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BREEDING OF ROMNEY-CROSS SHEEP.

WOOL-IMPROVEMENT DEMONSTRATION AT WALLACEVILLE.

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IN view of recent statements by the Bradford trade alleging deterioration in New Zealand Romney-cross wool—chiefly as regards increasing hairiness or medullation of fibre—it will be of interest to sheep-farmers to record the practical breeding operations carried out by the Department of Agriculture with a small ewe flock at the Wallaceville Veterinary Laboratory Farm, near Wellington, during the past five years. The work, it will be noted, was commenced well before the Bradford criticisms in question made themselves heard. Without entering into this particular controversy on one side or the other, it may be claimed that the Wallaceville results have provided a valuable demonstration of what can be accomplished in wool-improvement by any farmer within a comparatively short period. It has been shown that Romney-cross wool can be readily bred with a high degree of purity of fibre—in fact, that this, our predominant crossbred-wool product, is not inherently or necessarily defective as regards its internal structure.

RECORD OF WALLACEVILLE FARM FLOCK, 1920 TO 1924.

The ewe flock in 1920 was a mixed one of both Lincoln-Romney and Romney-Lincoln cross. The ewes were a fairly good line as regards constitution, but there were many defects in conformation, such as overlong faces, narrowness between the eyes, legginess, and lightness and roundness in the bone. The wool grown by the flock, which ranged

from 36's to 40's in spinning count, was of a very inferior quality. It was what is termed hairy, most of the fibres being medullated; pure kemps were also to be found in some of the fleeces. Moreover, the wool was too open for proper resistance to adverse climatic influences, with resultant unevenness of diameter in the fibres throughout their length. On looking over the line one would be doubtful as to there being any really pure wool in any of the fleeces, and this was confirmed by microscopical examination.

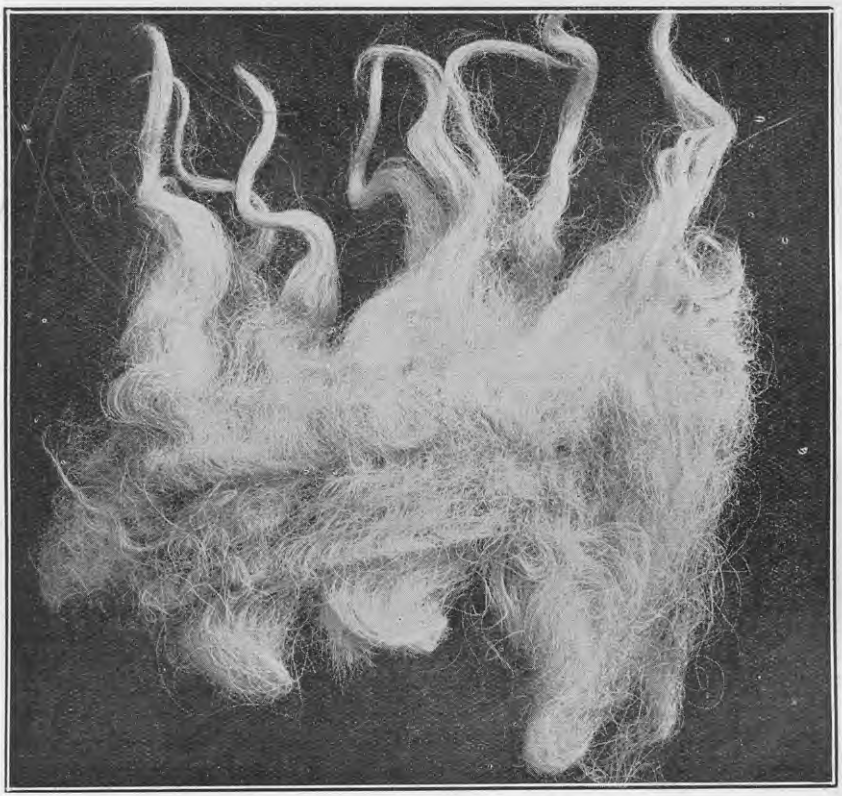


FIG. 1. SAMPLE OF WOOL FROM THE ORIGINAL EWE FLOCK AT WALLACEVILLE LABORATORY FARM; 1920–21 SHEARING.

Year 1920.—In this year the flock was divided, half being mated to a Southdown ram and half to a Romney. The Romney ram (No. 1) was an animal of sound constitution. In conformation he had a well-shaped head, good width between the eyes, face a nice length, and good neck, shoulders, and hind quarters, together with strong, flat bone. The wool grown by this ram was what is termed strong —that is, about the coarsest quality of its breed, 40's to 44's—with a fair amount of character in it. With but few exceptions the resulting crop of lambs from this mating showed a noticeable improvement in

the quality, character, and density of the wool. There was also a general improvement in the conformation of the lambs as compared with their dams. All the ewe lambs were kept, and were shorn when hoggets at the latter end of 1921. Any of those that had thrown back too much to their dams were culled out at this time, the fleeces taken off them being an excellent guide for this purpose. A microscopical examination of several samples of this line of hogget wool proved very clearly that good progress had been made by eliminating

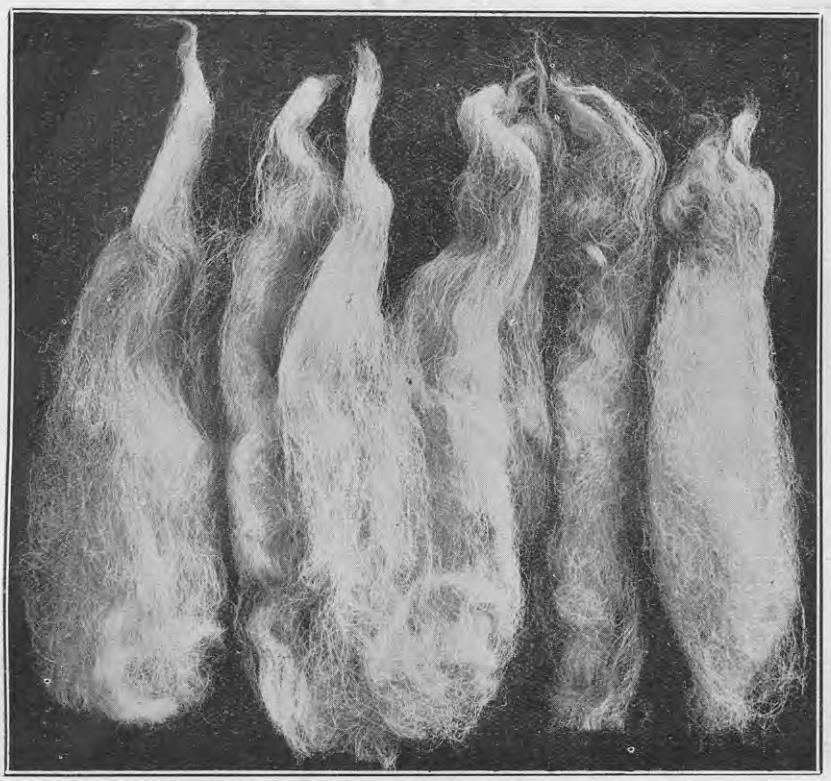


FIG. 2. WOOL FROM THROWBACKS AMONG PROGENY OF THE STRONG-WOOLLED ROMNEY RAM (NO. 1) AND THE ORIGINAL EWES; 1921–22 SHEARING.

a large proportion of the hairy element that had been present in the dams' fleeces. The wool consisted largely of what is termed broken medullated fibres, thus giving a strong indication that if these hoggets were mated with a fine-woolled Romney ram their progeny would grow a very high proportion of pure wool.

Year 1921.—The strong-woolled Romney ram (No. 1) was mated with the same ewes in 1921, and a similar result was apparent in the crop of lambs from this mating. A few of the coarsest of the ewe

lambs were culled out, but the bulk were kept, and were shorn as hoggets in 1922. An examination of the fleeces showed the same results as in the previous line of hoggets, which was only to be expected as the animals were full sisters. On the farm we now had two lines of ewes by the same ram out of the same ewes.

Year 1922.—The strong-woolled ram was now replaced by a fine-woolled Romney (No. 2). Many of the oldest ewes had been culled out and sold about this time. The new ram was of splendid constitution, and possessed good conformation—neck well set, shoulders

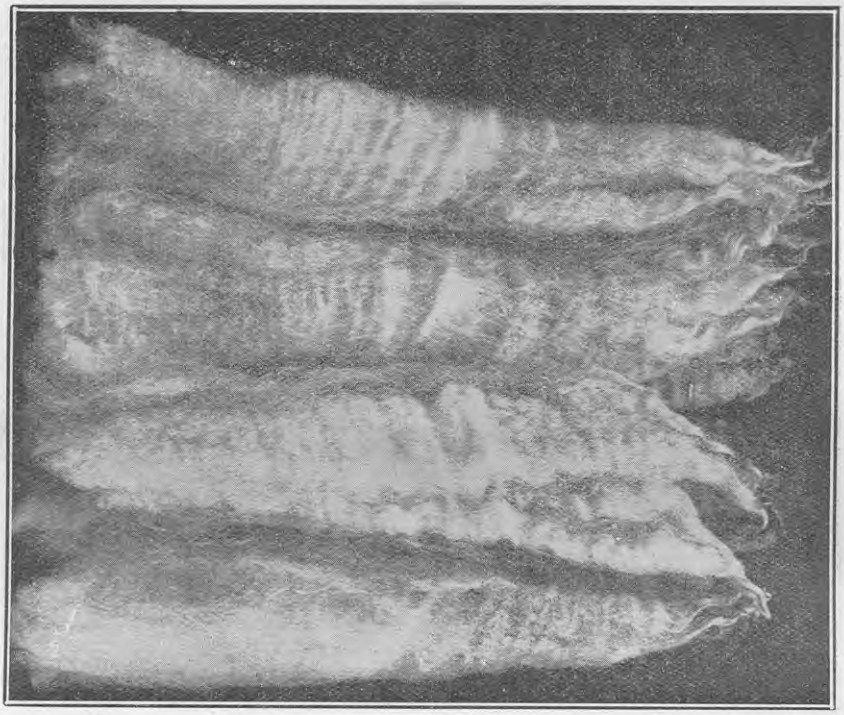


FIG. 3. WOOL FROM HOGGETS, PROGENY OF THE STRONG-WOOLLED ROMNEY RAM (NO. 1) AND THE ORIGINAL EWES; 1921–22 SHEARING.

level and set forward, level back, good loin and hind quarters, well-shaped head, breadth between the eyes, and face a nice length. The wool grown by this ram was very even in quality—46's to 48's—and had considerable character. It also possessed a fair degree of density—a most desirable feature. He was, in fact, a very good all-round animal, and it is a pity he could not have been used on a larger place.

This ram was mated with the ewes on the farm, including the ewe hoggets lambed in 1920 and shorn in latter part of 1921. The crop of lambs from the mating was very good, showing a decided improvement in both conformation and wool. All the ewe lambs were kept

on the farm, and were closely examined when they were brought in for shearing in 1923. Only two were culled out on account of wool-defects throwing back to the original line of ewes in 1920. This hogget wool showed the great improvement that had taken place by using ram No. 2. The wool was more even in quality; it had a higher spinning count; also greatly increased density (number of fibres per given area of skin); the yolk was carried out to the tip, giving strength to the fibre (thus enabling it to undergo the combing process with very little loss in noil). There was also increased character, making it a more

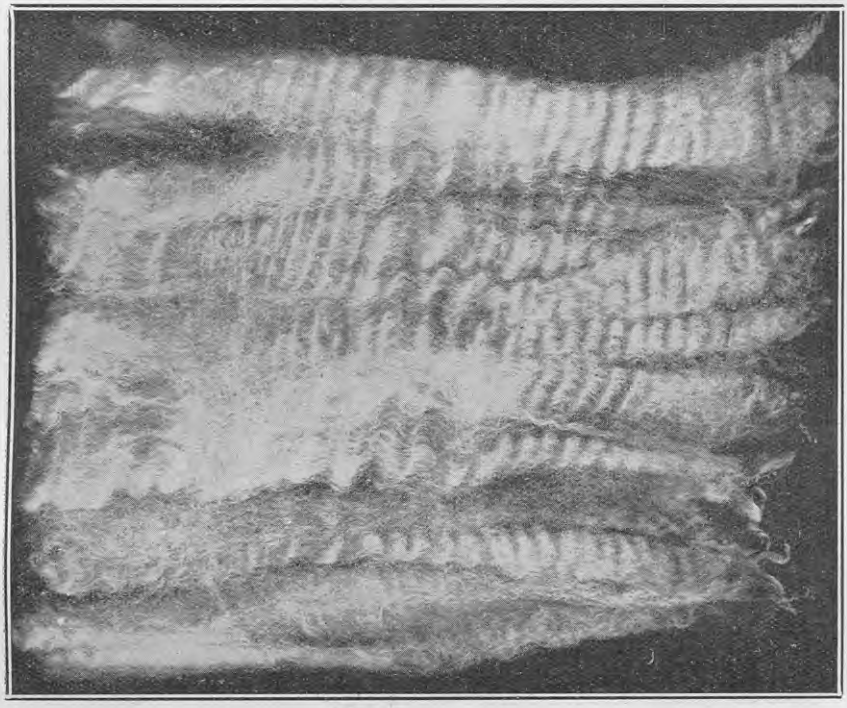


FIG. 4. WOOL FROM HOGGETS, PROGENY OF THE FINE-WOOLLED ROMNEY RAM (NO. 2) AND THE FIRST-CROSS EWES; 1923–24 SHEARING.

First-cross ewes were by ram No. 1 out of original ewes.

elastic, pliable, and soft handling wool (thereby enabling a high class of material to be made from it). A microscopical examination of samples taken from each fleece showed very clearly the great difference between the wool of these hoggets and samples taken from their grand-dams. A few of the fibres in some of the samples still showed slight medullation, but this was broken or patchy, the other parts of the fibre being pure wool. In several of the samples all the fibres were pure wool. The scaling on the fibres and the evenness of diameter throughout their length were also very satisfactory.

Year 1923.—In this year ram No. 2 was mated with the same ewes as in 1922, and also had for service the ewes from the 1921 lambing. The lambs produced from this mating were again very good. The ewe lambs were kept and shorn as hoggets at the end of 1924. The wool was excellent to the eye and touch. Samples were taken out of each fleece, and a microscopical examination showed the same good results as in the 1923 hogget wool. This was to be expected, the two lots being full sisters.

Year 1924.—For the mating season of 1924 another Romney ram (No. 3) was secured. He was lacking a little in conformation, and although he could be classed as a fine-woolled Romney his wool did not have the same degree of character in it, nor the density, that characterized

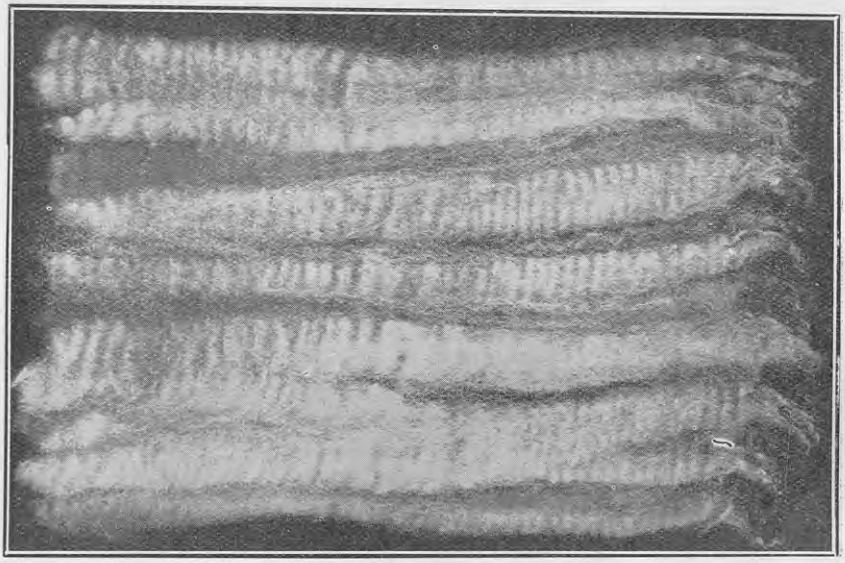


FIG. 5. WOOL FROM HOGGETS, PROGENY OF THE FINE-WOOLLED RAM (NO. 2) AND THE FIRST-CROSS EWES; 1924–25 SHEARING.

[*All photos by H. Drake.*

the fleece of ram No. 2. These deficiencies are certain to be shown in his progeny, and will be watched for very closely at the 1925 shearing for future guidance.

It may be recorded that the hoggets of 1924 averaged the very satisfactory fleece weight of 11¼ lb. at shearing.

Summary.—In 1920 the farm had a line of ewes growing a very inferior wool, rightly termed "hairy." These ewes were mated with a strong-woolled Romney ram (No. 1) for two years in succession. This ram was then disposed of, and some of the oldest original ewes were sold off. In 1922 a fine-woolled Romney ram (No. 2) was brought to the farm and mated with the remainder of the original ewes and ewes from the first mating of ram No. 1. In 1923 more of the original line

of ewes were sold, and ram No. 2 was mated with any that were left, also with the two lots of ewes produced by the mating of ram No. 1 with the original ewes. In 1924 another fine-woolled Romney ram (No. 3) was procured and mated with the flock, in which were included both lots of ewes sired by ram No. 1 and lambed in 1920 and 1921 respectively. Ram No. 3 was also mated with the first lot of ewes by No. 2 ram, lambed in 1922.

GENERAL.

The prices paid for the different rams here referred to were: No. 1, £15; No. 2, £8; and No. 3, £8 8s. Such prices are within reach of any sheep-farmer who desires to effect an improvement in his wool-clip.

For the current (1925) season a fine- and dense-woolled Romney ram has been purchased at a price of £12 12s. He is being mated with the ewes from the 1922 and 1923 crossings and a few ewes of previous matings. Results will continue to be watched and records taken.

The maxim that "The ram is more than half the flock" has been fully borne out in the results of the breeding conducted at Wallaceville. A sound, practical demonstration has been given of the great improvement that can be effected by using good rams and culling out the most defective ewes in the flock. The covering grown by the ewes in the past has been brought from medullated fibres, with kemp among the fleece, up to the present fleece, in which there is practically no kemp, and the greater proportion of the fibres are pure wool—in some of the samples every fibre being pure. It has been clearly shown that Romney crossbred sheep in New Zealand will grow as much pure wool as any other breed or cross.

It may be added that the dual-purpose feature of the Romney breed—meat as well as wool—has not been lost sight of in the breeding operations here recorded. The wether lambs from the several matings have been regularly sold as high-grade fat stock.

Sheep-farmers visiting Wellington and interested in this matter will be welcome to inspect samples of the wool referred to at the Live-stock Division headquarters, Dominion Farmers' Institute Building.

Shipment of Green Cheese.—In the course of a recent address on the cheese trade to the Dairymen's Association of Western Ontario Dr. J. A. Ruddick concluded his remarks regarding the shipping of green cheese as follows: "Before we leave this matter I should like to refer once more to the foresight and precautions taken by our chief competitors, the New-Zealanders. Although New Zealand cheese, even if shipped direct from the hoop, is nearly three months old before it can reach the consumer, the New-Zealanders have taken the precaution to legislate that no cheese shall be offered for grading until it is fourteen days old. A person who knows the conditions in both countries is sure to be struck by the fact that while in Canada we seem to be possessed of a desire to market our cheese at the earliest possible moment, in New Zealand a matter of a week or a month's delay is scarcely taken into account. I think the New-Zealander realizes that delay very often means improvement in quality, and that, so far as the market is concerned, it is just as likely to be favourable at one time as another. There are no recognized periods now when prices are likely to advance as there used to be in the old days with its off season of production."

THE PEAR-MIDGE.

FURTHER OBSERVATIONS AND CONTROL WITH CALCIUM CYANIDE.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

THE original account of the pear-midge (*Perrisia pyri*) in New Zealand—published in this *Journal* for August, 1921—dealt with the life and seasonal histories of the insect, and results of control experiments carried out at that time. In the following pages the position is reviewed from the first appearance of the midge in the Dominion to the present time, and the results of control experiments with calcium cyanide are discussed.

A feature in the midge-infested areas near Auckland, where the pear-trees have been subjected to severe infestation for the past four or five years, is that the trees are stunted, and the leaves which do develop are dwarfed, while their green colour has assumed a fairly yellowish tint.

SPREAD OF THE MIDGE.

Auckland: The initial outbreak of pear-midge in New Zealand occurred in the spring of 1916 at Avondale, near Auckland (area 1 on map). From there it rapidly spread during the succeeding years to adjoining districts, and by the 1920–21 season had become established over Eden County and southern part of Waitemata County (area 2, shaded), as well as in the Waikato (area 6). In the following season it appeared northward at Huapai (area 3) and Komiti (area 4), and southward at Te Kauwhata (area 5).

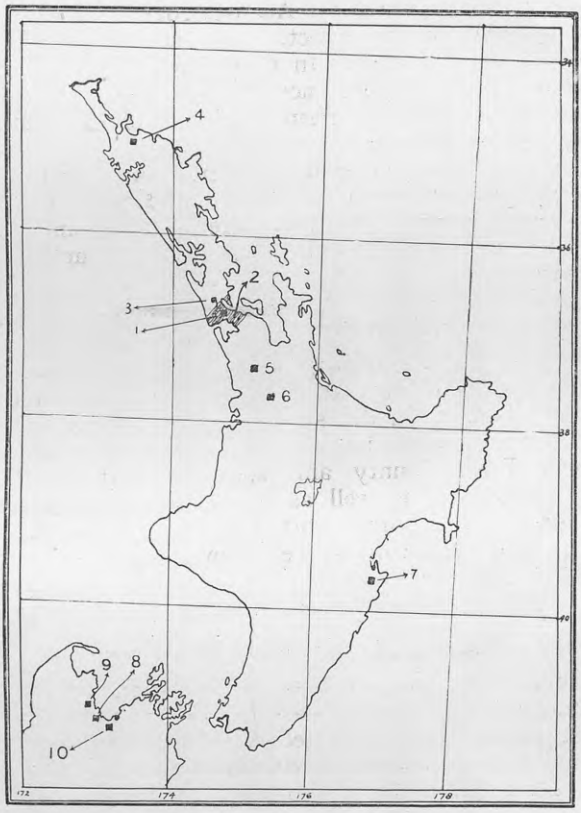
Hawke's Bay: At Hastings (area 7) the midge appeared during the spring of 1920, infesting a block of orchards eastwards of the railway.

