



The New Zealand Journal of Agriculture.

VOL. XVIII.—NO. 5.

WELLINGTON, 20TH MAY, 1919.

COCKSFOOT.

ITS ESTABLISHMENT AND MAINTENANCE IN PASTURE.

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AMONG the main grasses used in the formation of New Zealand pastures cocksfoot, owing to its many valuable characters, is perhaps the most important. The large yield, high degree of palatability, great adaptation under varying conditions of soil and climate, and great permanence when rationally treated are among the many qualities that have rendered this grass essential in the production of much long-rotation and permanent grassland. In short-rotation pasture cocksfoot is not used to anything like the same extent as it is on leas of longer duration. There is very little doubt, however, that its use should be very greatly extended in all rotation grassland throughout New Zealand on soils where perennial rye-grass runs out within two to five years of sowing.

Although the value of cocksfoot is fully appreciated by New Zealand farmers, except those concerned only with short-rotation grassland, there are many points regarding its establishment and management that require elucidation. In this article it is proposed to deal with a few of the salient features regarding the production and maintenance of cocksfoot pastures, but in the first place it is well to outline some

of the weaknesses or disadvantages of cocksfoot, some of which are of general application, while others are connected with environmental conditions.

DISADVANTAGES OF COCKSFOOT.

Broadly expressed, cocksfoot possesses two grave disadvantages: these are its tussocky growth-form and its almost complete stoppage of growth during the winter. Both these characteristics render it unsuitable for sowing down as a pure pasture, and, in fact, nearly all its defects can be primarily traced to one or other of these characters. Apart from these real disadvantages there are others more or less erroneously attributed to this grass that have hindered it from attaining an even more important position than it at present occupies in New Zealand grassland. One of the main defects commonly attributed to cocksfoot is that it is extremely slow in reaching maturity, and that the herbage produced is insignificant until after from two or more years from sowing. It is therefore considered quite unsuitable for short-rotation pastures such as characterize the grassland of the cropping-areas of the South Island. There is a certain amount of truth in this contention, but in many cases it is based on irrational sowing and management rather than on any natural slow development of the grass.

So far as growth-form is concerned cocksfoot belongs to the tussock-forming grasses as distinguished from the mat-formers. Under grazed conditions, however, the tussock form is more or less avoided by the plants being kept eaten down fairly close to the ground. Again, the tussock form can be largely stopped provided a very close growth of plants is secured. In the first case, where the tussocky nature of the grass is inhibited by close grazing, great damage is often done by many of the shoots being pulled up, especially in the winter. It is commonly said that cocksfoot is very deep-rooted, but this does not alter the fact that portions of each heavily grazed-down tuft can be more readily pulled up than is the case with almost any other grass. Where the tussock-growth form is avoided by the production of excessive numbers of plants, or, in other words, by very heavy seeding, the bulk of herbage produced is very seriously affected. This is especially true on soils of moderate or low fertility and on dry soils generally.

With regard to the poor winter growth of cocksfoot, this is characteristic of it in all parts of New Zealand; but there is, of course, a far more extended dormant period in the South Island than there is in the North. It is probably due to its poor winter and early spring growth that cocksfoot is unpopular in many dairying districts in the North Island where very early calving is practised. Its excellent growth, however, during the summer, when the growth from rye-grass is low, makes cocksfoot quite one of the best of grasses for milk-production, especially on soils that suffer from any extended summer drought. This fact is now being generally recognized, and in consequence cocksfoot is often the main grass used in dairying-pasture mixtures.

EMPLOYMENT OF COCKSFOOT.

Cocksfoot can be said to be used in all long-rotation and permanent pasture mixtures except on those soils—such as the richer portions of the Heretaunga Plains—where perennial rye-grass is truly permanent,

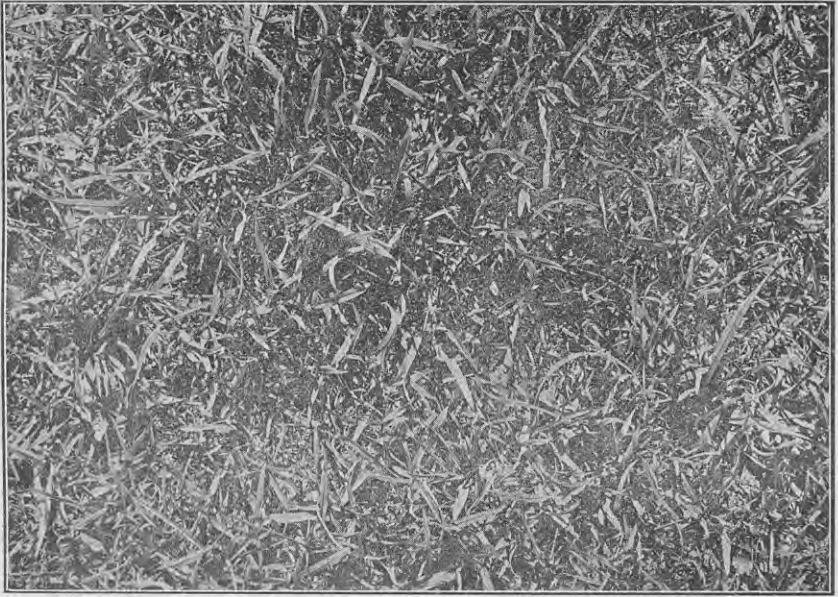


FIG. 1. COCKSFOOT GRASSLAND, EIGHT YEARS OLD, SHOWING A COMPACT SOLE HELD TOGETHER WITH POA PRATENSIS.



FIG. 2. WEEDY SUCCESSION ON SIMILAR LAND WHERE COCKSFOOT WAS NOT USED.

[E. Bruce Levy, photos.]

and on certain reclaimed swamps where meadow-foxtail may take its place. The amount used per acre varies from 1 lb. to as high as 12 lb. per acre. For my part, I can see no object in using very small amounts in any seeding. Where, say, only 1 lb. is used the chances of establishment are quite remote, and the grass will never occupy any important position unless natural seeding is allowed. As a general rule, I consider that never less than 4 lb. should be sown, even where the land is said to hold perennial rye-grass permanently. On land where the pasture desired is definitely of a cocksfoot type not less than 10 lb. and in many cases 12 lb. is not too heavy a seeding if continuous grazing is to be adopted. On much bush-burn country 10 lb. of cocksfoot is regularly used in a total seeding of from 24 lb. to 28 lb. per acre.

This is, in general, a much heavier seeding of cocksfoot than was formerly employed. The reasons for this increase are due to much of the bush-burn country being of distinctly inferior quality, and also to the fact that present-day bush-burn sowings are more heavily stocked in their earlier stages. At the present time the cocksfoot on new burns is rarely allowed to seed—a condition common in past times. I am inclined to think that the present system of close feeding of bush-burns during their first year is a great mistake, especially on second-class soils. In cocksfoot-establishment too much stress cannot be given to the importance of the production of vigorous plants during the first year following sowing.

This brings up the point as to whether turnips and rape—with consequent heavy stocking of the young grass—should be included in bush-burn mixtures. The practice, of course, is very general and applies to all grades of bush-burn soils. It seems clear to me that on second-class or worse land brassicas should be excluded, and all the manurial stimulation of the ashes should be available for the rapid and vigorous establishment of the grasses, especially of the cocksfoot. On such soils, if the cocksfoot-plants are not vigorously established in the first season they are never likely to produce much herbage, and the whole future production of the grassland will be seriously impaired. On better-class soils the inclusion of brassicas is probably sound, as the fertility of the soil itself is sufficient to allow of the proper establishment of the grass even when heavy stocking is practised. Once cocksfoot is properly established and has formed large plants it will continue to grow freely even on poor soils, but when checked in its early stages on such ground it is never satisfactory and is very liable to become eaten out.

CONDITIONAL NON-PERMANENCY OF COCKSFOOT.

On much bush-burn country, especially on steep slopes, cocksfoot, even when apparently properly established, does not last for more than a few years, after which either undesirable successions, such as fern, become dominant, or the pasture gradually turns into danthonia grassland. This non-permanency of cocksfoot is due to the plants being pulled right out of the ground by stock. The bare ground between the plants becomes washed or blown away, and the cocksfoot-plants are left growing on the tops of little hillocks of soil. They are then pulled out with the greatest ease.

This condition is quite a common one, and can be avoided only by the initial production of a close and compact sward. The tussocky nature of the cocksfoot itself quite prevents this being accomplished unless a liberal seeding of grasses that will fill in all bare spaces is carried out in the original sowing. Such grasses must be of a mat-forming type, and for this purpose the value of *Poa pratensis* is often underestimated. Crested dogstail, again, although not a true mat-former, is highly valuable in conjunction with *Poa pratensis* in binding together the cocksfoot-plants and preventing them being pulled out. On soils where cocksfoot is likely to suffer in the manner described at least 3 lb. of *Poa pratensis* and 2 lb. of crested dogstail per acre should be included in the mixture.



FIG. 3. COCKSFOOT ON HILLSIDE.

Showing inability of cocksfoot to hold on steep hillsides unless surface is bound by companion mat-forming grasses such as *Poa pratensis* and crested dogstail.

[E. Bruce Levy, photo.]

It is also highly necessary that on such soils the cocksfoot should not be checked in its early growth, and quite light grazing during the first two seasons is advocated. In many cases, again—and this is particularly true of tussock country—continuous grazing results in cocksfoot being virtually eaten out. Under such conditions spelling the ground, especially during spring and early summer, has often a remarkable effect in regenerating cocksfoot.

USE IN SHORT-ROTATION GRASSLAND.

In the cropping-areas of the South Island, where short-rotation grassland lasting from two to four years is a feature, cocksfoot does not occupy an important position. The reason is largely the current opinion that cocksfoot does not yield sufficiently heavily in its earlier

years to warrant inclusion except in limited quantities. These short-rotation pastures, consisting mostly of perennial rye-grass, are eminently satisfactory during the first year, but the rye-grass soon becomes weak, and in general they require to be ploughed up before the end of their third year. This system of short-rotation pastures to be ploughed up as soon as they have run out has been general in the South Island for many years, and is highly unsatisfactory from the upkeep of soil-fertility standpoint. Rotation grassland, apart from the feed it produces, must be looked upon as the humus-renovator in the cropping system. The rye-grass pastures of the South—and this refers more particularly to the lighter lands of Canterbury—are markedly inefficient in this respect. What is required are pastures that at the end of their third or fourth year will yield large amounts of organic matter when they are ploughed under. A more extended use of cocksfoot in short-rotation grassland would tend in this direction.* Without doubt, fairly heavy sowings of cocksfoot should be a feature over all the light land of the South Island, where this grass is at the present time studiously avoided. A typical Canterbury mixture would consist, roughly, of 20 lb. of perennial rye, 3 lb. of clovers, with perhaps 2 lb. of Italian rye, and from 1 lb. to 2 lb. of cocksfoot. The seed is generally spring-sown with a cereal—oats in the majority of cases—and often the cocksfoot, owing to the dry conditions engendered by the cereal to be harvested, does not establish at all.

Apart from modifying the mixtures so as to make cocksfoot the dominant ingredient, it will be necessary in the drier soils of Canterbury to either spring-sow apart from a harvested cereal or autumn-sow if lasting and productive pastures are to be secured. The superior results following sowing grass with rape or soft turnips clearly indicate that spring sowing with a harvested cereal is an unound practice. However, as oats often end the annual crops of a rotation and grass of necessity has to follow, autumn sowing following oats is advocated for the establishment of pastures largely of cocksfoot, provided the season has not been exceptionally dry and the oat crop has not exhausted the water resources of the soil. Under such circumstances the late autumn sowing of green-feed oats followed by spring sowing of the grass should be adopted. The type of mixture I should advise would be somewhat as follows: Cocksfoot, 12 lb.; rye-grasses, 10 lb.; clovers, 4 lb.; and perhaps 2 lb. of crested dogtail.

On the Ashburton Experimental Farm the value of heavy sowings of cocksfoot for rotation pasture is well shown. The land is of a distinctly poor character, the soil being thin with gravel coming close to the surface. The ordinary rye-grass mixtures run out after the second year, and give virtually no feed during the summer and autumn. On such land excellent results have followed the sowing in early March of the following mixture: Cocksfoot, 15 lb.; Italian rye, 3 lb.; perennial rye, 5 lb.; crested dogtail, 2 lb.; cow-grass, 2 lb.; white clover, 1 lb. At the end of two years this mixture has resulted in an excellent pasture of cocksfoot, crested dogtail, and clovers, and it is also noticeable that the rye-grass plants are markedly more vigorous.

* Dr. Hilgendorf, in his book on New Zealand pastures, well points out the value of cocksfoot for largely replacing rye-grass on the short-rotation grassland of Canterbury.



FIG. 4. TUSOCK-DANTHONIA GRASSLAND WHERE COCKSFOOT HAS BEEN VIRTUALLY EATEN OUT.

Showing inability of cocksfoot to stand hard and constant grazing.



FIG. 5. BACKGROUND OF FIG. 4. SPELLED GROUND BEYOND FENCE, SHOWING ABUNDANT GROWTH OF COCKSFOOT BETWEEN TUSSOCKS.

[E. Bruce Levy, photos.]

than in the ordinary rye-grass plots, which are beginning to thin out. The pasture, in fact, has a really good sole with virtually no bare spaces. I would be inclined in future to increase the amount of white clover, as although there are large quantities of seed in the ground a good growth of white clover right from the germination of the cocksfoot appears to exert a remarkable effect on cocksfoot-development. Unfortunately, on much of the lighter land of Canterbury the growth of white clover is feeble except in seasons of more than average rainfall. A clover that will grow well on soils which normally dry out badly in the summer is one of our most urgent requirements. As Dr. Hilgendorf has pointed out, *Lotus corniculatus* should prove of great value in this respect. At any rate, the synchronous production of a clover of not too smothering a character appears to be extremely beneficial for the rapid establishment of cocksfoot.

THE EFFECT OF CLOVER ON COCKSFOOT.

At the Central Development Farm, Weraroa, remarkable results have followed the sowing of large amounts of white clover along with a liberal seeding of cocksfoot. Two adjacent plots were laid down in the autumn of 1917. In one plot 14 lb. of cocksfoot and 6 lb. of white clover per acre were sown, and in the other 14 lb. of cocksfoot and 3 lb. of crested dogstail. During the spring and summer of 1917 the clover plot consisted of a very vigorous growth of dark-green cocksfoot and white clover, while the cocksfoot in the adjacent plot remained small and much lighter in colour. In the spring of 1918 the results were even more marked. The cocksfoot in the plot where clover was sown commenced growth quite one month sooner than in the other, and was superior in all respects. In February, 1919, both plots were cut for seed, that where clover was grown yielding at the rate of 250 lb. per acre, while the other produced 120 lb. Apart from this, the main growth in the no-clover plot occurred, as is usual, along the margins, while in the clover plot the growth of cocksfoot in the centre was equally vigorous with that along the edges.

This stimulating effect of large quantities of white clover indicates the great value of a good growth of clover right from the time of the sowing of the cocksfoot. It would appear to be highly probable that much of the benefit of phosphatic top-dressing of pastures is due indirectly to the general clover response that follows rather than to any immediate benefit the grasses themselves derive from the fertilizer.

DEPRESSING EFFECT OF ITALIAN RYE-GRASS.

Owing to the very vigorous and immediate growth of Italian rye this grass has become very popular as the temporary filler in mixtures for pastures of long duration. In many cases the amount per acre has been as high as 10 lb., used, of course, in conjunction with the various other more permanent grasses and clovers. The idea is that the Italian will furnish an abundance of feed during the first year, and that afterwards the more permanent elements will take its place. This perhaps is true with regard to many grasses that are likely to seed under grazed conditions, but so far as cocksfoot-establishment is concerned excessive amounts of Italian have a most depressing effect. As is well known,

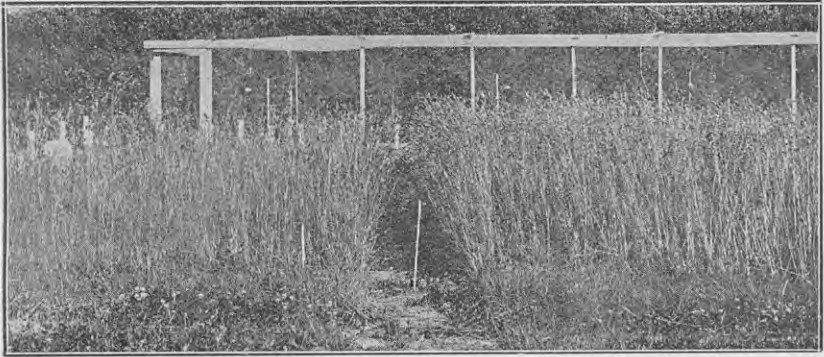


FIG. 6. PLOTS AT WERAROA SHOWING SUPERIOR COCKSFOOT-GROWTH WHEN COMBINED WITH CLOVER.

On right, cocksfoot-clover; on left, cocksfoot alone.



FIG. 7. CLOSE VIEW OF COCKSFOOT-CLOVER PLOT SHOWN IN FIG. 6.

Yielded cocksfoot-seed at rate of 250 lb. per acre.

[Miss F. Wain, photos.]

cocksfoot under more or less continuous grazing, which is the treatment generally accorded New Zealand grassland, rarely produces any seed-heads. This is especially true on sheep pastures, and applies also to cattle and dairying grassland, except on the ungrazed patches surrounding cattle-droppings.

This non-seeding of grazed cocksfoot is one of its most important characteristics from an establishment point of view. It emphasizes the fact that the amount of cocksfoot in a pasture will depend primarily upon the amount that is sown and on the number of plants that will be established during the first few months following sowing. In general, comparatively no increase in the number of cocksfoot-plants occurs in the seasons following sowing, and, as will be pointed out, a reduction in the number of plants generally occurs. Thus any increase in the amount of ground occupied by cocksfoot will in all cases be due to increase in size of individual plants alone. Again, the ability of individual cocksfoot-plants to cover any considerable area depends very largely on whether or not vigorous plants have been developed during the season following sowing. Where excessive amounts of Italian rye are used the cocksfoot-plants are in general small and weak in the year following seeding. As the cocksfoot is kept hard grazed down it stands little chance of developing vigorous plants after the Italian has disappeared. There is no doubt that the failure in many parts of the North Island to establish good cocksfoot pastures in the renovation of bush-burn grasslands is due to the excessive use of Italian rye coupled with overstocking before the cocksfoot-plants are properly established.

Some very instructive examples of the depressing effect of Italian rye-grass on cocksfoot-establishment are afforded at the Central Development Farm. In one paddock of temporary pasture 4 lb. of cocksfoot per acre was included in a number of plots where Italian rye and prairie-grass were the main grasses used. In the rye-grass plots Italian was sown at the rate of 24 lb. per acre. In the first year the plots were heavily grazed in the winter and spring, and two hay crops were also harvested. The amount of cocksfoot in the hay was nil, what plants there were in the plots not being sufficiently high to be cut by the mower. In the prairie-grass plot, where the same amount of cocksfoot was used and 60 lb. of prairie sown, considerable amounts of cocksfoot were present in the second crop of hay, and the plants were large and vigorous. In the second year the plots were again grazed, mainly with cattle, during the winter and spring, and another hay crop harvested in December. On going over the field shortly before cutting, very few cocksfoot-heads could be seen in the Italian-rye plots, while the prairie plot contained ten times the number, and the cocksfoot-plants were strong and vigorous, yielding an abundance of herbage.

