate of an analysis of a sample of seeds is given in Appendix XVI. (p. 88).

* In the case of Seed Stations connected with the Union of Agricultural Experiment Stations in the German Empire (*Verband Landwirtschaftlicher Versuchsstationen im Deutschen Reiche*) samples containing 1 grain of dodder are not recorded as free from dodder.

SEED TESTING IN BERLIN.

Seed testing is done in Berlin in connection with the Agricultural Control Station (formerly Experiment Station for Agricultural Chemistry), the work being done through the Association of Agricultural Experiment Stations of the German Empire.* As in most seed-testing stations in Germany the rules for testing followed are those of the Association, and are embodied in the "Technical Rules for Seed Testing."

The examination of seeds in Berlin is conducted by one officer in charge (P. Filter), one assistant and two ladies.

The numbers of samples of seeds examined since 1906 are as follows:—

	Grass.	Clovers.	Other Seeds.	Total.
1906	201	228	157	586
1907	161	269	153	583
1908	195	214	148	557
1909	111	165	107	383
1910	110	382	268	760
1911	116	383	271	770
1912	198	505	321	1,024
1913	199	527	340	1,066

Average Purity and Germinating Capacity of Seeds examined at Berlin for the last 5 Years.

Kind of Seed.	Average Purity.	Average Germinating Capacity.
	Per cent.	Per cent.
Trifolium pratense ..	96.8	85.7
" repens ..	93.6	81.4
" hybridum ..	93.5	83.4
Medicago sativa ..	97.2	85.1
Lolium perenne ..	93.5	85.0
" italicum ..	95.8	85.3
Festuca pratensis ..	89.0	91.7
" ovina ..	64.5	78.6
Poa pratensis ..	82.5	73.5
Alopecurus pratensis ..	69.9	72.0
Dactylis glomerata ..	80.4	91.9
Cynosurus cristatus ..	94.8	82.9
Phleum pratense ..	96.9	92.8
Poa compressa ..	84.4	70.8

* *Verband Landwirtschaftlicher Versuchsstationen im Deutschen Reiche.*

APPENDIX I.

Results of Analyses of Seeds at Copenhagen, 1902-12 and 1911-12.

Averages for 1902-12.

Averages for 1911-12.

Kind of Seed.	No. of Sam- ples.	Fresh wgt. of 1,000 seeds in grammes	Purity.			Germination.			Purity.			Germination.		
			Seeds of other culti- vated plants. Per Cent.	Weed Seeds. Per Cent.	Rub- bish. Per Cent.	Pure Seeds. Per Cent.	Energy of Ger. Per Cent.	Germination of Pure Seeds. Per Cent.*	Pure Seeds. Per Cent.	Weed Seeds. Per Cent.	Rub- bish. Per Cent.	Pure Seeds. Per Cent.	Energy of Ger. Per Cent.	Germination of Pure Seeds. Per Cent.*
<i>Trifolium pratense</i> ..	3,365	1.75	0.3	0.6	2.3	96.8	81.5	89.2+ 9.2	86.3	0.6	1.69	1.57	0.1	0.57
" <i>repens</i> ..	923	0.654	1.4	1.1	1.8	95.7	76.3	82.4+14.0	78.9	3.0	0.637	2.06	0.1	0.19
" <i>hybridum</i> ..	1,030	0.680	2.1	0.4	1.2	96.3	81.4	87.5+ 9.5	84.3	2.6	0.723	2.36	1.8	0.47
" <i>incarnatum</i> ..	36	3.22	0.2	0.4	2.5	96.9	88.7	96.7+ 0.8	93.7	0.6	2.61	1.11	0.4	1.69
<i>Medicago lupulina</i> ..	782	1.60	0.1	0.5	1.1	98.3	77.3	88.2+ 6.1	86.7	0.1	1.57	3.74	0.0	1.44
" <i>sativa</i> ..	427	2.01	0.2	0.3	2.1	97.4	69.1	85.3+11.6	83.1	0.1	2.06	0.398	0.9	0.52
<i>Anthyllus vulneraria</i> ..	340	2.42	1.9	0.8	2.7	94.6	75.8	85.1+ 9.5	80.5	1.8	2.36	1.8	0.4	1.69
<i>Lotus corniculatus</i> ..	417	1.10	0.3	1.9	1.7	96.1	55.5	77.6+15.3	74.6	0.4	1.11	0.4	1.69	1.5
<i>Ornithopus sativus</i> ..	37	3.48	0.6	2.4	2.7	94.3	68.9	89.8+ 0.7	84.7	0.0	3.74	0.0	1.44	1.3
<i>Phleum pratense</i> ..	1,178	0.409	0.7	0.4	0.8	98.1	91.6	94.8	93.0	0.9	0.398	0.9	0.52	1.0

APPENDIXES.