Nelson: The midge made its first appearance in the South Island in an orchard at Tasman (area 8) during the spring of 1921, and spread from there to adjoining areas, as well as attacking orchards separated from the originally infested one by low ridges. Shortly after this the midge was reported westward at Riwaka (area 9), while not until last spring (1924) did it appear to the west in the orchards in the Redwood's Valley and Stoke districts (area 10).

A consideration of these midge-infested districts shows that they lie in at least five naturally isolated areas: Waitemata and Eden Counties (1, 2, and 3), Komiti (4), Waikato (5 and 6), Hawke's Bay (7), and Nelson (8, 9, and 10). The natural barriers are distance, air-currents, sea, or mountain-ranges. The absence of pear-orchards over given areas is also an isolating factor.

Two factors have been responsible for the spread of the midge from its initial point of establishment at Avondale to the other districts recorded above. These factors are (1) natural dispersion by the flight of the insect aided in many cases by wind, and (2) artificial dispersion in the larval and pupal stages in soil surrounding roots of nursery stock.

Natural dispersion was no doubt the chief means by which the areas in the vicinity of Auckland City became infested, though the movement of nursery stock played some part, particularly in the infestation of an area such as at Huapai, which is partially isolated by low hill country. The establishment of the midge in the other districts enumerated can be accounted for only by artificial dispersion in the first instance, though natural agencies came into play in these districts



MAP SHOWING DISTRIBUTION OF PEAR-MIDGE IN NEW ZEALAND.

(1) Avondale (initial outbreak); (2) Waitemata and Eden Counties; (3) Huapai; (4) Komiti; (5) Te Kauwhata; (6) Hamilton; (7) Hastings; (8) Tasman; (9) Riwaka; (10) Redwood's Valley and Stoke.

after the initial establishment. It seems, therefore, that attention has not been given to the recommendation made in the former article (page 89, *Journal*, August, 1921) that "the greatest care should be taken in exporting from a midge area not only pear-trees but all nursery stock, since it requires but very little soil infested by midge-larvæ to spread this pest broadcast over a wide area."

INFLUENCE OF CLIMATE.

Though no detailed observations have been made on the extent to which the pear-midge is influenced by climate, there are certain features worthy of mention. It is well known that climate is a limiting factor in the establishment and dispersal of insects, and variations in the intensity of midge infestation and in the period of first spring emergence in the different districts seem, in part at least, to be due to differences in moisture.

The areas where infestation is most severe are in the Waitemata and Eden Counties, and at Tasman and Riwaka in the Nelson District, but particularly the former; while in Hawke's Bay infestation is comparatively light. Further, the emergence of the first spring brood of midges commences during late September in Waitemata and Eden Counties and also at Tasman and Riwaka, but during the second week of October in Hawke's Bay.

The following figures (kindly supplied by the Dominion Meteorological Office) show the total mean rainfall in the three main midge areas for the months April to October, when the hibernating midge-larvæ are in the ground: Auckland (area 2), 29·32 in.; Motueka (area 9), 32·32 in.; Hastings (vicinity of area 7), 22·62 in. These figures show that the rainfall at Auckland and Motueka is much higher than at Hastings. This feature, when correlated with the earlier spring emergence of midge in late September in the vicinity of Auckland City and in the two Nelson districts, and the later emergence in October in the Hawke's Bay area, shows that moisture has apparently a direct influence upon the emergence of the overwintering stage of the midge. There are at present no temperature statistics from actual midge-infested areas available for comparison, though figures from the meteorological stations at Auckland, Nelson, and Napier show that Auckland has the highest temperature and Nelson the lowest—a feature seemingly bearing out the opinion that moisture is the main climatic factor influencing midge emergence.

CONTROL WITH CALCIUM CYANIDE.

Owing to the pear-midge larvæ when on the trees being protected by the rolled-up leaves, none of the sprays tested have been sufficiently effective. However, the habit of the larvæ entering the ground to hibernate and pupate presents an opportunity for control.

Though a number of insecticides have been experimented with in soil-treatment (*Journal*, August, 1921), no results of a practical value were obtained until the present season, when calcium cyanide was used. This is a preparation manufactured by the American Cyanamid Company, New York, and at the time of these experiments was prepared in three forms—granules, flakes, and dust. Owing to later improvements in the manufacturing processes, however, the granules can now be made at less cost and placed on the market at the same rate as formerly charged for the flakes, which have been withdrawn. On the cyanide being exposed to the atmosphere, hydrocyanic-acid gas is generated, and its value as a soil-fumigant is at once apparent. The opinion has been put forward that too great a danger to life is involved by the use of this material, but that is by no means so if ordinary common-sense is used in its handling. Certainly the danger is comparatively small when the cyanide is used out of doors.

In the following experiments against one of the summer broods of midge, carried out at Mr. F. G. Platts's orchard at Henderson, the granular cyanide was used. Six dosages were laid out, each involving three plots of infested soil under as many trees, making a total of eighteen trees treated. Over the treated area under each tree two emergence tents were pitched, so that six observations were made for each dosage. As a check twelve tents were pitched under untreated trees. Owing to lack of sufficient cyanide the experiments were not made more extensive.

The dosages of cyanide to each area of 200 sq. ft. were as follows, the material being spread on the ground and worked, not turned, in with a spade: (1) 2 lb., (2) 1¾ lb., (3) 1½ lb., (4) 1 lb., (5) ¾ lb., (6) ½ lb.

An examination of the emergence tents at the time when the midges were due to emerge showed that the efficiency of the cyanide divided the dosages into two groups, one comprising dosages (1), (2), and (3), and the other the dosages (4), (5), and (6). In the first group there was 100 per cent. control, and in all of the second group but little control, if any. Certainly the weakest dosages, (5) and (6), cannot be claimed to have had any effect, since the numbers of midges emerging into the tents over these plots could not be said to be any less than those in the check tents.

Owing to results between the two groups of dosages—(1), (2), (3) and (4), (5), (6)—being so decidedly positive and negative, a later attempt was made with dosages of strengths each descending by 1 oz. from 1½ lb. to 1 lb. to every 200 sq. ft. of infested ground. In this experiment, carried out to determine if there was a weaker effective dosage between (3) and (4), thirty-six observations were made, exclusive of checks. Nine dosages, each involving infested ground under two trees, were applied. On each of these eighteen plots an emergence tent was pitched, together with an emergence box. This latter, turned mouth downwards, measured 10 in. (high) by 14 in. by 20 in. (inside measurements), and was lined with black paper. On the top five holes were bored, in each of which was inserted a glass tube 1 in. in diameter and open at both ends except for a muslin cap over the outer one. A cork fitted with a narrow tube was inserted into the opposite end within the box, in order to prevent any midges from leaving the tubes once they had entered. It was hoped by this means to make counts of the midges emerging from each dosage, but the moisture which collected in the bottom of each tube interfered with this.

The results of these experiments, however, as gauged from the tents, showed that the dosage of 1½ lb. to 200 sq. ft. was the weakest effective strength that could be used for 100 per cent. control. Acting on this basis it is intended to extend the work on a larger scale, treating whole orchards under commercial conditions in order to test the efficiency of the cyanide against the hibernating midge-larvæ. A point of interest in the experiments was that though the pear-midge was controlled by the stronger dosages, the latter had apparently no effect on certain other underground insects, since there was a general emergence in all the tents of such insects as the cicada (*Melampsalta cingulata*), and several ichneumon flies and muscid flies.

The quantity of cyanide required to treat a midge-infested orchard will vary with the spread of the trees. In mature orchards where trees

overlap, the full acreage must be treated at a maximum cost, but with upright mature varieties or younger trees less cyanide will be required, until a minimum is reached in a newly planted orchard or in a nursery. It is not known at present just what the exact cost of treatment with calcium cyanide would be, but in any case the results here recorded, together with the reduced price of the granules, show that at least young orchards (or even some mature ones) and nurseries, where isolated, could be economically treated at present.

That ordinary winter cultivation, if carefully carried out, will reduce the numbers of midges emerging in the spring has been proved (*Journal*, August, 1921), but no concerted attempt has been made to follow this line of treatment, which requires that orchards be well kept throughout the year, so that the thorough turning-in of the midge-infested surface soil is made possible during the insect's hibernating-period. Not only is the pear-midge so reduced in numbers, but also other insects hibernating underground.

THE PEAR-MIDGE PEST.

SPRAYING EXPERIMENTS AT HENDERSON.

R. H. MAKGILL, Auckland.

THE damage caused by the pear-midge in those parts of New Zealand which this pest has reached is so great, and the control is so difficult, that the writer ventures to record even the small measure of success he has obtained by repeated spraying in his orchard at Henderson, near Auckland.

In the annual report for 1919 of the Bristol University Horticultural Research Station Mr. A. H. Lees, Research Entomologist, describes a nicotine-paraffin insecticide spray having the following composition: Soft soap, 15 lb.; paraffin, 2 gallons; nicotine, ½ lb.; water, 100 gallons. He advocates the use of this spray in summer-time against woolly aphis.

In conversation with the writer Mr. Lees suggested that it might be found of service against pear-midge, not with a hope of destroying the well-protected larvæ, but in order to deter the adult female from laying her eggs. Trials were accordingly made in 1922 and again in 1924, but on both occasions in place of paraffin and soft soap given in the formula a miscible oil ("Olene") was used in a strength of two parts per cent. As the paraffin is used chiefly as a carrier and spreader of the nicotine, it was thought that this change was of little consequence, and it simplified the making of the spray. Certainly the modified mixture acted well when used against woolly aphis, and its application for that purpose would have been continued had not the introduction of *Aphelinus mali* made its use unnecessary. If the mixture were carefully made no scorching of leaves resulted. However, it was found that if the nicotine (Black Leaf 40 being used) were put into the oil emulsion without previous dilution a certain amount of the oil was thrown out of suspension and floated as a scum. If this scum was sprayed on the leaves, especially of P. Barry, a certain amount of scorching resulted.

The trees selected for experiment were eighteen young pears of mixed varieties, planted in 1922 in a block of land newly broken in from pasture that year. Fifteen P. Barrys planted in 1921 among other older pears were also used.

SEASON 1922–23.

In 1922 the midge was detected in the tent traps on 14th September, but no female midges were found till 1st October. The Black Leaf and oil spray was first applied on 3rd October to the newly planted block of pears and to nine of the P. Barry trees.

On 10th October the first evidences of infestation were detected on some Beurre Diel trees next to the P. Barrys, and five days later it was seen on the P. Barrys which had not been sprayed. None of the sprayed trees showed any signs of the midge.

On 25th October the ground immediately around all the young pear-trees was sprayed with pure kerosene, with a view to attacking the pupæ which by that time would be due to hatch out from the first infestation.

On 1st November the P. Barry trees were sprayed with a mixture composed of molasses, 6 lb., to 100 gallons of water, and Black Leaf 40, one part in 1,000. This spray seemed to act well, for, despite daily rain showers, by 8th November the newly formed shoots showed no signs of midge-infestation, and the odour of the Black Leaf could still be detected on the sprayed leaves. This was not due to the kerosene spraying of the ground, as other trees so treated but which had not received the Black Leaf and molasses mixture showed infestation. It was decided then to continue to treat the P. Barry trees with this spray, and use the Black Leaf-oil spray only on the newly planted pears.

The next application of the Black Leaf and molasses mixture to the P. Barrys was on 21st November, three weeks after the first. It was found, however, that this interval was too long, because, although the Barrys were nearly free from infested leaves at the time the second spray was applied, by 27th November a fairly wide infestation was manifest, and as the leaves were by then beginning to blacken it seemed probable that the eggs were layed just prior to the second spray. The constant rains during the first fortnight of November no doubt contributed to the failure of the remedy. The spray was repeated on 6th December, but with little effect, and for the rest of the year the Barrys were markedly infested with midge.

Turning again to the block of newly planted pears which had been sprayed on 3rd October with the Black Leaf and oil mixture, in common with other pears the ground round these trees was treated with kerosene on 25th October, but the trees were not again sprayed with the mixture till 10th November. At this time scarcely one infested leaf could be found on the eighteen trees, which had made satisfactory growth and had acquired a good crop of leaves.

On 21st November a female midge was observed laying eggs on one of these trees, showing that the spray had lost its effect during the eleven days which had elapsed since its application. The spray

was accordingly repeated on the same day, but by 27th November a fairly widespread infestation of the new leaves was apparent, the eggs probably having been deposited prior to 21st November.

The spray was repeated on 5th and 22nd December, 14th January, and 3rd February, but with very little result during December and January, and during these months there was little new growth or formation of serviceable leaves. After the final spraying on 3rd February, however, some midge-free leaves developed during the ensuing week, but no further observations were made that season.

During the same season a number of adult Bon Chretien and Beurre Bosc pear-trees were sprayed with the Black Leaf and molasses mixture, the dates being 1st and 21st November and 6th December. The spraying on the first of these dates was productive of some result, as the new growth was fairly free from midge infestation till 10th November. Thereafter the midge appeared to gain ground, and the two last sprays had little, if any, effect.

SEASON 1923–24.

During the season 1923–24 only the Black Leaf and molasses mixture was used—applied about every third week. As before, the young trees were kept almost free from midge infestation till the last week in November, after which the spray showed little effect, and was not repeated after December.

SEASON 1924–25.

It was thought that possibly a better result might be obtained with more frequent sprayings, so during the spring of 1924 the new block of pear-trees was treated with the Black Leaf and oil mixture once a week. The dates of the sprayings were 6th, 13th, 21st, and 27th October, 1st, 10th, 17th, and 24th November, 1st, 7th, 15th, 22nd, and 29th December, and 5th January.

This season the midge infestation was noticed first on the Beurre Diel leaves about 13th October, the leaves beginning to blacken about the 18th. By 27th October the young pears sprayed with the mixture were quite free from midge, except a small tree, planted this season, which stood apart and was overlooked in the spraying on 13th October. During the first three weeks of November this freedom continued, only one or two leaves—which perhaps had not been well sprayed—showing infestation. The trees by now had made a reasonable growth and had a good crop of leaves. Some continued wet weather about the middle of November may have weakened the spray deposits on the twigs, for on 26th November slight infestation was found on all the trees.

It may be doubted, however, whether rain alone was the cause of the spray losing its effect, for on 4th December, only three days after the last spraying, a female midge was found depositing eggs on a bud. The weather had not been wet, and the question arises whether the increasing temperature may not have been responsible for the failure, nicotine being a volatile substance. However this may be, from December onwards the spraying failed to control the midge, thus repeating the experience of the two previous years.

During this season a material sold as Vistolene was tried in a strength of 1 part in 100 parts of water on the P. Barry trees. The dates of the sprayings were 21st October, 10th November, and 1st and 7th December, while one tree was sprayed with the Black Leaf and oil mixture each week on the same dates as were the block of younger trees. The first two sprayings with Vistolene had some effect, the treated trees showing considerably less infestation than neighbouring unsprayed trees, though not nearly so free as the tree which received the weekly treatment. The Vistolene had little effect after the middle of November, however.

CONCLUSIONS.

The results suggest that by the use of nicotine the pear-midge can be kept in check during October and the first two weeks of November sufficiently to permit of the early twig-growth becoming established and to enable the trees to set a fair covering of leaves. This is certainly an advantage, especially when dealing with young growing trees. Some of the treated trees, planted in 1922, are now over 6 ft. in height, contrasting favourably with untreated trees of like varieties, which have made little growth in the same time. Insufficient experiments were made to demonstrate whether with adult trees the destruction of buds by the midge could be delayed sufficiently to enable the fruit to set, and to allow of the establishment of the leaves necessary to the nutrition of the fruit-bud.

The Keiffer variety appears to be attacked by the midge just as much as other varieties, but, being of early habit, the buds have set and the leaf crop is established before the midge has become prevalent. After the middle of October the new growth on the Keiffer is infested Growth is checked, but not the fruit crop. With later-blossoming varieties, such as Bon Chretien and Beurre Bosc, the difficulty arises that measures taken to combat the midge must also tend to discourage the visits of bees, and thus pollination may be interfered with. Spraying should be suspended while the blossom is fully open.

From the middle of November till late in February nicotine loses its effect. During the seasons under consideration wet weather may have been responsible for this failure—at least in November; but the effect of the increasing temperature on a volatile substance like nicotine has to be considered. Again, it has been shown by Miller that, after the hatching-out of the second infestation between 1st and 10th November, the midge remained on the wing for the remainder of the month. This must greatly increase the difficulty of protection. This raises the question of the frequency of spraying. During October the results when the spray was applied weekly were little better than when applied at intervals of three weeks, but in the latter part of November it appeared that a weekly spraying was insufficient. It is proposed next spring to apply fortnightly sprays during October, weekly in the first half of November, and thereafter bi-weekly sprays, by way of experiment. From the commercial point of view bi-weekly spraying can hardly be regarded as practical.

In regard to the composition of the spray, the nicotine salt is the active agent, and the most suitable "carrier" has not been determined. On the whole the miscible oil appeared to give the most lasting results. If ordinary oil be used it is advisable to use a strength

not greater than 1½ per cent., owing to the tendency to scorch. Molasses proved satisfactory, and is easily dissolved. Possibly a simple soap solution may be found equal to the agents tested.

The experiments with Vistolene were not sufficiently extensive to warrant a definite opinion, but it did not seem as effective as nicotine.

The results of the various trials viewed in general were disappointing, but suggest that in the use of a deterrent spray the solution of the problem may be found.

WHITE BUTTER FROM HEIFER'S MILK.

E. E. ELPHICK, M.R.C.V.S., D.V.H., Veterinarian, Wellington.

AN interesting local case of abnormality in a cow's milk has recently come under the writer's notice. The animal concerned, a 3½-year-old Friesian-Ayrshire cross, calved for the first time on 30th January last. A feature of her first milk, which at once drew the owner's attention to it, was the entire absence of visible colostrum. Later there appeared to be no cream on the milk, which had a uniform fixed white colour throughout. The owner, who happens to sell a little milk, thinking perhaps there was a considerable deficiency in butterfat, had the milk tested, when it gave a 4·35-per-cent. test. The heifer was running on good pasture, and was not getting hay or other dry feed. A proportion of her milk has since been set for cream and churned, with the result that the product has been a perfectly white butter.

According to Palmer (Missouri Circular 74, 1915) the natural yellow colour of butter is derived from two yellow pigments—carotin and xanthophyll—which are also present in the green chlorophyll of plants. These pigments, particularly carotin, are found in the cow's blood, and in this way pass from the feed to the udder, where they colour the milk-fat. Certain feeds are classified according to their carotin content, this explaining why cows fed on green pasture produce a yellower butter than when they receive dry fodder and grain by-products in winter. It is further stated that the high-coloured fat of the Channel Island breeds is due largely to the fact that they make use of more feed carotin than others. It is also common knowledge that the colour of butter varies with the period of lactation. There is no difference, however, immediately after parturition in any breeds, the colostrum of all cows being highly coloured. As the period of lactation advances the intensity of the colour decreases.

The peculiarities of the present case may be summarized as—(1) A newly calved heifer giving a milk apparently free of colostrum, or if colostrum was present it was entirely lacking in pigment; (2) the feed is green pasture, which is rich in high-colour carotin; (3) the heifer is at the commencement of her lactation period and not at the end, when a low-coloured butterfat would be expected, particularly in a cow of her breed.

The explanation appears to be a physiological one. Either the yellow pigment from the feed has not been assimilated during the process of digestion, or there is some deficiency or peculiarity in the cellular elements of the milk-glands which has rendered them incapable of extracting these pigments from the blood-stream.

WHEAT MANURIAL TESTS IN CANTERBURY.

SEASONS 1923–24 AND 1924–25.

F. E. WARD, Instructor in Agriculture, and A. W. HUDSON, Assistant Instructor in Agriculture, Christchurch.

DURING the season 1923–24 the Canterbury Soils Improvement Committee conducted three manurial trials on wheat, and this season—1924–25—the Fields Division of the Agriculture Department has completed an additional seven. The results, which indicate a decided increase in yield from phosphate manuring, are given in a concise form in the following pages, but readers interested in a full account of the experiments, the results of which were treated statistically, may be referred to a bulletin which it is proposed to publish later.

MANURES USED.

The manures used were as follows, the quantity being per acre in each case:—

Season 1923–24: (1) Superphosphate (42/44), 1 cwt.; (2) superphosphate (42/44), ¾ cwt., plus dried blood, ¼ cwt.; (3) basic superphosphate, 1 cwt.; (4) basic superphosphate, ¾ cwt., plus dried blood, ¼ cwt.

In 1924–25 it was decided that in order to get a true estimate of the value of dried blood this constituent should be added to the same quantity of phosphatic fertilizer as was sown on the plots having phosphate alone. Therefore the mixtures of phosphate and blood were sown at the rate of 1 cwt. phosphate plus ¼ cwt. of blood per acre. Manures (1) and (3) were repeated unaltered.

The object in the selection of the manures used was to test the soluble phosphate—super—against the less soluble phosphate—basic super—and to ascertain the effect of nitrogen as dried blood in combination with these fertilizers. All fields contained controls, or non-manured areas, so that the increases due to manuring could be estimated.

METHOD OF SOWING.

The fertilizers were applied in long narrow strips, and repeated several times in the same field. Numerous weighings were made in each strip, enabling great reliance to be placed on the results obtained. The fertilizers were applied with great care under the personal supervision of the writers. Known areas were first drilled with a given weight of manure, and adjustments made until the drill was sowing exactly the amount required. This was done with each manure in turn, as different manures run at different rates, and the same manure will run differently under varied climatic conditions. When these drill adjustments had been made, the drilling of the plots was proceeded with.