Again, in the autumn of 1918 a field was laid down in various plots in each of which cocksfoot at the rate of 14 lb. per acre was sown, together with other grasses and clovers. Two plots of 4 acres each were sown with the same mixture, except that one contained no Italian, while the other had 10 lb. included. The difference in the cocksfoot in these two plots has been most marked. In the December following, or eight months after sowing, a splendid thick growth of cocksfoot had been produced on the no-Italian area, while where Italian had been used the cocksfoot-plants were small and scattered. Any one viewing

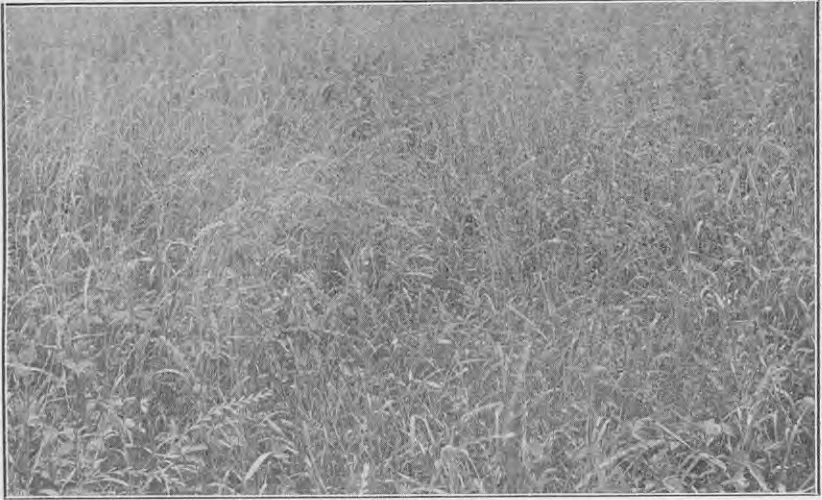


FIG. 8. JUNCTION OF TWO PLOTS AT WERAROA, SHOWING THE DEPRESSING EFFECT OF ITALIAN RYE-GRASS ON COCKSFOOT-ESTABLISHMENT.

On left, Italian-rye plot with virtually no cocksfoot present. On right, prairie-grass plot with considerable amount of cocksfoot. Four pounds of cocksfoot was sown over each plot.



FIG. 9. TWO-YEAR-OLD COCKSFOOT ON POOR STONY GROUND AT WERAROA, WHICH HAS NOT YET FLOWERED.

[Miss F. Wain, photos.]

the two areas would have said that at least four times as much cocksfoot had been used on one area as on the other. As the paddock had been grazed almost entirely with cattle, there were numerous patches on both plots marking droppings where the grass had not been eaten. In no case on the area where Italian was sown were there any seed-heads of cocksfoot in these patches. On the other hand, in all the ungrazed patches on the no-Italian areas the cocksfoot was seeding freely. At the time of writing (end of April), just twelve months from the date of seeding, the cocksfoot-no-Italian area is a splendid cocksfoot pasture, and in combination with crested dogstail, which was used at the rate of 4 lb. per acre on both blocks, forms an excellent even sward. The cocksfoot-plants in the Italian block, on the other hand, are still small, and under heavy grazing would never form a sufficiently compact sole to remain permanent.

It is probable that small seedings of Italian rye would exert no harmful effect on cocksfoot-establishment, but I am inclined to think that in no case should the amount exceed 4 lb. per acre. Again, on ground of only moderate fertility I should omit Italian altogether. On bush-burn country where perennial rye-grass does not hold longer than from two to three years, and where if possible cocksfoot should be the dominant grass, I should include Italian rye-grass rather than any perennial, using, say, about 4 lb. per acre. The depressing effect of Italian is not so marked on bush-burns, as in general the whole seeding is much lighter than on ploughed land, and competition is not so keen in the early stages of the development of the land into grass.

THE TOP-DRESSING OF COCKSFOOT.

As has been mentioned, on pastures that are continually grazed cocksfoot rarely produces any seed-stalks. This is in marked distinction to such grasses as the ryes and crested dogstail. Again, on soils of low fertility cocksfoot may not flower until two or three years after sowing, even if left unstocked. The same phenomenon also occurs on the short-rotation grassland of Canterbury, where small amounts of cocksfoot may be included. Much of this grassland in its first and second years is harvested for rye-grass seed, but cocksfoot is rarely found in any appreciable amount in farmers' dressed seed from such crops. In cocksfoot-establishment rapid growth from germination onwards is always a factor of intense importance. If the early growth is slow, unless the soil is of exceptional fertility, further development is unsatisfactory. On soils where cocksfoot appears naturally difficult to establish, top-dressing with a nitrogenous manure so as to stimulate growth seems to be necessary. The wonderful results of heavy seedings of clover with cocksfoot seem to point to this, and an experience at Weraroa appears to support such view. In the autumn of 1917 a block of 6 acres of pure cocksfoot was laid down on some very stony ground on the farm—so stony, in fact, that one end of the area is used as a gravel-pit. On this ground considerable extents of the cocksfoot did not produce any seed-heads even nearly two years after sowing, the plants remaining about 6 in. high. The area was stocked for a few days in the winter of 1918, and in January of this year it was noticeable that over all the area where the cocksfoot remained stunted there were vigorous patches of cocksfoot with seed-



FIG. 10. PART OF TWO-YEAR COCKSFOOT FIELD ON POOR STONY GROUND AT WERAROA, SHOWING VIGOROUS GROWTH ON PATCHES MANURED BY CATTLE-DROPPINGS.



FIG. 11. TWO-YEAR COCKSFOOT-PLANTS IN SAME FIELD IN FULL SEED ON CATTLE-MANURED PATCHES.

[Miss F. Wain, photos.]

heads over 2 ft. 6 in. in height, marking the site of droppings from the stock that had been grazed on the area the previous winter. In order to test the effect of top-dressing a definite series of experiments is being conducted on this area, and the results should prove of great value.

SEED-PRODUCTION.

Roughly about 2,000 tons of cocksfoot-seed is sown annually in New Zealand. The majority of this is produced locally, the larger portions being grown in the Canterbury District. When harvested by hand in the Banks Peninsula area it is termed "Akaroa cocksfoot," and when machine-harvested on level ground it is traded as "Plains cocksfoot" and generally contains considerable amounts of perennial rye-grass. When the rye is in large quantities a high bushel-weight is obtained without the amount of blowing necessary to raise a farmers' dressed Akaroa line to the 16-17 lb. standard.

The germination of New Zealand cocksfoot when germinated under the methods adopted at the Department's seed-testing station is often considerably lower than is looked upon as satisfactory in Europe. This is due to the fact that local seed generally contains a large percentage of empty husks. In many cases quite 30 per cent. by numbers of the apparently mature seeds are devoid of kernels. Since 1908, when the price of cocksfoot began to increase considerably, cleaning has not been satisfactory. It is true that the separation of extraneous seeds has improved, but far too many empty husks are left in the average machine-dressed line. So long as the dressed line is comparatively free from extraneous seed and the weight reaches a 16-17 lb. standard no attention is given to the quantity of empty husks remaining.

This is not such a serious matter, so far as local consumption is concerned, provided the buyer purchases on a germination test, but for export the case is very different. At one time New Zealand was one of the main countries exporting cocksfoot to Great Britain, but before the war Denmark was occupying the position previously held by New Zealand in this respect. The reason for this was almost entirely owing to the Danish seed being better blown and freer from empty husks than our local exportations. Before it can be expected that New Zealand shall again occupy the premier position on the London market more care will have to be taken in removing the empty husks from the lines that are exported.

Taken as a whole an average good crop of cocksfoot will yield from 150 lb. to 200 lb. of seed per acre. Of this amount anything from 10 to 20 per cent. will represent weed-seeds and other rubbish lost in the cleaning, so that an average good crop will yield from 130 lb. to 170 lb. of dressed seed. The Danes secure yields far in excess of this, and it was largely due to their large yields that they could afford to undersell New Zealand seed on the London market. In general, the Danish cocksfoot is grown in rows and intercultivated when necessary. The result is that the individual plants grow to great proportions and in consequence yield heavily. Yields of over 6 cwt. per acre are said not to be unusual. As the areas are kept free from weeds, the loss in dressing is not nearly so great as it is in New Zealand. Apart from this, Danish seed is generally larger than that grown here, and the germination is more vigorous. During the past few years very large amounts

of Danish seed have been imported into New Zealand, and its high germination and bold appearance have enabled it to be sold at higher prices than the best local lines could command.

At the Central Development Farm there is an area of cocksfoot of one of the pure strains selected at Moumahaki. This is being grown on the Danish system in rows 3 ft. apart. This season the plot yielded at the rate of 500 lb. of farmer-dressed seed, weighing $14\frac{1}{2}$ lb. per bushel. The example gives a clear indication of the large yields that are possible when cocksfoot is grown in this manner. It has been found,



FIG. 12. COCKSFOOT SEEDLINGS (NATURAL SIZE) IN PURE SOWING.

[E. Bruce Levy, photo.]

however, that a space of 3 ft. between the rows is too much, and better results would follow a spacing of, say, 28 in. So far as intercultivation is concerned, this would not be necessary to any extent after the first two years, as the plants would finally meet between the rows and keep down weeds. After harvesting the ground could be stocked, and excellent late summer and autumn feeding would be secured. Heavy stocking of areas devoted to cocksfoot-seed production should, however, not be encouraged, and in order to secure the best results no late spring feeding-off should ever be carried out.

Noxious Weeds.—Ox-eye daisy has been declared a noxious weed by the Kowai County Council. Gorse has been similarly declared by the Ohura County Council.

CONTROL OF BROWN-ROT OF STONE-FRUITS.

THE PAST SEASON'S EXPERIMENTS.

THE brown-rot experiments conducted by the Department in the 1917-18 season, and published in the *Journal* for April and May, 1918, were continued on a more extended scale during the past season. A different phase of control was tested in four orchards in the Henderson District in co-operation with the local fruitgrowers' association. At Arataki Horticultural Station the experiments were again a prominent feature of the work. In Hawke's Bay, in addition to Arataki, trials were made in three private orchards, each of which was used to test a special point. Full reports on all these trials are published herewith. A further series of experiments was conducted by the Stoke Fruit-growers' Association in co-operation with the Department, but these tests were barely concluded at the time of writing.

Although there were no outstanding features in the results of the various tests which could be followed with assured success, the data obtained, nevertheless, have been very valuable. The weather was much kinder, and the losses from brown-rot, not only in the experimental orchards but in orchards generally, were much less than for the two or three previous seasons. The weather, coupled with the individual efforts of the majority of growers, no doubt contributed to the reduction of the disease.

Together with control in the orchard the Department is also investigating the development of brown-rot after the fruit is picked, packed, marketed, and up to the time that it is ripe enough for the retail trade. In Hawke's Bay this past season most of the fruit was traced from the experimental orchards through the auction-rooms to the retailer. Next season it is proposed to extend investigations and make a special feature at the Arataki Horticultural Station of noting the development of the disease after the fruit is picked. In this connection the use of new and second-hand cases will be tried, as well as picking the fruit from the same trees in various stages of ripeness. Experiments to ascertain the advisability of dipping or spraying the fruit after it is picked will also be continued. In these trials the fruit will be despatched to market and kept under supervision up to the time that it is ripe enough for the retail trade.—*T. W. Kirk, Director of the Horticulture Division.*

ARATAKI.

The following report on brown-rot experiments with peaches at the Arataki Horticultural Station is furnished by Mr. T. E. Rodda, Manager :—

The scheme on the peach section was slightly different from what was practised at this station last year. In this section a block of 336 trees was selected, comprising forty-eight rows of seven trees each. Every alternate tree in each row was pruned in the ordinary way. The

remainder were treated by thinning out wood only, no laterals or leaders being stopped. All prunings were carefully collected and burned, as well as all mummified fruits, &c., that remained from the previous season's crop. The land was ploughed during the last week in July, 1918, and was given a dressing of 6 cwt. of carbonate of lime per acre during August.

All trees were sprayed in early spring at the "pink" stage, twenty-four rows receiving 8-6-40 bordeaux, the remainder 8-3-66 bordeaux. A severe frost during October destroyed a large percentage of the crop. The weather throughout the growing season, though changeable and somewhat cold at times, was not so congenial for the development and spread of the spores of the brown-rot disease as it was last year. Moist humid conditions were not nearly so prevalent.

Half of the block was sprayed three times during the fruiting season, and the other half was treated five times during the same period. For the purpose of simplifying the perusal of this report, trees sprayed three times during the fruiting-period are set down under the heading of "A" treatment, and the remainder under "B" treatment. Although there are only two trees of each variety, row 1 is a complete test on the same varieties against row 2, row 3 against row 4, and so on right throughout the whole forty-eight rows.

The following tables will show the treatments and the percentage of brown-rot recorded up to and at the time of picking.

"A" Treatment.

All trees in this treatment were sprayed three times during the fruiting-period: (1) When majority of blossoms had fallen; (2) when fruit had set; (3) when fruit began to swell prior to ripening.

No. of Row.	Early Spring (Pink) Treatment.	Fruiting-period Treatment.	Percentage of Rot at Time of Picking.
1	Bordeaux, 8-6-40 ..	Lime-sulphur, 1-120	1.47
2	" 8-3-66 ..	Atomic sulphur, 8-100	3.33
3	" 8-3-66 ..	Lime-sulphur, 1-120	5.40
4	" 8-6-40 ..	Sulphur atoms, 8-100	4.59
5	" 8-6-40 ..	Lime-sulphur, 1-120	1.91
6	" 8-3-66 ..	Self-boiled lime-sulphur, 8-8-50 ..	3.82
7	" 8-3-66 ..	Atomic sulphur, 8-100	7.44
8	" 8-6-40 ..	Lime-sulphur, 1-120	7.51
9	" 8-6-40 ..	Atomic sulphur, 8-100	0.90
10	" 8-3-66 ..	Sulphur atoms, 8-100	1.40
11	" 8-3-66 ..	Atomic sulphur, 8-100	0.77
12	" 8-6-40 ..	Self-boiled lime-sulphur, 8-8-50 ..	2.98
13	" 8-6-40 ..	Sulphur atoms, 8-100	1.53
14	" 8-3-66 ..	Lime-sulphur, 1-120	2.63
15	" 8-3-66 ..	Sulphur atoms, 8-100	7.54
16	" 8-6-40 ..	Atomic sulphur, 8-100	6.95
17	" 8-6-40 ..	Sulphur atoms, 8-100	5.45
18	" 8-3-66 ..	Self-boiled lime-sulphur, 8-8-50 ..	4.87
19	" 8-3-66 ..	Self-boiled lime-sulphur, 8-8-50 ..	11.06
20	" 8-6-40 ..	Lime-sulphur, 1-120	14.72
21	" 8-6-40 ..	Self-boiled lime-sulphur, 8-8-50 ..	6.83
22	" 8-3-66 ..	Atomic sulphur, 8-100	1.72
23	" 8-3-66 ..	Self-boiled lime-sulphur, 8-8-50 ..	3.56
24	" 8-6-40 ..	Sulphur atoms, 8-100	0.47

" B " Treatment.

All trees included in this treatment were sprayed five times during the fruiting-period : (1) When majority of blossoms had fallen ; (2) when fruit had set ; (3) at stoning-period ; (4) one month later ; (5) when fruit began to swell prior to ripening.

No. of Row.	Early Spring (Pink) Treatment.	Fruiting-period Treatment.	Percentage of Rot at Time of Picking.
25	Bordeaux, 8-6-40 ..	Lime-sulphur, 1-120	2.35
26	" 8-3-66 ..	Atomic sulphur, 8-100	10.90
27	" 8-3-66 ..	Lime-sulphur, 1-120	3.18
28	" 8-6-40 ..	Sulphur atoms, 8-100	8.09
29	" 8-6-40 ..	Lime-sulphur, 1-120	2.42
30	" 8-3-66 ..	Self-boiled lime-sulphur, 8-8-50	2.13
31	" 8-3-66 ..	Atomic sulphur, 8-100	2.46
32	" 8-6-40 ..	Lime-sulphur, 1-120	0.80
33	" 8-6-40 ..	Atomic sulphur, 8-100	2.83
34	" 8-3-66 ..	Sulphur atoms, 8-100	3.00
35	" 8-3-66 ..	Atomic sulphur, 8-100	16.66
36	" 8-6-40 ..	Self-boiled lime-sulphur, 8-8-50	26.66
37	" 8-6-40 ..	Sulphur atoms, 8-100	32.25
38	" 8-3-66 ..	Lime-sulphur, 1-120	25.64
39	" 8-3-66 ..	Sulphur atoms, 8-100	7.37
40	" 8-6-40 ..	Atomic sulphur, 8-100	Nil.
41	" 8-6-40 ..	Sulphur atoms, 8-100	4.76
42	" 8-3-66 ..	Self-boiled lime-sulphur, 8-8-50	Nil.
43	" 8-3-66 ..	Self-boiled lime-sulphur, 8-8-50	20.58
44	" 8-6-40 ..	Lime-sulphur, 1-120	3.34
45	" 8-6-40 ..	Self-boiled lime-sulphur, 8-8-50	50.00
46	" 8-3-66 ..	Atomic sulphur, 8-100	44.00
47	" 8-3-66 ..	Self-boiled lime-sulphur, 8-8-50	50.00
48	" 8-6-40 ..	Sulphur atoms, 8-100	Nil.

EFFECTS OF SPECIFICS ON FRUIT AND FOLIAGE.

Lime-sulphur : Sherwin Williams dry powder was used, and was dissolved in hot water and tested with the hydrometer. It was diluted to the strength of 1-120 based on a 33° test. It slightly scorched the tender tips of the young growths, but did no serious damage to foliage or fruit.

Self-boiled lime-sulphur : This preparation scorched the foliage and fruit rather seriously for the first and second sprayings, but was not quite so severe as the season advanced. The trees, however, retained a rather sickly appearance for some time after each spraying.

Atomic sulphur : This specific did not injure fruit or foliage in the least. All trees treated looked exceedingly green and healthy right throughout the season.

Sulphur atoms : This preparation seems to have exactly the same action on fruit and foliage as atomic sulphur.

SUMMARY.

Judging from the foregoing results it cannot be claimed as regards spraying that any one of the specifics showed any outstanding superiority over the others for the control of brown-rot. All preparations failed to prevent it entirely.

The average percentage of diseased fruit harvested was not nearly so high as last year. Possibly drier weather conditions may account for this. It was very noticeable right throughout the year that none of the fruits showed any signs of infection until they were almost ripe. In many instances fruit that was picked from trees that showed no signs of the disease at any time during the season or at time of picking became very badly infected after being stored a few days. On the other hand, fruits harvested under similar conditions showed no signs of disease after being stored in the fruit-room for over a week. A fair amount of the fruit (assorted varieties), picked and packed on the hard side, was forwarded to Wellington and, according to the reports received, was opened up in most instances in good condition. A special test in marketing was made with two varieties—Shanghai Free and Royal George Cling—by picking and packing some of the fruit that was well matured but not soft, and some fruit on the green side, from each variety. New cases were used. The matured fruit was packed in one compartment and the green fruit in the other compartment, the varieties being kept separate in each instance. This fruit (two cases) was despatched to Wellington with the request that a careful examination be made for brown-rot when the cases were received. The cases were opened up three days after being picked. Fruit packed on the green side was still sound in both cases, but the matured fruit was showing 29.41 per cent. of rot in No. 1 case and 3.03 per cent. in No. 2 case. The remainder of the fruit (green at time of picking) was examined again two days later, with the result that 48.14 per cent. in No. 1 case was infected and 6.55 per cent. in No. 2 case. Owing to the light crop and the numerous varieties grown here I could not obtain sufficient fruit of any one sort to carry out conclusive experiments in transporting and marketing, so as to arrive at a definite conclusion which treatment or series of treatment ensured the fruit arriving at the market in the best saleable condition.