<i>Lolium perenne</i> ..	1,411	1.99	2.9	0.1	1.2	95.8	84.8	89.7	85.9	2.04	3.2	0.12	1.4	95.3	90.2	92.5	88.2
" <i>italicum</i> ..	1,287	1.98	1.3	0.2	2.2	96.3	86.9	90.3	87.0	1.95	1.4	0.15	3.8	94.6	89.3	92.4	87.4
<i>Festuca pratensis</i> ..	1,441	1.88	1.8	0.3	2.6	95.3	80.7	92.5	88.2	1.84	4.4	0.56	7.0	88.0	78.6	93.0	81.8
" <i>duriuscula</i> ..	178	0.787	0.8	0.3	17.1	81.8	74.7	84.9	69.4	0.682	1.4	0.19	17.7	80.7	71.7	80.4	64.9
<i>Bromus arvensis</i> ..	869	2.16	0.4	0.5	2.8	96.3	91.5	94.1	90.6	2.09	0.4	0.58	3.0	96.0	95.1	96.4	92.5
<i>Schedonorus inermis</i> ..	24	3.76	0.2	1.1	19.0	79.7	78.9	91.4	72.8	3.77	0.4	1.69	28.5	69.4	84.0	88.6	61.5
<i>Avena elatior</i> ..	1,044	3.28	3.0	0.1	8.2	88.7	83.5	87.8	77.9	3.12	3.5	0.16	8.5	87.8	85.9	88.6	77.8
<i>Dactylis glomerata</i> ..	3,237	0.964	2.2	0.3	12.8	84.7	83.3	92.6	86.6	1.06	2.0	0.31	14.4	83.3	85.7	93.8	78.1
<i>Alopecurus pratensis</i> ..	423	0.849	2.2	1.3	25.7	70.8	71.1	82.1	55	0.853	1.8	0.75	32.8	64.7	77.5	84.3	54.5
<i>Holcus lanatus</i> ..	102	0.407	3.8	1.2	17.1	77.9	80.1	87.5	68.2	0.358	4.5	1.59	17.1	76.8	75.8	82.4	63.3
<i>Agrostis alba</i> ..	104	0.095	0.6	1.3	4.6	93.5	88.1	93.4	87.3	0.093	0.6	0.78	6.1	92.5	89.4	92.5	85.6
<i>Poa trivialis</i> ..	297	0.181	0.8	0.7	9.6	88.9	78.6	89.4	79.5	0.182	0.8	0.72	13.1	85.4	81.1	90.5	77.3
" <i>pratensis</i> ..	126	0.217	0.3	0.7	16.3	82.7	52.5	75.7	62.6	0.205	0.5	1.20	19.6	78.7	57.6	79.1	62.3
<i>Cynosurus cristatus</i> ..	35	0.569	1.3	1.1	0.9	96.7	77.6	91.1	88.1	0.365	0.7	0.92	0.5	97.9	88.7	94.5	92.5
<i>Beta vulgaris</i> ..	4,635	20.5	0.1	0.0	2.4	97.5	76.2	80.9	78.9	1.834	16.8	0.0	3.4	96.6	69.9	75.3	72.7
" <i>saccharifera</i> ..	56	19.7	0.1	0.0	2.3	97.6	79.5	81.4	79.4	18.4	0.1	0.02	3.3	96.6	73.2	78.7	76.0
<i>Daucus Carota</i> ..	508	1.14	0.0	0.5	6.9	92.6	62.0	70.2	65.0	1.20	0.0	1.22	11.0	87.8	60.0	66.5	58.4
<i>Brassica campestris</i> ..	645	2.01	0.0	0.0	3.0	97.0	88.1	97.0	94.1	1.95	0.1	0.04	4.8	95.1	89.9	96.9	92.2
" <i>rapifera</i> ..	612	2.93	0.0	0.0	1.5	98.5	83.0	94.1	93.7	3.07	0.0	0.04	1.7	98.3	87.7	94.9	93.3
<i>Avena sativa</i> ..	572	38.4	0.4	0.0	0.0	95.2	95.2	97.4	96.5	37.9	0.3	0.02	0.5	99.2	97.4	98.5	97.7
<i>Hordeum distichum</i> ..	362	46.3	0.1	0.0	0.0	95.9	95.9	97.9	97.3	45.0	0.1	0.01	0.6	99.3	98.4	99.1	98.4
" <i>vulgare</i> ..	130	37.8	0.2	0.1	0.1	99.2	96.4	97.9	97.1	35.2	0.2	0.08	0.5	99.2	97.3	98.2	97.4

* The added figures in these columns represent the allowance in each case for "hard seeds."

APPENDIX II.

Table showing the Countries for which analyses of different species of seeds were made (as far as these were given) at Copenhagen in 1911-12:—

	Denmark.	Sweden and Norway.	Finland.	Russia.	Germany and Austria-Hungary.	British Isles.	Holland and Belgium.	France.	Italy.	America.	Australia.
<i>Trifolium pratense</i>	14	4	—	115	76	1	—	—	—	—	—
" <i>repens</i> ..	—	—	—	—	28	—	—	—	—	1	—
" <i>hybridum</i> ..	3	4	—	28	6	—	—	—	—	—	—
<i>Medicago lupulina</i> ..	—	—	—	—	15	2	16	—	—	7	—
" <i>sativa</i> ..	—	—	—	—	45	—	—	—	—	—	—
<i>Anthyllis vulneraria</i>	—	—	—	3	18	—	—	—	—	—	—
<i>Lotus corniculatus</i>	1	—	—	—	1	—	—	—	—	—	—
<i>Phleum pratense</i> ..	7	10	4	4	7	—	1	—	19	—	—
<i>Lolium perenne</i> ..	46	—	—	—	—	54	—	—	—	13	—
" <i>italicum</i> ..	187	—	—	—	—	1	—	—	—	—	—
<i>Festuca pratensis</i> ..	273	—	—	—	—	—	—	—	—	—	—
" <i>duriuscula</i> ..	—	—	—	—	8	—	—	—	—	1	—
<i>Bromus arvensis</i> ..	30	—	—	—	—	—	—	—	—	—	—
<i>Avena elatior</i> ..	66	—	—	—	—	—	—	—	—	—	—
<i>Dactylis glomerata</i>	765	—	—	—	—	—	3	—	—	—	—
<i>Alopecurus pratensis</i>	1	—	9	—	—	—	—	—	—	—	—
<i>Poa trivialis</i> ..	8	—	—	—	—	—	—	—	—	—	—
" <i>pratensis</i> ..	—	—	—	—	—	—	—	—	—	—	—
<i>Holcus lanatus</i> ..	1	—	—	—	—	—	—	—	—	2	—
Total..	1402	18	13	150	204	58	17	3	19	24	5

APPENDIX III.

Particulars of the best samples investigated at Copenhagen in the year 1911-12.

	Purity.	Weeds.	Weight of Seed.	Germination.
<i>Trifolium pratense</i> ..	99.3	0.05	1.75	97.0+2.7
" <i>repens</i> ..	97.0	0.05	0.703	88.5+10.0
" <i>hybridum</i> ..	98.7	0	0.707	79.3+20.7
<i>Medicago lupulina</i> ..	99.3	0.12	1.67	96.0+2.3
" <i>sativa</i> ..	98.6	0	1.98	91.0+7.7
<i>Anthyllis vulneraria</i>	98.4	0.27	2.57	88.0+12.0
<i>Lotus corniculatus</i> ..	99.1	0.10	1.14	95.3+0.5
<i>Phleum pratense</i> ..	99.7	0	0.457	99.0
<i>Lolium perenne</i> ..	97.0	0	2.36	99.0
" <i>italicum</i> ..	99.0	0.05	2.16	97.0
<i>Festuca pratensis</i> ..	98.6	0	2.01	97.3
" <i>duriuscula</i> ..	90.1	0	0.830	89.7
<i>Bromus arvensis</i> ..	99.2	0.10	2.69	99.7
<i>Avena elatior</i> ..	97.1	0	3.58	95.2
<i>Dactylis glomerata</i>	97.0	0	1.20	97.3
<i>Alopecurus pratensis</i>	78.0	0.20	0.880	93.0
<i>Poa trivialis</i> ..	97.4	0.20	0.198	93.7
" <i>pratensis</i> ..	86.4	0	0.217	81.7
<i>Beta vulgaris</i> ..	100	0	36.0	99.0
<i>Daucus Carota</i> ..	—	—	—	92.7
<i>B. campestris rapifera</i>	—	—	—	100
<i>B. Napus rapifera</i> ..	—	—	—	100

APPENDIX IV.

Results of Analyses of *Uncontrolled* Seeds, Copenhagen, 1911-1912.