During the growing-period observations were made from time to time. In all cases, except the Irwell plots, marked differences could

FIG. 1. ADJACENT PLOTS, SHOWING TYPICAL DIFFERENCES IN THE EARLY SPRING BETWEEN TREATED AND UNTREATED AREAS.

Left—manured area; right—no manure.

FIG. 2. SHOWING MANURED (LEFT) AND UNMANURED (RIGHT) PLOTS.

The difference between plots was here very apparent at harvest-time. In some cases differences which were very marked in the early spring were scarcely discernible at harvest-time.

be seen between the manured and non-manured areas, but no definite superiority of any one manure over another could be discerned.

METHOD OF HARVESTING.

Season 1923–24: Areas of approximately $\frac{1}{4}$ acre were carefully measured, and the number of sheaves dropped by the reaper-and-binder on that area was noted. A large number (twenty-two) of these sheaves from each area was weighed to the nearest ounce, and thus the average weight of sheaves on each treatment was obtained. The product from these strips, which were at least 5 chains long, was stooked separately, and when fit to thresh the bands of several sheaves taken indiscriminately were cut and handful samples taken. These were tied and the heads placed in small bags to avoid loss. Each sample was carefully weighed, and flail-threshed in small strong bags. The grain from each sample was then weighed, and the ratio of grain to straw calculated. From the data so obtained the yields per acre were calculated. This method, planned by Mr. M. J. Scott, chemist at Lincoln College, though involving a large amount of very careful work, gave highly satisfactory results, the calculated yields being practically identical with threshing returns at the College.

Season 1924–25: This year the actual sheaves from the plots were threshed in a small mill adapted to the purpose. Smaller areas were cut either with scythe, reap-hook, or reaper-and-binder, and the product stooked and threshed separately. By this method the plots were in closer proximity to the controls, and the difficulties of land variation were largely overcome. Varying-sized plots, from $\frac{1}{160}$ acre to $\frac{1}{50}$ acre, were cut in different fields. Where small plots yielding about five sheaves were cut a large number was taken. With the larger plots yielding about sixteen to eighteen sheaves few plots were required. The method was highly satisfactory, and overcame some of the experimental difficulties which occurred in the previous season.

RESULTS OF THE EXPERIMENTS.

The results so far show a definite increase from both forms of phosphate, but no conclusions can yet be drawn as to which is the better form. Likewise, sufficient data are not yet to hand to enable an estimate of the value of dried blood to be made. The yields are given in the following records. In the 1924–25 experiments the yields on manured plots are compared with those of the controls situated immediately alongside them, each manure being adjacent to a control.

Season 1923–24.

Experiment 1: On farm of Mr. R. T. McMillan, Irwell. Previous crops—1922–23, barley; 1921–22, wheat; 1920–21, grass. Date of sowing experimental plots—First week in June, 1923. Variety of wheat—College Hunters. Yields per acre—Super, 41·8 bushels; basic super, 42·3 bushels; super and blood, 42·9 bushels; basic super and blood, 43·1 bushels; controls, 41·4 bushels. The application of the statistical method proved the differences to be non-significant, and the slight differences which occurred are due merely to chance variation.

FIG. 3. PREPARING FOR HARVESTING OF PLOTS BY BINDER.

Where no difference in ripeness between plots occurred the binder was used, and plots of a definite length and a definite number of "coulters" in width were marked out by pressing the standing crop (along a coulter mark) in direction of wind.

FIG. 4. HARVESTING PLOTS WITH REAP-HOOK.

Owing to differences in ripening between plots in some cases (the phosphated plots ripening first) it was necessary to cut at different times. The reap-hook proved to be a convenient (though slow) means of cutting. The photo shows two adjacent plots being reaped, the wheat being laid in neat sheaves and tied by hand.

Experiment 2: On farm of Messrs. W. and A. Campion, Prebbleton. Previous crops—1922–23, wheat; 1921–22, potatoes; 1920–21, grass. Date of sowing of experimental plots—Early in June, 1923. Variety of wheat—College Hunters.

Fertilizer.	Yield per Acre.	Increase per Acre due to Manure.	Cost of Manure per Acre.*
	Bushels.	Bushels.	s. d.
Super	46·3	9·0	7 3
Basic super	42·4	5·1	6 9
Super and blood	43·6	6·3	8 8
Basic super and blood	41·6	4·3	8 4
Control	37·3	..	..

* Based on following prices at county stations: Super (42/44), £7 5s. per ton; basic super (40/43), £6 15s. per ton; blood, 13s. per cwt.

NOTE.—The value per bushel of the additional increase will be the market value of the wheat less harvesting, threshing, and haulage costs per bushel. Apart from the cartage and trouble of sowing manure, a high-yielding crop costs no more to sow than a low-yielding one.

Season 1924–25.

The table of results of the 1924–25 experiments (next page) shows no differences between yields in the Irwell tests, except in the case of basic super and blood. This is because the differences which do occur are, like those of the previous year, non-significant. The yield of basic super and blood shows a significant decrease below that of its control. This provides a very interesting case, which we do not pretend to be able to explain, but it is a noteworthy fact that a similar result was obtained with this manure in an experiment conducted by Mr. M. J. Scott at Lincoln College in 1923–24.

FIG. 5. SMALL THRESHING-MILL PLANT ADAPTED TO CEREALS.

Threshing operations in progress at one of the experimental areas. Note tripod breakwind to facilitate weighing with sensitive balance. Portable 5–7 h.p. petrol-engine.

1924-25 Experiments.

Farmer and Locality.	Previous Crops.	Date of Sowing of Experimental Plots.	Yields, in Bushels per Acre.		Increase due to Manure.	Yields, in Bushels per Acre.		Increase due to Manure.	Yields, in Bushels per Acre.		Increase due to Manure.	Yields, in Bushels per Acre.		Increase due to Manure.	Variety of Wheat.
			Super.	Control.		Basic Super.	Control.		Super and Blood.	Control.		Basic, Super, and Blood.	Control.		
R. T. McMillan, Irwell	1923–24, peas .. 1922–23, wheat 1921–22, fallow	17/5/24	41·0	39·8	..	42·0	41·8	..	42·5	42·4	..	40·1	42·5	−2·4	College Hunters.
J. Foster, Ladbrooks	1923–24, grass.. 1922–23, grass.. 1921–22, grass..	11/6/24	51·0	44·7	6·3	52·9	44·7	8·2	57·1	47·7	9·4	53·4	47·7	5·7	College Hunters.
W. & A. Campion, Prebbleton	1923–24, vetches 1922–23, vetches 1921–22, turnips	20/5/24	53·4	49·4	4·0	54·4	49·4	5·0	56·4	52·4	4·0	54·9	52·4	2·5	College Hunters.
F. Carpenter, Prebbleton	1923–24, vetches 1922–23, vetches 1921–22, oats ..	9/6/24	49·3	41·2	8·1	48·2	41·2	7·0	47·3	38·8	8·5	45·4	38·8	6·6	College Hunters.
F. Morrish, Springston	1923–24, rape .. 1922–23, wheat 1921–22, grass..	19/5/24	38·4	35·1	3·3	39·3	35·4	3·9	39·0	31·5	7·5*	38·0	33·0	5·0	College Velvet.
W. & A. Campion, Prebbleton	1923–24, potatoes 1922–23, grass.. 1921–22, grass..	28/6/24	38·3	28·9	9·4	36·8	28·9	7·9	36·7	23·5	13·2†	36·3	23·5	12·8†	College Hunters.
F. Carpenter, Prebbleton	1923–24, potatoes 1922–23, grass.. 1921–22, grass..	10/6/24	43·7	32·9	10·8	39·6	32·9	6·7	42·0	31·8	10·2	43·5	31·8	11·7	College Hunters.
Average increase due to manures (excluding McMillan's experiment)			..	..	7·0	..	..	6·4	..	..	8·8	..	..	7·4	

Cost of manures per acre: Super, 7s. 3d.; basic super, 6s. 9d.; super and blood, 10s. 6d.; basic super and blood, 10s. 2d.

In all other cases the increases are highly significant, but the behaviour of the various manures on different farms emphasizes the necessity of carrying out experiments in different places and for a number of seasons before definite conclusions can be drawn.

Footnotes to Table of 1924–25 Experiments (opposite page).

* The large increase for super and blood over control in this case must be regarded with caution. The plots cut for the estimation of yield had the misfortune to be disturbed by stock while in stook, and those that were mixed had to be discarded. It so happened that at one end of the manured strips the differences between manures and controls were much greater than at the other. The plots from which the super and blood yields were estimated were mainly from the end of greatest differences, the plots from the other manures being chiefly from the portion of least difference. It is likely, therefore, that in this case the super and blood has an unfair advantage.

† Here again the comparative large increases from the mixtures containing blood are due to the low-yielding controls with which they are compared. Whether the same increases would have been caused by the phosphate alone one cannot say, but if basic super is compared with basic super and blood in this experiment it will be noted that there is practically no difference between them. This comparison is justified, as these two treatments were adjacent to one another in the experiment.

The writers wish to express their appreciation of the generous assistance given by the farmers on whose farms the trials were conducted; also their indebtedness to Dr. F. W. Hilgendorf and Mr. M. J. Scott for much valuable advice given in planning the experiments and application of the statistical method. To Messrs. A. Scott, J. B. Garnett, E. R. Hudson, E. Bates, and M. Grant, who at various times assisted in the harvesting operations, our thanks are due.

The Te Mania Rabbit-proof Fencing District has been abolished by Order in Council gazetted on 19th March.

Impounding Act.—Sections 5 and 6 of the Impounding Act, 1908, have been brought into force in Maniototo County.

Seed Impurity in New Zealand Barley.—The High Commissioner recently forwarded a packet of small round seeds which had been collected by a Birmingham merchant from New Zealand barley passing through his hands during the last few years. The impurity has been dentified as four-seeded vetch (*Vicia tetrasperma*). The matter has been reported by the Department of Agriculture to the New Zealand Grain, Seed, and Produce Merchants' Federation. There should be no difficulty in dressing this weed-seed out of any lines of barley exported.

Wheat and Oats Threshings.—Returns of actual threshings up to 19th March received by the Government Statistician from threshing-mill owners showed that until then 1,144,359 bushels of wheat and 1,380,135 bushels of oats had been threshed out. The average yields per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 34·73 bushels for wheat and 40·90 bushels for oats. The figures for the Canterbury and Otago Land Districts respectively were as follows: Canterbury—Wheat, 977,724 bushels threshed, averaging 35·27 bushels per acre; oats, 937,017 bushels threshed, averaging 41·41 bushels per acre. Otago—Wheat, 136,697 bushels, averaging 32·43 bushels per acre; oats, 245,254 bushels, averaging 39·86 bushels per acre.

PRESERVATIVE TREATMENT FOR FARM TIMBER.

I. METHODS OF DEALING WITH FENCING-POSTS.

A. R. ENTRICAN, Engineer, State Forest Service, Wellington.

FENCING-COSTS have risen to such heights during the last few years that they now form one of the major expenses of farm maintenance and improvement. Post and other timber prices have led the general upward tendency in the prices of construction materials, and reflect the serious depletion of our forest resources. Hitherto farmers have procured their fencing-posts from timber growing on the farm or in the immediate vicinity, but they are now becoming increasingly alive to the scarcity of naturally durable woods.

Many non-resistant species are available at comparatively low prices from the native forests and the farm plantations. Labour costs, however, form such a large proportion of the total fencing-charges that the use of these posts is a poor investment except for fences of a purely temporary character. This disadvantage may be overcome by so treating the posts with an approved wood-preservative that they are able to compare favourably and economically with posts of the more durable timbers. The treatment is a relatively simple one, and its principles easily understood. For those methods available to the farmer the equipment required is cheap and easily procurable. The use of ordinary care in its operation will render a high degree of efficiency in the treatment.

A similar position exists with reference to other farm timbers, such as service telephone and electric-power poles, foundation timbers, barn timbers, bridge timbers, wooden gates, windmill-frames, well-kerbing, &c. For the up-to-date and progressive farmer the preservative treatment of such material will conserve his wood-supplies and render a substantial saving in expenditure.

NATURAL DURABILITY OF TIMBER.

The destruction of wood by decay is due to low forms of plant-life known as fungi which use as food certain substances of the wood. These fungi consist for the most part of fine thread-like filaments which penetrate the wood-cells, disintegrating the wood substance and leaving behind the punky powdery residue so characteristic of decayed wood. In places the filaments grow out to the surface of the wood to form compact bodies, such as the bush fungus of commerce, frequently found growing on the trunks of both living and dead rimu, beech, tawa, mahoe, and other trees. They are an indication of advanced decay, and function as spore-producers, spores corresponding to the seeds of the higher orders of plant-life. Like these latter, they are distributed principally by the wind. Certain conditions of air, moisture, temperature, and food are necessary for their germination and the subsequent growth of the fungi. According to the control exercised over these factors, either by the nature of the wood itself or by the conditions under which it is used, will the natural durability be affected.

As the sap-wood of all trees contains a large amount of protoplasm, starch, and other essential plant-foods, it exhibits poor durability, seldom exceeding four years when in contact with the ground. The natural durability of heart-wood varies with the timber. It is considered to be determined largely by the presence of certain vital oils which prevent the growth of fungi.

DURABILITY OF NEW ZEALAND TIMBERS.

New Zealand has been fortunate in its supplies of durable fencing-timbers. Totara ranks first in importance, but is becoming increasingly scarce. Table 1 has been prepared to show the average range of life of the principal commercial timbers, including both native and introduced woods. The figures given refer to posts cut from the heart-wood of sound and healthy mature trees grown and used under average conditions of soil and climate. The woods in Class 6 are generally used for temporary fences only.

Table 1.—Average Range of Life of the Principal Fencing-timbers used in New Zealand.

Class 1 : Over 30 years—Puriri, silver-pine, totara, broadleaf.
Class 2 : 20 to 30 years—Kowhai, hinau, kawaka, black-locust.
Class 3 : 15 to 20 years—Hard red and black beech, matai, jarrah.
Class 4 : 10 to 15 years—Maire, kauri, *Eucalyptus amygdalina, E. botryoides, E. coriacea, E. eugenioides, E. Macarthuri, E. viminalis, E. obliqua, E. globulus.*
Class 5 : 5 to 10 years—Pukatea, rata, manuka, mangeao, mountain-beech, tanekaha, tawhero, kamahi.
Class 6 : Under 5 years—Rimu, silver-beech, white-pine, rewarewa, taraire, tawa, miro. All thinnings and immature timber of the eucalypts in Class 4, and of pines, spruces, larches, and softwoods usually planted.

Users of posts are warned against drawing rash conclusions from these summarized data. The conditions of growth, the quality of the timber, and the conditions of use to which the figures apply must all be considered in studying the table.

CONDITIONS OF GROWTH.

Posts cut from immature and fast-growing trees generally exhibit little resistance to decay. The average range of life of even the durable species, such as ironbark, is only eight to twelve years. That of the remaining woods is reduced proportionately.

Late autumn and winter are the best seasons for felling trees. The timber then dries slowly and evenly, minimizing splits and checks, in which insects and fungi usually commence their destructive work. Insects are noticeably absent at this time of the year, and by late spring the wood will have dried sufficiently to resist the attack of these pests. Almost equal durability is obtainable from wood cut at other seasons of the year, but rigid precautions must be observed if excessive splitting and checking, and insect and fungal attack, are to be avoided.

INFLUENCE OF CLIMATE AND SOIL.

Climatic conditions in New Zealand are conducive to decay throughout the year. The climate is typically a temperate one. Except in a few localities there is a copious and well-distributed rainfall and a high atmospheric humidity, both of which produce conditions favourable to decay. Shrimpton (1) reports that the

average life of Australian hardwood poles is greater in the dry localities on the east coast of the South Island than in wetter and more humid districts. Crawford (2) confirms this statement, finding that the same species give a higher average life in the dry, far west of New South Wales than in the wetter coastal regions.

Decay is most active near the ground-line, where the wood is continually damp through contact with the wet ground. In damp clayey soils the decay extends only 2 ft. to 3 ft. below the surface, but in loose and sandy soils, where the air-supply is better, it may reach to depths of 5 ft. to 6 ft. Post-tops, joints in framed timbers, and other points where water collects also exhibit serious decay. In the presence of excessive moisture, however, decay cannot proceed, as illustrated by the kauri and silver-pine logs which are being recovered from swamps in which they have been buried for hundreds of years.

RELATIVE DURABILITY OF GREEN AND SEASONED TIMBER.

Hicks (3) and other authorities (4) report that the natural durability of untreated wood is slightly greater for timbers set green than for those placed after seasoning, a view which is supported by Shrimpton (1) as a result of his experience with poles in New Zealand. This may be explained by the fact that whatever the moisture content of the timber when first placed, that portion below the ground-line must ultimately come into equilibrium with the moisture content of the surrounding soil. By placing the post or timber when green, splits and checks will be largely eliminated at the ground-line, thus avoiding a condition favourable for decay.

PRINCIPLES OF WOOD-PRESERVATION.

In commercial timber-treating practice natural durability is improved by injecting antiseptics to poison the wood substance upon which the fungi live. Except in the case of a few porous woods it is impracticable to impregnate the wood throughout, it being the usual practice to create an outer protective envelope around the untreated interior wood. It is generally assumed that the increased durability due to any treatment will be in approximate ratio to the depth of penetration and to the amount and permanency of the preservative employed. Since it is difficult to treat the heart-wood of most timbers, the natural round post is the most satisfactory form of timber for treatment. Where the heart-wood is naturally durable, however, split and sawn posts containing a proportion of sap-wood may be treated with advantage. The financial saving due to a preservative treatment is obviously greater when applied to a non-durable wood than to a durable timber.

The important wood-preservatives fall into two general classes—coal- and wood-tar derivatives, such as creosote, carbolineum, &c.; and mineral salts, such as zinc chloride, sodium fluoride, &c. The latter, being water-soluble salts, are not suitable for fencing-post work in New Zealand unless employed in conjunction with creosote oil, crude petroleum, &c., which will resist the natural tendency of our rainfall to leach out the preservative and render the wood non-resistant to decay. The two factors governing the value of

a preservative are toxicity and permanency, but these are not often possessed by the same material. For this reason, and on account of the rising costs of creosotes, increasing attention is being paid to the use of such mixtures as creosote and crude petroleum, and zinc chloride and crude petroleum.

PREPARATION OF WOOD FOR TREATMENT.

Except for pressure processes all timber should be thoroughly seasoned before treatment. Care must be exercised to prevent insect and fungal attack during this period. The primary objects of seasoning are to facilitate the penetration of the preservative and to prevent the exposure of untreated wood by checking and splitting after the timber has been treated. All framing—that is, cutting, notching, boring, &c.—of timbers should be done before treatment, otherwise subsequent framing will expose untreated wood, which will require further protection.

METHODS OF APPLYING PRESERVATIVES.

Impregnation under pressure is the most satisfactory method of treating wood with preservatives. Pressure plants are seldom available for farm use, but, where possible, should be used, as they give a more efficient and economical treatment.

The open-tank process is the most effective method of treatment for farm use. Although referred to as a non-pressure process, it uses atmospheric pressure to secure impregnation of the wood. The posts are heated for a certain period in a hot bath of the preservative maintained at a temperature of 180° to 200° F. This has the effect of partially expanding and driving out the air and moisture in the wood. On transferring the posts to a cold bath of the preservative maintained at a temperature of 90° to 100° F., or on allowing the hot bath to cool, the air and moisture in the wood contract and the atmospheric pressure forces the preservative into the timber. Except in the case of a few easily treated woods, there is little absorption of the preservative during the hot bath. The periods of immersion in the hot and cold baths vary with the species.

A few porous woods such as *Pinus radiata (insignis)* and *P. muricata* may be successfully impregnated by soaking in a bath of the preservative at ordinary air-temperatures, but the timber must be particularly well seasoned.

In the dipping process the wood is immersed for a period of from five to fifteen minutes in a hot bath of creosote maintained at a temperature of 180° to 200° F. For this treatment the timber requires to be not only thoroughly seasoned but also free of any surface moisture due to rain, dew, &c. Some porous woods are impregnated to a depth of 1 in. by the dipping process, but generally the penetration is small, although most checks and splits are well covered with the preservative.

A brush application of hot creosote or carbolineum is the simplest treatment available for the farmer. The treatment should be in the nature of a swabbing or mopping of the preservative over the wood, rather than a mere painting application. This tends to fill checks and splits which are otherwise unprotected. The presence of superficial

moisture is fatal to the process. Two coats are usually applied, the first being allowed to dry before the application of the second.

ABSORPTION AND PENETRATION.

The amount of preservative absorbed by the sap-wood varies with the timber, the pines absorbing as much as 30 lb. per cubic foot of wood, and the eucalypts only 15 lb. per cubic foot. A minimum absorption of 20 lb. per cubic foot for pines and of 10 lb. per cubic foot for eucalypts is recommended for the butt treatment of posts. For the upper portion of the posts the minimum absorption should be at least half that recommended for the butt treatment.

For posts and other timbers in contact with the ground it is preferable that the whole of the sap-wood and as much of the heart-wood as possible be impregnated, but this is sometimes difficult to accomplish, and impossible on the score of economy. The minimum penetration recommended by the Forest Service is 1 in.

HOW TO PRESERVE FENCING-POSTS AND OTHER FARM TIMBERS.

Only sound wood free from decay is suitable for treatment. Once started, decay is not necessarily stopped by the preservative, but may continue to destroy the interior of the wood beneath the treated portion. It is necessary to bark or peel all round forms of timber immediately after felling, preferably in the winter, otherwise fungi and wood-boring insects quickly commence their destructive activities beneath the loose pieces of bark, where the moisture tends to collect, and where conditions are favourable for rapid decay. The removal of the thin inner bark of the wood is important, as comparatively small particles prevent penetration of the preservative, and their removal after treatment exposes a surface of untreated wood through which decay enters.

Fence-posts are best seasoned by open piling, as shown in Fig. 1, in a shady yet exposed locality where there is ample circulation of air both beneath and through the whole pile. Damp ground and both living and rotting vegetation are to be avoided. Too rapid seasoning damages timber by excessive splitting, &c. This applies particularly to locally grown Australian hardwoods.