According to results it appears that the untipped lateral system of pruning did not make any difference in the control of the disease.

HAWKE'S BAY COMMERCIAL ORCHARDS.

The brown-rot experiments in commercial orchards in Hawke's Bay were in charge of Mr. Gordon Esam, Acting Assistant Director of the Horticulture Division (then Orchard Instructor for the district), who supplies the following report:—

Messrs. M. Curtin, of Pakowhai; E. S. French, of Mahora; and N. Johnson, of Havelock North, very kindly placed their orchards at the Department's disposal for the purpose of the experiments.

MR. CURTIN'S ORCHARD.

The work done in Mr. Curtin's orchard, together with the results, will first be dealt with. This orchard is situated in a district which practically escaped the late spring frosts, the Burbank plum being the only variety seriously affected. The stone-fruit portion of the orchard is made up of 16 Burbank plums, 16 Goldmine nectarines, and the remainder peaches—namely, 16 Eulatis, 32 High's Early Canada, 32 Wiggins, 48 Hale's Early, 16 Kia Ora, 16 Kalamazoo, 16 Sea Eagle, and 48 Hobbs' Late.

Half the orchard was ploughed and a cover-crop sown on 8th May, 1918. It was proposed to try the effect of a green crop in smothering and checking the spread of brown-rot spores, but the crop failed, and the value of this test was therefore lost.

The orchard was pruned and all the prunings gathered up and burnt prior to sowing the cover-crop. Pruning formed part of the experiment, to ascertain whether the seccateurs were a medium of carrying infection on to the fruiting-laterals when they were shortened. One half of the orchard was pruned on the method adopted in the district—that of tipping the greater portion of the one-year-old wood. On the other half the fruiting-laterals were left full length and no one-year-old wood tipped. Provision was made for new wood in this method by systematically taking out over the whole surface of the tree a portion of the wood, particularly the two- and three-year-old wood. It could be fairly estimated that nearly half the fruiting-wood was cut out. In each method half the trees were allowed to remain as they were with full centres and quite dense, and in the other half the centres were well opened up. There was very little difference between the weight of crop harvested on the two methods of pruning. If anything the advantage was with the untipped lateral. The open centres were better than the full centres; the crop was certainly as heavy, and ripened much better and more evenly. The trees, when the foliage was on, were also very much easier to spray. As far as brown-rot was concerned there was no more infection on one method of pruning than on the other.

In regard to cultivation, it was mentioned earlier that one-half of the orchard was ploughed and seed sown on 8th May. Although the seed failed to come up, the ground was not touched again until the first week in December, when it was again ploughed. The other half of the orchard was ploughed in the spring just prior to the peaches showing pronounced bud-movement. The strips left by the plough along the rows were dug in each instance immediately after the ploughing was finished. The ground was kept well cultivated and free from weeds.

Spraying was followed on set lines. As the buds of each variety showed pink in the spring they were sprayed with bordeaux, 8-6-40. When the majority of the petals had fallen they were again sprayed with lime-sulphur, 1-120. Bordeaux, 2-3-40, was tried at this stage on several varieties, but it was inclined to be rather severe on the young leaves. No more spraying was done until a few days before the first picking of each variety was ready, when they were again sprayed with lime-sulphur, 1-120. It was originally intended to spray two or three times during the interval between the fruit setting and ripening, but as no brown-rot showed up between these stages it was not considered necessary. Where the leaves had been weakened with rust or shothole fungus the lime-sulphur at picking-time caused a few of the older leaves to drop, but not in sufficient quantities to do harm. Victor Leggo's Giraffe brand lime-sulphur was used in this orchard.

Strict attention was paid to thinning. No matter how light the crop was, all fruits were spaced so that no two fruits would touch even when the fruit ripened. Thinning was done between 16th and

20th November, and was all completed before the stone hardened. The orchard was kept clean throughout the season, and all fallen fruit gathered up regularly and destroyed.

In summarizing the results in this orchard it is very satisfactory to record that not only was the quality of the fruit better than formerly, but the returns also showed a good improvement. Mr. Curtin estimates his total loss of fruit from brown-rot at not more than two cases. Sea Eagle, which ripened in February, was the worst variety, and this infection followed a spell of wet weather.

Most of the fruit was picked into benzine-tins, then tipped on to a bench, and from there packed into new cases. I should like to mention here that most of the varieties were picked over five or six times and only the more matured fruit pulled. Mr. Curtin was marketing most varieties from fourteen to twenty days, covering from five to seven sales, and rarely had to reject a fruit that was too ripe for market, although he allowed all the fruit to mature and develop high colour before picking. Over 90 per cent. of the crop was marketed in Napier, and throughout the season maintained the top price in the market. The same buyers always purchased the fruit, and it is natural to assume that they could not continually pay the top price for it if they lost any or had any trouble with brown-rot. As a matter of fact, some of the buyers informed me that not only was the quality good, but they could also depend on the fruit not developing brown-rot.

It is interesting to note the factors that led up to the special demand for the fruit from this orchard. There is no doubt that thinning played a prominent part; it was well done, and the fruit developed good size. Secondly, the fruit was allowed to mature and colour well before being pulled, but it was always picked while still firm enough to carry to market.

MR. FRENCH'S ORCHARD.

Mr. French's orchard promised an excellent crop all round. Pruning, ploughing, and spraying in pink with bordeaux, 8-6-40, and at fruit-set period with lime-sulphur, 1-120, was done in a similar manner to that indicated with Mr. Curtin's orchard. Just when the fruit was well set and forward this locality was hit by a late frost, and Mr. French was one of the unlucky ones, as it left him with a very light crop. What fruit escaped was on the tops of the trees; only an odd fruit here and there could be reached from the ground.

As the crop was so light no great attention was paid to thinning. Spraying was persevered with except on two or three varieties that had no crop at all. The orchard was sprayed from the fruit-set period at intervals of about four weeks with lime-sulphur, 1-100, Victor Leggo's Giraffe brand being used. The last spraying was given a few days before the fruit was picked. The summer spraying did no harm to foliage. Practically no fruit was lost from brown-rot. Two lines were traced to the markets and later to the retailer. Although each line was perfectly sound when marketed, a little brown-rot developed while it was in the hands of the retailer during the process of ripening.

Unlike Mr. Curtin's fruit, that from this orchard was pulled before it had attained the same maturity, and was picked direct into second-hand cases and subsequently passed over a grading-machine before being packed into new cases. Unfortunately, owing to the light crop it was not possible to investigate further this aspect of infection after the fruit was pulled. Whether it was the stage of maturity at which the fruit was pulled, thereby taking longer to ripen, or picking into second-hand cases, or whether the fruit picked up the spores in the auction-rooms or subsequently, it is difficult to say.

However, comparing the results here and in Mr. Curtin's orchard, the indication is that all possible avenues of infection should be eliminated after the fruit is pulled. The results suggest that the more mature a fruit is when picked (provided it is firm enough to carry to market in good condition) the less the risk there is of losing it from brown-rot. Mr. Curtin's fruit was usually picked and packed one day, carted to the market (some ten miles) the next day, and was ripe enough for the retailer to dispose of in five or six days.

MR. JOHNSON'S ORCHARD.

The third orchard was used to test self-boiled lime-sulphur in the proportion of 8 lb. lime and 8 lb. sulphur to 50 gallons water. One half of the orchard was sprayed with this and the other half with ordinary lime-sulphur solution, 1 part to 120 parts water. The orchard was pruned similarly to the other two, and the whole was ploughed in the spring just before bud-movement. The strips left by the plough along the rows were also turned over by the spade before any spraying was done.

The trees were sprayed with bordeaux, 8-6-40, in the pink. Three subsequent sprayings were given, the first when the fruit had set, the second about four weeks later, and the other about four weeks before harvesting.

Although the first spray of self-boiled lime-sulphur appeared to injure the young leaves it did not affect the crop, as the trees very quickly recovered from the check. Sherwin Williams lime-sulphur was used at this stage on the other half of the same varieties with good results.

The second spraying of both self-boiled lime-sulphur and ordinary lime-sulphur solution had a very considerable burning effect on foliage, so much so that it caused about half the foliage to fall. As a result of the sudden loss of leaf-surface half the crop fell. This was the most disappointing feature of the whole experiments. As far as self-boiled lime-sulphur is concerned one would not be surprised, as this is a new spray in New Zealand and was undergoing trial in the district for the first time. It is possible that the local lime, which is not up to the standard procurable in some other districts, is not suitable for this mixture. On the other hand, no good lime-sulphur solution at a strength of 1-120 should do the damage that was done in this orchard. No Sherwin Williams solution was available for the second spraying, and a brand known as "Cooper's" was used. It is quite evident that this brand, while it may be safe on other fruits, is most unsuitable for peaches. Contrast this damage at 1-120 with the good and safe results in Mr. French's orchard with Giraffe brand at 1-100.]

Although half the crop was lost the original spraying programme was carried out. The third spraying of self-boiled lime-sulphur was not nearly so drastic on the foliage—in fact, it could be said that the little burning it did would cause little or no harm. A different brand of lime-sulphur solution was used for the third spraying with good results and no damage to foliage.

So far as brown-rot infection is concerned there was less in this orchard than in either of the other two. In fact, the manager informed me that he found altogether less than two dozen infected fruits. A couple of consignments were examined in the Wellington markets and opened up in good order. Unfortunately, the fruit was then lost sight of, and it was not again examined when it became ripe and fit for consumption.

THE HENDERSON TESTS.

Mr. J. W. Collard, Orchard Instructor, Auckland, supplies the following report on the work carried out at Henderson:—

The Henderson Fruitgrowers' Association, having expressed its willingness to again co-operate with the Department on similar lines to those followed the previous season, and several of the members having again placed their peach-orchards at the disposal of the Department for this purpose, it was decided to continue the tests on the same orchard blocks (with additional areas in each case) in which the operations were carried out last season—namely, those of Mr. F. G. Platt, Mr. Thomas Colebrook, and Dr. Makgill (an extra block being secured in this orchard). The tests were divided into four groups, and were carried out in separate orchards.

THE MAIN EXPERIMENTS.

As was the case last season, the blocks selected for the carrying-out of the tests were such that as many varieties as possible could be brought under the same test in one block, having regard for the condition of the trees and general suitability. The conducting of these experiments on the same trees as in the previous season, although on extended areas, in itself constituted an additional test. In orchard No. 1 the sprayings were so arranged that rows of trees receiving summer application crossed those which were dressed with copper sulphate (1-20) in May, thus providing further tests.

The work in all the orchards was duly carried out according to the plan laid down, with the exception of some slight delay in the application of the fruit-set sprays on two of the blocks, owing to the prevailing influenza epidemic. This, however, cannot be considered as having made any material difference to the results obtained.

The sprays used in autumn and early spring were copper sulphate, 1-20, and bordeaux, 8-6-40, respectively; and in summer bordeaux, 2-3-40 and 3-4-40, commercial lime-sulphur, 1-125 and 1-120, and self-boiled lime-sulphur, 8-8-50. Atomic sulphur was not used, this spray having been substituted by self-boiled lime-sulphur, which had not hitherto been employed to any extent in the Auckland District, and consequently the results from its use have been eagerly watched by orchardists.

In addition to the sprays, soil-dressings were applied in the form of sulphate of iron, both in solution and pulverized form.

The main objects of the tests were as follows:—

With spring and summer cultivation: (1) To test autumn sprayings in conjunction with spring and summer sprays; (2) to test spring sprays in conjunction with summer sprays; (3) to test soil-treatment with sulphate-of-iron solution and powder.

With autumn cultivation followed by cover-crop throughout spring and summer: (1) To test spring sprays in conjunction with summer sprays; (2) to test autumn sprays in conjunction with spring and summer sprays.

The summer treatment in the several blocks was as follows:—

No. 1 orchard was reserved entirely for testing sulphur compounds—*i.e.*, commercial and self-boiled lime-sulphur.

No. 2 orchard for bordeaux followed by commercial lime-sulphur, and bordeaux followed by self-boiled lime-sulphur.

No. 3 orchard for bordeaux followed by commercial lime-sulphur, and for commercial lime-sulphur only.

No. 4 orchard was reserved entirely for testing self-boiled lime-sulphur only.

No cross-ploughing was carried out, all strips between the rows being dug.

The results obtained this season may be considered a distinct improvement on those achieved last season, but against this must be taken into consideration the fact that conditions were less favourable for the development and spread of the disease. As far as weather conditions were concerned, the experience of growers in the Auckland District during the season just past was quite the reverse of that of the previous season, fair weather having prevailed almost throughout the stone-fruit season. In a degree this is to be regretted, as the value of our tests is accordingly decreased.

At the conclusion of this year's tests I am in a position to endorse several statements made in last season's report—namely, that the intensity of attacks from brown-rot on stone-fruits is due firstly to existing weather conditions, secondly to soil and situation (especially with regard to shelter), and thirdly to variety.

Generally speaking, there was no blossom-bud infection from the disease this season, and practically throughout the district the disease was at a minimum while weather conditions remained favourable, but immediately northerly weather set in, bringing with it humid conditions favourable for spore-development, infection became very heavy on several of the more susceptible varieties which were near the ripening-stage at that time. Throughout the peach season, however, there were only two such spells of unfavourable weather, each of short duration.

My theory put forward in last report, that the probability of infection increases as the fruit approaches the ripening-stage, has been amply endorsed during these tests.

Close observation was made in stone-fruit orchards from time to time throughout the season, and much evidence (a good deal being

of a contradictory nature) was obtained. One thing stands out very clearly in all cases that have come under my notice, and that is that the man who has taken sufficient precautions during previous seasons to destroy infected fruits and mummies, and to burn his peach-prunings, has less trouble from brown-rot.

DATA AND PROVISIONAL CONCLUSIONS.

As a result of the season's treatment on the areas under test the following data and provisional conclusions have been arrived at:—

(1.) Bordeaux, 3-4-40, caused slight scorch in all cases when applied at "three-quarter petals fallen" period. On the following varieties no damage of any consequence was done: Paragon, Elberta, Lippiatt's Late Red, and Carmen.

(2.) Bordeaux, 2-3-40, caused slight scorch to Triumph when applied at "three-quarter petals fallen" period.

(3.) Commercial lime-sulphur, 1-120, caused slight scorching on Lippiatt's Late Red in orchard No. 2, at "fruit-set."

(4.) Self-boiled lime-sulphur, 8-8-50, when only slightly overboiled caused scorching on Osprey at "three-quarter petals fallen." This, however, caused no material damage, as the blossom-shucks prevented injury to the fruit.

(5.) Self-boiled lime-sulphur, 8-8-50, has so far proved the safest summer spray for stone-fruits, provided caution is taken in its manufacture.

(6.) Judicious thinning of fruits, and the destruction of infected fruits throughout the season, both in the orchard and in the packing-sheds, tends to minimize the possibility of infection.

(7.) The leaving in the orchard of mummified fruits and the stacking-away in shelter-belts of winter prunings is the surest method of inviting further trouble from this disease.

(8.) Brown-rot disease is epidemic, and it is therefore incumbent to be prepared for an outbreak—not wait until the trouble appears and then adopt combative measures.

(9.) The percentage of rot on Paragons in No. 1 orchard which were injured last year by spray, and which therefore carried less foliage this season, was much less than on those uninjured.

(10.) Acetate of copper as a summer spray stripped the foliage entirely.

(11.) There was no noticeable difference in trees treated with sulphate of iron.

COVER-CROPS.

In orchard No. 3 and part of No. 2 cover-crops of *Lotus angustissimus* were grown as a deterrent to the spread of spores. Although no actual difference in the amount of infection was noticeable on portions so treated as compared with those untreated, the value of such crops for the purpose for which they were intended is questionable. In fact, I am inclined to the opinion that their capacity for holding moisture and thereby increasing humidity has the effect rather of assisting than of checking the development of the trouble.

BROWN-ROT CONTROL EXPERIMENTS AT HENDERSON.

Winter.				Summer.				Result.		
Spray.	Formula.	Applied.	Spray.	Formula.	Applied.	Number of Cases.	Number of Fruits produced.	Number of Fruits affected.	Percentage.	
ORCHARD No. 1.—MR. F. G. PLATT.										
1. Copper sulphate	..	May	Commercial lime-sulphur	I-125	$\frac{3}{4}$ petals fall	256	20,480	640	3 $\frac{1}{2}$	
Bordeaux	Colour-bud ..	"	"	Fruit-set					
2. Bordeaux	Colour-bud ..	Commercial lime-sulphur	I-125	$\frac{3}{4}$ petals later	193	15,440	1,047	6 $\frac{3}{4}$	
3. Copper sulphate	..	May	"	"	Fruit-set					
Bordeaux	Colour-bud ..	Commercial lime-sulphur	I-125	$\frac{3}{4}$ petals fall	279	22,320	446	2	
4. Bordeaux	Colour-bud ..	"	"	Fruit-set					
5. Copper sulphate	..	May	Commercial lime-sulphur	I-125	Early ripen	279	22,316	441	2	
Bordeaux	Colour-bud ..	"	"	Fruit-set					
6. Bordeaux	Colour-bud ..	Commercial lime-sulphur	I-125	$\frac{3}{4}$ petals fall	279	22,316	441	2	
7. Copper sulphate	..	May	"	"	Early ripen					
Bordeaux	Colour-bud ..	Commercial lime-sulphur	I-125	$\frac{3}{4}$ petals later	279	22,316	441	2	
8. Bordeaux	Colour-bud ..	"	"	Fruit-set					

ORCHARD No. 2.—MR. J. COLEBROOK.

e. Bordeaux ..	8-6-40	Colour-bud ..	Commercial lime-sulphur ..	3-4-40	½ petals fall	537	43,160	421	½
			" ..	1-120	Fruit-set				
			" ..	" "	Four weeks later				
			" ..	" "	When fruit begins to ripen				
f. Bordeaux ..	8-6-40	Colour-bud ..	Bordeaux ..	3-4-40	½ petals fall	240	19,200	338	1½
			Self-boiled lime-sulphur ..	8-8-50	Fruit-set				
			" ..	" "	Four weeks later				
			" ..	" "	Fruit begins to ripen				

ORCHARD No. 3.—DR. MAKGILL.

c. Copper sulphate	1-20	May	Bordeaux ..	2-3-40	½ petals fall	70½	5,640	783	13½
Bordeaux ..	8-6-40	Colour-bud ..	Commercial lime-sulphur ..	1-120	Fruit-set	63	5,040	862	17
d. Bordeaux ..	8-6-40	Colour-bud ..	Commercial lime-sulphur ..	1-120	Fruit set	9½	725	66	9

ORCHARD No. 4.—DR. MAKGILL.

a. Copper-sulphate solution	1-20	May	Self-boiled lime-sulphur ..	8-8-50	½ petals fall	213	17,040	2,688	15½
Bordeaux ..	8-6-40	Colour-bud ..	" ..	" "	Four weeks later				
b. Bordeaux ..	8-6-40	Colour-bud ..	Self-boiled lime-sulphur ..	8-8-50	Fruit-set	85	6,800	266	3½
			" ..	" "	About four weeks later	88	7,040	81	1½

SEPARATE SERIES FOR HENDERSON FRUITGROWERS' ASSOCIATION ON ORCHARD OF DR. MAKGILL.