1911-1912.

Kind of Seed.	No. of Tests.	Purity under Guarantee or under Average.					Germination under Guarantee or under Average.						
		2-3 %	3-5 %	5-8 %	8-13 %	over 13 %	3-4 %	4-6 %	6-9 %	9-15 %	15-30 %	over 30 %	
<i>Trifolium pratense</i> ..	64	6	7	1	1	2	1	2	1	—	2	1	
" <i>repens</i> ..	9	—	—	1	1	—	—	—	1	1	1	1	
" <i>hybridum</i> ..	17	3	2	2	1	—	—	4	3	4	7	4	
<i>Medicago lupulina</i> ..	22	1	2	1	1	—	—	—	—	—	2	—	
" <i>sativa</i> ..	4	1	1	—	—	—	—	—	—	—	—	—	
<i>Anthyllis vulneraria</i>	2	1	—	1	1	—	—	1	1	4	1	2	
<i>Lotus corniculatus</i> ..	14	1	3	1	—	—	—	2	1	1	1	1	
<i>Phleum pratense</i> ..	37	1	—	1	—	2	—	—	1	1	1	2	
<i>Lolium perenne</i> ..	22	—	—	—	1	2	—	2	2	3	4	5	
" <i>italicum</i> ..	20	1	2	3	1	9	—	2	3	2	1	3	
<i>Festuca pratensis</i> ..	39	5	6	—	5	—	—	—	1	1	3	1	
<i>Bromus arvensis</i> ..	6	—	—	—	—	—	—	2	1	1	—	—	
<i>Avena elatior</i> ..	20	—	3	1	4	6	—	2	3	2	1	—	
<i>Dactylis glomerata</i> ..	50	1	4	5	3	2	—	—	—	1	—	2	
<i>Alopecurus pratensis</i>	4	—	—	—	—	—	—	—	—	—	—	1	
<i>Agrostis alba</i> ..	1	—	—	—	—	1	—	—	—	—	—	—	
<i>Bromus mollis</i> ..	1	—	—	—	—	—	2	—	2	1	—	—	
<i>Beta vulgaris</i> ..	16	—	—	—	—	—	—	—	—	—	—	—	
Total ..	348	21	30	17	16	27	1	15	18	24	26	24	

APPENDIX V.

Form of Certificate for Complete Analysis.

DANISH STATE INSTITUTE FOR SEED CONTROL.

Analysis No.

The complete analysis of the sample received from _____
 with the marks _____ has given the
 following results

- I. (a) Purity _____ per cent.
 (b) Impurities, _____ per cent.
 (c) Seeds of foreign cultivated plants, _____ per cent.
 (d) Weed seeds, _____ per cent.

Total foreign matter, _____
 The seeds of foreign cultivated plants consist of

The number of dangerous weed seeds per kilog. were :

*Matricaria inodora.**Anthemis arvensis.**Chrysanthemum segetum.*" *Leucanthemum.**Cuscuta Trifolii.**Cuscuta* sp.*Daucus Carota.**Ranunculus repens.*

Other weed seeds found :

II. Weight.

Fresh weight of 1,000 pure seeds _____ grammes.

III. Germination of pure Seed.

- (a) Of the pure seeds set to germinate there germinated
 in _____ days . per cent., and
 in _____ days per cent.
 (b) Sound "hard" seeds found were .. per cent.
 (c) Dead seeds per cent.

100 per cent.

From I. (a) and III. (a) calculated pure germinating
 seed = $\frac{\text{Purity} \times \text{Germination}}{100}$ = _____ per cent.

Remarks :

APPENDIX VI.

Purity and Germinating Capacity of Seeds examined at
 Hamburg.

Species.	1911-12.				1891-1912.			
	Purity.		Germinating Capacity.		Purity.		Germinating Capacity.	
	No. of Samples.	Average per cent.	No. of Samples.	Average per cent.	No. of exams.	Average per cent.	No. of exams.	Average per cent.
Red Clover ..	353	95.3	366	87+8*	3,276	94	3,781	87
White Clover ..	174	86.8	169	77+14	1,370	90	1,691	77
Alsike ..	135	92.2	137	81+8	1,003	90	1,215	85
Trifolium ..	18	94.1	20	94+1	34	94	58	86
Lucerne ..	147	97.9	158	93+3	745	96	758	90
Black Medick ..	93	97.4	103	87+3	478	95	661	81
Sainfoin ..	5	96.8	9	78	18	97	91	70
English Rye-grass ..	115	92.0	133	38	646	92	880	83
Italian Rye-grass ..	70	94.9	71	85	398	95	503	80
Cocksfoot ..	152	75.7	123	83	1,173	78	924	83
Timothy ..	91	92.8	110	94	967	96	1,487	89
Foxtail ..	50	48.8	44	68	283	62	346	64
Poa pratensis ..	97	76.5	93	72	501	81	633	67
Poa trivialis ..	39	81.7	34	88	155	86	158	80
Festuca pratensis ..	113	79.6	90	73	492	91	783	72
Festuca ovina ..	52	68.7	69	34	230	84	477	68
Crested Dogtail ..	42	94.4	53	142†	137	98	1,578	152†
Mangolds ..	27	97.4	117	106†	10	97	150	155†
Sugar Beet ..	3	92.6	9	—	455	94	—	—
Linseed ..	106	93.5	—	—	—	—	—	—

* The added figures indicate the "hard seeds" counted as germinable.
 † Seedlings from 100 fruits.

Form of Certificate of an Analysis of French Rye-grass, Hamburg.
Botanische (ARMS.) Staatsinstitute.

(Botanisches Garten, Botanisches Laboratorium und Botanisches Museum, Abteilungen für Warenkunde, für Samenkontrolle und für Pflanzenanbau.)
Government Station for seed-investigations.

Address:
Botanische Staatsinstitute
Abt. für Samenkontrolle

Postfach: Gruppe 1, 499.
 Altkadenbank 40.
 Bornumland: (Zwischengasse) Kontor 54.

Abteilung für Samenkontrolle.

Station
 d'essais de semences
 de l'Etat.

HAMBURG 36, den 191....
 Jungferstraße.