Poles and large structural timbers which show a tendency to split are best protected by the use of S-shaped irons, which are driven into the wood across the incipient splits to hold the timber in place. They are to be purchased for a few pence each. End coatings, such as coal-tar, pitch, and petroleum residue, effectively prevent end-checking.

Under favourable conditions posts season sufficiently for treatment in from 60 to 180 days, according to the species and to the period of the year. Only the sap-wood or that portion to be treated requires to be thoroughly seasoned. By weighing a few specimen posts at regular intervals the state of seasoning is obtainable with fair accuracy. When the weights remain fairly constant during two weeks of good seasoning-weather the posts are dry enough to treat. A glazed appearance on the surface of the posts is a sign of case-hardening, which seriously retards penetration. It is remedied by shaving off the hardened surface for a distance of 6 in. above and below the ground-line.

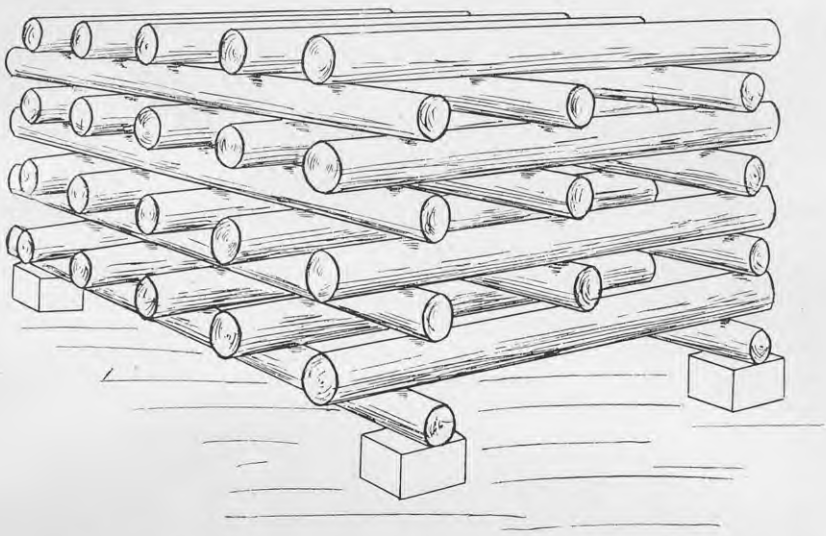


FIG. 1. SHOWING METHOD OF OPEN PILING OF POSTS FOR SEASONING.

PRESERVATIVES. (SEE APPENDICES FOR SPECIFICATIONS.)

For general farm-work a good grade of creosote containing a low percentage of low-boiling oils is recommended. Either the British Standard Specification or any of the three grades specified by the American Wood-preservers' Association can be used with confidence.

Carbolineums are generally proprietary preservatives containing higher-boiling oils than the creosotes. They are invariably higher in price, but only for brush or spray treatments are they superior to creosote. The American Wood-preservers' Association's specification is recommended to consumers of this class of preservative.

A number of low-temperature creosotes are now available on the New Zealand markets, and in the absence of a standard specification the Forest Service will shortly issue a tentative specification. These preservatives are superior to both ordinary creosote and carbolineum, both from the point of view of toxicity and of permanence.

Coal-tar is not recommended as a wood-preservative, as more harm than good is likely to be done if the timber is not thoroughly dry. Nevertheless Bradley (5) has successfully treated *Pinus radiata* posts by soaking them in a hot solution of this material.

CONSTRUCTION OF TREATING PLANTS.

The same plant may be used for the open-tank, soaking, dipping, or painting process. The simplest equipment consists of a 90-gallon steel oil-drum measuring approximately 3 ft. 4 in. in height and 2 ft. 4 in. in diameter. These drums may be purchased from benzine companies at an approximate cost of 30s. One end is knocked out, and the drum filled with about 40 gallons of creosote or other preservative. It is placed over a fire-trench in the ground, a fire

lighted, and the preservative heated up to a temperature of 200° F. The posts are placed with the butt ends in the tank and given the requisite hot bath, at the conclusion of which the fire is withdrawn and the posts allowed to cool off until the desired penetration and absorption have been obtained. The posts are next upended and the tops given a somewhat lighter treatment. If two of these drums are provided, one for the hot bath and one for the cold bath, the process can be carried on continually, without the necessity of waiting for the cooling of the hot bath.

Much economy of time, effort, and material is secured by the use of a long open tank in which the complete post can be immersed. The tank is constructed either of wood or of steel, according to the way in which the equipment is to be used. If it is to be employed for the cold bath alone, then it can be constructed of wood throughout, as shown in Fig. 3, the heating of the bath to 90° F. being secured by the addition of quantities of heated creosote, &c. On the other hand, if it is desired to use the tank for both hot and cold baths, then it is impossible to use this construction unless steam heating from a traction or other boiler is available. An alternative construction uses framing-quality timber and a soldered galvanized-iron lining. Where only direct heating is available the tank is constructed of iron plate.

For the treatment of boards and scantling a tank of this description 18 ft. long is of the greatest value on the farm. The handling of the material is greatly facilitated by the provision of some form of overhead gear whereby posts, timbers, &c., may be loaded and unloaded in cages into the tanks. This is a matter best left to the ingenuity of the operator. A handy arrangement for the handling of small quantities of timber consists of a number of wire ropes. One end of each rope is attached to one side or other of the tank, the other end remaining free. By laying these wires across the tank the timbers may be raised or lowered at will, as shown in Fig. 4. In a similar manner a number of iron or wood straps are required to keep the wood below the surface of the preservative.

Unless covers are provided the tank should be deep and narrow rather than shallow and wide. An adequate drainage-platform or tank economizes the use of the preservative. It is a necessary adjunct to the simplest plant, even with the brush treatment, where swabbing is preferable to mere painting. A portable plant operated on the co-operative principle by a number of farmers appears to be the most economical type of equipment for this work.

An 18 ft. tank similar to that shown in Fig. 4 costs approximately £20. In $\frac{1}{8}$ in. iron the cost is approximately £30. Suitable substitutes will naturally suggest themselves to the farmer. Old boilers, water-troughs, hydraulic piping, and other such articles have all been pressed into the service of the wood-preserver.

OPERATION OF PLANT.

The Forest Service has investigated the non-pressure treatment of fencing-posts cut from the thinnings of various species growing in the Rotorua plantations, but the tests have in most cases been too

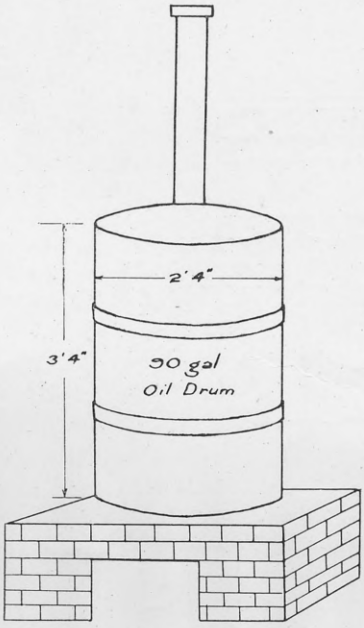


FIG. 2. OPEN TANK FOR BUTT TREATMENT. (DIAGRAMMATIC ONLY.)

A fire-trench in the ground can be used in place of the brickwork, as described in the text.

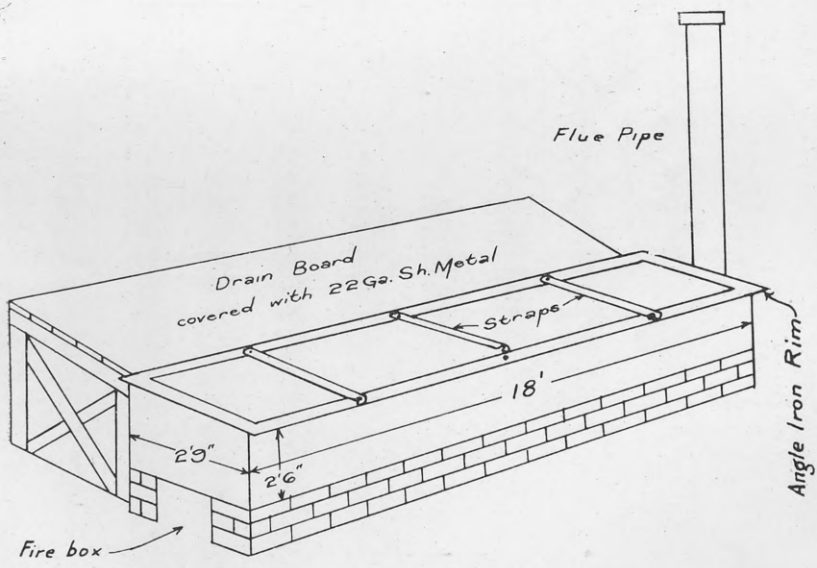


FIG. 3. LONG OPEN TANK FOR FULL-LENGTH TREATMENT. (DIAGRAMMATIC ONLY.)

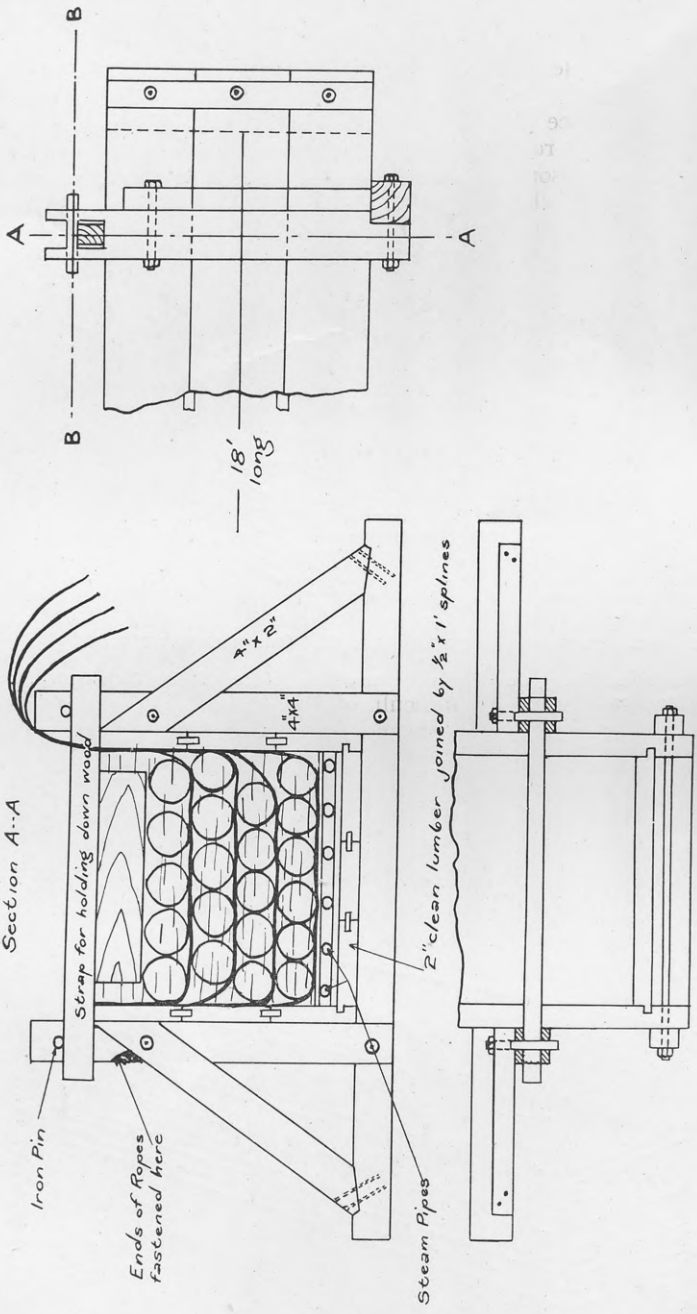


FIG. 4. SECTION OF LONG WOODEN TANK.

few in number to allow any final conclusions to be drawn. The work was done in co-operation with a Wanganui firm—New Zealand Coal-tar Products (Limited)—which donated a quantity of creosote corresponding to Grade 2 of the American Wood-preservers' Association's specification.

For general guidance Table 2 has been drawn up to give an indication of the treatment required by various woods, but frequent tests of penetration and absorption are necessary to adapt the treatment to the varying physical characteristics of the wood. In the case of the more porous woods, such as *Pinus radiata* and *P. muricata*, the times of treatment may possibly be considerably shortened.

Table 2.—Open-tank Treatment of Exotic Timbers.

Species.	Butt.		Top.	
	Hot Bath.	Cold Bath.	Hot Bath.	Cold Bath.
	Hours.	Hours.	Hours.	Hours.
Pinus Murrayana	1	1	..	1
P. muricata	1	2	..	2
P. pinaster	1½	3	..	3
P. radiata	1½	3	1½	1
P. Laricio	1½	3	..	1
P. Austriaca	2	4	2	4
Larch (on two successive days) ..	8	16	8	16
Eucalypts	2½	3	2½	3

P. Austriaca was the most difficult of the pines to treat. Larch was difficult to impregnate, and the results indicate that the English practice of two series of hot and cold baths of eight and sixteen hours respectively are required for effective treatment. All the eucalypts examined, including *E. ovata, E. risdoni, E. coriacea,* and *E. amygdalina,* required approximately the same treatment. Stephens (6) finds that other eucalypts respond to this treatment.

Absorptions are best measured by weighing sample posts before and after treatment, and penetrations by drilling auger-holes several days after treatment, as the creosote has a tendency to spread even after extraction from the cold bath. The auger-holes require to be stopped with creosoted plugs. The treatment must be varied until the desired absorptions and penetrations are obtained. If the penetration is not sufficient, either the hot or the cold bath should be lengthened; whereas with a satisfactory penetration accompanied by too heavy an absorption the cold bath should be shortened. To secure the best results the temperature of the hot bath should increase slowly up to the maximum. Fluctuations of temperature should be avoided.

For those timbers requiring the same treatment in both butt and top the posts are completely immersed for both the hot and cold baths. Where the top requires a cold bath alone, only the butt is given a hot bath, the whole post being later immersed in the cold bath. Sometimes, as in *Pinus radiata,* the top requires a shorter cold bath than the butt. This is conveniently secured if the depth of the long tank is sufficient to allow the post to be stood upright at the end of the

period required for the treatment of the top. Any of these treatments can be secured by the use of the round or long flat tanks such as are shown in Figs. 2 and 3.

Particular care is necessary to prevent creosote spilling over on to open fires, with consequent loss of posts and equipment.

CARE OF TIMBER AFTER TREATMENT.

Treated timber requires careful handling so that the treated envelope of wood remains unbroken. Exposure of any untreated wood, either by cutting or by accident, should be remedied by applying several coats of hot preservative. If posts are not used immediately after treatment they should be piled well off the ground—in close piles if completely treated, but in open piles if only the butt has been preserved.

In setting the posts the heavily treated butt portion should extend at least 6 in. and if possible 12 in. above the ground.

EXTRA LIFE DUE TO TREATMENT.

Unfortunately, there are few authoritative records available regarding the relative durability of treated and untreated fence-posts in New Zealand. The New Zealand Railways creosoted a large number of rimu and white-pine sleepers over twenty years ago, and many of them lasted for as long as fourteen years, the chief cause of removal being mechanical failure rather than decay. Bradley (5) has also treated *Pinus radiata* with good results. Weiss (7), one of the recognized American authorities on the subject of wood-preservation, has estimated the life of treated and untreated posts as follows: Untreated, five years; brush-treated creosote, nine years; dipped creosote, eleven years; impregnated with creosote, twenty-one years. The records of the German Post and Telegraph Department over a period of fifty years show that creosoted pine poles have an average life of 20·6 years.

COST AND VALUE OF TREATMENT.

The chief item of cost in the treatment of fencing-posts is the preservative. The average range of prices in the main New Zealand centres for the principal preservatives purchased in bulk is as follows, the lower values referring to locally made products, the upper to imported materials: Creosote, 1s. 6d. to 3s. per gallon; carbolineum, 2s. 6d. to 5s. 6d. per gallon; low-temperature creosote, 1s. 6d. to 7s. 6d. per gallon. Freight charges to the farm make the cost somewhat higher.

The cost of applying the preservative is difficult to estimate, as opportunities of using labour already employed, cost of fuel, &c., all require consideration. Operating under the most exacting conditions as regards the allocation of costs, it is not likely that they will amount to more than 3d. per post.

The amount of creosote absorbed varies with the species and the treatment. Table 3 has been prepared to show the volume of preservative absorbed by various-sized posts, adopting a minimum penetration of 1 in., and a minimum absorption for pines, larch, &c., of 20 lb. per cubic foot of treated wood for the butt portion and of

10 lb. per cubic foot for the top portion, and for eucalypts of 10 lb. per cubic foot for the whole post. All posts are 6 ft. in length.

Table 3.—Volume of Treatable Wood and Amount of Creosote absorbed per Post.

—	Minimum Penetration.	Average Absorption in Pounds per Cubic Foot.	Diameter of Post.			
			4 in.	5 in.	6 in.	7 in.
	Inches.					
Volume of treatable wood ..	1	..	..	..	..	..
Cubic feet	..	..	0·4	0·5	0·65	0·8
Absorption by pines ..	1	15	..	..	..	..
Gallons	..	..	0·6	0·8	1·0	1·2
Absorption by eucalypts ..	1	10	..	..	..	..
Gallons	..	..	0·4	0·5	0·65	0·8

Example 1: Given that *Eucalyptus ovata* posts can be cut and delivered from the farm plantation for 6d. per 5 in. post, and that creosote is delivered for 1s. 8d. per gallon, estimate the total cost of a treated post using the above-quoted minimum penetrations and absorptions—

	s. d.	s. d.
Cost of post delivered at plant	..	0 6
Cost of treating—		
Labour	0 3	
Creosote (volume equals ½ gallon, costing 10d.) ..	0 10	
		1 1
Total		1 7

RELATIVE COSTS AND SERVICE CHARGES.

The fundamental problem of farm economics is that of investment, and in choosing between treated and untreated posts an analysis of the relative investment costs based on compound-interest calculations is necessary if sound judgment is to prevail. Comparisons are best made on the basis of annual service charges, which are determined by the sinking-fund method. These annual service charges represent the equal annual payments which at annual compound interest will provide for renewal at the end of the life of the post without any scrap value for the post. They are determined by the formula :—

$$\frac{CR\ (1 + R)^n}{(1 + R)^n - 1}$$

where C = final cost of post in place, R = rate of interest (5 per cent. = 0·05), n = life of post in years.

Table 4 has been compiled from this formula to show the annual service charges on a post costing 1s. set in place, with interest at 5 per cent. The table may be applied to give annual service charges on posts of other values by simple multiplication.

Example 2: What is the annual service charge for a post costing 1s. 7d. treated, *plus* 1s. to set (see previous example), and having an estimated life of fifteen years? Table 4 shows that the annual service charge for a post with a life of fifteen years and costing 1s. set in place is 0·097s.

Table 4.—Annual Service Charges on Posts costing 1s. in Place. Interest at 5 per Cent.

Computed from the formula :—

$$\frac{CR\ (1 + R)^n}{(1 + R)^n - 1}$$ where C = final cost of pole in place, R = rate of interest (5 per cent. = 0·05), n = life of post in years.

Life in Years.	Annual Cost.	Life in Years.	Annual Cost.	Life in Years.	Annual Cost.
	s.		s.		s.
1	1·050	11	0·121	21	0·078
2	0·504	12	0·113	22	0·076
3	0·367	13	0·107	23	0·074
4	0·282	14	0·101	24	0·073
5	0·231	15	0·097	25	0·071
6	0·197	16	1·092	26	0·070
7	0·173	17	0·089	27	0·069
8	0·155	18	0·086	28	0·067
9	0·141	19	0·083	29	0·066
10	0·130	20	0·080	30	0·065

The annual service charge for a post costing 1s. 7d. in place is 0·097 × 2·6, equals 0·252s., or approximately 3d.

By estimating the initial costs and lives of the treated and untreated posts and determining their annual service charges a fair approximation of the economics of the problem may be obtained.

Example 3 : Ascertain if the treated *Eucalyptus ovata* post of the two previous examples is cheaper to use than a totara post costing 3s. with an estimated life of thirty years.

	Totara.	*E. ovata.*
	s. d.	s. d.
Cost of post	3 0	0 6
Cost of treatment	..	1 1
Cost of setting	1 0	1 0
Total cost	4 0	2 7
Life (years)	30	15
Annual service charge	0·065×4 = 0·26s.	0·097×2·6 = 0·25s.

The *Eucalyptus ovata* is thus slightly cheaper to use.

CONCLUSIONS.

Preservative treatment makes available for fencing purposes many timbers hitherto regarded as unsuitable for such work. Other farm timbers may also be treated with advantage, a variety of preservatives other than creosotes being available for this class of treatment. Owing to the lower costs of these preservatives the economy to be effected in the treatment of such timbers is generally greater than can be attained with fencing-material. A further article will be contributed dealing with these methods of treatment.

APPENDICES.

(1.) BRITISH STANDARD SPECIFICATION FOR CREOSOTE FOR THE PRESERVATION OF TIMBER.

This specification covers the requirements of creosote suitable for the treatment of railway-sleepers and telegraph, telephone, and hangar poles.

Type A.

(1.) The material shall consist essentially of a distillate of coal-tar, and shall be free from any admixture of petroleum or similar oils.

(2.) The specific gravity shall be not less than 1·015 and not more than 1·07 at 38° C. (100° F.) when compared with water at the same temperature.

(3.) The material shall become completely liquid on being slowly warmed to 38° C. (100° F.) with stirring, and on cooling down shall remain completely liquid after standing for two hours at 32° C. (90° F.).

(4.) The amount of water in the creosote shall not exceed 3 per cent.

(5.) When 100 c.c. measured at 38° C. (100° F.) of the dry creosote are distilled from a 250 c.c. distillation-flask at such a rate that the distillation is complete in about twenty minutes, there shall distil at 760 mm. pressure—Up to 205° C. (401° F.), not more than 7 c.c. ; up to 230° C. (446° F.), not more than 40 c.c. ; up to 315° C. (599° F.), not more than 78 c.c. : the volume of all fractions being measured at 38° C. (100° F.). The residue above 315° C. (599° F.) shall be soft and not sticky, and its weight shall be not less than 22 grms.