G. Bordeaux ..	8-6-40	Colour-bud ..	Bordeaux ..	3-4-40	½ petals fall	21	1,680	54	3
			With lysol ..	2 pints	Fruit-set				
			Water ..	40 gals.					
			Lysol ..	2 pints					
			Water ..	40 gals.					
H. Bordeaux ..	8-6-40	Colour-bud ..	Bordeaux ..	3-4-40	½ petals fall	13	1,040	49	4½
			With lysol ..	1 pint					
			Water ..	40 gals.					
I. Bordeaux ..	8-6-40	Colour-bud ..	Bordeaux ..	3-4-40	½ petals fall	17	1,360	51	3½
			Acetate of copper ..	6 oz.	{When colour shows on fruit				
			Water ..	50 gals.					

SEPARATE SERIES OF TESTS.

Members of the Henderson Fruitgrowers' Association who were not on the advisory committee suggested that certain trials be carried out under the co-operative scheme. It was found necessary to make a separate test, and for this purpose a row of twenty-four trees of Paragon peach was obtained in the orchard of Dr. Makgill. Following is a plan of the work carried out:—

Winter treatment: Destroy old leaves and fruit; prune trees; plough land in August; and give ordinary cultivation.

Spring and summer treatment: Divide the trees into three sections—G, H, and I—each to comprise eight trees, and spray as follows:—

G. Lysol sprays: Spray with 8-6-40 bordeaux at colour-bud, followed by 3-4-40. Bordeaux with lysol, 2 pints to 40 gallons, when three-quarter petals have fallen, and again when fruit has set, using lysol only, 2 to 40.

H. Spray with bordeaux, 8-6-40, at colour-bud, followed by bordeaux, 3-4-40, with 1 pint lysol to 40 gallons of water when three-quarter petals have fallen.

I. Acetate-of-copper sprays: Spray with bordeaux, 8-6-40, at colour-bud, followed by bordeaux, 3-4-40, when three-quarter petals have fallen, and again followed by 6 oz. acetate of copper to 50 gallons of water when colour shows on the fruit.

There was no appreciable difference between these trees and those untreated alongside.

ENSILAGE IN SOUTHLAND.

DEMONSTRATION AT GORE EXPERIMENTAL AREA.

By W. J. McCULLOCH, Fields Instructor, Invercargill.

ENSILAGE-MAKING has been so far very little practised in Southland—in fact, ensilage might almost be termed an unknown quantity in most parts of the district. It is hoped, however, that in future more interest will be manifested in this very useful form of preserving our surplus summer growth to assist in tiding over that period between the last of the turnip crop and first spring growth, which is so keenly felt in the South.

During the past season a few progressive farmers made the attempt, and in nearly every case good ensilage has resulted. Most of these ensilage-makers, however, were not without their initial troubles, owing in some cases to inexperience and in others to well-meaning but mistaken attempts to improve on proven methods. A few references to some of these cases may be of use to prospective makers. One farmer, for instance, after considerable labour making an excavation in a terrace, struck a nice spring of water. He laid planks over this and built the material on top, having also a portion of the fodder protruding out

of one end. The result was uneven heating, and anxiety. Such an excavation is quite unnecessary. The same farmer afterwards made a stack in the open with success and a great deal less trouble.

Another settler started to build a stack on good lines, but was worried because the temperature did not immediately rise to the required degree. On visiting the farm I found that the crop of oats and tares, which was very heavy, had not yet matured sufficiently. Strange as it may appear, the general idea seems to be that the material should be very green for ensilage. This is wrong; the cereal should be beginning to turn colour at the ground, with the grain in the dough stage. If one is forced to cut too early, the crop should be left lying to wilt for a day or so before stacking, and even then the farmer should not get impatient if the temperature does not rise quickly. Simply go ahead with other work on the farm—for a week if necessary—waiting until the temperature is right before adding more material. It will always rise if given sufficient time.

In another case I found a very nicely built stack sinking unevenly, the cause being unknown to the builder. It was evidently the result of a heavy gale of wind a few days previously, which had driven all the heat to one side of the stack. The remedy in this case was to hang a stack-cover on the windy side and so prevent the wind from driving the heat through.

Yet another farmer had built a rough structure of heavy planks in the form of a square, with spaces the width of the planks between each. Into this structure the material, which had been bound in sheaves, was tramped endways, sideways, and in all directions. The result was that the outside of the stack did not sink evenly, having got jammed between the planks in the open spaces, and consequently the air gained admission for some distance from the outside. Thus the heart of the stack was splendid ensilage, but probably 2 ft. or 3 ft. of the outside would be wasted.

An important point should be emphasized. Some farmers imagine that ensilage is simply one grade of fodder. This is not so. Ensilage is simply a fodder preserved in nearly its original state. Thus, if Canadian thistles and Yorkshire fog are made into ensilage one can only expect to take out a food of similar feeding-value plus the advantage of the fermentation which has taken place and which makes any fodder more digestible. To make the best ensilage one must use the best material, and as economy in handling is a very important factor the farmer should endeavour to do so in a wholesale manner by the use of the proper devices, which can, if necessary, be home-made and cost very little.

THE GORE DEMONSTRATION.

During the past season a useful demonstration of ensilage-making on approved lines, with specially grown crops, was carried out by the Department at the Gore Experimental Area. In order to have sufficient bulk of material to make a stack four sections of land on the area were selected, aggregating some 8 acres. These sections were sown in different mixtures for the purpose of obtaining information as to the yield in the district of certain crops acknowledged as suitable for ensilage generally. All the mixtures were sown on 1st October, 1918,



MAKING ENSILAGE AT THE GORE EXPERIMENTAL AREA.

Stack in process of building at corner of field in background. Reaper-and-binder at work on crops.

with superphosphate at the rate of 2 cwt. per acre in each case. The cutting of the crops took place between 14th and 19th February, 1919. The following were the mixtures and results:—

Section 1.—*Huguenot wheat and golden tares*, sown at the rate of 2 bushels of wheat and 1 bushel of tares per acre, gave a yield of 7.91 tons per acre. It should be stated that the wheat after brairding was for some time easily the best crop of any, but eventually fell behind the others badly, with the result that the tares took possession and were a splendid crop to the detriment of the wheat. This may be attributed to the fact of wheat generally slowing up during the tillering-stage, together with the backwardness of the past season at that period and the more hardy nature of the tares to withstand such conditions. I am of opinion that even in ordinary seasons in the South such a mixture is not too well balanced, and that the wheat should be more heavily seeded and the tares decreased. A very important fact demonstrated is that this crop should be sown a month or six weeks earlier, but in the present case unforeseen circumstances prevented the work being carried out.

Section 2.—*Cape barley and golden tares*, sown at the rate of 1½ bushels of barley and 2 bushels of tares, gave an average yield of 7.15 tons per acre. This crop came along very well, and matured fully three weeks ahead of any of the others. The balance of barley and tares may be considered just right for the proper growth of each.

Section 3.—*Ryecorn and golden tares*, sown at the rate of 1½ bushels of ryecorn and 1 bushel of tares, averaged a yield of 8.63 tons per acre. The balance in this case might be improved, as the ryecorn certainly had a smothering effect on the tares, and I would suggest slightly less cereal with the same amount of tares. In other words, the ryecorn, although very good, might have been sown thinner to the advantage of the tares. This crop matured earlier than the wheat, but not so early as the barley.

Section 4.—*Garton oats and golden tares*, sown at the rate of 2 bushels of oats and 1 bushel of tares, yielded some 12 tons per acre. This was a very heavy crop, and the balance of tares would be considered about right, but the oats matured later than the ryecorn in section 3. Although the result of the oats-and-tares mixture demonstrated it to be much the heavier crop to grow for ensilage in the South, still the fact should not be ignored that owing to the more hollow straw of oats ensilage experts do not prefer it, being more in favour of the firmer-strawed cereals. This does not refer to feeding-values, but more especially to the making of ensilage. It is contended that there is less risk of mildew with the more solid-strawed cereals.

The making of the ensilage was carried out under the supervision of Mr. W. Dibble, Assistant Agriculturist. The stack was built on a base of 23 ft. by 18 ft., this being rather larger than usual owing to no hoist being available. The estimated weight of the material ensiled was 50 tons. During the operations Mr. Dibble gave an address on ensilage-making generally to an appreciative gathering of farmers, also boys of the Gore High School.

RURAL INCOME-TAX.

SPECIMEN RETURN FOR DAIRY-FARMERS.

By A. D. PARK, A.I.A.N.Z., Accountant to the Department.

SECTION 85 of the Land and Income Tax Act, 1916, sets out the items deemed to be comprised in the term "assessable income," and, *inter alia*, includes, under subsection (d), "All profits or gains derived from the use or occupation of land, or the extraction, removal, or sale of minerals, timber, or flax, whether by the owner of the land or by any other person." This clause brings into consideration as assessable the income derived from land by a farmer. It is not necessary for the person deriving the income to own the land, neither is it necessary for the products of the land to be sold for assessable income to be charged.

Subsection (c) includes, "All profits or gains derived from the sale or disposition of land or any interest therein, if the business of the taxpayer comprises dealing in such property, or if the property was acquired for the purpose of selling or otherwise disposing of it at a profit." This clause is intended to cover the buying, selling, or exchanging of freehold or leasehold interest in land by means of which profit is made. It would not be applicable to the ordinary *bona fide* farmer who disposes of land at a profit in an isolated transaction, but should it turn out that the land in question, even if farmed, was originally bought by the farmer as a speculation, then the profit made on the sale would be assessable.

RETURNS OF INCOME.

Returns of income are required to be furnished annually on or before 1st June by all persons in business and by all farmers, irrespective of the amount of income derived by them, and by all other persons whose income exceeds the sum of £250. Returns should be made up to 31st March, but taxpayers may with the approval of the Commissioner of Taxes compile their return to a date other than 31st March if found to be more suitable. In such cases the return should be furnished as early as possible after the date the taxpayer closes his books for balancing purposes.

The return should show the exact income and expenditure for the year under the various headings set out in the form, and the numbers and values of live-stock on hand at the beginning and the end of the year; also farm-produce (if any). In furnishing a return for any year the values entered for live-stock and produce at the commencement of the year must in all cases agree with the values entered in the previous year's return prepared at the expiry of that year. It is advisable for farmers to adopt a reasonable standard value for their live-stock and adhere to that value in rendering returns for income-tax. Unless this is done it is quite possible that a taxpayer may be levied with tax on income which is not realized.

If no return of income is furnished by a taxpayer, or if an *estimated* or *incomplete* return is furnished, an assessment is made by the Tax Department on an amount which is considered by it fair and reasonable. The Act provides that a notice of assessment must be sent to all taxpayers, so that a taxpayer who is thus assessed in default of a return, or on account of an unsatisfactory return, is given the opportunity if he is dissatisfied with the assessment of furnishing a proper return and having, if his case warrants it, a correct assessment made. Taxpayers should be particularly careful to lodge an objection to an incorrect assessment before the date specified on the notice. Failure to do this renders the taxpayer liable to the amount of tax assessed, as the Commissioner has the power to refuse to reconsider any assessment unless objection is made at the proper time.

The exemptions allowable from the assessable income in the *ordinary* assessment are as follows:—

(1.) Ordinary exemption of £300, which is allowed where the assessable income is £600 and under. Where the assessable income exceeds £600 the exemption diminishes by £1 for each £1 of the excess over £600. So that on assessable incomes of £900 and over no exemption under this heading is allowed.

(2.) Life insurance: This exemption is limited to £50, and must be on the taxpayer's own life. Insurance premiums paid on children's lives are not allowable.

(3.) Superannuation-fund payments, limited to £100.

(4.) Exemption for children: £25 is allowed for each child under the age of sixteen on 31st March in the year for which the return of income is made, and is all irrespective of the amount of income derived.

(5.) An exemption of 5 per cent. on the unimproved value of all land owned by the taxpayer and used in the production of his assessable income.

The exemptions allowable in the ordinary assessment are not allowable in the war-tax assessment. The law provides that the excess of the assessable income over £300 shall be chargeable with tax in that assessment.

The rate of income-tax chargeable in both ordinary and war-tax assessments is 6d. in the £1 on taxable amounts of £400 and under. On amounts in excess of £400 the rate increases by $\frac{1}{200}$ d. for each £1 of the taxable amount in excess of £400. The maximum rate is 3s. in the £1, which is reached on a taxable amount of £6,400. To the tax calculated in the war-tax assessment at the rate chargeable is added a super tax of 50 per cent. The maximum rate of income-tax is therefore 7s. 6d. in the £1 (3s. in ordinary assessment plus 4s. 6d. in the £1 in war-tax assessment).

The rates of taxation given are those chargeable in assessments made on income derived during the year ended 31st March, 1918, and on land owned at that date. The rates chargeable in assessment to be made for the current year will not be known until this year's Taxing Act is passed in Parliament.

In the case of partnerships a joint return should be made showing the net income derived and the shares of the partners therein. Individual returns need not be made by the partners unless they derive income in addition to that derived from the partnership.

SPECIMEN RETURN FOR DAIRY-FARMERS.

With the foregoing preliminary remarks I propose to take a case representative of one branch of farming and illustrate how the income-tax form required should be filled in, as follows:—

John Robinson, of Levin, is a dairy-farmer and owns 100 acres of freehold land the capital value of which is £6,000, made up of unimproved £4,000, and improvements £2,000. These figures are assumed to be according to the county valuation roll. On the farm there is a mortgage of £3,000 at 5½ per cent. interest.

During the year ended 30th June, 1918, he has sold—

	£	s.	d.
Dairy-produce for	962	0	0
40 cattle for	140	10	0
Horse for	10	0	0
Pigs for	60	0	0
Hides and skins for	5	0	0
Roots for	20	0	0

The value of meat and other produce consumed for private and domestic purposes during the year was £50.

Live-stock and produce on hand at the end of the year (30th June, 1918) was—

	£	s.	d.
74 cattle at £8	592	0	0
5 horses at £15	75	0	0
Pigs	20	0	0
Chaff	60	0	0

Live-stock and produce on hand at the beginning of the year (1st July, 1917) was—

	£	s.	d.
75 cattle at £8	600	0	0
5 horses at £15	75	0	0
Pigs	20	0	0
Chaff	42	0	0

Purchases of live-stock for the year were—

Cattle, 1 at	40	0	0
Horse, 1 at	30	0	0
Boar, 1 at	5	0	0

Other expenses during the year were—

Local rates	60	0	0
Insurance	10	0	0
Interest on mortgage	165	0	0
Seeds bought	10	0	0
Foodstuffs bought for stock	15	0	0
Wages paid for labour	150	0	0
Rations bought for employees	50	0	0
Repairs and maintenance, and depreciation on buildings	65	0	0
Freight and cartage	5	0	0
Manures, sacks, cases, &c.	37	0	0
Chaff-cutting	5	0	0
Petty expenses	10	10	0

These details are now entered on the tax-return form as shown in the accompanying facsimile.

Part A.

CLAIMS FOR SPECIAL EXEMPTIONS.

NOTE.—In the case of partnerships, the particulars in respect of each partner should be separately shown.

1. Amount actually paid by me during the year as life insurance premiums on **my own life**, for my own benefit or for the benefit of my wife and children £. 30
- NOTE.—This deduction is limited to £50, but in all cases the exact figures should be stated.
2. Amount claimed in respect of payments to National Provident Fund, Superannuation Fund, or Insurance Fund of Friendly Society £. —
- (Specify name of Fund here).....
3. Amount claimed in respect of my own children under the age of sixteen years dependent on me, particulars of whom are given hereunder £. 75
(£25 for each child)

Name of Child.	Place of Birth.	Date of Birth.
<i>George Robinson</i>	<i>Leam</i>	<i>30th Dec. 1904.</i>
<i>Mary Eileen Robinson</i>	"	<i>3rd. March 1907.</i>
<i>Harold Williams Robinson</i>	"	<i>6th June 1909.</i>

4. Five per cent. on the unimproved value of my interest, as shown on District Valuation Roll, in the land used in the production of the income shown in this return—namely:—

No. on District Valuation Roll.	District, County, Borough, or Town District in which Land situated.	No. of Section, Block, Survey District, Street, or other Reference to Locality.	Area.			Purpose for which Land used.	Number of Months for which used.	Unimproved Value (as shown on District Valuation Roll).
			A.	B.	P.			
<i>12</i>	<i>Horowhenua</i>	<i>Section 61 Block II Waiohau S.D.</i>	<i>100</i>	<i>-</i>	<i>-</i>	<i>Dairying</i>	<i>12</i>	<i>4000</i>

CLAIM FOR DEPRECIATION OF PREMISES.

Amount actually written off the Buildings Account during the year in respect of depreciation of premises used in the production of the income shown in this return, particulars of which are given hereunder — £ 27

Where situated.	Nature of Premises.	Purpose for which used.	Materials of which built.	Number of Months during the above Year for which the Premises were used.	Cost of Premises to me.*
<i>Section 61</i>	<i>House</i>	<i>Dwelling</i>	<i>Wood & iron</i>	<i>12</i>	<i>850</i>
<i>Block II</i>	<i>Stables</i>	<i>Live stock</i>	<i>do.</i>	<i>do.</i>	<i>250</i>
<i>Waiohau S.D.</i>	<i>Milking shed</i>	<i>Dairying</i>	<i>do.</i>	<i>do.</i>	<i>150</i>

* The cost of the land on which the buildings, &c., stand should not be included.

Part B.

Statement of Receipts and Expenditure in respect of Properties let during the Year ended on 31st March, 1919.

Receipts.	£	Expenditure.	£
Rental received from houses		Rates	
" farming property let to (State names and addresses of tenants)		Ground rent paid in respect of lease	
.....		Insurance	
.....		Repairs and maintenance	
.....		Expenses of collection	
Rental received from business premises		Mortgage interest: (State names and addresses of mortgagees)	
" other sources ... ..		.....
(Specify).....		Other interest: (State names and addresses of persons to whom money is owing)	
.....		
.....		Net income from properties	
TOTAL	£	TOTAL	£

It is presumed that Robinson took advantage of the provisions in the Act and secured the Commissioner's consent to his closing his books on 30th June, on the grounds that the latter was a more convenient date for his farming operations.

It should be understood that in the deductible expenses for labour may be included wages paid by the farmer to members of his own family, except, of course, his wife. Such payments, however, require to be supported by documentary evidence if asked for by the Tax Department.

In connection with the claim for depreciation of premises it may be explained that "written off" means actually written off in pursuance of a proper system of accounting. In the case of a dwelling depreciation is allowed on one-third of the cost, the other two-thirds being regarded as used for private purposes.

The taxpayer should for his own information keep a copy of the return he submits to the Commissioner of Taxes, in order that he may be able to check the assessment of tax when made.