Mr.
 Herr

The analysis of the sample sent on the
 Die Untersuchung der am
 L'analyse de l'échantillon adressé le

French ryegrass — Französischem Raygras — *Perennial*

gezogen von d. Herr

marked:
 gemarkt:

marked:
 gemarkt:

has given the following result: hat nachstehendes Resultat ergeben: *donne le résultat suivant:*

1. reine Samen (Keimkraft) purity, *semences pures*
2. Knaulgras; *cockfoot, dactylis*
3. Wiesenschwingel; *meadow fescue, fragaria des prairie*
4. Goldhafer, Rispengräser; *net and meadow grass, various founding, pattern*
5. Treppen; *brassica, brassica*
6. Raygras, Hopfenkeice; *yellow lupine, minette etc*
7. Unkrautsamen; *wheat seeds, various other*
8. Spreu; *chaff, husk, various other*
9. Sand; *sand, rubble*

good grains:
 Gute Gräser
 bonnes graminées
 0/10

Of one clean well germinated
 Von 400 reinen Samen keimten
 De één schoon welk gezaaid

within
 0/10

Hamburgische Botanische Staatsinstitute.
 Laboratorium für Warenkunde.
 Abteilung für Samenkontrolle.

for.
 Gebühr: Mark

APPENDIX VIII.

Form of Report of a Seed Investigation, Wageningen.

HOLLAND GOVERNMENT STATION FOR SEED-INVESTIGATIONS

P. F. BROUWING JR. DIRECTOR.

WAGENINGEN, to

REPORT OF INVESTIGATION

to

Sample: (marked:)

Register number: (received: th. ult)

I. PURITY.

- a. Genuine, undamaged seeds: per cent.
- b. Seeds of other cultivated plants, chaff, dust, defective and sterile seeds, fragments of plants, straw, sand, dirt, stones, etc. } Impurities:
- c. Weed-seeds and other noxious impurities per cent.

II. GERMINATING POWER OF THE "PURE SEED."

- a. Germinating energy in days per cent.
- b. Germinating power
- c. Impervious seeds, not inhibiting water
- d. Absolute germinating power per cent.

III. INTRINSIC VALUE OR VALUE FOR USE OF THE SAMPLE:

IV. CUSCUTA.

Number of dodder-seeds in

V. VOLUME WEIGHT OF THE SAMPLE:

VI. ABSOLUTE WEIGHT OF seeds:

ABSOLUTE DRY WEIGHT OF seeds:

REMARKS.

RESPECTFULLY,

Costs: B. Holl. Curr.
 loco Wageningen

DIRECTOR

APPENDIX IX.

Average Purity and Germinating Capacity of certain Seeds examined at Wageningen in the 3 Years, 1st June, 1911, to 31st May, 1914.

Species.	Purity.	Germinating Capacity.
	Per cent.	Per cent.
<i>Alopecurus pratensis</i>	81.0	74
<i>Cynosurus cristatus</i>	98.5	88
<i>Dactylis glomerata</i>	86.6	88
<i>Festuca ovina</i>	87.2	78
<i>Festuca pratensis</i>	95.2	92
<i>Festuca rubra</i>	92.0	66
<i>Linum usitatissimum</i>	98.7	93
<i>Lolium italicum</i>	97.1	84
<i>Lolium perenne</i>	96.0	88
<i>Lotus corniculatus</i>	94.8	70
<i>Medicago sativa</i>	97.0	92
<i>Onobrychis sativa</i>	77.5	77
<i>Phleum pratense</i>	97.2	94
<i>Poa pratensis</i>	80.6	78
<i>Poa trivialis</i>	91.5	84
<i>Trifolium hybridum</i>	95.5	89
<i>Trifolium incarnatum</i>	95.5	92
<i>Trifolium pratense</i>	95.6	93
<i>Trifolium repens</i>	95.3	90
<i>Vicia sativa</i>	95.6	90

APPENDIX X.

Regulations as to Seed Control, Switzerland.*

GENERAL REGULATIONS.

Control Firms and Control Contracts.—(1) With the object of controlling the trade in artificial manures, food-stuffs and seeds the Central Administration of the Swiss Agricultural Experiment and Investigation Stations at Liebefeld, near Berne, makes contracts with societies, traders and other interested persons, such contracts being known as control contracts. Firms entering into such contracts are called Control Firms.

(2) The following are the conditions of the contract:—

(a) The firms must recognise the provisions of the present decree as binding on them;

(b) They must bind themselves to give the guarantees required under the decree for their goods and give their purchasers vouchers for free analysis;

(c) Purchasers buying from control firms have *ipso facto* the right, subject to the provisions of this decree, to have the goods purchased analysed free of charge by the Swiss Agricultural Investigation Station for the district;

(d) The firms must recognise the examinations carried out by the Stations for purchasers and must bind themselves to give compensation to the purchaser when the value is below guarantee.

(3) Control contracts may be entered into at any time and remain in force at least one year from January 1st of the following year. If no notice is given six months before the termination of the contract, *i.e.*, before July 1st in the year, the control contract will remain in force for a further year.

For firms which enter into the control contract before July 1st, the whole of the yearly control fee will be charged, but for those entering into the contract later than July 1st, one-half will be charged.

(4) Firms must bind themselves to give the composition, and, if desired, the origin of the goods offered for sale; such descriptions as are calculated to mislead the buyer are not allowed.

(5) A control firm must not produce or sell any substance of unknown composition.

(6) The Central Administration will publish annually a list of control firms and their goods. Grass seed mixtures are not accepted for this list.

(7) Control firms will be removed from the list, where, through their own fault, goods are sent irregularly for examination, and further, those firms which after fruitless warning continue to sell goods of low value or are guilty of any other fraudulent transactions calculated to deceive their customers. As a rule, firms which do not send during the year at least five samples for paid analysis or for control analyses of goods procured from other control firms are to be removed from the list.

The Swiss Department of Agriculture will decide whether a firm struck from the list can after the lapse of any period be re-admitted as a control firm.

(8) Control firms must obtain the vouchers for free analysis from the Central Administration of the Swiss Agricultural Experiment and Investigation Station at Liebefeld, near Berne. These will be supplied free.

* Translation of Swiss Decree of 9th June, 1913.

(9) Control firms must send in to the Central Administration five copies of their lists of goods, prospectuses and labels.

(10) When the Central Administration has reason to doubt the correctness of the information given by a control firm as to its trade, it can, for the purpose of determining the control fee, require a list of its consignments, with the addresses of the purchasers, date, kind and weight of the goods. The control firms are bound to accede to such a request.

Reckoning of Periods of Time.—Every period of time laid down in the decree is considered as adhered to, when the communication or despatch through the post or by telegraph bears the stamp of the last day of the period.

In reckoning the periods of time for the despatch of samples to the Stations, Sundays and holidays are not reckoned.

TRADE IN SEEDS.

I.—Control Examinations.

Control Fees.—(1) Control firms must pay a yearly fee, varying with the extent of their trade and quite independent of the number of analyses carried out. The minimum amount is £1 in the case of Swiss firms and £2 for foreign firms, and must be paid in advance.

(2) The amount of the fee is agreed upon in the contract; but, on important changes taking place in the amount of business, can be altered at the beginning of the calendar year, by mutual consent, and without the insertion of any notice in the contract. The control firms must pay the fees for the current year to the Central Administration by June 30th at the latest.