(6.) The amount of tar acids shall be not less than 5 per cent. and not more than 16 per cent. by volume.

(7.) The amount of matter insoluble in benzol (benzene) shall not exceed 0·4 per cent. by weight.

Type B. Alternative for Scotch Creosote.

(1.) Scotch creosote shall conform to the above specification with the following exceptions :—

(2.) The specific gravity shall be not less than 1 at 38° C. (100° F.). In the case of the blast-furnace oil the specific gravity may be lower, but shall not be less than 0·940 at 38° C. (100° F.).

(3.) The distillate at 315° C. (599° F.) shall be not more than 85 c.c., and the residue not less than 15 grms.

(4.) There shall be no upper limit to the amount of tar acids.

(2.) AMERICAN WOOD-PRESERVERS' ASSOCIATION STANDARD SPECIFICATION FOR CREOSOTE OIL FOR TIES AND STRUCTURAL TIMBER FOR OPEN-TANK TREATMENT.

(1.) The oil shall be distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements :—

(2.) It shall not contain more than 3 per cent. of water.

(3.) It shall not contain more than 0·5 per cent. of matter insoluble in benzol.

(4.) The specific gravity of the oil at 38° C. compared with water at 15·5° C. shall be not less than 1·03.

(5.) The distillate, based on water-free oil, shall be within the following limits :—

	Grade 1.	Grade 2.	Grade 3.
Up to 210° C., not more than ..	5%	8%	10%
Up to 235° C., not more than ..	25%	35%	40%

(6.) The residue above 355° C., if it exceeds 5 per cent., shall have a float test of not more than 50 seconds at 70° C.

(7.) The oil shall yield not more than 2 per cent. coke residue.

(8.) The foregoing tests shall be made in accordance with the standard methods of the A.W.P.A.

(3.) AMERICAN WOOD-PRESERVERS' ASSOCIATION STANDARD SPECIFICATION FOR HIGH-BOILING OR ANTHRACENE OIL FOR BRUSH OR SPRAY TREATMENT.

(1.) The oil shall be a pure distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements :—

(2.) It shall be fluid at 15° C. and crystal-free at 38° C.

(3.) It shall not contain more than 1 per cent. of water.

(4.) It shall not contain more than 0·5 per cent. of matter insoluble in benzol.

(5.) The specific gravity of the oil at 38° C. compared with water at 15·5° C. shall not be less than 1·09 nor more than 1·13.

(6.) The distillate, based on water-free oil, shall be within the following limits : Up to 235° C., not more than 2½ per cent. ; between 235° C. and 300° C., not more than 20 per cent. ; up to 355° C., not less than 50 per cent.

(7.) The residue above 355° C., if it exceeds 35 per cent., shall have a float test of not more than 50 seconds at 70° C.

(8.) The oil shall yield not more than 2 per cent. coke residue.

(9.) The foregoing tests shall be made in accordance with the standard tests of the A.W.P.A.

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COLLAR-ROT OF PEAS.

INCIDENCE OF THE DISEASE.

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DURING the past four or five years a disease — now locally known as collar-rot—has become common in the pea crops of New Zealand, but apparently it was not until the 1924–25 season that it reached sufficient importance to warrant inquiry from seed merchants and growers. Evidence supplied by farmers indicates that the extent of diseased crops fluctuates from year to year, but the amount of damage which occurs during any season shows the necessity for a thorough investigation into the cause.

Although the occurrence of an unhealthy condition of some crops has been known for some years, it was not until October, 1924, after an examination of a Wellington-grown crop of garden-peas which was suspected of being diseased, that a preliminary investigation was begun. Later, in November, specimens of affected plants were received from Marlborough and the Hutt Valley (Wellington), and inspection of

the crops grown for the vegetable-market and the seed trade shows that in New Zealand the disease is widespread. From these samples and from the crops examined it is known that the disease is present in the districts of Dunedin, north and south Canterbury, Marlborough, Nelson, and the Hutt Valley. This wide distribution means a considerable variation of soil and climatic conditions, but under no circumstances has the trouble been totally absent, although certain factors, which will be discussed in a subsequent paper, tend to lessen or increase the virulence of the disease. Similar diseased crops have occurred in other countries, particularly "stem-blight of peas" in the United States (1), but the literature available does not indicate clearly either the distribution or the importance of the disease.

SURVEY OF PEA-CROP AREAS.

In the early part of the season—October and November last—a survey of some of the pea-crop areas was undertaken, particular attention being paid to the crops of Marlborough, one of the important pea-growing districts in New Zealand. In this area and Canterbury the bulk of the crops are for seed purposes, whereas the crops of Dunedin, Nelson, and the Hutt Valley are mainly grown for the vegetable-market; but in all cases the early symptoms of the disease are similar, notwithstanding differences in soil, climate, and methods of sowing. The first signs of any variation from the normal growth is a yellowing of the culm, a condition which is considered by the growers as being due to excessive soil-moisture. This diseased appearance may occur at any time during the life of the plant, but it is most noticeable and more prevalent in the early spring, when the plant has attained to a height of 3 in. to 8 in. Although heavy and continuous rain or drought may give rise to this sickly nature of the crop, the condition, if disease is present, always persists after a return to normal soil-moisture content has been attained. Death of the plant does not necessarily occur, but the growth is seriously retarded, so much so in some cases that the total seasonal growth does not exceed 6 in. In some crops all the plants may be badly affected, while in others the seriously diseased plants may be confined to large or small areas throughout the fields; but in all the crops examined, comprising many examples of apparently healthy and diseased crops of the previously mentioned districts, the disease has been present. The extent of the disease may vary in effect from almost total destruction of the crop, as far as ultimate seed-yield is concerned, to an amount which is only noticeable by a detailed examination.

Inspection of the spring growth of the yellowed pea-plants showed that the roots and basal portion of the stems were decayed, a feature which has given cause for the local name collar-rot. Such plants are readily withdrawn from the soil, owing to the absence of healthy secondary roots. This decay, generally of a brown colour, may only affect the epidermal tissue of the root, but where conditions favour the growth of invading organisms the vascular system may be destroyed. In the first case the growth of the plant may not be appreciably retarded, but in the second, where the connection between the root and shoot may be completely rotted off, wilting of the plants results. Where the disease has not materially affected the conduction-vessels (the central core) the plant is often able to put forth a fresh

root-system, by which a moderate growth is obtained, but the life, growth, and usefulness of the new roots are subject to attack under the same conditions which influence the life of the original roots. The tap-root and secondary roots, when diseased, are destitute of root-hairs, and the root-nodules generally abundant on leguminous plants are absent.

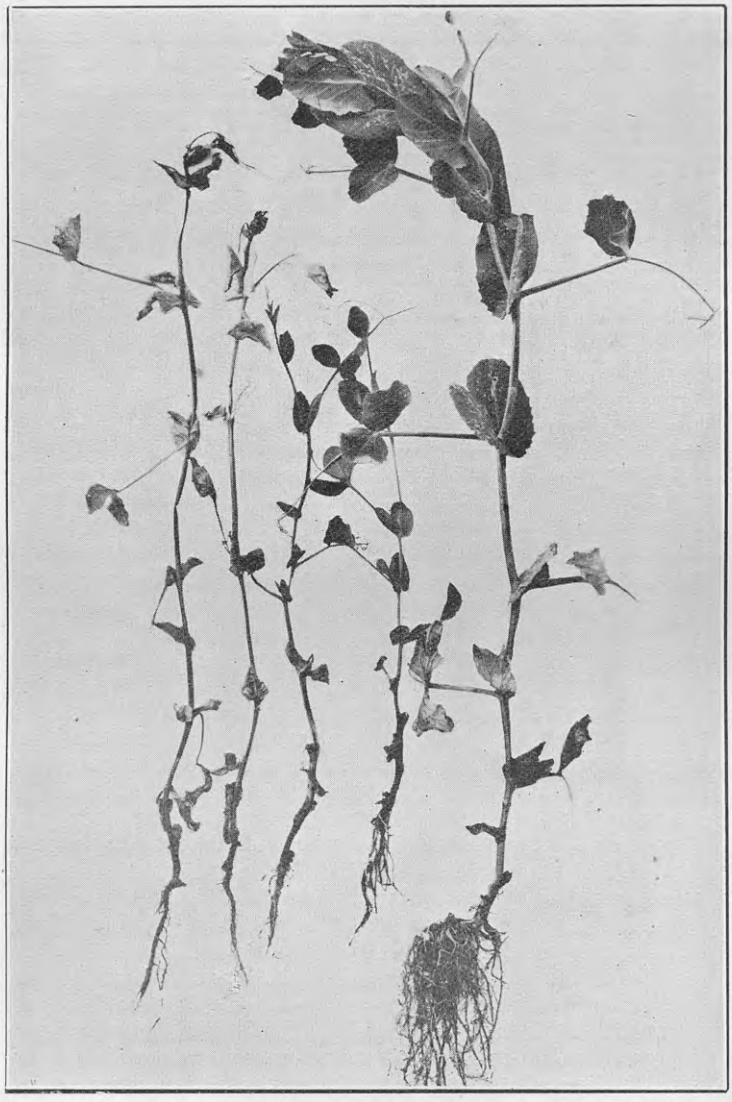


FIG. I. SHOWING FOUR DISEASED PEA-PLANTS ON LEFT AND HEALTHY PLANT ON RIGHT.

Healthy plant was sown from same line of seed and at same time as diseased plants.

[*All photos by H. Drake.*

FIG. 2. SHOWING NEW ROOT-SYSTEM AND OLD TAP-ROOT ROTTED OFF.

Later seasonal examinations have shown that in those crops where the wilting was extensive in the spring the yellow condition has persisted and the growth has remained stunted. Needless to say, the seed-production from such crops is negligible, and it is not an uncommon practice to feed them off with sheep.

In addition to the above-mentioned features of the disease other symptoms appear which at first apparently have no connection with the early stages. At the time of flowering and setting of the seed—and this may occur on plants which have not shown any indication of previous wilting—dark brown and grey spots of $\frac{1}{8}$ in. to $\frac{1}{4}$ in. in diameter appear on the leaves and petioles. On the culms occur similar blue-black oval lesions, varying in size from $\frac{1}{2}$ in. in length to

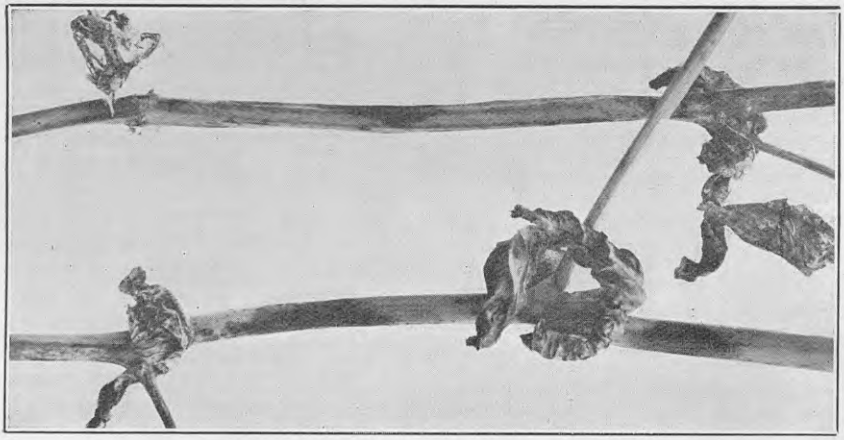


FIG. 3. LESIONS ON CULM OF PEA-PLANT.

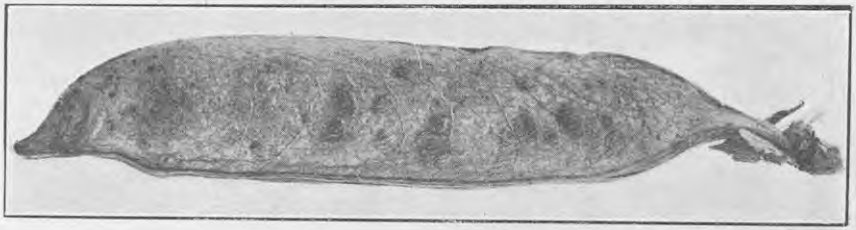


FIG. 4. PEA-POD ATTACKED BY THE DISEASE.

areas covering the greater portion of the culm. Only where the stems are subjected to very moist conditions does the staining of these lesions penetrate far into the tissue of the stems, the usual effect merely being a darkening of the cortex. The pods are often affected in the same manner, showing grey and brown spots, varying in size from small pin-points to patches covering the greater portion of the pod, or more often being small raised disks of $\frac{1}{16}$ in. to $\frac{1}{8}$ in. in diameter. Where the pods are more or less covered with these spots the husk is stained internally, and the seed may have a similar brown stain. The presence of lesions on the leaves, culms, and pods, and the staining of the seed, do not have any serious effect, if any, on the host, but the condition under which they occur and the relationship to the disease of the spring growth will be more fully discussed in a later article.

ECONOMIC IMPORTANCE OF THE DISEASE.

The New Zealand agricultural statistics (2) include the data regarding peas and beans under the one heading, but, assuming that the proportion of beans sown in the years previous to 1915 has not altered greatly in recent years, then the acreage of peas can be estimated by reducing the following totals by 17 per cent.: 1915–16, 9,359 acres; 1916–17, 11,905 acres; 1917–18, 11,685 acres; 1918–19, 17,929 acres; 1919–20, 14,416 acres; 1920–21, 14,466 acres; 1921–22, 12,789 acres; 1922–23, 24,449 acres; 1923–24, 18,676 acres.

Although a reduction of 17 per cent. of the foregoing acreages may be approximately correct in the case of the pea crops for threshing, it is doubtful if a similar reduction of the total values will give a true estimate of the value of the pea crop. Following is the estimated combined value of peas and beans for the past ten years: 1915–16, £49,978; 1916–17, £82,113; 1917–18, £125,033; 1918–19, £151,785; 1919–20, £166,188; 1920–21, £142,158; 1921–22, £135,759; 1922–23, £261,580; 1923–24, £136,045.

These values and acreages do not include the crops grown for the vegetable trade, of which the Wellington City market alone consumes about £5,000 each year.

Literature (2) (3) dealing with similar diseases in America and Europe does not give reliable estimates of the proportion of loss apart from stating that they are considered a serious trouble in connection with the canning industry. It is difficult to estimate the amount of damage caused by collar-rot in New Zealand, but when it is considered that all garden-pea varieties are more or less susceptible to

the disease, which under suitable conditions may partially or completely ruin the crops, it is evident that the trouble is of decided economic importance, calling for further investigation. Further, the loss sustained is not confined solely to those crops which are a total failure, but varies according to the virulence of the disease, so that a removal of the cause would not only obviate the complete failures, but also improve the growth and average yield of what are regarded as satisfactory crops.

Results of field examinations, life-history of the casual organism, and control measures will be dealt with in subsequent articles.

LITERATURE CITED.

(1.) JONES, F. R. Stems and Root-rot of Peas in the United States caused by a Species of Fusarium. *Journal of Agricultural Research*, vol. 26, pp. 459–476, 1923.
(2.) Statistical Report on the Agricultural and Pastoral Production of the Dominion of New Zealand, 1923–24.
(3.) VAN HOOK, J. M. Blighting of Field and Garden Peas. *Ohio Agricultural Experiment Station Bulletin* 173, pp. 233–246, 1906.

TESTING OF PUREBRED DAIRY COWS.

JANUARY TO MARCH C.O.R. LIST.

W. M. SINGLETON, Director of the Dairy Division.

DURING the first quarter of the present calendar year some forty-six cows received certificates under the certificate-of-record system, details of their performances appearing in the appended list.

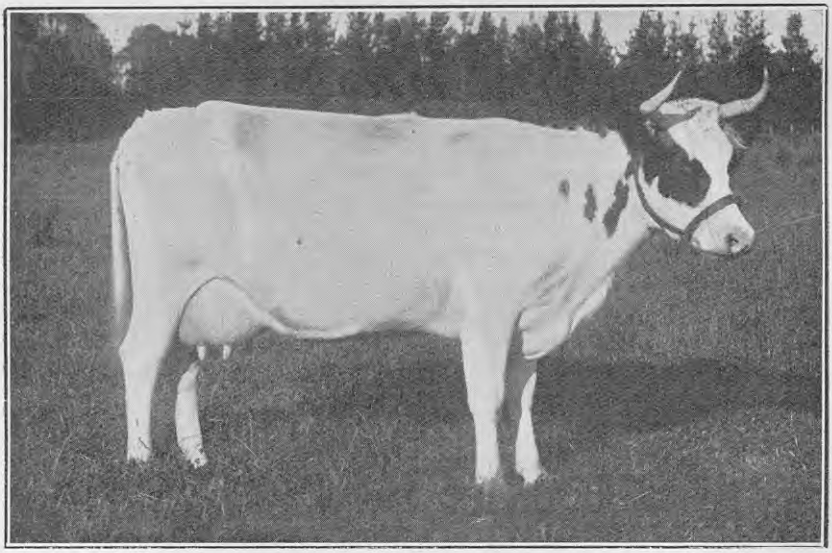
Perhaps the most creditable performance noted in the list is that of the junior two-year-old Ayrshire, Fair Maid of Greenbank, owned and tested by Mr. W. Moore, of Homebush, Masterton. Commencing test at the age of 2 years 27 days, she has gained a C.O.R. for 673·56 lb. butterfat. This entitles her to the leadership of the two-year-old Ayrshires, displacing Mr. W. Hall's Dimple of Edendale (529·46 lb. fat, on a record commenced at 2 years 327 days). Fair Maid of Greenbank is the only tested daughter of Brown Boy of Riki. Her dam is Bright Smile 4th of Greenbank (also owned and tested by Mr. Moore), who has qualified for certificate of record on a yield of 519·62 lb. fat at 2 years 21 days. Records such as these are doing much to bring the Ayrshire breed to that place which it deserves among our special-purpose dairy breeds.

Among the Friesians the highest yield here recorded is that of Dominion Jocrest, who was bred and tested at the Central Development Farm, Weraroa. Her production of 692·70 lb. butterfat was made under twice-a-day milking and practically average farm conditions during the whole period. This is the fourth consecutive lactation on which Dominion Jocrest has qualified for a first-class C.O.R. Her sire is the imported Woodcrest Joe, sire of nineteen C.O.R. daughters,

all of whom have gained their certificates on records made at the Central Development Farm. The dam of Dominion Jocrest is Dominion Julia de Kol, a certificated daughter of Sir de Kol Inka Pietertje (imp.), who is sire of sixteen C.O.R. daughters.

The highest record in the Jersey section is that of the senior two-year-old Holly Oak Sister Sue, with 671·76 lb. butterfat. This heifer was tested by Mr. R. Weinberg, of Nihoniho, and bred by Mr. John Hale, New Plymouth. The pedigree of Holly Oak Sister Sue is a particularly strong one, especially on the male side. She is closely related to such proven sires as Soumise Tom, Sunflower's Perseus (both champion butterfat bulls), Molina's General, Soumise Majesty, and Campanile's Sultan. Sultan's Daisy—968·22 lb. butterfat—at one time New Zealand's champion C.O.R. Jersey cow, appears twice on the sire's side and four generations back.

In this list appears the record of the Red Poll cow Wayward 6th B. No. 1, who was bred by Sir R. Heaton Rhodes, Otahuna, Tai Tapu. She was owned and tested by Mr. G. S. Young, West Plains, Southland, and has the distinction of being the first privately owned Red Poll to qualify for a C.O.R., all previous certificates for this breed having gone to the Central Development Farm herd, Weraroa. Wayward's record of 511·42 lb. butterfat is not only a Red Poll class-leadership, but is the highest C.O.R. yet awarded to a representative of the breed in New Zealand. Mr. Young is to be congratulated on the result of his first year's C.O.R. testing.



FAIR MAID OF GREENBANK (W. MOORE, HOMEBUSH).