From the return it will be seen that John Robinson's net assessable income is £600, and his assessment under present rates is arrived at as follows:—

			<i>Ordinary Tax.</i>		
			£	s.	d.
Assessable income	600	0 0
Less ordinary exemption	300	0 0
				<hr/>	
Less children's allowance	£300	0 0
				<hr/>	
				75	0 0
				<hr/>	
Less life-insurance premiums	£225	0 0
				<hr/>	
				30	0 0
				<hr/>	
Less 5 per cent. on unimproved value of land (£4,000)	£195	0 0
				<hr/>	
				£200	0 0
				<hr/>	
				<hr/>	

There is thus no balance available for the ordinary tax.

			<i>War-tax and Super Tax.</i>		
			£	s.	d.
Assessable income	600	0 0
Less exemption	300	0 0
				<hr/>	
				£300	0 0
				<hr/>	
War-tax at 6d. in £1	7	10 0
Super tax (50 per cent.)	3	15 0
				<hr/>	
				<hr/>	
				£11	5 0
				<hr/>	

The total income-tax payable is therefore £11 5s.

NOTE.—The writer's acknowledgments are due to Mr. W. M. Singleton, Assistant Director of the Dairy Division, for his assistance in assuming figures as to dairying operations on as near a practical basis as possible. Other branches of farming may be dealt with later.

THE PIG SHORTAGE.

AN INQUIRY AND ADVICE FOR FARMERS.

By the Live-stock Division.

A SHORTAGE of pigs having been apparent in the Dominion for some time past special attention has been given to the matter by the Department. With a view to obtaining all information possible, Inspectors of Stock throughout the Dominion were recently circularized and asked to report as to whether they were of opinion that farmers in their districts were keeping pigs in less number than during the preceding year, and, if so, what they considered to be the reason for this. The replies received and published below are self-explanatory. In view of the trend of the dairy industry in the direction of utilizing dairy-factory by-products for commercial purposes, thus rendering them unavailable for pig-feeding, steps are being taken to furnish farmers with direct information and general advice regarding pig-rearing and pig-feeding under the changing conditions now existing and likely to continue. Demonstrations on the lines of farmers themselves producing on their own farms suitable and payable food for pigs are also being arranged. The Inspectors' replies from the various districts are as follows:—

Hawera.—A less number of pigs are being kept this year than last year, the reason given being that last season calves were fetching a good price, and in consequence farmers disposed of their breeding-sows. Another reason given for people not keeping pigs is on account of the cheesemaking, as when the whey is separated the feeding-value of the residue is very slight, and consequently food has to be purchased. It is certain that a farmer cannot rear pigs and calves in large numbers at the same time, and it is a question which will give the best returns; but it is anticipated that there will be a big demand for pigs next season.

Amberley.—A less number of pigs is being kept, the reason given being shortage and high cost of pig-feed, high cost of weaners, and the rearing of calves.

Timaru.—Pigs are more plentiful than they were last year. Pigs are not kept to any great extent in this district, and then only by the small farmer.

Balclutha.—A less number is being kept, the reason given being more interest taken in calf-rearing and scarcity of pig-food. Another reason given is that the whey at the cheese-factories is being put through the separator, thus reducing its value as a pig-food.

Hamilton.—There has been a big reduction in the number of pigs owing to high prices being obtained for calves. This year calves are abnormally low in price, and bacon-pigs are selling at a good price, and as a result pig-breeding will again become popular.

Auckland.—A gradual reduction in number kept, owing to high prices being obtained for calves and to the scarcity and high price of pig-feed. As the price for the latter has now dropped more pigs will be kept this year. Another reason given for the decrease in pigs is the manufacture of casein and dried milk, thus shortening the supply of skim-milk and whey.

Woodville.—The number of pigs kept has been reduced by 50 per cent. during past two years. This has been brought about owing to the high prices being obtained for calves and to the increased cost of pig-feed; but if the present price for bacon-pigs continues farmers will devote more time to this industry.

Hastings.—Fewer pigs being kept than last year, owing to increased cost of food and to good prices being obtained for calves.

Paeroa.—Less number of pigs being kept than last year, due to good market prices for calves. As prices for latter are now on the downward grade the farmers have decided to go in more for pigs. This season the supply of weaner pigs was not equal to the demand.

Feilding.—Farmers are not keeping the usual number of pigs, owing to beef and mutton being more profitable and to the fact that a much larger quantity of milk is being manufactured into casein and dried milk.

Wanganui.—Pig-breeding is on the increase owing to the high prices ruling for weaners. The general condition of the pig industry is very poor, as the farmer makes no provision for winter feed, but depends entirely on milk. The housing provided is also very poor.

Wairoa, H.B.—Pig-breeding is not carried out to any great extent, as farmers find it pays better to rear calves. Another factor against pig-breeding is that there is no bacon-factory in this district, and the district is more suitable for cattle and sheep.

Gore.—A less number of pigs is being kept, owing to the manufacture of sugar of milk and whey-butter, thus cutting off the main supply of pig-feed. Another reason is the high cost of suitable feed for pigs.

Oamaru.—Less number of pigs being kept, owing to high prices prevailing for calves.

Tauranga.—No alteration in number kept. Very little pig-breeding is done on account of difficulty in getting the pigs to a market and to the absence of a factory in the district. If the price of calves continues to fall and buyers continue to take delivery of pigs at specially appointed depots the industry will receive more attention.

Gisborne.—Less number of pigs being kept, owing to high price of calves. The shortage of young pigs is now realized, and farmers are endeavouring to improve the position by breeding.

Dunedin.—Less number of pigs being kept, owing to cost of feed. Farmers consider it more profitable to give the milk to calves than to buy feed to supplement the milk to feed pigs.

Ohaeawai.—No reduction noticeable. While prices for calves keep up farmers will not bother with pigs. Other reasons against pig-rearing are want of railway facilities and the absence of a factory in this district.

Christchurch.—A less number is being kept. The reduction is due to high prices for feed, difficulty in securing labour, and good prices being obtained for wool, lamb, and mutton.

Te Kuiti.—Less number of pigs kept, due to good prices obtained for calves. The price of the latter has now dropped, and in consequence the farmers have decided to go in for pigs.

Opunake.—Not the same number kept as last year. This has been due to the high prices being obtained for calves, and to the inclement weather during spring causing the death of a number of young pigs.

Opotiki.—Slight decrease in number kept, due to high prices being obtained for calves, and scarcity of labour. As the price of calves is now falling and labour becoming more plentiful, it is anticipated that the pig industry will receive more attention.

New Plymouth.—Less number being kept, due to the manufacture of cheese and casein, thus lessening the value of the residue of pig-feed. Owing to high prices being obtained for calves last year many farmers disposed of their breeding-sows. Now that pigs are scarce and the price of calves has fallen more attention will be paid to the pig industry.

Kaikoura.—No reduction in the number of pigs kept.

Palmerston North.—Pigs are not being kept in the same number. This has been due to the manufacture of casein and cheese.

Blenheim.—Decrease in number kept, on account of the profitable nature of calf-rearing and to the high cost of suitable pig-feeds. It is anticipated that the industry will be gone in for more this year, owing to the fall in the value of calves. If farmers could be assured that pigs could be fed almost exclusively on green stuff the industry would receive more attention.

Whangarei.—Less number being kept, owing to good prices being obtained for calves. As the price of the latter is on the down grade it is anticipated that more attention will now be given to the pig industry.

Stratford.—Less number being kept, owing to the manufacture of casein and cheese, the by-products of these being practically valueless as feed.

Nelson.—Less number being kept. It is anticipated that the number will increase, as calves are not likely to become more valuable than at present. The manufacture of cheese is also against pig-rearing.

Chatham Islands.—Pigs are kept for local consumption only.

Masterton.—Decided decrease in number kept, due to increased cost of suitable feed and to good prices being realized for calves. As the price for these is not keeping up it is expected that more attention will be given to pig-breeding.

Hokitika.—About the same number being kept. The climate in this district is not suitable for pig-breeding, and pig-feed is very dear. The facilities for sending pigs to market are not good, and the local demand is limited.

A CASE OF FAULTY CALF-MANAGEMENT.

A GOOD example of trouble among calves owing to failure to realize and carry out simple factors in good management came under notice last month. A settler in a North Island district wrote for advice regarding mortality among his weaner calves, certain symptoms, such as a dry cough, in the affected animals being described. The calves in general were stated to be in "excellent condition," and running in a hillside paddock with "good feed and good pure water springs." As the trouble appeared to be due to some cause which could be ascertained only on the spot the district Stock Inspector was directed to visit the farm and look into the matter. His report speaks for itself, as follows:—

"The owner is a dairy-farmer who raises thirty or forty calves each year. The calves are raised on whey. At weaning-time he has been in the habit of turning the calves out into the particular 30-acre paddock where the mortality has occurred. Asked why another paddock had not been used, the reply was made that they did not want to spread 'the disease.' The mortality consists of three calves last year and three so far this year. I made a careful examination of the paddock, in which I found about twenty calves running. The land is rough and the pasture coarse and innutritious, consisting mainly of native grasses, utuwai, fern, and cocksfoot. The water-supply, which is not good, consists of two small sluggish streams in the bottom of boggy gullies, whilst the favourite drinking-place appeared to be a shallow pool of still water, in which the calves puddled and dunged. No recent deaths had taken place, so I could make no post-mortem examination. I made a careful inspection, however, of the calves in the paddock, and whilst the majority were in fair order there were three or four looking very dull and listless, with staring coats, pot-bellied, and visible mucous membranes pale. When disturbed each had a frequent short husky cough. I concluded that the condition was due to parasitic bronchitis, and have accordingly advised the owner how to treat the affected animals, and to move the stock to a fresh paddock where there is a pure water-supply and a more nutritious pasture."

SEED - POTATOES.

EXPERIMENT AT WERAROA REGARDING SIZE, ETC.

By W. DIBBLE, Assistant Agriculturist.

THE object of this experiment was to obtain data as to the most profitable and economical size of cut or whole potato for seed purposes, and at the same time to test the best depth at which to plant the seed as a preventive against blight. Particulars of the variations of seed used will be found in the table on next page.

A level piece of land of even quality throughout, with a good average depth of soil, was selected for the experiment. The soil in question is rather heavy alluvial, with a porous subsoil. It had been laid down in grass from 1912 to 1918, and continually used as a night paddock for draught horses. Prior to 1912 it was heavy bush land.

On 1st August, 1918, the land was ploughed with a three-furrow plough drawn by an oil-tractor, at a depth of 6 in., turning a 12 in. furrow. On 30th August the land was disked twice. On 5th September it was again ploughed, a double-furrow plough being used, at a depth of 8 in., turning a 10 in. furrow. The soil was then given a thorough cultivation and brought to a loose and friable condition. A few loose tufts of grass were showing, indicating that not sufficient time had elapsed to permit of them rotting before the second ploughing. On 12th September the land was moulded up in ridges with a double mouldboard plough, at a depth of 8 in.

The potatoes were planted on 13th September. The seed chosen was the Up-to-Date variety, procured from the Ashburton district. To all appearances the tubers were healthy and sound, but on being cut some were found with signs of disease. The manure used was superphosphate, 5 lb. 7 oz. being applied to each drill, equalling 1 cwt. 3 qr. 27 lb. to the acre. The drills were 6 chains 28 ft. in length and 2 ft. 6 in. between rows. The sets were graded and planted as follows: 339 sets in each drill, planted 14½ in. apart, and covered with soil to an average depth of 8 in. The weather conditions at time of planting were perfect, and the land was in good order.

During December, when inspecting the different rows of potatoes, it was specially noticed that there was little difference in the growth of each row. As regards blight, although the haulms seemed badly affected during part of the growing-period, the tubers were comparatively free from disease. In my opinion, the unusual depth at which the potatoes were planted prevented the disease from spreading to the tubers. The crop was sprayed with bordeaux on 6th December.

The potatoes were lifted with a potato digger on 23rd April. The proportion of table and seed sizes yielded were two and one respectively.

The table potatoes throughout were an even and excellent sample. Particulars of seed, yields, &c., are given in the following record:—

Drill.	Particulars of Seed.	Weight of Seed planted.	Equivalent per Acre.	Yield of Drills.			Equivalent Yield per Acre.
				Table.	Small.	Total.	
1	Large tubers, 2 in. and upwards in diameter, uncut	70	Cwt. 25·68	lb. 352	lb. 173	lb. 525	Tons. 9·63
2	Small tubers, 1½ in. in diameter, uncut	23	8·43	285	140	425	7·79
3	Medium tubers, 1½ in. to 2 in. in diameter, uncut	60½	22·19	212	100	312	5·72
4	Large tubers, cut in three (control drill)	23	8·43	300	145	445	8·16
5	Large tubers, cut in halves	31½	11·55	410	200	610	11·19
6	Medium tubers, cut in halves	23½	8·62	327	160	487	8·93
7	Medium tubers, cut in three (control drill)	19	6·97	345	165	510	9·35
8	Small tubers, cut in halves	12½	4·58	352	168	520	9·53

My own experience, extending over a long period when growing potatoes in the Auckland and Waikato districts, is that cut seed planted in well-prepared and drained soil proves the most economical not only in the saving in weight of seed, but also in obtaining better results; and, further, that where facilities will allow in well-prepared land potatoes should be planted deeper than is customary, as a preventive against blight.

Experimental Orchard for Canterbury.—An area comprising 4 acres of orchard and 4 acres of grassland, situated at the corner of Harewood and Isleworth Roads, Papanui, Christchurch, has been leased by the Department from Mr. R. Herdman Smith for the purposes of an experimental orchard, and was taken over on 1st May. A scheme of experiments has been arranged and is being put into operation forthwith. The area will be under the supervision of the District Orchard Instructor, and a working overseer has been appointed.

The Vintage and Table-grape Production.—Owing to unseasonable weather the vintage in all vine-growing parts of the Dominion was fully a month late this season. The make of wine is estimated at 48,000 gallons, or about one-fifth less than that of the previous vintage. The production of table grapes has also been less this season owing to the same causes. The yield from 850 glasshouses is estimated at a total of 457,405 lb.

Elimination of Waste.—As a result of official supervision of the discharge of foodstuffs at docks in the United Kingdom during three months of last year over 1,000 tons of poultry-feed was salvaged from ships by sweeping out the holds, &c. Steps were taken to improve methods of discharge in order to avoid such losses in future.

WORK FOR THE COMING MONTH.

THE ORCHARD.

By the end of May the stone-fruits will have dropped their leaves and assumed their winter condition. This is a very important season in the stone-fruit section of the orchard for the control of brown-rot. All possible and probable sources by which infection is carried over to the spring should be removed. An early opportunity should be taken to destroy all mummified fruits, whether they are on the ground or still attached to the tree. Neglect of this simple precaution is only encouraging early infection in the spring. In addition, all prunings should be gathered up and destroyed.

While on the subject of diseases, growers are reminded to keep a sharp lookout for San Jose scale in their orchards. It not only infects the stone- and pip-fruit section, but can often be found attacking the small fruits. Where it is discovered or known to exist an oil or strong lime-sulphur spray should be put on at once. It is one of the scale pests that is active in the dormant season, and when in sufficient numbers it will considerably reduce the vitality of the tree. Though it is a most prolific breeder it is one of the easiest scales to control, and one thorough application is usually sufficient, although two sprayings are advisable to make certain that it is completely eradicated.

Pruning is recognized as the principal winter operation in the orchard. Although the pruning of peaches and nectarines that suffer from die-back and bud-drop would be better delayed until later on in the winter or early spring a start can be made pruning those fruits any time after these notes appear. In dealing with peaches and nectarines which produce their fruit on one-year-old wood provision must be made, when pruning, not only for a good crop of fruit, but also for a sufficient supply of new wood for the succeeding season. The way to bring about these ideal results, so far as pruning is concerned, is rather difficult to indicate except in a special article. Speaking generally, they are attained by cutting out as much of the two- and three-year-old wood as possible, and by proportionately reducing the fruit-bearing wood over the whole tree. In the warmer districts the average variety of peach and nectarine crops much freer and more consistently when the fruit-bearing lateral is left full length or only slightly reduced. Some varieties produce good crops no matter how the fruiting laterals are treated, but with shy bearers and varieties that suffer from bud-drop or die-back the long untipped lateral is recommended for fruit-production. No matter what method of treating the fruiting laterals is adopted, fully one-third to one-half of the fruit-bearing wood should be removed so as to ensure that the tree will make sufficient wood for the succeeding season. Keep the centres of the trees well open ; it will pay to do so.

Other matters of detail are fully dealt with in the district notes which follow.—*Gordon Esam, Acting Assistant Director of the Horticulture Division.*

AUCKLAND.

June month may perhaps be regarded as the slackest time for the orchardist, but growers of stone-fruit who are anxious to get other work well in hand may proceed with the pruning operations. Any draining-work that requires to be done should be attended to this month. Work among shelter-trees which require trimming, or temporary belts which require thinning out or lopping, may be carried out before the rush of pruning and winter spraying comes. In cases where the preparation of land for planting is yet undone, and weather conditions permit, opportunity should be taken of putting this work through. Autumn ploughing in the orchard should now be completed. If any repairs are needed to glasshouses or sheds, these should not be overlooked whilst there is a general slackness in the more important work. Replenish stocks of spraying-materials and manures, and overhaul sprayers.

—*J. W. Collard, Orchard Instructor, Auckland.*

HAWKE'S BAY.

The pruning of stone-fruit trees should be pushed on, and whatever system of pruning is adopted it is important that the fruit-bearing wood be properly spaced so as to ensure the even distribution of fruit and prevent dense clusters of fruit. Fruit on overlapping laterals can cause just as much overcrowding as unthinned fruits, and in consequence increases its susceptibility to brown-rot. Bearing trees that have not furnished well with lateral growth should have the leaders well cut back to a strong lateral, which should be left uncut. This will have the effect of promoting growth in more desirable positions on the tree. Pruning of pip-fruits will follow, and when the various varieties are ready every opportunity should be taken to get on with this work. A lot of work has to be carried out during the dormant period, and anything which can be done now will ease the rush of work later in the season.

Where the land has been properly prepared planting can now be done. Under no circumstances should trees be planted when the land is saturated with moisture, and if trees come to hand at such a time they should be heeled in until the ground is in a fit condition.

Established young trees often develop woolly aphid on important parts of the tree. The most satisfactory way to deal with these colonies is to paint with a stiff brush with warm oil, 1-1.

Stone-fruits may be sprayed as follows: Bordeaux, 8-6-40, for die-back and fungoid diseases; lime-sulphur, 1-15, for San Jose scale and fungoid diseases; oil, 1-17, for San Jose scale and red mite; oil, 1-25, for woolly aphid on pip-fruits at fall of leaf.

—*W. H. Rice, Orchard Instructor, Hastings.*

NELSON.

Pruning: This operation is one of the important factors in securing a vigorous and fruitful condition in the orchard. Besides the well-known principles of pruning the local conditions must be considered—the quality of the land and the variety of fruit-tree to be operated on and its present condition; also a definite objective is required. Best results are obtained only after carefully considering these points. Beginners may be reminded that the art of pruning is only mastered by practice. As always, avoid extremes—the over-vigorous tree, the stunted tree, the straggling tree, and the tree that is crowded and over-furnished with branches, or, what used to be very common, bare barren branches about the base of the tree with a heavy crowded top. It is for the pruner, chiefly, to correct these conditions and establish a thrifty fruitful state. The pruning of bush fruits should not be omitted. Some plantations of gooseberries and currants would give 100 per cent. better results with proper pruning.