(3) No special arrangements for preliminary or other analyses may be made in the control contract which would serve to indicate to the firms the quality of their seeds. Such analyses will be charged for according to the tariff mentioned later.

Guarantee.—The guarantee to be given by the control firms under the control contract for the seeds sold must comprise genuineness, purity, germinating capacity and freedom from adulteration of the agricultural or forest seeds.

The firms must guarantee in particular:—

- (1) A certain minimum content of genuine pure seeds and the origin. They are bound to give the origin in their seed lists.
- (2) A certain minimum content of genuine germinable seeds.
- (3) With all clover seeds (*Trifolium*, *Medicago*, *Lotus*, *Anthyllis*), the absence of dodder (*Cuscuta* sp.).
- (4) With flax seeds and spurrey, the absence of flax dodder (*Cuscuta Epilinum*).
- (5) With sainfoin the degree of freedom from Burnet (*Poterium Sanguisorba*).
- (6) By special agreement between the contracting parties the absence of other weeds can be guaranteed.
- (7) The guarantee for purity and germinating capacity must be given in percentage figures of the total weight, i.e., the seller guarantees how many kilogrammes per cent. of genuine pure seeds there are at least, and how many seeds per 100 genuine seeds at least are germinable.
- (8) The control firms must give guarantees even when the composition or quality of the goods sold is unknown to them. In such case the price per kilogramme of pure, germinable seeds must be previously agreed upon between seller and purchaser, and payment made upon the results of the analysis.

(9) The same must hold good when the seeds are sold according to sample. In this case the purchaser must send in the sample, as well as a sample of the seeds as actually delivered, to the Control Station.

(10) With regard to the genuineness of such seeds as can not be determined with certainty, as for example kinds or varieties of *Brassica*, *Trifolium*, *Medicago*, etc., the culture experiment to be carried out by the station must decide the point and the seller must give the necessary guarantee.

Free Analyses and Vouchers.—(1) Purchasers who buy their seeds from a control firm have the right to a free analysis in each case, of a sample of the goods received, from the seed station for the district, in order to ascertain whether quality and content come up to the given guarantee.

(2) The free analysis of goods from control firms is dependent upon the following:—

- (a) That the quantity of a certain kind of seed purchased is at least 1 kilogramme in the case of vegetable seeds, 25 kilogrammes in the case of cereals, and 5 kilogrammes in the case of other seeds.
- (b) That a voucher is produced showing that the goods come from a control firm.

(c) That the method of taking the sample for analysis and the dispatch of the same is carried out according to certain regulations (as to which see later).

(3) The right to analysis and to the advantages accruing therefrom is lost when the purchaser fails to send in a sample for analysis within three days of the receipt of the goods.

Taking and Dispatch of Samples for Analysis.—(1) The taking of samples for analysis must be carried out by a person holding an official position (*Amtsperson*); or by the purchaser or his agent, in the presence of the seller or of an unbiased, capable witness acquainted with the provisions of the present decree. It is absolutely indispensable to the proper conduct of the control that average samples should be dispatched. For this purpose, as a rule, the whole of the goods of one kind sold must be thoroughly mixed. If the goods are in sacks these must as a rule be emptied in order to carry out mixing. If the mixing of the whole is not practicable or takes up too much time, samples must be taken from places in the upper, middle and lower layers of the heap or individual sacks and carefully mixed on a clean, dry surface; the average sample is to be taken from this mixture. The sample is to be packed in a strong, durable bag, provided with a seal or lead by the person taking the sample, and labelled.

(2) The samples for analysis are to be securely packed and dispatched, carriage prepaid, in the following amounts:

- 50 gr. of grass seeds and similar seeds.
- 100 gr. of clovers, conifers, beets, etc.
- 250 gr. of cereals, sainfoin and other large seeds.

For determination of the volume-weight or hectolitre-weight, 1½ litres of oats and spelt seeds and ½ litre of all other kinds are necessary.

(3) The purchasers in French Switzerland and in the Canton of Tessin must send the samples to the Swiss Seed Testing Station at Lucerne, and those in other parts of Switzerland to the Swiss Seed Testing Station at Zürich.

(4) At the same time the voucher received from the seller must be sent, after it has been signed by the person taking the sample. If for any reason the purchaser supplies no voucher, the invoice

together with a certificate attesting to the correct taking of the sample and the guarantee given by the seller, is sufficient.

Where a calculation as to compensation has to be made by the Seed Station, the price and cost of carriage must be specified on the voucher.

(5) The "after examination" (*Nachuntersuchung*) relates to the guaranteed contents and quality.

(6) If the taking or dispatch of the samples has not been carried out according to the above regulations, the analysis is not made until the sender has rectified the mistake or explained to the Station that he will pay for the analysis according to the tariff given below.

(7) The remainder of the sample sent in will be kept by the Station for three months, for possible further analysis, reckoning from the day of the dispatch of the results of the analysis.

Results of Analysis.—(1) The samples sent in will as a rule be provisionally judged as to genuineness, purity and probable germinating capacity, within 24 hours of receipt.

If the seeds are to be tested for germinating capacity, the sender will receive a provisional report on the progress of germination.

(2) As soon as the analysis is completed the result will be communicated, post free, by the Station to the sender and to the control firm.

(3) If desired, the results will be telegraphed or telephoned, the cost being debited to the person instructing this procedure.

Protests.—(1) If the purchaser or seller wishes to dispute the results of the analysis, the Station is, within ten days of the receipt of the intimation, to carry out a further analysis (unless the objection appears to be totally unfounded).

(2) The results of the second analysis can only be disputed when it is shown by two analyses of the original sample carried out by two other official Seed Testing Stations, that the analysis of the first Station errs to a greater extent than the "latitude" (see later).

(3) The cost of the two analyses by other Stations and of the new samples, must be borne by the party in error.

Compensation.—(1) If the results of the analysis are below the figures given in the guarantee, the control firms must compensate the purchaser on the basis of the estimated price, due regard being paid to the cost of transport. Should the purchaser desire it, the control firm must take back the goods, repaying their cost and the cost of transport.

(2) The control firms must pay compensation for lower content than guarantee when the deficit is greater than that allowed, and the limits of error of the analyses, together known as "latitude." The latitude in the case of all seeds = 5 per cent. of the real value.

The real value is $\frac{P \times G}{100}$, where P = purity and G = germinating capacity. The compensation is reckoned on the real value.

In every case when the deficit is greater than the latitude, compensation must be in respect of the whole of the deficit below guarantee.