C.O.R. in Ayrshire two-year-old class: 12,281·3 lb. milk, 673·56 lb. butterfat.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Fairfield Rosette ..	R. Maddren, Winchester ..	1 360	240·5	344	8,095·0	424·40
Middlewood Ruth ..	Kilgour and Gibson, Kiwitea	2 38	244·3	308	6,166·9	346·10
Princess Rosebud ..	C. Care, Cambridge ..	2 47	245·2	317	5,486·3	329·52
Senior Two-year-old.						
Holly Oak Sister Sue†	R. Weinberg, Nihoniho ..	2 138	254·3	365	11,764·7	671·76
Victoria Regia* ..	F. J. Finer, Ngutuwera ..	2 107	251·2	365	13,042·7	643·61
Alfalfa Sweet Heather	F. J. Saxby, Hamilton ..	2 318	272·3	364	8·539·3	593·79
Jersey Park Fairy ..	W. Pollock, Hawera ..	2 156	256·1	365	7,751·0	475·55
Rosemont Princess Royal	E. L. Roose, Pukekohe ..	2 94	249·9	365	7,740·6	381·59
Bilberry's Bright Eyes	K. Rothe, Riverlea ..	2 326	273·1	365	7,567·6	365·48
Molina's Lady Violet	G. L. Lewis, Fendalton ..	2 350	275·5	365	6,284·4	341·09
Maori Flower ..	G. L. Lewis, Fendalton ..	2 306	271·1	292	6,262·7	334·56
Three-year-old.						
Camelia's Choice ..	A. J. Smith, Cardiff ..	3 106	287·6	365	9,180·8	554·61
Four-year-old.						
Irene's Goldie ..	A Buchanan, Palmerston North	4 18	315·3	365	10,224·1	602·64
Awatane Portia ..	J. Nicholson, Manakau ..	4 7	314·2	365	10,796·8	527·18
Fairview Magpie ..	Dr. G. Walker, Maunu ..	4 104	323·9	365	8,855·2	441·11
Mature.						
Countess of Concord..	C. Waterhouse, Waverley ..	7 19	350·0	365	10,848·25	581·51
Lemon Blossom ..	A. A. White, Auckland ..	5 105	350·0	365	7,698·75	493·35
Capsicum's Ladylike	C. A. Willis, Pukekohe ..	6 45	350·0	365	9,794·0	482·81
Rewa Saint ..	W. H. Booth, Carterton ..	5 99	350·0	360	8,062·5	426·67
Ena	G. L. Lewis, Fendalton ..	5 0	350·0	319	7,477·2	414·87
	FRIESIANS.					
Junior Two-year-old.						
Heroic Queen* ..	J. McAnulty, Ashburton ..	2 57	246·2	365	18,495·8	561·77
Waireka Hengerveld Pietje Pontiac*	A. M. Budd, Carterton ..	2 8	241·3	365	16,308·4	559·36
Taumata Abbekerk Cornella*	A. M. Budd, Carterton ..	2 40	244·5	365	13,658·3	525·77
Waireka Pietertje Posch*	A. M. Budd, Carterton ..	2 16	242·1	365	14,619·0	515·99
Rosevale Queen Isobel Triumph*	McDonald and Co., Dunedin	2 19	242·4	365	11,277·1	354·54
Junior Three-year-old.						
Springbank May Pontiac*	John Court, Ltd., Auckland	3 144	291·4	359	15,128·6	499·59
Ashlyn 49th* ..	R. A. Wilson, Turakina ..	3 58	282·8	351	12,692·2	479·06
Senior Three-year-old.						
Taumata Netherland Pietje Pontiac*	A. M. Budd, Carterton ..	3 355	312·5	365	16,595·5	488·04
Lady Dinkum Domino*	A. M. Budd, Carterton ..	3 307	307·7	294	10,745·1	395·03
Junior Four-year-old.						
Kittie Maid of Maplehurst*	R. A. Wilson, Turakina ..	4 54	318·9	274	12,182·0	365·22

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Mature.		Yrs. dys.	lb.		lb.	lb.
Dominion Jocrest ..	Central Development Farm, Weraroa	6 298	350·0	365	22,568·5	692·70
Maud Fayne Johanna 2nd†	Voss Bros., Longburn ..	7 251	350·0	312	15,170·9	563·09
Lady Pietje Alcartra*	Bloomfield Farm Company, Wellington	5 39	350·0	365	15,688·1	458·09
Sunnycroft Pietertje*	A. M. Budd, Carterton ..	6 17	350·0	282	13,745·7	447·00
Dutch Cadilac Queen*	W. I. Lovelock, Palmerston North	5 52	350·0	350	11,124·2	381·30
	AYRSHIRES.					
Two-year-old.						
Fair Maid of Greenbank*	W. Moore, Homebush ..	2 27	243·2	365	12,281·3	673·56
Mature.						
Fair Maid of Edendale	W. Hall, Lepperton ..	9 61	350·0	365	11,409·3	459·99
Ivanhoe Bessie* ..	A. M. Weir, Menzies Ferry	5 20	350·0	287	11,244·4	352·43
	RED POLLS.					
Two-year-old.						
Wayward 6th B. No. 1*	G. S. Young, West Plains ..	2 188	259·3	365	11,228·0	511·42
	Second-class Certificates.					
	JERSEYS.					
Junior Two-year-old.						
Pine Bank Topsy ..	J. Meuli, Normanby ..	2 25	243·0	365	7,690·0	392·66
Pine Bank Mona ..	J. Meuli, Normanby ..	2 50	245·5	365	7,037·8	371·67
	FRIESIANS.					
Junior Two-year-old.						
Lady Posch of Oakview†	Brown Bros., Matatoki ..	2 54	245·9	363	6,836·0	331·26
Carlyle Pietje Fobes†	Brown Bros., Matatoki ..	2 8	241·3	365	8,258·2	329·56
Junior Four-year-old.						
Ellerlea Monona Minto de Kol*	A. C. M. Finlayson, Kamo ..	4 34	316·9	365	15,996·7	603·18
Mature.						
Pauline Acme 3rd* ..	John Court, Ltd., Auckland	11 314	350·0	351	21,471·3	670·35
Ashlynn 24th† ..	Piri Land Company, Auckland	5 48	350·0	365	13,879·4	470·26

HONEY-GRADING STORE AT GREYMOUTH.

THE Greymouth Harbour Board has erected, at the request of the West Coast beekeepers, a grading-store for honey at Greymouth. The store has been approved in accordance with the regulations relating to the export of honey from New Zealand, and the permit to grade honey at Molan's Store, Thompson Street, Greymouth, formerly appointed under the above regulations, is now cancelled.

CLUB-ROOT IN TURNIPS.

TRIALS WITH "DISEASE-RESISTANT" VARIETIES IN OTAGO AND SOUTHLAND.

R. B. TENNENT, N.D.D., Instructor in Agriculture, Dunedin.

DURING the season 1923–24 field trials of several varieties of turnips claimed to be highly resistant to club-root were conducted in Otago and Southland. In the present article a brief description of the economic importance of this disease is given, together with a record of the observations made in connection with the trials. The occurrence of dry-rot disease in the same plots is also recorded incidentally. Where the general term "turnip" is used it is intended to include both soft and swede varieties.

The turnip crop may be regarded as the most important cultivated crop, apart from grass, grown in Otago and Southland, approximately 205,000 acres having been grown there during the season 1923–24. The value of the crop to the southern farmer lies in the comparative ease with which it may be grown, coupled with its relatively high yield and great utility as a winter feed for stock. Such features give it a leading place in the farming practice of the South rivalled by no other crop. Consequently, when weather conditions, or the incidence of certain bacterial or fungoid diseases, or the attack of insects, are such as to reduce the yield per acre, such a visitation is a most serious one for the farmer, seeing that the successful wintering of his stock is to a large measure regulated by the success or failure of his turnips.

Turnip-growing was introduced into Otago and Southland by the early Scottish farmers who settled in that part of the Dominion. With increased settlement turnip-growing also increased, and each succeeding year saw larger areas laid down. With the increased acreages shorter rotations between turnip crops were evolved, this to a large measure accounting for the spread of various diseases. Also the common practice of purchasing turnips—a large portion of which are often infected with club-root—and feeding such roots on clean land is a common means whereby disease is spread from farm to farm. It is only by a realization of the danger of carrying out this practice that the farmer can hope to prevent the introduction of disease on his property. The position to-day is that in certain localities of Otago and Southland turnip-growing is, to say the best, a most precarious undertaking. A large number of farmers find that they can only grow turnips with great difficulty, that failure is more often likely to accrue than success, and, in short, that they have been forced to abandon turnip-growing as a reliable farm practice, thus being forced into growing less satisfactory substitutes.

The two chief diseases to which the turnip is susceptive in Otago and Southland are club-root or finger-and-toe (*Plasmidophora brassicae*) and dry-rot (*Phoma napo brassicae.*) In this article, however, only minor reference is made to the latter disease, the main observations being concerned with club-root.

No definite figures are available in regard to the annual loss experienced by farmers as a result of club-root infection, and it will be realized that such pecuniary loss will vary considerably with the seasons, being lower in a dry and higher in a wet one. Estimating the average yield of turnips over all classes of country in Otago and Southland as about 15 tons per acre, and giving those turnips a value of £1 per ton, it then follows that the gross value per acre works out at £15. According to official statistics 205,000 acres of turnips were grown in 1923–24 in those districts, thus representing a monetary value of approximately £3,075,000. Making a deduction from this sum of 15 per cent., estimated as the loss incurred by club-root infection — namely, £461,250 — it can at once be realized of what importance is the finding of some means of counteracting this disease. Including resultant losses directly due to the primary loss just indicated, the total amount would probably be brought well up to the million sterling mark.

PLAN OF THE EXPERIMENTS.

Seeds of the following varieties were submitted for trial: (1) Irvine's Purple-top swede, (2) Irvine's Green-top Yellow turnip, (3) Sutton's Hardy White swede, (4) Mein's Purple-top swede, (5) Mein's Green-top Yellow turnip, (6) Mein's Purple-top Yellow turnip, (7) Bangholm swede.

In planning the experiments it was realized that, as the infection of the different fields varied considerably, an endeavour would have to be made to obtain the same intensity of infection by sowing the trial seed along with a control in various portions of the fields. Accordingly the ordinary turnip-ridger was employed, each drill of the ridger sowing different seed. For example, one drill would sow Bangholm seed, and the other a commercial strain of turnip similar in qualities to Bangholm swede. When the drilling was completed the field consisted of alternate rows of Bangholm and commercial swede, so that the variety under trial and the control were as nearly as practicable subjected to similar conditions in so far as soil infection was concerned. This method was adopted in the case of each variety of seed under trial, commercial seed being used as a control, this being selected to conform as nearly as possible with the type of turnip under trial. The fields selected for trial were known to be infected with club-root.

When the crops were matured ½-chain strips of adjacent rows of trial and control turnips were examined microscopically for club-root and dry-rot. These ½-chain rows were also weighed. Double rows were taken in this manner at varying places of the fields. The results obtained from this preliminary investigation are given below, a commentary being made on each result:—

IRVINE'S PURPLE-TOP SWEDE.

Three trials of this variety were carried out, two at Gore Experimental Area and one on the property of Mr. W. Scott, Mataura.

Trial 1. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Irvine's Purple-top swede..	40	29	72·5	4	10·0	114
	Commercial swede ..	37	37	100·0	1	2·7	101
B	Irvine's Turple-top ..	32	17	53·1	1	3·1	111
	Commercial	39	32	82·0	4	10·2	120
C	Irvine's Purple-top ..	35	21	60·0	5	14·3	119
	Commercial	42	32	76·2	4	9·5	112
D	Irvine's Purple-top ..	45	19	42·2	2	4·4	111
	Commercial	42	11	26·2	2	4·7	89
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Purple-top ..	152	86	12	56·5	7·9	28 13
..	Commercial	160	112	11	70·0	6·2	26 13

In this trial, as will be noted, the infection of club-root in the ground was high. In the case of Plots A, B, and C, Irvine's seed showed superiority in club-root resistance over the commercial swede. In Plot D the position, however, was reversed. The infection of the swedes by dry-rot was slight, being about equal in both varieties.

2. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Irvine's Purple-top swede	23	11	..	47·8	..	56
	Commercial swede ..	35	24	1	68·5	4·1	85
B	Irvine's Purple-top ..	39	16	2	41·0	5·1	96
	Commercial	38	23	10	60·5	26·3	60
C	Irvine's Purple-top ..	49	26	2	53·0	4·0	132
	Commercial	48	33	3	68·7	6·2	115
D	Irvine's Purple-top ..	40	15	1	37·5	2·5	110
	Commercial	49	29	5	59·0	10·0	106
E	Irvine's Purple-top ..	38	15	3	39·4	7·8	118
	Commercial	39	21	2	53·8	5·1	95
F	Irvine's Purple-top ..	45	22	2	48·8	3·3	108
	Commercial	42	9	2	21·4	4·7	115
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Purple-top ..	234	105	10	44·8	4·2	26 3
..	Commercial	251	139	23	55·3	9·1	23 7

In this case, as in Trial 1, Irvine's swede showed superiority in regard to club-root resistance over the commercial strain in all but Plot F. Here the position was entirely reversed. On the whole, Irvine's was less infected with dry-rot than the commercial strain.

3. T. Scott's Farm, Mataura.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Irvine's Purple-top swede	47	11	..	23·4	..	32
	Commercial swede ..	14	3	..	21·4	..	18
B	Irvine's purple-top ..	50	35	..	70·0	..	30
	Commercial	27	13	..	48·1	..	20
C	Irvine's Purple-top ..	37	30	..	81·0	..	25
	Commercial	38	34	1	89·5	2·6	25
D	Irvine's Purple-top ..	42	37	..	88·0	..	30
	Commercial	24	23	..	95·8	..	14
E	Irvine's Purple-top ..	45	35	..	77·8	..	26
	Commercial	17	11	..	64·7	..	16
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Purple-top ..	221	148	..	67	..	7 4
..	Commercial	120	84	1	70	0·8	4 13

In Plots A, B, and E the commercial swede used showed less infection than Irvine's This piece of ground was very badly infected with club-root, and a large number of misses occurred in the ½-chain lengths. Whether those misses were accountable to club-root or not is problematical, but it would appear that in the majority of instances such was the case. If so, a different result would most likely have been obtained, for it is noticeable that in the case of each plot a larger number of Irvine's than commercial swedes were examined, thus rendering Irvine's more likely of showing a higher percentage of infection. This crop was remarkably free from dry-rot infection.

Summary.

As a result of this trial, and taking into account the remarks made in connection with Trial 3 of this series, it would appear that Irvine's Purple-top swede shows a higher capability of resisting club-root than the commercial strains used. The same conclusion is arrived at in regard to its resistance to dry-rot.

IRVINE'S GREEN-TOP YELLOW TURNIP.

Three trials of this variety of soft turnip were made, two at Gore Experimental Area and one on Mr. Raynbird's farm, Otago Peninsula.

4. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Irvine's Green-top Yellow turnip	36	17	4	47·2	11·1	69
	Commercial turnip ..	42	26	8	61·9	19·0	105
B	Irvine's Green-top Yellow	32	3	..	9·3	..	68
	Commercial	47	2	4	4·2	8·5	121
C	Irvine's Green-top Yellow	36	4	6	11·1	16·6	98
	Commercial	36	2	..	5·5	..	59
D	Irvine's Green-top Yellow	40	..	3	..	7·5	70
	Commercial	35	5	14	14·3	20·0	113
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Green-top Yellow	144	24	13	16·6	9·0	19 4
..	Commercial	160	35	26	21·8	16·2	25 2

The infection with club-root was very light in all plots but A. In the case of Plots A and D the infection with dry-rot was greater than on the other plots. As will be noted, Plots A and B showed the greater percentage of infection with Irvine's turnip. The reverse was the case in Plots C and D. The averages show a higher percentage of club-root infection in the commercial turnip over Irvine's turnip. This also is the case in regard to dry-rot infection. It should be noted that the commercial turnips, despite the heavier infection, gave a heavier yield per acre.

5. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Irvine's Green-top Yellow turnip	40	1	1	2·5	2·5	57
	Commercial turnip ..	57	2	10	3·5	17·5	106
B	Irvine's Green-top Yellow	30	..	..	..	..	74
	Commercial	36	..	7	..	19·4	105
C	Irvine's Green-top Yellow	33	3	1	9·1	3·0	50
	Commercial	44	13	4	29·5	9·1	76
D	Irvine's Green-top Yellow	35	3	3	8·6	8·6	45
	Commercial	46	10	6	21·7	13·0	90
E	Irvine's Green-top Yellow	38	2	..	5·3	..	55
	Commercial	41	9	4	22·0	9·7	70
F	Irvine's Green-top Yellow	33	1	1	3·0	3·0	32
	Commercial	38	9	1	24·0	2·6	98
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Green-top Yellow	209	10	9	4·3	4·1	13 2
..	Commercial	262	43	33	16·4	12·6	22 19

In this case Irvine's turnip showed a decided superiority in regard to club-root resistance, particularly where the incidence of infection in the soil was high. This also applies in the case of those turnips infected with dry-rot, with the exception of Plot F. As was the case in Trial 4, the commercial turnip gave the heavier yield per acre, notwithstanding its greater degree of infection. As will be seen in the averages, the incidence of disease in this trial was comparatively slight.

6. Mr. Raynbird's Farm, Otago Peninsula.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Irvine's Green-top Yellow turnip	19	..	..	..	..	54
	Commercial turnip ..	36	4	4	11·1	11·1	67
B	Irvine's Green-top Yellow	43	..	..	..	..	53
	Commercial	45	2	3	4·4	6·6	59
C	Irvine's Green-top Yellow	41	2	2	4·8	4·8	50
	Commercial	26	10	13	38·4	5·0	42
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Irvine's Green-top Yellow	103	2	2	1·9	1·9	13 2
..	Commercial	107	16	20	15·0	18·7	14 3

Club-root infection in this trial, also dry-rot infection, were distinctly more pronounced in the case of the commercial turnip. Again, however, it is noticeable that the recorded yield per acre of commercial turnips was higher than that recorded for Irvine's.

Summary.

From the three trials of this variety distinct indication is given that Irvine's turnip has a greater degree of resistance to both club-root and dry-rot than the commercial strains used. This is particularly noticeable in the case of Trials 5 and 6. The yield per acre of Irvine's turnips was lower in each case when contrasted with the commercial turnip, but as the value of a turnip is to a large measure regulated by its keeping-quality it would appear that the disadvantage of a comparatively low yield in the case of Irvine's is more than compensated by the lesser percentage of infection throughout the crop.

SUTTON'S HARDY WHITE SWEDE.

Two trials of this variety were conducted, one at Gore Experimental Area, and the other on Mr. Raynbird's farm, Otago Peninsula.

7. Gove Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Sutton's Hardy White swede	33	11	3	33·3	9·1	53
	Commercial swede ..	30	19	..	63·3	..	30
B	Sutton's Hardy White ..	31	4	3	12·9	9·7	63
	Commercial	32	22	2	68·7	6·2	67
C	Sutton's Hardy White ..	35	7	6	20·0	17·1	68
	Commercial	38	27	3	71·0	7·9	72
D	Sutton's Hardy White ..	45	38	4	84·4	8·8	60
	Commercial	42	36	3	85·7	7·1	58
E	Sutton's Hardy White ..	29	24	3	82·8	10·3	45
	Commercial	23	22	4	95·7	17·4	22
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Sutton's Hardy White ..	173	84	19	48·6	11·0	14 10
..	Commercial	163	127	12	77·9	7·3	12 10

In all plots but one, Sutton's seed here showed a slight superiority over the commercial seed in so far as club-root infection was concerned. The reverse was the case in regard to dry-rot infection. Both varieties were badly infected by club-root and showed little resistance to the disease.

8. Mr. Raynbird's Farm, Otago Peninsula.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Sutton's Hardy White swede	30	16	..	53·3	..	50
	Commercial swede ..	33	15	1	45·5	3·0	48
B	Sutton's Hardy White ..	25	23	1	92·0	4·0	68
	Commercial	27	25	4	92·6	14·4	67
C	Sutton's Hardy White ..	32	17	2	53·1	6·2	52
	Commercial	41	19	6	46·3	14·6	56
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Suttod's Hardy White ..	87	56	3	64·3	4·4	14 5
..	Commercial	101	59	11	58·4	10·9	14 8

As in Trial 7, both varieties were heavily infected with club-root, Sutton's swede, if anything, the more so. The percentage of dry-rot present was comparatively low, showing in favour of Sutton's swede. The yield per acre in this case was practically equal for both varieties.

Summary.

On viewing the results of this trial one is forced to conclude that Sutton's variety has no claim to be resistant to club-root disease. Plot B of Trial 8 showed that where the disease was severe in the field this swede became badly infected.

MEIN'S PURPLE-TOP SWEDE.

One trial only was made with this variety—namely, at Gore Experimental Area, as follows:—

9. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	lb.
A	Mein's Purple-top swede ..	34	23	4	67·6	11·8	75
	Commercial swede ..	34	30	3	88·2	8·8	72
B	Mein's Purple-top ..	36	19	5	52·7	13·8	94
	Commercial	35	34	11	97·4	31·4	72
C	Mein's Purple-top ..	33	20	6	60·6	18·2	85
	Commercial	41	37	6	90·2	14·9	72
D	Mein's Purple top ..	37	21	2	56·7	5·4	67
	Commercial	42	38	4	90·5	9·5	76
E	Mein's Purple-top ..	28	16	1	57·1	3·5	75
	Commercial	31	27	2	87·1	6·4	66
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Mein's Purple-top ..	168	99	18	58·9	10·7	20 19
..	Commercial	183	166	26	90·7	14·2	18 1

Mein's seed showed a superiority in regard to disease-resistance in so far as club-root disease was concerned. In regard to dry-rot the results were variable, in some instances the control swedes proving superior. Neither variety showed a high degree of resistance, and the claim made in connection with Mein's seed cannot be regarded as fully substantiated from the observations made in this trial.

MEIN'S GREEN-TOP YELLOW TURNIP.

A single trial of this variety was conducted on Mr. Irvine Martin's farm, Gore, results being as follows:—

10. Mr. Irvin Martin's Farm, Gore.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	lb.
A	Mein's Green-top Yellow turnip	44	2	2	4·5	4·5	40
	Commercial turnip ..	43	..	2	..	4·6	46

Trial 10—continued.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
B	Mein's Green-top Yellow ..	45	6	4	13·3	8·8	36
	Commercial	41	..	..	..	..	40
C	Mein's Green-top Yellow ..	42	2	2	4·7	4·7	28
	Commercial	27	..	3	..	11·1	22
D	Mein's Green-top Yellow ..	48	1	2	2·1	4·2	36
	Commercial	35	..	3	..	8·5	26
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Mein's Green-top Yellow ..	179	11	10	6·1	5·6	8 9
..	Commercial	146	..	8	..	5·5	8 16

As will be noted, Mein's turnip showed no superiority over the commercial variety. The percentage of club-root infection in the field was low, and consequently the information tabulated is a poor index of the probability of this turnip's disease-resistant properties. It is particularly to be noted that none of the commercial turnips was infected with club-root, whereas 6·1 per cent of Mein's showed infection. In regard to dry-rot resistance both varieties showed equal infection.

MEIN'S PURPLE-TOP YELLOW TURNIP.

This variety was tested at the Gore Experimental Area, with results as tabulated :—

11. Gore Experimental Area.

Plot.	Variety.	Number of Roots examined.	Number of Roots infected with		Percentage of Roots infected with		Weight of Roots examined.
			Club-root.	Dry-rot.	Club-root.	Dry-rot.	
							lb.
A	Mein's Purple-top Yellow turnip	54	8	5	14·8	9·3	41
	Commercial turnip ..	37	2	3	5·4	8·1	32
B	Mein's Purple-top Yellow	45	4	1	8·8	2·2	40
	Commercial	36	3	1	8·3	2·8	32
C	Mein's Purple-top Yellow	42	8	2	19·0	4·7	32
	Commercial	34	..	2	..	5·9	32
D	Mein's Purple-top Yellow	51	6	4	11·7	7·8	41
	Commercial	39	1	1	2·5	2·5	40
	Averages of Plots.						Average Yield per Acre. Tons cwt.
..	Mein's Purple-top Yellow	192	26	12	13·5	6·5	9 14
..	Commercial	146	6	7	4·1	4·8	7 19

The commercial strain in this trial showed superiority in regard to club-root and dry-rot disease-resistance.