Planting: In a commercial orchard the importance of planting the right varieties of fruit-trees is very great. What the land will grow best and what the market demands are the chief indications of what to plant. Inside these limits personal preference and skill may be considered. After deciding on the planting-list it is worth going to some trouble to get the right class of tree. It should be neatly "worked," with rather strong well-ripened wood and strong root-system

of a stock of good repute. A tree of this type will keep these characteristics as long as it stands in the ground. In planting it is usual to gridiron the rows in at least twos or fours—*i.e.*, plant several rows of one variety, then several of another—for the sake of pollination.

Shelter: One of the advantages of Nelson as a fruitgrowing district is its relative immunity from heavy winds. Even so, however, on level country and in certain localities ample shelter should be provided. There is no comparison between trees suffering from windage and those enjoying protection. A shelter plantation or hedge is a cheap and easy advantage; it is an insurance against loss by winds, which may easily do great damage amongst heavily loaded trees.

—*W. C. Hyde, Orchard Instructor, Nelson.*

CANTERBURY.

During the month of June the dormant season's work in the orchard will be commenced. The keynote to success in these operations is thoroughness. A start will be made with the pruning of the various classes of trees, preparatory to spraying. When pruning, care should be taken to cut away all diseased and dead branches and twigs, and if large cuts are made it is advisable to paint the surface of the cuts for the prevention of disease. After pruning see that the orchard is thoroughly cleaned up and all prunings destroyed; plough under all dead leaves and fruit. Shelter belts and hedges round the orchard should receive some attention at this time of the year. If only planted a short time, give them a good pruning to induce stronger growth the following season. In some cases, especially with poplars which have grown to a considerable height, a good topping will be beneficial. Drainage, if not attended to earlier, should also receive attention. Too much importance cannot be attached to thorough drainage of the orchard, not only to take off the surface water—thus making cultivation much easier and better—but for the prevention of fungus disease on the roots of the trees.

Where it is intended to spray twice for red mite, woolly aphis, and scale, the first application of red oil, at a strength of 1-8, should be given, using as strong a pressure as possible, driving the spray into all the crevices, so that no part of the tree will be missed. For fungus diseases, especially on the pear and peach, a pure bluestone spray at a strength of 1-10 or 12 has been found very effective in this district at this time of the year, and is strongly recommended. If pure bluestone is not used, bordeaux, 8-6-40, is recommended during the dormant season.

—*G. Stratford, Orchard Instructor, Christchurch.*

OTAGO.

Pruning will be the main work during the latter part of May and through June, and will take up the greater part of the orchardist's time. At the same time the trees that it is desired to re-graft should be marked off. Scions for this purpose can be left on selected trees till about the end of July, and then kept heeled in a shady place till required.

Spraying for scale insects, red mite, aphis, &c., can be delayed till later. The oil sprays for this work do better when applied during the warmer days, the spray penetrating much better into the cracks and crevices; also the scaly coverings begin to relax somewhat with the advent of spring. Spraying for fungus diseases, such as peach-curl, shothole, and black-spot, should also be left till the early spring, but, as stated in last month's notes, an additional application of bordeaux is worth while for rust and die-back where prevalent. Where leaf-curl has been bad the previous season on susceptible varieties the application is also advisable.

It should pay this season to market late apples judiciously; prices are likely to be good. Pack and grade well, and market the varieties as they mature. Enough attention is not paid to this matter; higher returns could often be obtained if this were done. For weeks past shop-windows have been full of practically green Delicious which would fetch more money in the markets later, and their presence tends to reduce the value of other mid-season varieties. In the windows at the present time can also be seen Sturmer Pippins. These cannot possibly command the price they will later on, and must reduce the price of other varieties that require to be disposed of at this time. For cool-storing purposes select the best sizes; do not store extra-large fruit and fruit off young trees. Use special care in packing, wrap fruit for long distances, and do not include fruit with broken skins from any cause whatever. Upon these points, combined with care at the cool store and even temperature, depends the whole success of the cool storing of fruit.

—*J. H. Thorp, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

By F. C. BROWN, Chief Poultry Instructor.

JUNE is generally an easy month on the poultry-farm, but nevertheless there are several important things which should now be attended to. Perhaps the most important is to see that the pullets are specially cared for, in order that they may produce their maximum egg-yield while high prices rule for this product. The first essential in this respect is to see that the birds are well housed and are provided with ample room to exercise under cover when unfavourable weather conditions prevail. The floor of the house should be covered with litter in which the grain foods should be scattered. This will induce the birds to exercise in searching for the grain—an essential to good health and vigour. Having the birds confined and under such favourable conditions will not only tend to promote egg-laying, but will be an assurance that the eggs can be gathered in a clean condition.

Hand-in-hand with good housing should go regular and liberal feeding. Only the best grain materials available should be used, while the mash should be made as appetizing as possible by moistening it with meat, soup, milk, or hot water. Further, to secure a maximum egg-yield at this period of the year, animal food, such as boiled meat, meat-meal, or milk albumen, must be provided. Green food must also be liberally fed, while crushed sea-shell, gravel, grit, and clean water should be always in reach of the birds.

Special attention to cleanliness and the prevention of insect pests is imperative for the maintenance of a healthy flock. The quarters should be frequently cleaned and sprayed with a good disinfectant or limewash. Especially must the nests be kept in a thorough sanitary state to ensure that they are free from vermin. Neglect to attend to this detail is a common cause of hens laying their eggs in the corners of the house, and laying away in hedges, &c., when provided with a free range. A kerosene-tin with the half of each end cut out makes a suitable nest, and is easily cleaned. When these are used, a good plan is to put in about 2 in. of clean sand before the nesting-material, such as hay, &c., is placed. The sand will prevent the latter from slipping when the hen enters or leaves the nest, thus lessening the risk of having broken eggs and the hens acquiring the habit of egg-eating. When cleaning operations are taking place a good idea is to place the tin nests over a fire for a few seconds, as this will have the effect of ridding them of any vermin that may be present. The perches may be treated in a similar manner when red mite is present, and with the same desirable effect.

THE SURPLUS COCKERELS.

It should be unnecessary to again emphasize the importance of sending to market all surplus cockerels that are four and a half to five months old. It is never wise to keep a cockerel beyond that age, for if not marketed then it will be weeks, and even months, before it can be brought to prime condition, and then, although heavier than at the prime-chicken stage, the return will not be as profitable as if marketed earlier. Once the chicken stage has been passed the con-

sumption of food is increased, this being caused by the greater growth of plumage, bone, &c., necessary for the development of an adult bird. Obviously this process must be completed before the matured adult stage can be attained. This, however, is not the only drawback, for even if a fully developed cockerel is marketed in absolutely prime condition it does not appeal to the poulterer, to whom it is known as a "stag." The fact of it having a well-grown spur, sharp at the point, reduces its value as a table bird. Such a bird is coarse and larger than is generally desired for the high-class trade. It is the flesh of a prime four- to five-months-old bird that is the most sought, and which commands the highest value.

BREEDING-PLANS.

It is now full time that the breeding operations were planned, especially in the case of the heavier breeds, such as Rocks, Orpingtons, and Wyandottes, as July and August, or early September at the latest, are the best months for hatching out the chicks of these breeds. Breeding-birds should be mated a few weeks in advance of the time that the eggs are required for hatching purposes. This will give them an opportunity of settling down, especially the male bird. Very often a vigorous male will exhaust itself at the outset, and it will be some weeks before it settles down and satisfactory fertility is obtained.

As to the number of hens to put with a male, this depends entirely on the vigour of the male, the range provided, and also the breed of the birds. When breeding-stock have their liberty, good results may be obtained with one male to twenty or even more females, but when confined in a run the number must be considerably reduced. No hard-and-fast rule can be laid down in this respect, and the poultryman must use his own discretion and be guided by the number of fertile eggs produced. As a general rule, when the birds are confined, and during the early season, six or eight hens of the heavier types are sufficient for one male. If the male is a vigorous one this number may be increased as the season advances. In the case of the lighter breeds, such as Leghorns and Minorcas, eight females may be mated to one male, and in the spring months up to twelve or even fifteen. Of course, when a high percentage of infertile eggs is produced it does not always follow that the male is overmated. Sometimes this is due to too few hens in the breeding-pen. When it is observed that the hens' backs are becoming bare and the feathers worn off this indicates that the male is a vigorous one and that more hens are required.

In choosing birds for the breeding-pen, whether it be males or females, aim for points indicative of constitutional vigour, such as a bold fiery eye, bright-red comb, a clean face free from feathers and wrinkles, short shanks wide apart, tight glossy plumage, and activity in habit. In addition the birds should be of a good size of their breed, possess breed-points, and be good feeders. Of course, in speaking of breed-points it may be safely said that there are few birds in any flock which have not got a fault. Therefore in mating up the breeding-stock it is essential to choose a male that is strong where the females are weak, or *vice versa*. Never breed from a pullet if it can be avoided, chiefly for the reason that on its appearance it may be selected as an

ideal breeding-bird, but when subjected to the test of a laying season it may not only prove to be a poor layer, but to possess a weak constitution as well. In such a case this would mean that the weak offspring would be hatched and probably half-reared before discovery of the mother's weakness. No female should be placed in the breeding-pen unless it has proved its value as a layer during its first season of production, and at the same time maintained constitutional vigour. Of course, early-hatched well-matured pullets that have been bred on proper lines, when mated with a second-year cock, may produce excellent progeny. The risk, however, of having a high percentage of weak ones is always there, as compared with using well-tested hens. Never mate young pullets and cockerels together, as the progeny from such a union generally lacks constitutional vigour, while the females will usually lay undersized eggs.

One little point that may be referred to in regard to male birds of the lighter breeds and which carry a heavy or falling-over comb and long wattles is the advisability of removing both the latter. The comb is often a burden for a bird to carry, while the wattles prevent it from picking up its grain, especially when fed in grass runs or deep litter. As a result its health and general condition become impaired, and consequently a high percentage of infertile eggs and weakly chicks follow. For a male bird to do the best service in the breeding-pen it must be maintained in its best possible form.

It is always advisable to give breeding-birds a good range, this being conducive to the maintenance of good health and vigour. Where they are kept in a confined space they should be induced to exercise as much as possible by making them scratch in litter for their grain food. On no account should breeding-birds be forced for egg-production. Rich foods, such as meat, &c., should be sparingly supplied. Good results as to both fertility and stock can be obtained from the feeding of mixed hard grain, such as wheat, maize, and oats, to the breeders night and morning. Breeding-birds require a liberal supply of green stuff, while ample fresh water and grit are details which must not be neglected.

THE APIARY.

By G. V. WESTBROOKE, Apiary Instructor.

In these days of organization and co-operation the worry of trying to sell the honey no longer occupies the attention of beekeepers, and they are thus able to devote their whole attention to production. This is as it should be, and leaves a little more time to devote to the off-season work of attending to the repairing of hives and covers, repainting, and generally to make plans for the coming season. If circumstances permit, they will be enabled to enjoy a well-earned vacation, knowing that the bees have been left in good condition, with a plentiful supply of stores, and so will be all right to leave for a few weeks. It may be well to remind those beekeepers who feel they have earned this rest that the annual conference of New Zealand beekeepers will be held at Wellington on the 11th, 12th, and 13th June. The

gathering will be held this year in the Dominion Farmers' Institute building. Important matters relating to the improvement of the industry will be discussed, and all apiarists and keepers of bees are cordially invited to attend by the National Beekeepers' Association.

TREATING WAX IN SMALL QUANTITIES.

There is very little work to be done among the bees during the next two months. In fact, if previous instructions have been carried out there should be no necessity to open the hives for some time. The present month, however, is a good time to melt up any wax. The best method of doing this has several times been fully described in past issues of the *Journal*. These methods, however, apply more particularly to the larger beekeeper who possesses a wax-press. It may be of some use to explain a simple method of securing the wax from small quantities of combs, for those who have but one or two hives, as follows: Take the combs, after straining out the honey, and place them in a scrim bag; then put this into a large copper nearly filled with water, placing a few weights on top so as to keep all the scrim below the surface of the water. Bring the water to the boil, and leave it until cold. The wax can then be lifted off in a cake and remelted in a smaller vessel, so as to make it more compact; or, if preferred, the hot wax may be skimmed off into another receptacle and then allowed to cool. The best method of cleaning the copper after this operation is to empty it first, place a few pieces of paper or shavings in the fireplace—sufficient to heat up the metal without burning it—and then with a damp cloth wipe out the particles of wax, which will have melted.

NEXT SEASON'S PLANS.

Beekeepers would be well advised to make all their preparations for next season as early as possible. Do not wait until the spring before making up your mind what your plan of campaign will be. Settle the question now as to whether you intend to increase your colonies or run the apiary for honey only, and plan out all details. By so doing, you will have a definite object in view, and this will be going a long way towards success.

VITICULTURE.

By S. F. ANDERSON, Vine and Wine Instructor.

THE COOL VINEHOUSE.

THE vines are now entering on their rest period. Ventilators should be left open night and day, as frosts will do no injury at this stage, and the drier the atmosphere the better. Should the vine-borders on examination show extreme dryness—that is, approaching a dusty condition—a soaking may be necessary. The dry autumn experienced in a large portion of the North Island may have reduced the vine-borders to an exceptionally dry condition. It might be questioned why indoor-grown grape-vines should suffer from want of water any more than those in the vineyard. It is because conditions under glass are more artificial, and to permit extreme dryness means more or less of a

check. The effect of lack of water on a plant is exemplified in the extreme case of miniature plants, such as those shown by the Japanese, which are produced mainly by being kept at nearly starvation-point as regards water. The better the vine-borders have been made the safer they are from extreme conditions of moisture and dryness. Good drainage allows the get-away of excessive moisture, but also provides for that capillary attraction of moisture during periods of drought.

Pruning should not be commenced until the leaves have all fallen. It may be instructive at this period to quote Sir J. D. Hooker. He writes, "The death and separation of the leaf previous to its fall from the parent plant are not accidental, but due to the following causes: First, and chiefly, because there is developed at the base of the leaf or its stalk (if it has one) a transverse layer of cells which die after the leaf has performed its functions, and thereby produce their separation. The leaf consequently falls off, leaving a clean scar. Secondly, because the leaf rapidly acquires in spring its full size, whilst the branch on which it grows goes on thickening; consequently the tissues at the point of union tend to become disunited. Thirdly, because the fluids contain earthy matter, much of which is deposited in the leaf-tissues, thereby preventing them performing their functions and hastening their death. This is proved by burning spring leaves, which yield but little ash, while autumn leaves yield relatively more even than wood. It is further remarkable that the substances contained in falling leaves are those which have ceased to be of value to the plant. The starch and protoplasmic substances, together with the most important mineral matters, such as phosphoric acid and potash, are transferred to the permanent parts of the plant before the leaves fall." This quotation is made especially for the information of those who prune before the natural fall of the leaf with the mistaken view of "plumping up the buds." We can assist nature, but not by unnatural methods.

THE GARDEN.

By W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

In the *Journal* for March of this year some results of trials with cauliflowers at the Arataki Horticultural Station were detailed. These trials should be of interest to cultivators in the warmer parts of the Dominion, to those who grow for the market, as well as private gardeners. In some of the warmer districts, particularly where the summers are usually very dry, the cultivation of this class of vegetable is attended by great difficulties; in fact, at times it is impossible to grow them. Even the hardy broccoli often fails to survive the combined effects of dry, hot weather and the ravages of the cabbage-moth (*Plutella cruciferum*). The Arataki trials show that cauliflowers can, in the warmer climates, be produced a month earlier than is possible in the most favourable places in other districts, and two months earlier than they can be obtained in many places. The cabbage-moth does not affect winter and spring crops, and there are no difficulties to contend with. Snowball cauliflower at Arataki, sown on 1st April and planted on 6th June, gave the first heads on 24th September. It may be remarked that

Early London and Early Paris would come in the same time. Early Erfurt and Veitch's Giant, sown and planted on the same dates, gave the first heads on 21st October, when the earlier crop was nearly gone. Early Erfurt and Veitch's Autumn Giant, sown on 1st May, came into cut on 30th November. This crop would last till the New Year. These trials appear to show that in certain districts broccolis could well be dispensed with and the quicker-growing cauliflowers substituted; but more particularly the trials show the value of the earlier crops for market purposes.

Spring cabbages are amenable to the same conditions, and should also receive attention. For these crops blood-and-bone manure is an efficient fertilizer. Apply at least 2 oz. per square yard broadcast before planting. Nitrate of soda should be applied at $\frac{1}{2}$ oz. per square yard in two dressings, the first soon after growth begins, the second four or five weeks later. The first dressing should be strewn close around the plants, the second broadcast. In places where growth is not so forward the plants should be drawn from the seed-beds and pricked out in a good plot of ground preparatory to the final planting. The early varieties of cauliflowers and early cabbages are liable to bolt prematurely. Early planting or pricking out overcomes this tendency to a large extent, and, together with the dressings of nitrate of soda, usually makes them safe.

Peas may be sown before the end of May in all places not subject to very severe frost. Dwarf varieties are usually sown, but in places subject to high winds, or where slugs or birds are very troublesome, it is found best to sow a variety of medium growth. The rows are given the support of sticks as soon as the plants are well up. The sticks render slug-control easy, save them from wind, and birds will hardly trouble them. Broad beans should be sown in all places about the middle of June.

Lettuces in some places grow the whole year round—in all places, in fact, except the coldest. For winter use small-growing varieties, such as Tennis-ball and All-the-year-round, are planted in the sunniest position available, preferably on beds raised a little above the ordinary surface.

SMALL FRUITS.

Pruning bush-fruits should be undertaken as soon as the foliage is off. A necessary preliminary, in my opinion, is to clear the ground of weeds, removing such as would prevent the easy clearing-up of the prunings of the bushes. If there are many tall weeds the best plan is to mow them. They might then be left to be raked up with the prunings. The ground should not be dug before pruning, as that would make it difficult to take up the small pieces of wood cut off. I consider it important that this should be done, as when dug into the ground they generate fungus that may prove injurious. The prunings can be readily raked up on a firm surface. They should then be burned, thus destroying any insect pests and disease germs that may be on them.

Gooseberries.—Endeavour should be made to get the bushes into an upright form. Some varieties assume this habit naturally, and those of a drooping habit can be got upright by skilful management. It is important to have a clean stem that does not branch close to the ground. A bush that has branches rising from beneath the surface

should not be tolerated. Excess branches is a serious fault too often seen. A large number of branches does not result in heavy crops of fruit, for want of light starves many of the fruit-spurs, and others produce but poor fruit. A bush that is open to light and air will produce good fruits on every part, the gross result in weight of fruit far exceeding that from a crowded bush perhaps twice as large. Besides this, there is the increased labour in pruning, gathering the fruit, and general handling incidental to crowded bushes. Four branches are sufficient to start a bush, these being duplicated by a slight shortening of the leaders each year until sufficient height has been reached. From the leaders it is permissible to allow subsidiary branches to extend, but not in numbers that will crowd the bush, nor should they extend far. When growing, the fruit should all be visible. If it has to be searched out by lifting branches the bush is too crowded and will not be as profitable as it should be. Varieties of a drooping habit can be got more upright by judicious pruning, cutting away spreading branches on the outside, and shortening others. Restricting the number of main branches and keeping the bushes open will strengthen the framework and enable the branches to stand up. The system of spur-pruning once adopted has long been discontinued. In most places it results in crowding the bushes with young shoots, and it is better to cut superfluous shoots clean out. The general plan of pruning is to reduce the laterals slightly if they are long, or if they are very thin; short, stout laterals need not be touched. This refers to the general outline of the bush. On the lower portion of the bush, and particularly on the inside, the laterals, which in such positions are not usually very strong, should be spurred back to about 1 in.