(3) If the analysis of clover seeds reveals the presence of Dodder, the purchaser has the right to return the goods delivered, and to claim the price paid and the costs of transport. When the sample tested contains only one Dodder seed, the goods cannot be returned until the analysis of a second sample, which may be taken by the purchaser without a witness, also reveals the presence of Dodder.

(4) If the goods delivered contain more than 20 Dodder seeds per kilogramme the seller is bound in addition to pay the purchaser compensation equal to 5 per cent. of the value.

(5) The following are the regulations as regards sainfoin. When goods purchased as free from Burnet contain more than 10 Burnet seeds per kilogramme, the purchaser has the right to return the goods to the seller and claim repayment of price and costs of transport.

Goods containing only 10 or less Burnet seeds per kilogramme are considered free from Burnet.

(6) When the goods contain more than 100 Burnet seeds per kilogramme, the seller is bound in addition to pay the purchaser compensation equal to 5 per cent. of the value.

(7) When, by special arrangement, the absence of other weed seeds is guaranteed, but without any arrangements being made as to a definition of what constitutes absence, the same regulations as to Burnet (5 and 6) are held to be in force.

(8) If the goods are shown to be adulterated or not genuine, or if the description of origin is false, so that, in the opinion of the Seed Station of the district, the purchaser suffers damage by using the seed, the seller is bound to pay the purchaser, in addition to the price already paid and the costs of transport, compensation equal to 5 per cent. of the value. If the seeds sown are only discovered to be untrue to name after a culture experiment has been carried out by the Station or the seeds have been sown in the field, the competent judge of the regular jurisdiction must decide the compensation if the parties are unable to come to an agreement on an arbitration made by the Station.

(9) If the purchaser breaks into the consignment before the verdict of the Seed Station is received, he loses the right of returning the goods: he can only claim for the deficiency in contents as established by the analysis.

(10) The seller has no recourse when the goods are sent back on the ground of deficient supply.

(11) Demands for compensation must be made to the seller within 10 days after receipt of the results of the analysis; no notice is taken of demands made thereafter.

Swiss Seed Firms.—(1) Swiss seed breeders and seed breeding associations formed by them, who wish to sell their seeds in the country with guarantee as to genuineness, purity and germinating capacity, may be wholly or partly exempted from the costs of the two investigations (*vor* and *nach*) so far as they undertake, in addition, the duties of Control Firms, and if the quantity offered is at least 250 kilogrammes in the case of cereals and other large-sized seeds, and 25 kilogrammes in the case of roots, clover, grass and other small-sized seeds.

(2) The respective control contracts will be made by the Central Administration and based on the proposals of the Seed Station for the district. The above regulations of this decree will apply to them.

(3) The Seed Stations have the right, for the purpose of determining genuineness of variety and condition of cultivation, to inspect the fields of such seed businesses and to exclude unsuitable seed.

(4) The Seed Stations will publish a list of seed firms under control and their goods, before the "ordering period" of the year.

II.—Further Investigations.

Dispatch of Samples.—As regards the dispatch of samples not taken under a control contract the regulations given above under the

heading Taking and Dispatch of Samples (p. 75) apply. The kind of examination desired must be stated exactly.

Tariff.—The costs of such analyses are reckoned according to the following tariff:—

	s.	d.
1. Investigation for genuineness, <i>i.e.</i> , determination of kind, variety or origin of the seed (without culture experiments)	1	3
2. Investigation for burnet or other large weed seeds		10
3. Determination of content of dodder in clover and flax seed, and of content of small weed seeds	1	8
4. Determination of purity and of foreign constituents, including dodder, burnet and other weed seeds, of which determination may be desired, in percentages:—		
(a) In the case of cereals, sainfoin and legumes	1	8
(b) In the case of all other seeds	2	6
5. Determination of germinating capacity in pines and beets	3	4
6. "Average samples"		10
7. Qualitative investigation and provisional evaluation including determination of content of dodder, burnet and other weed seeds, the absence of which will be guaranteed (without statement of percentage figures):		
(a) In the case of cereals and legumes	1	8
(b) In the case of all other seeds	2	6
8. Complete analysis—Nos. 1–7 inclusive (genuineness, purity, foreign constituents, content of dodder or other weeds, germinating capacity, provisional evaluation, reports from time to time upon the course of germination, and final report):		
(a) In the case of cereals and legumes	2	6
(b) In the case of all other seeds	5	0
9. A culture experiment to determine genuineness ..	3	4
10. Determination of volume weight of seeds by means of the apparatus of the German "Normal Eichungskommission"	1	3
11. Determination of absolute weight of pure seeds (weight of 1,000 seeds)	1	3
12. Determination of moisture content of seeds	1	8
13. Investigations of seed mixtures, screenings..	According to arrangement.	

For investigations not made under contract, communication of the results will follow receipt of costs.

Trade Allowances.—(1) Swiss agricultural or forestry institutes, authorities, associations of Swiss agriculturists or foresters who wish investigations carried out on their own account are allowed a reduction of 50 per cent. from the prices of the above tariff.

(2) Societies, merchants and seed breeders can make *special contracts* with the Swiss Seed Investigation and Experiment Stations, by which they have the right to a reduction in the price for investigations. The

price for a complete analysis hereunder is 5s. Single investigations are reckoned as fractions of a complete analysis on the following scale:—

1. Investigation for genuineness	0.2
2. Investigation for burnet or other weed seeds	0.1
3. Clover dodder	0.3
4. Determination of purity	0.4
5. Determination of germinating capacity	0.6
6. Qualitative investigation alone	0.3

There is no reduction in the charges for the other investigations in the tariff.

The reduction in contracts for:—

(a) 5 complete analyses in the year = 16½ per cent.

(b) 10 complete analyses in the year = 25 per cent.

(c) 25 and more complete analyses in the year = 33½ per cent.

but the following must be paid yearly in advance:

(a) £1.

(b) £1 16s.

(c) £4.

Swiss control firms are allowed a further reduction of 20 per cent. on the costs of analysis reckoned according to the foregoing provisions. The sums to be paid each year in advance amount under the contracts for control firms for

	£	s.	d.
(a) 5 complete analyses yearly		16	0
(b) 10 " " " "	1	8	10
(c) 25 " " " "	3	4	0

These charges under the contract will not be refunded or carried forward to a fresh account, even if the number of analyses specified is not reached.

(3) The making of special contracts with persons does not give them the right to be designated "control firms."

APPENDIX XI.

Average Purity and Germinating Capacity of Seeds examined at Zürich, 1911-12 and 1876-1912.