BANGHOLM SWEDE.

A trial of Bangholm swede was conducted at Gore Experimental Area on land known to be heavily infected with club-root. Three years previous to this trial the land had been limed with different quantities of burnt lime per acre, one strip being left as a control. Previous observations made on this block had indicated that as a means of control lime was of no great value. The following information is consequently of value not only in indicating the club-root resistant properties of Bangholm swede, but also in showing the effect of lime in relation to the disease. The tabulated statements explain the scheme of laying out the plots.

12. Gore Experimental Area.

Plot.	Variety.	4 Tons Burnt Lime per Acre.		8 Tons Burnt Lime. per Acre.		Control		16 Tons Burnt Lime per Acre.		2 Tons Burnt Lime per Acre.	
		Club-rooted.	Sound.	Club-rooted.	Sound.	Club-rooted.	Sound.	Club-rooted.	Sound.	Club-rooted.	Sound.
A	Bangholm swede ..	6	15	11	21	13	23	12	23	10	14
	Commercial swede ..	14	1	10	1	31	0	13	4	20	1
B	Bangholm	3	18	2	17	4	23	2	26	7	10
	Commercial ..	20	4	16	15	46	0	29	6	24	0
C	Bangholm	8	15	18	20	10	19	8	22	10	15
	Commercial ..	24	3	26	5	34	1	29	1	26	1
D	Bangholm	9	21	13	26	14	16	13	27	19	18
	Commercial ..	24	11	25	10	34	10	25	24	26	2

The figures represent numbers of roots, diseased or sound.

Variety.	4 Tons Burnt Lime per Acre.		Percentage of Infection.	8 Tons Burnt Lime per Acre.		Percentage of Infection.	Control.		Percentage of Infection.	16 Tons Burnt Lime per Acre.		Percentage of Infection.	2 Tons Burnt Lime per Acre.		Percentage of Infection.	Average Percentage of Infection over 5 Plots.
	Club-rooted.	Sound.		Club-rooted.	Sound.		Club-rooted.	Sound.		Club-rooted.	Sound.		Club-rooted.	Sound.		
Bangholm ..	26	69	27·3	44	84	34·3	41	91	31·0	35	98	26·3	46	57	44·6	32·7
Commercial ..	82	19	81·9	77	31	71·3	145	11	93·0	96	35	73·3	96	4	96·0	83·1

It will be noted that Bangholm swede showed a fair degree of disease-resistance in contrast with the commercial variety. The effect of the various applications of burnt lime appears to be negligible, and only emphasises the fact, as already stated in previous reports, that lime is not an efficacious remedy for the control of club-root.

GENERAL SUMMARY OF TRIALS.

(1.) The results so far obtained serve to pave the way for further experimentation, and indicate that where this class of work is being performed a large number of observations will have to be made to obviate the great variations which occur.

(2.) Insufficient roots were examined to eliminate any probable error in regard to the experiments.

(3.) Of the turnips submitted for trial none were immune to club-root disease.

(4.) Although a number of varieties showed a higher degree of resistance to club-root and dry-rot than the commercial varieties with which they were compared, it cannot be claimed that these varieties warrant the name of "disease-resistant"—all being fairly heavily infected.

(5.) Two varieties showed promise of being worthy of further trial under more exacting conditions, these being Bangholm swede and Irvine's Green-top Yellow turnip.

Thanks are due to those farmers who co-operated in carrying out the experiments. Mr. R. McGillivray and Mr. T. Pattinson, of this Department, both rendered valuable assistance in gathering the information.

A SIMPLE METHOD OF MAKING CONCRETE POSTS.

A FAIRLIE correspondent (R. E. G.) writes to the Editor as follows:—

"In your February issue there is an article on making concrete posts for farm-work in which the writer gives particulars for making the boxes, &c. Another method, which perhaps does not make such a neat post, but which answers very well, is as follows: Select a spot of old pasture with a good, firm sole of grass and solid subsoil—a patch of old twitch does very well. With a very sharp spade dig out a trench the size of the post required. If the ground is firm the sides will stand all right without boards or support. Then line the trench with stout tarred paper, old clean sacking, or other material to keep the concrete from the soil. Mix the concrete as directed, and put in the reinforcements as necessary. Before putting in the concrete I lay two or three pieces of No. 8 wire across the trench, and bend them to the sides as close as possible, leaving about 18 in. of wire projecting above the trench on each side. After the posts are made, cover with a wet sack or straw, or any waste material, to keep the sun and frost away, and leave for a month or more to mature. When the posts are ready the wires are brought together, twisted, and a crowbar or the like passed underneath. A couple of men can then lift the post out into a dray or cart. By leaving the posts in the ground they are kept damp and do not dry too fast in the sun or wind. Most farms have a creek or stream running through them, and there is generally good, old, firm ground on the banks that has not been ploughed. Often (as in my case) the shingle is in the creek and has been well washed ready for use."

London Market for Peas and Beans.—The following advice was cabled by the High Commissioner on 4th April:—*Peas*—Market dull. Partridge: New Zealand No. 1 sold at 65s. per 504 lb. ex store; Tasmanian quoted at 75s. to 82s. 6d. ex store, according to quality; English, good average, offered at 48s. to 50s. Blue: Dutch pressed for sale at low prices; no demand for New Zealand or Tasmanian. Nominal values are £16 and £18 per ton ex store respectively. *Beans*—Market dull. Good English spring offered at 53s. and winter at 47s. 6d. Chinese horse, spot, quoted at £10 10s. per ton ex store; new crop, July–September shipment, £9 17s. 6d.

SEASONAL NOTES.

THE FARM.

TOP-DRESSING OF PASTURE.

TOP-DRESSING should be carefully considered at this period, and arrangements made for the necessary supplies. Most grassland will greatly benefit by judicious top-dressing, but if the pasture is very deficient in clovers and contains much weed-growth it will be better, if possible, to renew it before spending money on top-dressing. As a general principle it is better to start top-dressing while the pasture is still in good condition, and thus preserve the good plants, rather than let them get weak and then try to restore them by means of manure. Nevertheless it must be recognized that even weak pastures are greatly benefited by top-dressing.

At one time it was generally considered the correct practice to apply heavy dressings and then let the land stand for several years, but recent experience goes to show that better results are obtained from lighter and more frequent applications, the ideal being to get the pasture in good heart and keep it in this condition by annual light dressings. If this practice is followed 2 cwt. per acre per year is ample, but if no top-dressing has been done for a few years, or if the pasture is very much run down, from 3 cwt. to 4 cwt. should be applied the first year, and followed up by lighter annual dressings.

Basic slag continues in great popularity in many districts, and at present prices is quite an attractive proposition under conditions favourable to its use. It suits heavy soils rather than light, moist conditions rather than dry, and old pastures rather than new. It is rather slower in action than super, but, given sufficient moisture, will take effect in a few weeks. Super is now used in increasing quantities for top-dressing, and is remarkably efficient on the lighter soils in particular, though valuable on clay soils also. In certain cases, however, it is found that to obtain the best results from super the soil must first have been limed; and where super is used it is a good general rule either to lime at regular intervals or to employ a mixture of lime and super. Various proportions may be used; it is best to mix three or four days ahead. Ground rock phosphate (Nauru, &c.) does well under certain conditions, but appears to depend for its effectiveness very largely upon a good supply of moisture and a certain amount of soil-acid. Hence it is unsuitable for dry soils, dry weather conditions, and land recently limed. A mixture of super and the ground rock in equal proportions is generally better than the latter used alone. On the poorer classes of land blood-and-bone gives excellent results, as also does bonedust on light open soils, but the cost of these two fertilizers is at present high, and money is better invested in super or slag, except under special conditions.

On certain soils, notably light sandy loams and peaty land, potash is generally a useful supplement to the usual phosphatic dressing. Kainit is often used for this purpose. It is a low-grade manure (14 per cent. potash), and is rather awkward to handle, but it has the virtue of

containing a large proportion of salt, which has a sweetening effect on land, and most pastures will benefit from an application of 2 cwt. to 3 cwt. per acre. When kainit is applied in conjunction with phosphatic fertilizers it is best to mix just before top-dressing.

Slow-acting phosphates (ground rock) should be applied in May; slag is best applied in June or July; and basic super or super in July or August. Before top-dressing, the pasture should be fed down fairly closely, and thoroughly tripod-harrowed afterwards. In order to obtain the maximum benefit from top-dressing, proper drainage must be provided. This also applies to liming.

There are reports of stock being injured by feeding on grassland immediately after it has been top-dressed, and for this reason it is better to keep the animals off for a week or so, or until there has been a good shower of rain.

ROOTS.

The mangold crop should be stored in May or June before frosts become severe. The usual method is to hand-pull the roots, twisting the tops off by a sudden jerk, while at the same time throwing the roots into rows four drills apart. They are then left to ripen for about a fortnight to three weeks before carting to the clamps. Pitting improves the feeding-value of mangolds; unless pitted they frequently cause scouring in stock. The heap should be covered with straw or piled under a plantation as a protection against frost. The roots are best arranged in shaped clamps, with the best-keeping varieties, such as Long Reds, at the end where they will be fed last. Where large areas are to be handled an implement made of two planks fixed together on edge in the shape of a V and drawn at the apex between every four drills facilitates harvesting. Although the mangold resists light frosts while standing in the ground, very little frost may cause considerable injury if the roots are left lying on the surface too long, as that portion of the root previously under the ground is tender.

Where necessary, or where the crop is showing signs of disease, the feeding-off of swedes can be commenced, together with a hay ration, using the poorest hay first. On heavy clay soils stock should be removed from the root breaks after heavy rain, otherwise the soil-texture may be spoiled. On this account swedes growing on heavy soils should not be fed off by cattle.

OAT-SOWING.

The coming month is a good period for sowing oats, especially crops intended for chaffing later. Sown then they provide considerable green feed during the late winter and early spring and ripen about New Year. In some districts this is an important point, as they can then be harvested before Californian thistle ripens its seed. In most spring-sown crops the thistle, where present, ripens about the same time as the oats. Algerians are generally best for autumn sowing, a suitable amount being about 2½ bushels to the acre, with 1 cwt. to 2 cwt. of super, according to the nature of the land.

Both oats and wheat should be treated with some reliable smut-preventive. Formalin or hot water treatments are those generally used in this country. Both hasten germination and cause the seed to swell and run slower in the drill, which requires setting to sow a larger quantity.

POTATOES.

Any mature potato crops still in the ground should be lifted before the land becomes sodden with winter rains. Digging should be done in good weather, and the tubers left on the ground for a few hours to dry before being placed in sacks. Corticium disease has been prevalent in some localities in the South. It has been present for many years, but appears to have become more virulent of late.

—*Fields Division.*

THE ORCHARD.

STORAGE.

ALL fruit appears to be maturing earlier than usual this season, and by the time these notes appear there will be only a few late varieties of pip-fruit to gather. As a general rule all fruit not intended for disposal immediately it has been gathered should be placed in cool storage if it is desired to keep it until after July or August. Sturmers, Rokewoods, Tasmas, and Lord Wolseleys will keep fairly well in ordinary storage, providing, of course, that they are left in a cool place. All fruit intended for keeping for any length of time should be free from blemish and skin-punctures.

BRANDING OF CASES FOR THE LOCAL MARKET.

It may be somewhat late in the season to give advice on branding cases for market. However, after the experience of inspection at the various markets during the past few months a few suggestions may benefit some who are as yet ignorant of the best methods to follow. Many growers act against their own interests through not placing on the ends of the case a few more particulars. One often comes across cases with only marks such as "K 147—1st Grade," or "L 678—2nd Grade." There is nothing to indicate what is contained in the case, whether apples or pears, or what variety. Buyers are left to find out for themselves, and the auctioneers are at a disadvantage. It is the grower who suffers every time when he fails to give a clear indication as to the value and quality of his fruit. It means very little extra trouble to give a few particulars on the case, either by means of a rubber stamp or a stencil. This facilitates selling, and often means better prices, and is altogether more satisfactory. The minimum particulars stamped on cases should be (1) the consignee's initials, (2) the consignor's registered number, and (3) the variety and size of the fruit. These are best grouped at the top, in the middle, and at the bottom respectively.

CULTIVATION.

The close of the picking season is a good time for ploughing the orchard. If cover-crops have been grown and these have not made sufficient growth the work may be delayed until a later period. All soils derive considerable benefit by being turned up to the winter frosts. When ploughing at this period provision should be made for the free drainage of water away from the trees. This is best done by turning the soil up to the trees and leaving a furrow down the centre

of each bay. When ploughing, every care should be exercised not to break branches from the trees or to unduly knock the trees about in any way. Likewise care should be taken not to plough too deeply near the trees, as this is likely to cause damage to the roots. For the purpose of ploughing close up there are now on the market suitable implements that enable one to practically cover all the land, except perhaps under very wide-spreading trees. These include ploughs with handles that will move to either side, and wide bridles which ensure that the horse walks some distance away from the trees. These are things worth considering, as hand-work in an orchard should be reduced to a minimum.

PRUNING AND GENERAL.

In some localities pruning will commence on stone-fruits during May, and it should always be pushed on with before the more severe winter weather sets in.

Steps should be taken to clean up the orchard at the end of the picking season, also to trim the fences, clean out the drains, and carry out the many other minor operations that are necessary to keep the place in good order. The first opportunity should also be taken of looking over the spray-pumps in readiness for next season's work. This is very necessary, in order that trouble may be avoided during the busy spraying season, when every hour is important.

—L. Paynter, Orchard Instructor, Christchurch.

CITRUS-CULTURE.

Full attention should now be given to final harvesting of the autumn crop of lemons. There will then be little else of consequence needing attention in the grove, with the exception of the fungicidal sprays mentioned in last month's notes, if such have not already been applied. Those growers who intend to put their citrus areas into a cover-crop are advised to plant blue lupins as soon as possible for ploughing under in the early spring. The best means for sowing lupins between the rows is the ordinary farm drill, using from 5 cwt. to 10 cwt. of basic super to the acre with the seed.

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

POULTRY-KEEPING.

MANAGEMENT OF THE LAYING PULLETS.

THE pullets must, of course, be depended upon for the bulk of the eggs in the winter season, as even the desired late-moulting hens will be taking a rest for the purpose of renewing their feathers. Even pullets bred to lay in winter are apt to go into a moult at any time now if subjected to improper management. Every assistance should therefore be given them so that they may lay to their maximum capacity.

Good feeding is imperative at this period of artificially induced production. The morning and midday meals may consist of a mash made of one part finely ground good-quality wheatmeal to two parts

of bran, moistened with milk or meat-soup, or, failing these, boiling water. The mash should be mixed to a crumbly condition, not sloppy. Give as much as the birds will eat without waste; any left over should be removed and less given the following day. Where meat is available it should be fed separately in, say, the proportion of 1 oz. (cooked) to each bird daily. In the absence of boiled meat, meat-meal should be judiciously added to the morning mash—say, about 6 per cent. of the entire mixture: in addition it may be provided in a separate receptacle, so that the birds (usually the best layers) that crave for more of this forcing-material may be able to secure it. Where more than an odd bird or two becomes affected with ovarian troubles, such as protrusion of the oviduct, &c., or if many shell-less eggs are being produced, the animal food should be given in a less quantity, as it indicates that the forcing diet is being oversupplied. For the evening meal, when the price warrants use, a mixture of equal parts of wheat, short plump oats, and maize provides a suitable ration. Care should be taken, however, to observe the manner in which the birds relish the different grains. Where it is noted that they are leaving any particular grain this should be given in a reduced quantity. Of course, allowance must be made for the fact that fowls will often take some time to become accustomed to a new kind of food. All grains should be fed in deep litter as a means of providing the birds with ample exercise in scratching for it. During the day green material, such as silver-beet, rape, cabbage, chaffed green oats, &c., should be liberally provided, while crushed oyster-shell, gravel grit, and clean water should be always available to the birds.

It is well to remember, where laying pullets are concerned, that sudden changes in the system of feeding are often responsible for retarding production; any contemplated change should be made by degrees. For a bird to lay out of its natural season good and liberal feeding is imperative, but protection from climatic extremes, absolute cleanliness, and general common-sense management are of equal importance, and must therefore go hand-in-hand with a sound system of feeding.

ECONOMY ON THE PLANT.

The heavy cost of production facing the poultry-keeper by way of dear foodstuffs makes it imperative that economy in all things connected with the plant be seriously considered—that is to say, if payable returns are to be forthcoming. The most important point in this respect is to see that all hens of the drone type, or those which have passed their best period of usefulness, are got rid of at the earliest possible moment. This applies equally to all surplus cockerels that have attained a marketable age—from four and a half to five months old. The poultry-keeper cannot afford to retain any bird on the plant that is not paying its way nor is likely to do so in the near future. Notwithstanding the high cost of food, poultry are a good proposition provided that nothing but high-class laying-stock is kept and modern methods of management are adopted, among which economy is an essential detail for the best results. Assuming the possession of a flock of nothing but high-type layers, it is the worst form of economy to stint them in their food. It is now generally recognized that the heavy-laying bird cannot be overfed with the right class of food.

Half-starved fowls are never profitable, and are generally the first to contract disease. It is always a sounder policy to cull the drones than stint the profit-makers.

It is poor economy to expect birds to lay well when overcrowded. It is better for five hundred layers to be doing their best under favourable conditions than to have double the number doing indifferently, to say nothing of lessening the risk of the birds contracting disease which may end in disaster. Wherever possible fowls should be fed in the house and made comfortable, especially during unfavourable weather. In this way a dual form of economy is brought about. Firstly, because only a minimum amount of food will be required to maintain the bird, as heat to dry it and ward off the cold when it is fed in the rain must necessarily come from the food eaten. Secondly, there is a great saving effected by protecting the grain from sparrows and other small birds. It is safe to say that on many plants the money saved in this way in one year would more than compensate the cost of making houses of sufficient depth to confine the birds and feed them under cover.

It is sound economy to put a wire-netting partition down the middle of a run, and keep the birds off one half, in order to give the ground a chance to sweeten by being turned over and sown down. There is nothing more conducive to heavy laying and the prevention of disease than a fresh, clean run. The clean run is just as necessary as the clean house. It spells economy to spare no effort to keep the quarters in a thorough sanitary state, and to guard against the birds being attacked by insect pests. These parasites cause a constant drain on the fowl's vitality, and where they are numerous it cannot make the best use of its food.

It is attention to the details that makes poultry-keeping pay—not doing one thing well and neglecting others. It should always be realized that the profit in poultry-keeping is not so much determined by the gross return as by the difference between cost of production and the market value of the produce.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

REMOVAL OF SUPERS.

AMONG the autumn work which must not be neglected is removal of the supers, and this should be undertaken as soon as the extracting-combs are cleaned up by the bees. It is bad management to leave the bees more space than they can occupy. By removing the supers the space in the hive is restricted, and consequently it is much easier to make the bees snug and warm for winter. Where the strength of the colony will permit this to be done, nothing is to be gained by leaving on the supers. However, it may be impossible in the case of strong colonies to confine the bees to the brood-chambers, in which case the supers can be left on the hives until the spring. By that time most of the bees will be in one story, and the supers can then be removed.

A good plan to follow in getting the bees to clean up the combs is to insert a mat, in which a small hole has been cut, between the brood-chamber and the super. The bees, finding the combs partly cut off by the mat, lose little time in removing the surplus honey. At this operation the excluders should be removed from the hives, and stored away until such time as they can be cleansed of burr combs. A little care is necessary in dealing with the excluders, so as not to bend the wires. They can be readily cleansed by plunging them into boiling water.

WINTER STORES.

The losses attendant upon starvation are no less serious a menace to the beekeeper than disease. While disease is met with from time to time, each autumn brings the problem of wintering the bees, and, while the professional will prepare his colonies so as to guard against serious losses, the average beekeeper is apt to overlook the essentials that make for success. There are factors, such as shelter, water-tight hives, vigorous young queens, &c., which all play a part in the wintering problem; but, above all, a supply of food sufficient to meet the colonies' wants must not be overlooked. The safe wintering of bees is a test of a beekeeper's capabilities, as he is called upon to gauge the amount of stores required to tide his bees over the period between the autumn flow and the appearance of the early nectar-secreting plants. Locality plays an important part, more especially where autumn flows are unknown and fine autumn weather prevails. In these districts the consumption of stores is greater, and a constant watch must be kept on the hives so as to determine the amount of food required to guard against loss, as breeding will be carried on until a later period in the season.

Various estimates have been given as to the amount of food required to winter the cluster—varying from 30 lb. to 40 lb.—and experience has proved that, providing a colony is left with this amount, it will not only winter well but will build up rapidly in the spring. In any case, it is by far the safest policy to leave an excess of food rather than run the risk of leaving the colony short and with barely enough to tide it over the dormant period. Where the amount of stores is less than 30 lb. the shortage can be made up quickly by the insertion of a few combs of honey. Calculating on the basis that a full comb contains 6 lb. of honey, it is easy to estimate the weight of honey in the hive. If, however, combs of honey are not available, feeding should be undertaken. This latter operation should not be delayed till the cold weather, but commenced early in the autumn.

For supplementing the stores, sugar syrup, fed in the proportion of two of sugar to one of water, is the best substitute for honey. Avoid using inferior qualities of sugar. None but the best white sugar should be fed. In feeding to augment the winter food-supply it is often necessary to give large quantities of syrup, and consequently large feeders must be adopted. The Miller and the division-board feeders are excellent for the purpose. The former enables about 10 lb. to 25 lb. of stores to be fed at one time. It is designed to be placed inside the super or upper story on top of the brood-frames, and has two compartments for syrup, the passage-way for the bees being in the centre through the bottom, directly over

the cluster. The division-board feeder is popular, and enables about 5 pints of syrup to be fed. Hanging between the frames, all that is necessary is to turn back the mat so that the opening in the top is exposed. The main advantage of this feeder is that food can be supplied without exposing the cluster and without the aid of smoke.