Red Currants.—The bushes should be started with four branches and a clean stem, the same as for gooseberries. Duplication of branches is secured by shortening the leaders each year to about 12 in. No subsidiary branches should be allowed until the bush attains its full height, which may be about 4 ft. A few short branches may then be allowed to grow on the inside of the bush near the top. The fruit is borne on spurs on wood that is at least two years old, and never on the last season's growth. Laterals should all be cut back to short spurs. It may be remarked that bushes are occasionally seen on which the laterals have not been cut back. These form fruit-spurs the second season, but such bushes are not permanently profitable.

Black Currants bear fruit on spurs on the old wood, and also on last season's shoots. In places where the borer is not troublesome the system of pruning recommended for red currants is the best for black currants also. The borer trouble, however, has made it necessary in many places to either adopt some other plan or abandon their cultivation. For this reason the clean-stem system has been abandoned. Cuttings are allowed to retain all their buds, which causes them to throw up shoots from beneath the surface. These are allowed to develop into branches, and the method permits the removal of older branches from time to time. Usually this is done when young branches are ready to take their place, irrespective of whether they are affected by borer or not. This plan is rendered possible by the habit of the black currant bearing fruit on the shoots of the previous season's growth. Pruning consists in removing old branches or portions of them so as to prevent crowding, and a slight shortening of long and medium length shoots; short shoots—those up to about 6 in. in length—are left intact. An open-centred bush is not desirable under this system.

Raspberries.—Dig out superfluous suckers; remove dead canes entirely; reduce new canes to about six of the strongest, and shorten those left for bearing by about 12 in.

Loganberries are to be relieved of the old fruiting-caness—it should have been done as soon as the fruit was past. The young canes should be tied in place and the weak tops cut back to ripe wood.

Gooseberries require spraying for leaf-spot. These, as well as currants and raspberries, are liable to be infested by scale insects. Lime-sulphur, 1 in 10, will serve the dual purpose of a fungicide and insecticide.

THE FLOWER-GARDEN.

This is an appropriate time for breaking up new ground, the soil being moist and easily worked. Except in specially favoured places where there is a considerable depth of loose soil the ground should be broken at least two spits deep. The top soil should be kept on top. If there is grass growing on it the turf should be stripped off first, because if it is dug into with the top spit it holds the clods together and it is a long time before they can be broken up. The turves cut off may be placed in the trench, or, what is better, stacked till the grass is dead and then dug into the soil, or kept for potting plants, raising seedlings in boxes, &c. Old gardens are sometimes benefited by retrenching. This can be done without moving shrubs and permanent plants and trees. It requires a little scheming, and all temporary plants have to be lifted.

Hedges may now be trimmed. Hedges that are well kept are trimmed twice each year—namely, during winter and near the end of the year. The summer trimming is light, merely cutting back the young growths. The winter trimming may be more severe, and affords opportunity for keeping a hedge from becoming too wide. In the ordinary course of trimming a hedge increases in width every time it is trimmed, as a portion of the young growth is left every time. In a few years the hedge reaches an undesirable width, wasting ground-space and causing additional labour in trimming. When the species of plant will stand drastic treatment it may be heavily cut back to form a new face. Some plants will not respond to such treatment. The labour involved in doing it might prevent it being done, and, moreover, it might not be desirable to have a bare face for a few weeks or months. The necessity for drastic treatment can be avoided, and the hedge kept from increasing in width by other means. A well-kept hedge has always abundant foliage independent of the last twigs. At the winter trimming a number of the growths should be cut back into old wood, taking off bunches of stubs formed by cutting back the face spray. These cuts are, of course, inside the face of the hedge. Only a proportion of the branches should be so treated each winter—just those that are becoming prominent and prevent the shears cutting hard back. By this means a hedge can be kept permanently to the width desired.

Rose-planting may be carried on for several months to come; still, it is better to get the bushes planted early, as they then break stronger. Bushes planted in June and after should be pruned before planting. Cut out weak shoots altogether, and shorten others to two or three buds in the case of young plants. The pruning of older bushes will be dealt with in the next issue of the *Journal*.

ANSWERS TO CORRESPONDENTS.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT FOR RED-WATER IN COW.

“INQUIRER,” Murchison :—

One of my cows has got red-water, and I would be pleased if you would advise the best treatment for this complaint. Is it necessary to isolate the animal ?

The Live-stock Division :—

The trouble you mention affecting your cow is dietetic in origin, and consequently in no way contagious. The cow should be changed to fresh pasture, and in cases where the symptoms are observed early a drench composed of 12 oz. to 14 oz. of common salt dissolved in a pint of gruel or warm milk is usually all that is required. Where the cow has been affected for some days, treatment should start by drenching with 1 pint of raw linseed-oil, and should be followed by administration morning and night of tonic powders, each powder consisting of carbonate of ammonia, $\frac{1}{2}$ oz. ; powdered nux vomica, 2 drachms ; bicarbonate of soda and powdered ginger, each 1 oz. ; to be given in a pint of warm gruel or milk for three or four days. In addition to the powders, linseed or oatmeal gruel should be given as frequently as convenient, and the animal kept rugged. Frequently obstinate constipation follows the diarrhœa at first present, and this should be counteracted by drenching at intervals of a few days with a pint of raw linseed-oil until the bowels act normally again.

PIG WITH SKIN TROUBLE.

“INQUIRER,” Taihape :—

I have a sow twelve months old. For the past nine months her skin has been continually breaking out in sores. A red rash comes, which irritates her and causes her to scratch until she draws blood. Her hair goes, and her skin becomes very hard and cracks. She eats well—milk, boiled potatoes, green food, &c. Would you advise me to kill her, or is there a remedy which would enable me to fatten her and eventually make bacon of her ?

The Live-stock Division :—

From your description of the case the trouble affecting the pig seems to be eczema. Taking into account the length of time the animal has been affected and the recurrent nature of the disease, we are of opinion that the latter has become chronic. Such being the case, any treatment advised would only have a temporary effect, the trouble being sure to recur. Therefore the best thing to do appears to be to have the animal destroyed and thus save further worry.

STRIPPING OF RYE-GRASS PADDOCKS.

L. FORBES, Spotswood, North Canterbury :—

Will you kindly inform me which is the best way of treating rye-grass paddocks as regards stripping ? Does stripping for seed take a lot of good out of the grass, or does the stripping knock out a large proportion which falls on the ground again, and so does very little damage ? Does it pay to strip, or is it more profitable to leave the paddock alone and let the sheep eat the herbage ?

The Agriculturist :—

As to whether or not periodical stripping of rye-grass pastures is detrimental, this will depend upon the character of the soil and upon the rainfall. If the soil is strong, or moderately so, and the rainfall satisfactory—particularly between the time of stripping and the appearance of the first frosts—the grass is enabled to recover readily after stripping, and as a rule no harmful effects ensue. Nevertheless it is best to refrain from stripping year after year, unless, of course, the soil is exceptionally productive. It is better to alternate the stripping and pasturing processes from year to year, thereby maintaining the vitality of the pasture grasses. A portion of the seed, of course, falls to the ground annually and some takes a hold.

STORAGE OF SEEDS.

FIELD AND Co., Devonport, Tasmania :—

Can you give us information regarding the best method of storage of seeds? The particular question is as to whether air should be excluded or not; for instance: (1) Seeds stored in glass bottles, say, fruit-jars with screwed-down tops; (2) stored in linen or other open-mesh bags; (3) stored in brown-paper bags. The question has arisen as to whether some varieties of seeds, especially of the brassica type, would develop deleterious gases, which would in a comparatively short time kill the germ.

The Biologist :—

The main point to observe in the storage of seeds is that they are stored in as dry an atmosphere as possible. For this reason packing in airtight tin-lined boxes has become popular. Seeds packed in this manner may be kept anywhere for the normal period that the seeds preserve their vitality. The only gas produced by properly dry seeds is carbonic-acid gas, but not in sufficient amount to injure the seed. If seeds are stored in a moist atmosphere they lose their germination very rapidly. One of the dangers of packing seeds in airtight receptacles is that the seeds may not be properly dry and, by giving off water, produce an atmosphere that is sufficiently moist to favour rapid loss of germination.

SHELTER-TREE FOR WET LAKESIDE.

W. DEAN, Waipukurau :—

I will be obliged if you can recommend a suitable tree to act as a breakwind on a lakeside where the ground is wet in winter and is occasionally flooded to a depth of 1 ft. Willows and poplars are too bare in winter for the purpose. I would risk the chance of ground not flooding till trees are established.

The Horticulture Division :—

In such a position as you describe—namely, ground that is flooded in winter—the best tree is the alder (*Alnus glutinosus*). This tree is deciduous, but thrives in wet ground, and would afford a fair amount of shelter even when bare of foliage. The trees might be planted 3 ft. or 4 ft. apart, and would soon close up. A belt or grove of alders when doing well is a remarkably pretty sight, especially when loaded with catkins.

GROWING TURNIP-SEED.

“INQUIRER,” Rototuna :—

Would you please inform me the correct time to sow swede turnips with the idea of saving some seed?

The Agriculturist :—

The best method of growing swede turnips for the purpose of saving seed is to raise them in the ordinary way and season for turnips. In the autumn or early winter outstanding roots are selected, topped somewhat, and stored in a

comparatively dry and cool place. In the following spring the selected roots are planted out in rows, and the seed eventually produced is saved during the latter part of the second season. Full information on turnip-seed production was given in the *Journal* for June, 1918.

TREATMENT FOR ECZEMA IN DOG.

A. FRIEDRICK, Marton :—

Would you please advise me if anything can be done for mange on a dog. I have a valuable sheep-dog, and he is just showing signs of mange on the back. I have tried a lysol bath, but it seems to have done no good.

The Live-stock Division :—

In all probability the skin-disease affecting the dog is not mange but a form of eczema, as mange is seldom seen in this country, whereas eczema is of frequent occurrence. Give the dog a laxative—1 oz. to 2 oz. of castor-oil. Wash the affected part with soap and warm water, then apply a little sulphur or zinc ointment. A little of the ointment should be applied twice daily. After the first washing, no more water should be used, the part being kept as dry as possible. Keeping the animal on soft diet for a time and giving four or five drops of Fowler's Solution in the food twice a day will greatly hasten a recovery.

LAWN INFESTED WITH PRUNELLA.

M. P., Dannevirke :—

I would like to know if by any means, other than breaking up, I could rid a lawn of prunella, which has taken possession at the expense of the fine lawn-grass sown about three years ago.

The Horticulture Division :—

The weed you mention, *Prunella vulgaris* (self-heal), could not be really eradicated from your lawn except by digging in spring and allowing it to fallow during the summer, in which case you would have to hoe frequently to destroy seedlings, or dig the plants out. If, however, a skilled scytheman was to mow the grass close to the ground a lot of the weeds would be cut off. With a bare surface, a strong sharp-toothed rake could be used to tear out a lot more, and the remainder could be dug with a fork. A dressing of superphosphate should then be given, followed by a light top-dressing of clean soil, the ground being then well rolled. It would be best to allow the grass to grow through the winter, and carry out the process mentioned in spring. If the lawn is well drained and fertilizer given to encourage the growth of the grass, self-heal should not be troublesome.

FEEDING LUCERNE HAY TO PIGS.

H. POYNTON, Ohau :—

Would you kindly furnish me with information on the proper way of feeding lucerne hay to pigs.

The Live-stock Division :—

At the Ruakura Farm of Instruction it was found that pigs showed no desire to eat the hay when thrown on the ground or placed in racks in the paddock, but if the lucerne was cut and given in the green state, or chaffed when freshly cut and mixed with the other food—pollard, meals, &c.—the animals readily partook of it. You might try soaking the hay in molasses before putting it in the racks for the pigs, and once having acquired the taste of the plant they may take it without further trouble. Only fine-stemmed leafy hay should be used; the coarse fibrous stems are practically of no value as a pig-food, and if eaten are liable to cause digestive trouble.

A FORESTRY POLICY FOR NEW ZEALAND.

ADDRESS BY THE COMMISSIONER OF STATE FORESTS.

AN important and interesting statement regarding forestry affairs in the Dominion and his policy as Commissioner of State Forests was made by Sir Francis Bell on the occasion of addressing the Conference of Crown Lands Commissioners held last month at Wellington, as follows:—

The Minister of Lands has been kind enough to grant me the opportunity of addressing this Conference of Commissioners of Crown Lands on the subject of forestry in New Zealand. Every Commissioner of Crown Lands is by virtue of his office Conservator of State Forests within his district, and in regard to the administration of State forests is guided by the direction of the Minister who holds the portfolio of State Forests, and it is therefore of public interest and advantage that I should have the opportunity of thus meeting you all in conference and explaining briefly the intentions of the Government. If in the course of my address to you I seem to define existing conditions which require no explanation to officers of the Department of Lands you will readily understand the reason to be that my address to-day may possibly reach a wider audience. But it is not my intention to weary you, and possibly others, with a retrospect of the previous management of our New Zealand forests. You and I together are concerned only with the present and the future; and it is with regard to the improvement of present conditions and the foundation of a policy for the future that I seek your co-operation.

Let me first remind you that the separation of the office of Commissioner of State Forests from that of the office of Minister of Lands began with my appointment to the former office in November, 1918, less than six months ago. It has not been considered advisable or necessary in the interval to create a distinct Department of State Forests, but a new office of Chief Officer of Forestry was created, and Mr. Phillips Turner appointed to it. He is the official head of a sub-department, and correspondence on forestry matters is conducted through him. It is the intention to establish a separate Department of the Government at a later stage, but there would have been great departmental inconvenience if the complete severance from the Department of Lands of forestry business had been suddenly effected after so lengthened a dual control. This matter of departmental control has been the subject of conference between myself and the Public Service Commissioner from time to time, and I wish to accept the entire responsibility for the postponement of the creation of a distinct Department. There has been no friction so far and no difficulty in administration.

With lands which have been already purchased by private individuals from the Crown the Department of Lands and the Department of State Forests have practically little concern. It may become part of the policy of a future Government to offer encouragement by State aid to private individuals and local authorities to plant timber-trees on their property, and it may, and probably will, be necessary for the State to repurchase areas of land held by private owners for purposes of State forestry. With the exception of those two subject-matters the Minister of State Forests is not concerned with consideration of private lands. It is with regard to the lands the title to which still remains in the Crown, and to a certain extent with regard to lands still owned by Natives, that it has become necessary to make such provision for the present and the future as shall ensure for the people of New Zealand a constant supply of timber for their own purposes. I use the words "for their own purposes" deliberately, and say that it is necessary to emphasize those words and their meaning. The export of New Zealand timber for use in countries outside New Zealand cannot continue in the future as it has in the past, and it has already become obvious that as to some classes of timber no further licenses can be granted to sawmillers without the condition that no timber sawn at the mill shall be sold for export. With regard to other classes of timber, for reasons which I will state later, the process of prohibition of export

may be more gradual. I sincerely trust that those engaged in the milling industry will realize the position, and that it may be found that there is ample room left in New Zealand for the profitable conduct of that industry without the aid of the foreign market. Apart from the actual shortage of supply for the wants of New Zealand which must result if timber is exported in the future as in the past, the high prices that can be obtained for our New Zealand woods in some markets outside our borders have so inflated the cost of those timbers in New Zealand as to increase beyond reason the price of timber in New Zealand for all purposes.

I desire, therefore, your assistance in the foundation of a policy which shall as far as possible conserve for the use of the people of New Zealand, both in the present and the future, such public lands now covered with timber as are not required for land-settlement purposes, and for the plantation of areas of open land which, though not required for land-settlement purposes, are suited for planting and afforestation. And I first remind you that the expression "State forest" includes only Crown lands which have already been proclaimed to be State forests under the State Forests Act. Such lands constitute only a small part of the area required. I am not able to give the exact acreage of the lands already proclaimed as State forests, because the plans of the State forest lands, the preparation of which began at the end of last year, are not yet fully completed. But approximately the area is 1,654,214 acres, of which only about 1,464,000 acres of this area are actually under forest. Part, however, consists of forest on high mountain-ranges, and therefore not commercially available for timber purposes; and other parts have been proclaimed to be State forests for the purpose of providing revenue for that branch of the Lands Department, and consist of lands really suitable for, and required for, land-settlement after the milling-timber has been cut and removed. The land which has been proclaimed to be State forest is, however, so far safe for the present and the future in that it cannot be taken out of the control of the State Forest Department without the concurrence of Parliament.

The serious and urgent problem for the Government arises with respect to the Crown lands covered with forest which have not yet been proclaimed to be State forests. The demand for land for settlement, more urgent now than ever by reason of the requirements for provision of land for our returned soldiers, prohibits the possibility of conserving all such forest lands for forest purposes, and we have therefore to accept as a maxim that where the land under forest is good and required for land-settlement purposes the timber must go and the land be cleared. Whether in such cases the timber is burned or milled concerns the Lands Department and not the Department of Forests, for if the land is not to be used as forest land the existence or non-existence of forest upon it is a matter of no moment to the Commissioner of State Forests. But in all cases where the land under the forest is not of the quality which I have just described questions at once arise between the two Departments. In many such cases, and in all cases where the land is not of at least average quality, I am quite satisfied that the best policy for New Zealand is to retain the land as forest, proclaim it State forest, and deal with it scientifically for the provision of timber, not merely for the present but until the distant future. It is, I believe, demonstrable that forest land so held and used provides a constant employment for a greater number of people per area than any other industry; but it would unduly tax your patience were I on this occasion to attempt that demonstration. I can only urge upon you that this is the matter for your closest consideration, as it is that which creates my strongest anxiety—the question, namely, with regard to all these Crown lands covered with forest, where the line shall be drawn dividing the land to be opened for settlement from the land to be proclaimed as State forest. That question can only be decided fairly and properly by the Commissioner of Forests recognizing on the one hand the urgent demand for settlement, and the Minister of Lands and the Commissioners of Crown Lands on the other hand recognizing that the future requirements of New Zealand demand the retention of large forest areas under State control. The misfortune from my point of view is that, with some notable exceptions, the valuable timber-trees of New Zealand stand on good soil rather than on poor soil.

It has been suggested over and over again that the line of demarcation between land to be held as forest and land to be used for settlement should be forthwith approximately determined by rough survey, and that throughout the forest lands of the Dominion the line of demarcation should be shown by beacons.

and other defining boundaries. That process has been adopted in other new countries where the lands available for settlement are in excess of the demand, and where for the present forest-trees can be defined without conflict with the Department of Lands. But the conditions in New Zealand are entirely different, and in any case such a process of immediate definition of boundary by demarcation was impossible for want of labour during the war, and, even if begun, would have occupied so long a time as to be useless for all practical purposes. For that reason I proposed to Parliament last session the method which I had devised while Acting Minister of Lands, of allowing any Crown lands to be proclaimed to be *provisional* State forests, leaving then the demarcation to be the subject of agreement between the two Departments whenever the Department of Lands considered that part of the provisional State forests should be used for settlement purposes. Parliament granted that power, and already considerable areas of Crown land have been so proclaimed and added temporarily and provisionally to the State forests of the Dominion under my control; and I hope that much larger areas of Crown land will be so proclaimed from time to time, so that when the question arises whether such land shall be marketed the opportunity will be present to retain a large part of it for forest purposes. I do not know whether there is any precedent for this method, but I am satisfied that in this respect alone the legislation of last session has laid the foundation of a policy of forest-conservation which, if adopted by future Governments, will ensure the consideration by forest authorities of every case where land covered with forest is proposed by the Lands Department to be used wholly for land-settlement purposes.