Species.	1911-12.		1876-1912.	
	Purity. Per cent.	Germinating Capacity. Per cent.	Purity. Per cent.	Germinating Capacity. Per cent.
Red Clover	96.4	87	96.2	90
White Clover	90.9	82	94.8	82
Alsike	92.3	85	95.4	85
Lucerne	96.2	89	96.7	90
Sainfoin	95.1	73	97.6	75
Crimson Clover	94.4	88	95.6	88
Hop Clover	95.4	83	96.3	76
Perennial Rye-grass	96.0	89	95.8	82
Italian Rye-grass	95.3	89	95.4	81
Timothy	93.0	94	97.8	92
Crested Dogtail	95.0	89	92.1	78
Foxtail	61.2	76	74.1	70
Meadow Fescue	86.0	88	94.3	84
Red Fescue	90.0	76	82.9	63
Sheep's Fescue	72.8	78	75.8	75
Smooth-stalked Meadow-grass	78.1	75	84.4	67
Rough-stalked Meadow-grass	85.9	86	88.4	77
Cocksfoot	74.8	89	77.5	83
Golden Oat-grass	73.3	76	70.9	64
White Mustard	97.5	82	95.8	83
Linseed	97.4	90	97.9	87
Turnip	—	—	97.2	87
Swede	—	—	98.7	88
Mangold	—	—	97.8	124

APPENDIX XII.

Maximum and Minimum Purity and Germinating Capacity of Seeds examined at Zürich in 1911-12.

Species.	1911-12.			
	Maximum.		Minimum.	
	Purity. Per cent.	Germinating Capacity. Per cent.	Purity. Per cent.	Germinating Capacity. Per cent.
Red Clover	99.8	99	62.8	13
White Clover	99.0	99	54.8	15
Alsike	99.4	98	48.4	32
Lucerne	99.5	97	86.0	76
Sainfoin	99.1	96	87.4	0
Crimson Clover	97.1	94	90.8	76
Hop Clover	99.7	98	83.5	6
Perennial Rye-grass	99.8	98	49.9	49
Italian Rye-grass	99.9	100	28.2	28
Timothy	99.7	99	63.4	63
Crested Dogtail	99.8	99	9.1	25
Foxtail	85.6	98	15.0	6
Meadow Fescue	99.3	97	34.2	0
Red Fescue	99.4	96	52.3	34
Sheep's Fescue	99.0	96	25.6	0
Smooth-stalked Meadow-grass	98.7	93	39.6	47
Rough-stalked Meadow-grass	99.1	98	37.2	23
Cocksfoot	96.4	99	12.0	46
Golden Oat-grass	87.4	93	16.5	19
White Mustard	99.3	99	96.0	32
Linseed	98.9	99	92.3	76
Turnip	99.6	100	93.5	52
Swede	99.5	100	96.9	53
Mangold	99.9	198*	95.0	0

* Number of seeds germinated from 100 fruits.

APPENDIX XIII.

Average Purity and Germinating Capacity of Seeds examined at Budapest in the Seven Years 1903-10.

Species.	Total Samples, 1903-10	Purity.			Total Samples, 1903-10	Germinating Capacity		
		Purity, per cent.				Germinating Capacity, per cent.		
		Max.	Min.	Aver.		Max.	Min.	Aver.
<i>Alopecurus pratensis</i>	31	92.40	86.10	78.78	52	87.50	26.00	71.45
<i>Avena flavescens</i> ..	27	94.81	28.48	70.06	33	93.00	20.50	70.17
<i>Cynosurus cristatus</i>	41	98.00	70.30	92.67	65	96.50	41.00	76.20
<i>Elytus glomerata</i>	194	97.08	33.26	72.01	238	98.00	33.50	84.82
<i>Festuca ovina</i> ..	36	95.20	65.60	80.77	56	92.50	24.00	72.34
<i>Festuca pratensis</i> ..	50	90.67	75.78	94.90	84	98.00	12.50	67.30
<i>Festuca rubra</i> ..	23	96.50	54.40	82.44	37	97.00	46.00	82.58
<i>Linum usitatissimum</i>	132	99.86	1.31	93.49	196	100.00	62.75	92.27
<i>Lolium italicum</i> ..	60	90.52	37.84	93.15	101	97.00	53.75	78.65
<i>Lolium perenne</i> ..	230	99.83	24.10	93.02	359	98.50	25.00	82.84
<i>Lotus corniculatus</i> ..	20	98.61	69.31	93.03	44	95.41	12.00	77.56
<i>Medicago sativa</i> ..	472	99.62	24.05	94.58	535	99.18	11.71	90.26
<i>Onobrychis sativa</i> ..	431	99.80	73.25	96.91	617	98.50	0.00	81.95
<i>Phleum pratense</i> ..	197	99.80	45.85	95.12	400	99.25	53.00	93.18
<i>Poa pratensis</i> ..	50	96.50	74.60	86.53	92	91.25	8.25	61.91
<i>Poa trivialis</i> ..	9	98.00	78.80	88.83	17	92.25	28.50	75.00
<i>Poterium Sanguisorba</i>	14	89.63	36.40	85.03	50	98.00	66.00	88.34
<i>Trifolium hybridum</i>	18	98.68	78.42	93.11	44	97.66	65.41	89.21
<i>Trifolium incarnatum</i>	27	98.80	67.70	93.50	91	100.00	9.75	88.67
<i>Trifolium pratense</i> ..	363	99.90	43.00	93.48	635	100.00	6.14	92.79
<i>Trifolium repens</i> ..	109	98.84	72.80	93.13	93	98.54	26.25	87.86
<i>Vicia sativa</i> ..	47	98.25	62.00	90.95	177	100.00	58.25	96.67

APPENDIX XIV.

Form of Report for Purity Test for Leguminous Seeds, Vienna.

Sender No

Kind of Seed { Described as
Correct Name

		Grammes.	Per cent.
Pure Seeds			
Impurities			
Total			Per cent.
	Weight of Sample.	Content.	Species of Dodder.
Clover Dodder.			
Origin			

Guaranteed: P % G % R.V. %

As delivered: P % G % R.V. %

Latitude L %

Compensation (deficit) C - %

Impurities:

Date of dispatch:

K.K. Samen Kontroll-Station in Wien.

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Form of Certificate giving Results of Analysis, Vienna.
RESULTS OF ANALYSIS.

CERTIFICATE FOR GRASSES, LEGUMINOSAE, ETC.

Vienna.....(Date).

Sender:

(Name and Address)

(These results only hold good for the samples tested).

No. of Analysis.	Date of Receipt.	Description of Seed Sample.	Weight of Sample in grammes.	Purity.	In the case of <i>Lolium italicum</i> of the pure Seeds there were		Impurities.	
					Awed.	Not awed.	Foreign Seeds, soil, sand, chaff.	Empty Seeds.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Per cent.			Per cent.	Per cent.

RESULTS OF ANALYSIS (Continued).