SHELTER.

As in the spring, a vital necessity at this time of the year is shelter for the hives. Brood-rearing must be encouraged if the bees are to go into winter quarters sufficiently strong to give good results the following season. If a shelter-hedge or fence has not been provided an excellent temporary breakwind of manuka scrub can be erected. Shelter without too much shade is the life of an apiary, and on no account should large trees be utilized as a means for protecting the hives. The spaces between the trunks are productive of draughts, and the high branches exclude too much of the sunlight. A live hedge 8 ft. to 10 ft. high is the ideal shelter for an apiary.

FOUL-BROOD.

The risk attendant on carrying over diseased bees is too great, as the trouble is more likely to be spread in the autumn and spring by robbing. In cases where weather conditions have prevented successful treatment, or in which disease is detected on making a final examination prior to putting the bees into winter quarters, it is advisable to remove all combs showing the slightest signs of disease. Where disease is detected in a bad form nothing will be gained by holding the colony over for treatment, and by far the safer plan is to destroy it. In mild cases remove all the diseased combs and substitute clean drawn-out extracting-combs; provided plenty of capped stores are given, this will tide the colonies over until the spring. Mark all infected colonies as a reminder for early treatment. Avoid disturbing diseased hives in the off season, and guard against manipulations calculated to disturb the bees and induce robbing.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

CROPS for early spring cutting should now be planted out without delay if this has not been already done. These crops consist chiefly of cabbage and lettuce, but cauliflower may be included in districts where the climate is sufficiently mild. In such districts it has a decided advantage over broccoli, which requires a very much longer growing-period, the first part of which is made difficult by the prevalence of cabbage-moth. On warm, well-drained land peas for early spring picking may be sown. Complete the earthing-up of celery. When asparagus foliage commences to turn colour cut it to the ground, remove it, and clean up the beds. The evergreen winter rhubarb may receive dressings of fertilizers now to induce a strong autumn growth. Land not required immediately for cropping will be greatly benefited by

being sown in a cover-crop to be turned in later. In many cases a dressing of lime applied before sowing would be a great advantage.

Hedges should be trimmed well back, and all necessary attention given to drainage. Heavy land of high value, such as is generally used for this class of cultivation, should receive careful attention in this respect. Open drains containing heavy summer growth, if allowed to continue in that condition, make the land cold and wet, and spring growth is therefore late in getting a start.

TOMATOES UNDER GLASS.

Growers of tomatoes under glass will commence operations for another season next month. As in most other undertakings, success largely depends on adequate preparations being made and the plants being given a good start. In these days of hydro-electric power some growers raise their plants in a propagating-house electrically heated, but many others will be using a hotbed. These are sometimes unsatisfactory. It should be remembered it takes two or three weeks to make a hotbed properly, and *fresh* stable manure is required for the purpose. The manure is conditioned by placing it in a compact heap. In three or four days, when it has heated up, it is shaken out and restacked, care being taken to moisten any portions that are dry. Repeat this operation when it has heated again, and after a similar interval it should be ready for use, and the hotbed can be made up. The object of this preparation is to secure an even state of fermentation throughout the mass, which can only be done by careful mixing and seeing that all parts are equally moist. Attempts to dispense with this preparation result in a fierce, uneven heat for a short period, after which the plants receive no benefit, but are subject to ordinary temperatures—a severe experience in the middle of winter, even though it may be under glass.

The compost heap for the seed-boxes will also possibly require attention. Unless it is already well mixed it would be as well to turn it over once or twice now, adding meanwhile any further ingredients that may be required.

TOBACCO.

Most of this season's tobacco crop will now be dried and ready for stripping. A great deal of damage is often done during this operation by handling the leaf before it is in the right condition. The result is badly broken leaves and a considerable loss of material. While the plant must be well dried out in the first place, it cannot be handled safely when in a brittle condition. One has to wait for humid weather, or create those conditions artifically, when the leaf will quickly become sufficiently pliable and tough to stand this operation without damage. Watch stocks carefully in order to avoid the development of moulds. The danger is greatest in wet weather.

SMALL FRUITS.

The planting-out of strawberry-plants should be completed as soon as possible, also the preparation of the land for other berry plants where an extension is decided upon. Cultivate deeply and subsoil the land; once it is planted there is no further opportunity of doing

so. Bush plants will be ready for lifting about the end of May. Select the plants carefully and place your order early.

SHELTER AND ORNAMENTAL PLANTATIONS.

During the short period from June to August inclusive trees and shrubs may be shifted in fine weather with safety, so that the time for action is now very close at hand for those who have this class of work to do. Not only does the land usually require thorough preparation, but the most careful consideration needs to be given to the scheme of planting, after which the plants should be selected and ordered without delay.

Many acres are wasted for years by hasty ill-considered planting which has afterwards to be removed. The taste and purpose of the planter and the climate and soil are the factors governing the situation. The two latter are frequently misjudged, and commonly full advantage is not taken of a soil and climate offering unique possibilities. Besides getting professional advice and keeping in touch with modern literature, the planter should carefully consider the condition and appearance of trees and shrubs growing in his locality on similar soil, and remember that outside of that experience he is entering on the experimental.

Among settlers in the back country it is common to speak of "white-pine land" or "birch country," &c., meaning that on the land in question in a primeval state such trees were outstandingly conspicuous. Further, experienced men know just the class of land that will be found associated with these types. This association is not confined to the larger timber-trees; it extends also to a large extent to the shrubs, climbers, and herbaceous plants and ferns. This habit of our indigenous vegetation is not peculiar, but applies also to the plants of other countries. The many exotics grown by nurserymen have to be studied from this point of view, and the planter working on these lines allies his efforts to a wonderful natural power that achieves its objects with maximum results. The planter is undoubtedly wise to keep his choice well within the list of plants adapted to the class of land and climate to be dealt with, whether the object be ornament or utility.

—*W. C. Hyde, Horticulturist.*

FORTHCOMING WINTER SHOWS.

Otago A. and P. Society: Dunedin, 2nd to 6th June.
Waikato Winter Show Association: Hamilton, 2nd to 6th June.
Manawatu A. and P. Association: Palmerston North, 16th to 20th June.
Wanganui A. and P. Association: Wanganui, 24th to 27th June.
Poverty Bay A. and P. Association: Gisborne, 25th to 27th June.
Wellington Winter Show Association: Wellington, 30th July to 15th August.
Auckland Winter Exhibition: Auckland, 27th July to 1st August.

Mole Drainage.—Where it is too expensive to tile-drain, and the subsoil is suitable, mole drainage will be found to have all the advantages of ordinary tiles with the exception of permanence, and is far less costly. Only land which is heavy in texture, free from stones, and with a good fall is satisfactory. Given these conditions the mole drains will usually last indefinitely.

ANSWERS TO INQUIRIES.

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.

"DEPRAVED APPETITE" IN COWS.

T. WEATHERALL, Blue Spur :—

My cows are always chewing bones, and if any manure is spilt they will lick the ground where it has dropped. They have plenty of rock-salt, but will not touch it. Please inform me if there is anything I could give them, or is it the land that requires something ?

The Live-stock Division :—

Depraved appetite or "pica" is a common complaint in certain localities, more especially on light land. It most often occurs in pregnant animals, and occasionally in young stock. The condition is recognized as the result of an insufficiency of lime or soluble salts in the soil. This being the case, it naturally follows that treatment of the soil—in this way removing the cause—is the logical procedure. Top-dressing with salt, lime, superphosphate, or basic slag gives good results. In dealing with the animals the diet should be as generous as possible. Crushed oats, bran, chaff, hay, or oaten sheaf should be fed. Once a day a handful of superphosphate should be given mixed in a feed of crushed oats, bran, and chaff ; or, in lieu of the superphosphate, bonemeal, charcoal, and salt—a handful of each—may be given.

FUNGUS DISEASE ATTACKING WALNUTS.

"INQUIRER," Morven :—

Could you give me advice as to what I could do to prevent a blight that has attacked the walnuts here ? I am sending some specimens. Even where the kernel is fully developed it sometimes shows signs of the disease just beginning. Quite a number of the nuts are useless. The trees show small pockets on the leaves.

The Horticulture Division :—

The Biological Laboratory reports that these nuts are infected with the fungus *Aspergillus glaucus*, a species not uncommon on the walnut and numerous other nuts. Little can be done in the way of remedial treatment, save to ensure that the nuts are thoroughly dried out before being stored.

PRESERVING HOME-MADE BUTTER.

"HOUSEWIFE," Hedgehope :—

Could you tell me a way of preserving home-made butter other than salting it down ; or any way to keep it that it will not taste salty when used ?

The Dairy Division :—

The only really effective way to ensure the minimum amount of deterioration in the quality of butter intended for keeping is to hold the butter in frozen storage. Actually, the addition of more than, say, about ½ oz. of salt to the pound of butter only increases the salty taste, and does nothing towards preserving the butter. To make butter for keeping it is advisable to scald the cream directly after separation, and to cool it down at once to a temperature of about 60° F., or lower if possible. Then churn it not less than about six hours or more than twenty-four hours afterwards, and while the cream is still sweet to the taste. Store the butter in well-closed containers and in as cold a place as possible.

HENS LAYING SOFT-SHELLED EGGS.

McDOWELL BROS., Mayfield :—

Kindly tell us the reason why hens continue laying soft-shelled eggs. We feed them every morning with bran and pollard mash with a small proportion of salt, and sometimes add a little burnt lime; evening feed, wheat or oats—mostly wheat. The hens get fresh water every morning and plenty of shell grit. They also have a good run-off on grass, clover, &c. They lay well, but soft-shelled eggs are the trouble.

The Chief Poultry Instructor :—

This disorder is generally the result of overfeeding forcing-foods, such as milk, meat, &c., or to the lack of lime as a shell-forming material, while in odd cases it may be due to some abnormal condition of the hen's reproductive organs. Seeing, however, that the ration provided is a plain one, and that ample sea-shell is available to the birds, it would appear that the usual causes of the trouble do not apply in your case. Evidently some local condition is responsible. In any case you are advised to discontinue adding burnt lime to the morning mash, as this may have an irritating effect on the ovary. Your best plan would be to leave the lime out in the weather till it becomes well broken down, after which the birds could be allowed to pick it when they desire. It may also be mentioned that as a shell-forming material fresh sea-shell is most desirable. Bleached shell, such as is often collected from the seashore, is not so good. There is nothing better than crushed burnt bone as a shell-forming material.

WINTER FARM-SCHOOLS, 1925.

THE Department of Agriculture has arranged courses of instruction for farmers in the various districts as follows :—

Auckland.—(1.) At Dargaville, 18th to 23rd May; enrolment with Mr. A. R. Valder, Dairy Factory, Mangawhare. (2.) At Whangarei, 18th to 23rd May; enrolment with Mr. F. W. Webster, Secretary, Farmers' Union, Whangarei. (3.) At Ruakura Farm of Instruction, Hamilton, 25th to 30th May; enrolment with the Manager, Ruakura Farm.

Taranaki.—At Manaia, 15th to 20th June; enrolment with the Instructor in Agriculture, Moumahaki Experimental Farm, Waverley.

Hawke's Bay.—At Hastings, 1st to 6th June; enrolment with Instructor in Agriculture, Department of Agriculture, Hastings.

Wellington.—(1.) At Central Development Farm, Weraroa, 11th to 16th May; enrolment with the Farm-manager, or Instructor in Agriculture, Department of Agriculture, Palmerston North. (2.) At A. and P. Showgrounds, Solway, Masterton, 8th to 13th June; enrolment with Department of Agriculture, Palmerston North or Masterton, or Provincial Secretary, Farmers' Union, Masterton or Dannevirke.

Marlborough.—At Blenheim, 6th to 11th July; enrolment with Instructor in Agriculture, Department of Agriculture, Blenheim.

Canterbury.—Travelling school, 22nd June to 4th July; enrolment with Instructor in Agriculture, Department of Agriculture, Christchurch.

Westland.—Travelling school, 13th to 18th July; enrolment with the Fields Instructor, Department of Agriculture, Hokitika.

Details of the respective schools (programme, accommodation, &c.) will be published in the local Press in each case; any further information desired may be obtained from the individual enrolling officers. Early enrolment is advisable.

WEATHER RECORDS: MARCH, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

MARCH is the first month of autumn in New Zealand, and the weather this year was in striking contrast to that experienced in 1924. While last March was one of the wettest months ever experienced, especially in the east-coast districts, this year it has been one of the driest months of March on record. The weather was, on the whole, dry and sunny, warm by day and cool at night. Changeable weather with squally and showery conditions was experienced in the first fortnight, especially in the west-coast and southern districts. Anticyclonic conditions ruled from the 14th to the 25th, and during this time there was very little wind. The latter part of the month was somewhat unsettled, and there were sharp frosts about the 29th and 30th which cut down tender vegetation. There was also a light frost on the 16th in many parts, and fresh snow was visible on the mountains. These frosts were considered early for this season, and seven were recorded in Christchurch, ranging from one to five points.

Rainfall was above the average in the high country of the South Island and in Westland and Otago, and slightly so at New Plymouth; but everywhere else it appears to have been considerably below the average.

Records of bright sunshine for the month are interesting, the totals being as follows:—

Station.	Hours	mins.	Station.	Hours	mins.
Auckland	195	20	Wellington	206	17
Waihi	235	2	Nelson	248	50
New Plymouth	195	15	Blenheim	200	32
Moumahaki	170	30	Hanmer Springs	241	20
Weraroa (Levin)	192	0	Hokitika	195	8
Napier	213	30	Invercargill	149	45
Masterton	222	5			

—*D. C. Bates, Director.*

RAINFALL FOR MARCH, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	0·50	8	0·24	3·58
Russell	1·01	6	0·46	3·42
Whangarei	1·52	10	0·70	5·10
Auckland	1·30	8	0·47	3·06
Hamilton	2·53	13	1·32	3·74
Kawhia	2·70	9	0·72	3·12
New Plymouth	3·90	11	2·18	3·46
Riversdale, Inglewood	5·34	11	1·55	7·39
Whangamomona	2·68	5	1·42	5·46
Tairua, Thames	0·52	2	0·46	6·73
Tauranga	1·74	8	1·34	4·18
Maraehako Station, Opotiki ..	1·30	6	0·76	3·90
Gisborne	0·82	8	0·32	4·60
Taupo	0·70	5	0·43	3·53
Napier	0·53	5	0·28	3·40
Maraekakaho Station, Hastings ..	0·31	5	0·12	3·10
Taihape	1·82	8	0·54	2·69
Masterton	0·45	7	0·16	3·23
Patea	2·41	10	0·41	3·60
Wanganui	2·26	7	0·50	2·60
Foxton	1·44	5	0·50	2·36
Wellington	2·08	5	1·40	3·29

RAINFALL FOR MARCH, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	4·13	14	1·15	5·80
Greymouth	6·13	14	2·20	9·12
Hokitika	11·71	18	5·84	9·72
Arthur's Pass	19·21	11	7·58	5·84
Okuru, Westland	18·46	12	9·12	15·48
Collingwood	..	..	..	4·19
Nelson	2·16	6	1·88	2·99
Spring Creek, Blenheim	1·57	3	1·52	1·81
Tophouse	2·78	9	1·76	3·44
Hanmer Springs	1·43	6	0·72	2·84
Highfield, Waiau	0·66	2	0·48	3·09
Gore Bay	1·47	4	0·90	2·14
Christchurch	1·13	6	0·52	2·11
Timaru	0·56	8	0·38	2·45
Lambrook Station, Fairlie ..	1·16	3	0·86	2·58
Benmore Station, Omarama ..	4·32	10	3·28	2·64
Oamaru	0·99	7	0·72	1·77
Queenstown	3·63	11	1·61	2·63
Clyde	3·06	8	1·68	1·50
Dunedin	4·00	13	2·13	2·99
Gore	3·65	16	1·00	3·23
Invercargill	5·14	..	0·78	3·86

HONEY-EXPORT CONTROL.

THE following regulations under the Honey-export Control Act were gazetted on 26th March: (1.) The maximum fees payable to members of the Control Board shall be as follows—Chairman, £50 per annum; other members, £25 per annum. (2.) The maximum rate of travelling-allowance payable to members of the Board shall be £1 per diem, plus actual locomotion expenses. (3.) The charge payable by way of levy on all honey intended for export shall be one-sixteenth of a penny per pound. (4.) Any moneys payable under clause 3 hereof shall be paid to the Collector of Customs, on behalf of the Board, on or before the entry of the honey for export.

On the same date it was prescribed that notice by the Control Board of its intention to assume limited control of honey exported from New Zealand to the United Kingdom, the Irish Free State, and the Continent of Europe, to the extent of determining that all such honey shall be consigned to the Board's London agents, shall be given in accordance with the following conditions: (1.) Such notice shall be given either by service or publication as hereinafter provided not less than seven days before it becomes operative. (2.) Where notice is given by publication in a newspaper or newspapers, such publication shall be made in the *New Zealand Gazette* and in at least one newspaper published in each land district. (3.) Where a notice is to be served on either an owner of any honey or on any person having possession thereof, such notice shall be forwarded by "registered post."

MEAT-FREEZING WORKS IN NEW ZEALAND, 1924-25.

Name and Address of Company.	Name and/or Location of Works.	Beef-killing Capacity per Day.	Sheep-killing Capacity per Day.	Storage Capacity, in 60 lb. Carcases Mutton
North Auckland and Auckland.				
Auckland Farmers' Freezing Company, Ltd., Auckland	Moerewa ..	200	2,000	100,000
,, ,, ,,	Southdown ..	200	3,000	202,000
,, ,, ,,	Horotiu ..	200	3,000	218,000
Westfield Freezing Company, Ltd., Auckland.. ..	Westfield ..	250	3,000	205,000
R. and W. Hellaby, Ltd., Auckland	Westfield ..	120	500	3,000
East Coast Co-op. Freezing Company, Ltd., Whakatane	Whakatane ..	200	1,000	120,000
Hawke's Bay and Gisborne.				
North British and Hawke's Bay Freezing Company, Ltd., Napier	Westshore* ..	50	2,500	40,000
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch..	Pakipaki ..	30	1,800	70,000
Nelsons (N.Z.), Ltd., Tomoana	Tomoana ..	150	5,000	180,000
Hawke's Bay Farmers' Meat Company, Ltd., Hastings..	Whakatu ..	80	4,000	80,000
Wairoa Farmers' Co-operative Meat Co., Ltd., Wairoa ..	Wairoa ..	100	3,000	165,000
Nelsons (N.Z.), Ltd., Gisborne	Waipaoa ..	150	3,500	270,000
Gisborne Sheep-farmers' Frozen Meat and Mercantile Company, Ltd., Gisborne	Kaiti ..	150	4,000	422,000
Ditto	Tokomaru Bay	60	3,000	140,000
,, ...	Hicks Bay ..	75	1,500	60,000
Taranaki.				
Thomas Borthwick and Sons (Aus.), Ltd., Waitara ..	Waitara ..	200	2,000	80,000
New Zealand Bacon and Meat Packing Company, Ltd., Wellington	Eltham* ..	60	..	25,000
Patea Farmers' Co-op. Freezing Company, Ltd., Patea	Patea ..	150	2,000	180,000
Wellington.				
Wanganui Meat-freezing Company, Ltd., Wanganui ..	Castlecliff ..	100	2,200	100,000
New Zealand Refrigerating Company, Ltd., Christchurch	Imlay ..	200	6,000	271,000
Otaihape Farmers' Meat and Produce Co., Ltd., Taihape	Winiata* ..	50	1,200	90,000
Feilding Farmers' Freezing Company, Ltd., Feilding ..	Aorangi ..	100	4,000	153,500
National Mortgage and Agency Company of New Zealand, Ltd. (Head Office, Dunedin)	Longburn ..	60	2,000	100,000
Wairarapa Frozen Meat Company, Ltd., Masterton ..	Waingawa ..	120	5,000	150,000
Gear Meat Preserving and Freezing Company of New Zealand, Ltd., Wellington	Petone ..	100	10,000	300,000
New Zealand Bacon and Meat Packing Company, Ltd., Wellington	Ngahauranga ..	120	3,000	120,000
Wellington Meat Export Company, Ltd., Wellington ..	Ngahauranga ..	120	8,000	240,000
,, ,, ,, ..	Kakariki* ..	100	2,000	90,000
Marlborough and Nelson.				
New Zealand Refrigerating Company, Ltd., Christchurch	Picton ..	30	2,000	30,000
Nelson Freezing Company, Ltd., Nelson	Stoke ..	30	500	50,000
Canterbury.				
Canterbury Frozen Meat and Dairy Produce Export Company, Ltd., Christchurch	Belfast ..	120	6,000	252,000
Ditto	Fairfield ..	..	4,000	100,000
,, ...	Pareora ..	25	4,500	233,000
New Zealand Refrigerating Company, Ltd., Christchurch	Islington ..	50	7,000	375,000
,, ,, ,,	Smithfield ..	50	6,000	304,000
North Canterbury Sheep-farmers' Co-operative Freezing Company, Ltd., Christchurch	Kaiapoi ..	100	4,000	222,000
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch..	Belfast ..	..	5,000	120,000
Otago.				
Waitaki Farmers' Freezing Company, Ltd., Oamaru ..	Pukeuri ..	..	3,500	230,000
New Zealand Refrigerating Company, Ltd., Christchurch	Burnside ..	50	3,500	216,000
South Otago Freezing Company, Ltd., Balclutha ..	Finegand ..	50	2,500	200,000
Southland.				
Ocean Beach Freezing-works (J. G. Ward and Co., Ltd., Managing Agents), Invercargill	Ocean Beach ..	50	2,500	110,000
Southland Frozen Meat and Produce Export Company, Ltd., Invercargill	Mataura ..	50	2,500	104,000
Ditto	Makarewa ..	120	2,500	75,000
,, ...	Bluff ..	..	..	114,000
Totals	..	4,220	144,200	6,889,500

* Not operating season 1924–25.