Before I proceed to refer, as I must, to the other powers granted by the legislation of last session I ask you to understand that I am dealing to-day with forests only in relation to the production of timber for commercial purposes. Scenic reserves and bush preserved for climatic purposes or for river-protection are matters which come under a different head of the duties committed to the Commissioner of State Forests. But with regard to rivers I desire incidentally to ask your consideration always of the possibility of preserving the bush in the headquarters of the sources of rivers and their tributaries, since such preservation is a method of avoiding serious floods in non-navigable rivers and conserving a constant flow in navigable rivers.

The further powers conferred by the Act of last session have enabled the passing of two classes of regulations. By the first class limitations have already been placed upon the export of certain classes of timber, and power has been taken to fix the prices of every class of milled timber in New Zealand. I have endeavoured to proceed gradually in this matter, for it would have been unwise and unfair to abruptly interfere with the course of the milling industry already established. I have had the valuable assistance of the Board of Trade, the members of which have devoted constant attention to the intricate questions involved, with the result that so far it has been possible to make the regulations after conference with a representative committee of the sawmillers. I am afraid that there is a general idea that nothing has been done; but I believe that that idea has gained ground simply because neither the Hon. Mr. MacDonald, the Minister in Charge of the Board of Trade, nor myself has thought it necessary to make public announcements from time to time on the subject. The details of what has been done, and the steps proposed to be taken in relation to the prices of timber, are matters with which I need not trouble you at this stage.

Under the second class of power granted by the Act of last session regulations have been recently made prohibiting the sale of standing timber, or the grant of licenses to cut standing timber, without the consent of the Governor-General in Council; and I gather from numerous communications that the effect of such regulations has been much misunderstood. Huge areas of land covered with valuable forest are now held under cutting licenses granted in the past. In many cases the land under forest is wholly unsuited for settlement. The miller is to go in and destroy, and what is left behind him will be barren and useless. Such cutting-rights ought not to have been indiscriminately allowed in the past; the right to grant them must as a matter of public policy in the future be subject first to inquiry by the Government officials. The regulations do not prevent any private owner from himself cutting or destroying the timber on his own land, and it is clear that a private owner who desires that others should mill his timber before his land is cleared would obtain the license as a matter of course. The power of Native owners to grant authority to destroy forest has, I admit, been

thus limited, but in my view no undue interference with the Native right has been effected. The power of Wardens in mining districts to grant licenses to destroy timber growing in many cases upon land which would be worthless for any other purpose has been curtailed to the necessary power to grant cutting-rights for mining purposes pure and simple. Against this there has been already violent protest; and I anticipate much further attack. So far as the protest is one voiced by the sawmillers it must be made plain that the policy is one that has been deliberately entered upon by the Government and will not be altered. So far as the protest comes from local authorities which have derived revenue from royalties upon all State timber, the question whether provision shall be made for that loss of revenue out of the Consolidated Fund has not yet been considered by Cabinet, and I am not in a position to indicate what will be the policy of the Government on that subject. But it would be absurd to contend that the forests of New Zealand are to be destroyed in order to provide revenue for local authorities. With regard to the operations which will continue to produce royalties from the milling of State timber (a matter separate and distinct from the reduction of such operations by the recent regulations), I have not proposed any amendment of the law which grants a proportion of those royalties to local authorities, and have not in view the proposal of any such amendment during the coming session. But sooner or later the whole revenue from State timber must come to the Dominion Treasury to the credit of the State Forestry Account. Hitherto the cost of State forestry has been almost entirely provided out of loan-money. Loan-moneys will still be required for some years for the acquisition of land and for planting operations. But ultimately the cost of administration should be provided out of the revenue derived from the forestry operations, and subvention to local authorities must come from the Consolidated Fund—that is to say, from taxation, and not from the profit derived by the State from milling-timber which is the property of the State.

I turn now from the consideration of the meaning and effect of the new powers by Parliament last session to a brief consideration of the present position and of the mode in which it is intended in future to exercise those powers and the powers originally granted by the State Forests Act. We have available under section 32 of the Finance Act of last year power to raise money for afforestation purposes to the extent of £200,000, and you will be glad to learn that none of that money has yet been raised and very little spent in anticipation of borrowing. It has been practically impossible during the war to obtain the services of a trained, educated Director of Forestry, and even now I believe there will be considerable difficulty in finding the man we really want. We have in New Zealand a number of men fitted to fill offices in the Department of Forestry, but experience of modern methods, and education in the scientific branch of forestry, are essential qualifications for the office of Director, and we shall probably have to seek applications for that appointment outside New Zealand. The Public Service Commissioner has consented to recommend the exception from the Public Service Act of the office of Director in order that selection may be made, as in the case of professors at the University.

We have to bear in mind that there are two very distinct matters to come under our administration. The first is the conservation of existing forest areas, and the second is the plantation of poor land now bare of forest; and I propose briefly to indicate what is proposed with regard to each of those distinct matters separately. First as to conservation of forest areas. In most of our forests any specific area comprises trees now fit for milling, and growing trees some of which will in a brief course of time be fit for milling and some of which will grow gradually into profit many years hence. The trees fit for milling may be milled for the present use of the people of New Zealand, and if confined to that use the milling need not proceed at any excessive rate. But the milling of the ripe trees must be so conducted as that no unnecessary injury is done to the growing trees. And further planting operations of a minor kind must be carried on as the area is cleared of milling-timber so as to provide by the young new-planted trees for the distant future of forest operations in that area. The nearly fit trees and the smaller trees which are already there and growing will provide for the coming years and for the less distant future. No sawmilling license should henceforth be granted for the cutting of timber upon land which is to be preserved as forest except upon those conditions. If the sawmillers will accept those conditions they will find themselves provided with a long tenure for their operations within every area of their license.

But if the sawmillers will not accept those conditions, then the alternative must be faced of confining sawmilling to State-owned mills. We have already some State milling operations conducted by the Railway Department upon timber lands reserved for railway purposes, and I have made proposals to that Department, which I trust may be accepted, for the transfer to the State Forest Department of all the Railway milling operations. In any case I believe it will be necessary to establish State sawmills in the Waipoua Kauri Forest.

I have been awaiting the publication by Mr. D. E. Hutchins of his "Report on the New Zealand Forests." His great experience enables him to give advice upon such matters as fire protection, which we shall doubtless accept for our guide. I conclude this brief reference to conservation of forest areas by reminding you that in this regard the question of the age at which New Zealand trees attain maturity does not arise for consideration. As I have said, on each area we have the trees actually growing to maturity—New Zealand timber-trees self-sown and growing in their natural conditions—and we save those trees until their maturity whatever the period may be. Many of the trees are already of the age of maturity, and others are growing naturally to that age. For example, if the age of maturity be 250 years, the milling operations will leave trees growing already of the age of 200 years, and a less time will elapse for those trees to attain maturity than the time required by quicker-growing foreign plantations.

With regard to the second of our principal operations—namely, plantation—we must remember in the present and the future that the land to be used must not be land which will be sought for settlement purposes, and therefore poor land; and, further, we must have regard to climatic conditions. A considerable rainfall is essential to produce the growth of most of the quick-growing trees, and therefore large areas of land which are considered by many persons to be fit for forest operations, because fit for nothing else, must be discarded from our consideration. Then, again, we have to remember that it is useless to plant trees for forest purposes unless they can be subsequently milled and used without a heavy cost of transit. Plantations of inaccessible hillsides are of no practical utility. I invite the Commissioners to advise me, through the Minister of Lands, of areas which fulfil the necessary conditions, and I hope to be able to establish on land so acquired in various parts of the Dominion nurseries and plantations of quick-growing trees to provide in the very near future timber for commercial purposes. I will not enter here upon the question of the kind of trees to be planted with that object. In New Zealand we have come to believe in the *Pinus insignis* as the tree most quickly producing profit, but I observe by the latest English report that English experts give the first place to the Douglas fir. The subject is one upon which expert advice has been sought and is being acquired. There is at the present moment difficulty in securing the services of men trained in nursery-work and capable of directing planting operations. It is certain that we must contemplate an increase in the rate of remuneration of that class of Government employee if our planting operations are to be extended. I hope and believe that many returned soldiers will be willing to take up plantation-work, but there are more vacancies than applicants at present.

Upon one subject closely allied with both forest conservation and plantation I must add a few words. The kauri grows largely on poor land. There are considerable areas, I believe, in the North of Auckland from which the kauri milling-timber has been removed, but where there is a large number of self-sown kauri-plants, and also a large number of younger kauri-trees unfit for milling. I hope that it may be found possible to bring under the control of the Forest Department a number of such areas where an attempt may be made to reproduce the kauri forests, partly by encouraging the growth of the trees already there and protecting them from fire, and partly by consistent planting of kauri-seedlings. Let us at least make the attempt not only to conserve as kauri forests the lands now remaining covered with such forests, but also to restore to the original condition of kauri forest the areas of poor land which were originally covered with kauri. Whether that effort be made for the benefit of the next generation, as some hope, or for generations one hundred and fifty years hence, as more believe, it should surely be made.

One last word as to the gradual disappearance of the white-pine and the continued permission to export a percentage of that timber. You are all aware that the white-pine grows principally upon good land, and therefore upon land required for settlement if it is Crown land, or upon land which the owner desires

to clear if it is private land. Already I have had statements from settlers that if they are unable to have the white-pine timber milled they must fell and burn it. It happens that the white-pine can be used in Australia for purposes for which it has gone out of use here, because for some reason the borer does not attack it in Australia. There is therefore a market in Australia for white-pine for building purposes, and, further, parts of the logs, which are regarded as refuse in New Zealand, are used in Australia for various purposes. We cannot postpone the destruction of the white-pine, because the land under it is valuable, and to entirely prohibit the export would only have the effect of ensuring its destruction by fire. The timber is so valuable for butter-boxes that it has always seemed most desirable to preserve it for use for that purpose as long as possible. But to effect that object it would be necessary to prohibit its rapid destruction, and that is impossible as against the urgent demand for the good land upon which it generally grows. There are areas, however, where the kahikatea is largely dispersed among rimu, and I trust that by withholding those areas from sale, and transferring them to the State forests, we may be able to continue the supply of white-pine for butter-boxes to New Zealand producers for some considerable time longer.

I think it necessary to allude to the fact that with regard to national-endowment lands the Law Officers have advised that they cannot be proclaimed as provisional State forests because of the preceding statutory appropriation of their revenues. I think that this difficulty can be met by appropriate legislation without unduly affecting the existing appropriation. The forest upon national-endowment lands should certainly be conserved at least as much as the forest upon lands which have not been by existing legislation reserved for the benefit of the future inhabitants.

Finally, I want your help and advice. Every one of you has far more experience than myself of the conditions and the difficulties. It is too much to hope or expect that there shall be no differences of opinion as we proceed to draw the demarcation-lines between the lands to be transferred to State forests and the lands you will control for disposition to the public. But with the co-operation of the Minister of Lands, and your help, I shall trust that the benefit of the doubt may be given in every case to an addition to the lands under the control of the Commissioner of State Forests, where there shall continue to grow and be milled the timber required for the use of the people of New Zealand.

CANTERBURY SEED-GROWERS' ASSOCIATION.

THE association is again this year distributing pure seed-wheat grown under the inspection of the honorary secretary, Dr. Hilgendorf, of Lincoln College. The following varieties are available—namely, Hunters or Red Chaff, Solid-straw Tuscan, Purple-straw Tuscan, and true Pearl—all of which have undergone five years' trial at Lincoln College, and have during that period shown themselves superior to commercial seed of the same variety. There are also small lots of White-straw Tuscan and Velvet raised as pure strains by a member of the association, but which have not yet been put through exhaustive competitive trials. Every sack of seed sent out bears a tag certifying that it has been inspected while growing, that it is true to name, relatively pure, and free from noxious weeds.

FORTHCOMING WINTER SHOWS.

Otago A. and P. Association: Winter Show, at Dunedin, 3rd to 6th June.

Waikato Winter Show Association: At Hamilton, 3rd to 7th June.

Taranaki Agricultural Society: Winter Show, at New Plymouth, 11th to 14th June.

Manawatu and West Coast A. and P. Association: National Dairy Show, at Palmerston North, 17th to 20th June.

Rangitikei A. and P. Association: Winter Show, at Taihape, 25th and 26th June.

IMPORTATION OF FERTILIZERS: QUARTER ENDED 31ST MARCH, 1919.

Kind.	Country of Departure.	Auckland.		New Plymouth.		Wanganui.		Wellington.		Napier.		Lyttelton.		Dunedin.		Invercargill.		Totals.			
		Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Tons.	£
Sulphate of ammonia	Australia ..	10	344	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Australia ..	576	7,573	..	..	..	..	10	133	..	..	..	..	..	..	..	..	..	..	..	..
	Australia ..	100	586	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Guano and rock phosphate	New Caledonia..	1,953	4,991	1,600	2,750	..	..	..	121	333	..	..	..	..	..	..	..	..	..	..	..
	Makatea Island	4,650	10,230	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Total ..	6,603	15,221	1,600	2,750	..	..	121	333	..	..	..	..	..	..	..	..	..	..	..	..
Superphosphate	Australia ..	1,450	7,426	335	1,290	..	..	..	700	4,087	..	..	312	1,587	..	..	..	..	..	..	..
Sulphate of iron	United Kingdom	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Australia ..	..	..	..	..	..	..	..	20	278	..	..	10	139	..	..	..	..	..	..	..
	U.S. America ..	1	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Total ..	1	13	..	..	..	..	..	20	278	..	..	10	140	..	..	..	..	..	..	..
Other manures ..	U.S. America ..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..
	Total ..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..

* Short-stated during 1918.

NOTE.—With regard to the "declared values" which are given above, the Comptroller of Customs supplies the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent. does not nearly cover the present freight, insurance, and other charges the statistical value is a long way less than the actual landed value."

MEAT-FREEZING WORKS IN NEW ZEALAND.

Name and Address of Company. <i>Land District.</i>	Location of Works.	Beef-killing Capacity per Day.	Sheep-killing Capacity per Day.	Storage Capacity, in 60 lb. Carcases Mutton.
<i>Auckland.</i>				
Whangarei Freezing Company, Ltd., Auckland ..	Whangarei Hds.	150	1,000	80,000
Auckland Farmers' Freezing Company, Ltd., Auckland	Southdown ..	200	3,000	215,000
" " " " " " " "	Horotiu ..	200	3,000	218,000
Westfield Freezing Company, Ltd., Auckland ..	Westfield ..	200	3,000	225,000
R. and W. Hellaby, Ltd., Auckland ..	" ..	120	500	5,000
East Coast Co-op. Freezing Company, Ltd., Whakatane	Whakatane ..	200	1,000	140,000
<i>Hawke's Bay.</i>				
Wairoa Farmers' Co-operative Meat Co., Ltd., Wairoa	Wairoa ..	50	2,000	165,000
North British and Hawke's Bay Freezing Company, Ltd., Napier	Westshore ..	40	1,500	36,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Pakipaki ..	30	1,500	71,000
Nelson Bros., Ltd., Tomoana ..	Tomoana ..	80	3,000	175,000
Hawke's Bay Farmers' Meat Company, Ltd., Hastings	Whakatu ..	80	2,000	155,000
Tokomaru Sheep-farmers' Freezing Company, Ltd. ..	Tokomaru Bay	45	2,500	140,000
Poverty Bay Farmers' Meat Company, Ltd., Gisborne	Kaiteratahi ..	100	2,000	250,000
Gisborne Sheep-farmers' Frozen Meat Company, Ltd., Gisborne	Kaiti ..	150	6,000	350,122
Nelson Bros., Ltd., Gisborne ..	Taruheru ..	85	2,500	100,000
<i>Taranaki.</i>				
Taranaki Farmers' Meat Company, Ltd., New Plymouth	Smart Road ..	100	2,000	135,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Waitara ..	200	2,000	100,000
New Zealand Farmers' Co-operative Bacon and Meat Packing Company, Ltd., Wellington	Eltham ..	75	..	25,000
Patea Farmers' Co-op. Freezing Company, Ltd., Patea	Patea ..	120	1,000	140,000
<i>Wellington.</i>				
Wanganui Meat-freezing Company, Ltd., Wanganui ..	Castlecliff ..	100	2,200	160,000
New Zealand Refrigerating Company, Ltd., Christchurch	Inlay ..	200	6,000	271,000
Otaihape Farmers' Meat Company, Ltd., Taihape ..	Winiata ..	50	1,200	125,000
Feilding Farmers' Freezing Company, Ltd., Feilding ..	Aorangi ..	100	2,200	153,534
National Mortgage and Agency Company of New Zealand, Ltd., Dunedin	Longburn ..	60	1,500	105,000
Wellington Farmers' Meat Company, Ltd., Masterton	Waingawa ..	250	6,000	353,000
Gear Meat Preserving and Freezing Company, Ltd., Wellington	Petone ..	100	10,000	415,000
Wellington Meat Export Company, Ltd., Wellington ..	Ngahauranga ..	120	8,000	291,905
New Zealand Farmers' Co-operative "Bacon and Meat Packing Company, Ltd., Wellington	Kakariki ..	100	2,000	117,000
	Ngahauranga ..	..	..	120,000
<i>Marlborough.</i>				
New Zealand Refrigerating Co., Ltd., Christchurch ..	Pieton ..	30	1,000	23,000
<i>Nelson.</i>				
Nelson Freezing Company, Ltd., Nelson ..	Stoke ..	..	350	40,000
<i>Canterbury.</i>				
Canterbury Frozen Meat Company, Ltd., Christchurch	Belfast ..	50	7,000	190,000
" " " " " " " "	Fairfield ..	..	4,000	80,000
" " " " " " " "	Pareora ..	25	4,500	230,000
New Zealand Refrigerating Co., Ltd., Christchurch ..	Islington ..	50	7,000	375,000
" " " " " " " "	Smithfield ..	50	6,000	266,000
North Canterbury Sheep-farmers' Co-operative Freezing Company, Ltd., Christchurch	Kaiapoi ..	50	2,500	139,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Belfast ..	..	4,000	126,000
<i>Otago.</i>				
New Zealand Refrigerating Co., Ltd., Christchurch ..	Pukeuri ..	..	3,000	230,000
" " " " " " " "	Burnside ..	50	3,500	216,000
South Otago Freezing Company, Ltd., Balclutha ..	Finegand ..	30	1,200	200,000
<i>Southland.</i>				
Birt and Co., Ltd., Invercargill ..	Ocean Beach ..	100	2,500	114,000
Southland Frozen Meat Company, Ltd., Invercargill ..	Mataura ..	50	2,000	91,459
" " " " " " " "	Makarewa ..	70	2,000	73,974
" " " " " " " "	Bluff ..	..	..	114,278
Total ..	..	3,860	129,150	7,385,272