Impurities (continued).		Number of pure Seeds germinating.		Hard Seeds.		Germinating Capacity. (13 + 15)	Remarks as to Origin. (17)	Special Remarks. (18)
Dodder.		No. of Days. (12)	Out of 100 Seeds. (13)	Per cent. (14)	To be added to number germinating. (15)			
In Words. (10)	No. of Seeds in Sample. (11)					Per cent.		

The fee for analysis amounts to
Duplicate fee, telegram charge, etc.

Total

*Form of Report for Germination Test for Leguminous and Grass
Seeds, Vienna.*

Sender	No.
Kind of Seed	Rev. No.
	"
Beginning of Experiment	Rev. No.
	"

Date of Revision.	Seeds Out of there germinated.				Hard Seeds.	Soft Seeds.	Remarks.
	<i>a.</i>	<i>b.</i>	<i>c.</i>	<i>d.</i>	<i>a.</i>	<i>b.</i>	

Provisional.	Final Result. Per cent.
Days	
Germinating Capacity%	
.....	
Germinating Energy %	

K.K. Samen-Kontroll-Station, Wien.

APPENDIX XV.

Average Purity and Germinating Capacity of Seeds examined at Vienna in 1912, with Average Values for 10 Years, and Limit Values.

Kind of Seed.	1912.		Average Values.*			Limit Values.†		
	Average Purity.	Average Ger. Cap.	Purity.	Ger. Cap.	Real Value.	Purity.	Ger. Cap.	Real Value.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
<i>Trifolium pratense</i>	94.7	91.5	97	88	85	96	83	80
" <i>repens</i> ..	91.6	88.2	96	77	74	95	72	68
" <i>hybridum</i>	94.6	89.6	96	85	82	95	80	76
" <i>incarnatum</i>	95.4	95.4	97	85	82	95	75	71
<i>Medicago sativa</i> ..	95.2	92.7	97	88	85	96	83	80
<i>Onobrychis sativa</i> ..	96.8	82.2	98	70	69	96	65	62
<i>Lolium perenne</i> ..	91.9	87.0	95	82	78	95	77	73
" <i>italicum</i> ..	93.2	87.3	95	77	73	92	74	68
<i>Festuca pratensis</i> ..	90.6	90.0	95	80	76	90	78	70
" <i>ovina</i> ..	70.6	72.0	75	66	50	75	60	45
" <i>duriuscula</i> ..	83.6	79.5	75	67	50	75	60	45
<i>Poa pratensis</i> ..	74.1	72.3	85	60	51	85	55	47
" <i>trivialis</i> ..	83.5	87.1	85	65	55	85	58	49
<i>Alopecurus pratensis</i>	70.0	67.6	75	62	47	70	55	39
<i>Dactylis glomerata</i>	84.9	91.0	77	83	64	75	78	59
<i>Cynosurus cristatus</i>	97.1	88.9	90	70	63	88	65	57
<i>Phleum pratense</i> ..	94.7	96.2	97	90	87	95	85	82
<i>Avena flavescens</i> ..	75.1	75.0	—	—	—	—	—	—
<i>Festuca ovina</i>	69.5	55.0	—	—	—	—	—	—
" <i>tenuifolia</i>	76.7	67.8	—	—	—	—	—	—
" <i>rubra fallax</i>	76.7	67.8	—	—	—	—	—	—
<i>Poa compressa</i> ..	78.5	78.5	—	—	—	—	—	—

* The average values are the average results of the last ten years analyses at the Station of trade-seeds, and on which a latitude of 5 per cent. has been allowed if below guarantee.

† The limit values are the figures which must be reached as a result of the analysis if the latitude of 3 per cent. of the real value is to be allowed. If the analysis differs from these figures the latitude is not allowed and compensation must be given in respect of every per cent. of deficit if the seeds are guaranteed.

Form of Certificate of an Analysis of Seeds at Breslau.

REPORT OF AN EXAMINATION OF SEEDS.

The Examination of the Seed sample received on _____, marked : -

Sent, according to the postmark, on..... from.....

Weight.....g., under unbroken cover.....sealed.....

without Certificate as to taking of Sample, has given the following
with
results:

The Germination Test gave after
.... days the average:—

the Sample. —	Percent.
Foreign Seeds of cultivated plants	1.0
Wheat Seeds	1.0
Seeds broken in threshing	1.0
Sand, small stones, soil and other worthless but harmless impurities	1.0
Empty grains (fruits) of the kind of Seed tested	1.0
True Seeds of the kind of Seed tested	1.0

	Per cent.
Broken fragments ..	..
Rotted or killed by fungi ..	..
Hard Seeds ...	..
Apparently still healthy ..	..
Total not germinated ..	..
Germinated Seeds ..	..

Number in g. of the sample . .

Germinated after	days
Per cent.	
100	10
100	20
100	30
100	40
100	50
100	60
100	70
100	80
100	90
100	100

True Value.....	Per cent.
Exchanges from 1 g.	

The "apparently still healthy" Seeds are determined from average samples. It is probable that an undetermined percentage, both of these and of the hard seeds, would germinate after a time, and would have some economic value.

Remarks.....

Expenses

In sending money please give
number of account.

Fees

The Director.

JAS. TRUSCOTT AND SON, LTD., SUFFOLK LANE, LONDON, E.C.

(APRIL, 1914, TO MARCH, 1915.)

[NOTE.—References to Insects, &c., and Fungi are indexed under the headings "Insects, &c.," and "Fungi" only, to Weeds under the heading "Weeds" only, to Fruit under the heading "Fruit" only, to Diseases of Animals under the heading "Diseases of Animals" only, and to Import and Export Regulations under the heading "Import and Export Regulations only.]

The names of the research and experiment stations at which the experiments summarised in the *Journal* have been conducted are indicated in italics, thus:—(*Rothamsted*). In the case of experiments conducted abroad, the name of the country is given.

Articles or reports on the following subjects appear in the *Journal* each month, or from time to time, and are not separately indexed:—Unit Prices of Artificial Manures, Notes on the Weather, Notes on Agricultural Labour in England and Wales, Notes on Agricultural Conditions in England and Wales, the Monthly Report on Crops of the International Agricultural Institute, Prices of Agricultural Produce, Outbreaks under the Diseases of Animals Acts, Prevalence of Animal Diseases on the Continent, Lists of Additions to the Board's Library, and Selected Contents of Periodicals.

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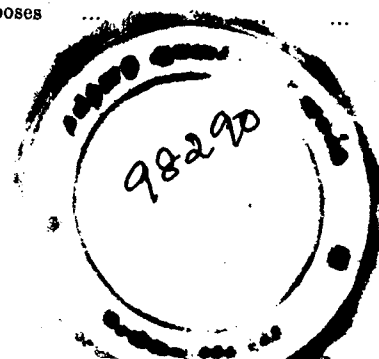
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