# APPENDIX.

## LIVE-STOCK DIVISION.

### REPORT OF C. J. REAKES, D.V.Sc., M.R.C.V.S., DIRECTOR.

Wellington, 29th May, 1916.

The Secretary of Agriculture, Industries, and Commerce.

I FORWARD herewith my report of the work carried out by this Division during the past official year.

C. J. REAKES, Director.

#### INTRODUCTION.

The work of this Division during the past year has been to some extent influenced by war conditions, and, while carrying on every branch of activity without interruption and with due efficiency, new developments in the form of increased work directed towards the further improvement of the productiveness, quality, and general health conditions of the Dominion live-stock have necessarily had to be postponed. Many capable officers are absent on active service, and a considerable proportion of those remaining here have had to devote more or less of their time to work directly associated with the operations of the Defence Department—a duty carried out with keenness and a full realization of the fact that the necessity for each doing his best in assisting towards bringing the war to a successful and honourable conclusion is the paramount consideration at the present time.

#### LIVE-STOCK.

No unusual disease conditions of a serious nature have come under notice, and the Dominion still maintains its position as a country remarkably free from serious communicable forms of disease. Severe drought conditions prevailed during the spring and summer months in Canterbury and North Otago, and to a less extent in parts of the North Island, pastoral operations suffering considerably in consequence. Elsewhere than in these drought-affected districts the good feeding-conditions, combined with high values for food-animals and their products, have rendered the season an excellent one for stockowners. Horses are the only class of farm animal which have not appreciated in value, and, in spite of large Government purchases for the Army, the horses bought last were purchased for no higher prices than those ruling at the beginning of the war.

#### BREEDING-STOCK.

Market conditions have had the effect of increasing the number of stock slaughtered for export, this applying particularly to cattle, and it is evident that the question of maintaining a sufficiency of beef-breeding stock in the Dominion requires consideration. Unfortunately, no yearly enumeration of cattle takes place, as is the case with sheep, and the last census having been made in 1911 the figures then obtained are of little or no value as a guide to the formation of a reliable opinion as to the present position. Statistical information regarding the number of cattle in the Dominion is now being collected, but it is not likely to be ready for some little time. The following figures, showing the number of cattle, exclusive of calves, slaughtered for export during the last three years, are, however, worthy of note:—

| Year ending 31st March— | Bullocks and Heifers. | Cows. | Bulls. | Total. |
|---|---|---|---|---|
| 1914 ... ... | 63,378 | 36,364 | 9,937 | 109,679 |
| 1915 ... ... | 112,414 | 58,247 | 11,459 | 182,120 |
| 1916 ... ... | 104,497 | 94,314 | 12,520 | 211,331 |

The largely increased slaughtering of cows is very noticeable; and, further, it has been observed that, apart from fat heifers, a number of young unfinished cattle, many of them heifers, have been slaughtered. If this apparently excessive slaughter of female stock continues and prevails to as great an extent, it spells trouble in the immediate future in the shape of at any rate a temporary shortage of breeding-cattle and a reduced output of beef at a time when, so far as present indications can be taken as a guide, beef values are likely to still be on a good basis.

As regards sheep, the increase in the number slaughtered for export is much less noticeable. The following are the figures for the three years ending March 31st :—

| | Sheep. | Lambs. |
|---|---|---|
| 1913–14 ... ... ... ... ... | 3,036,438 | 4,221,626 |
| 1914–15 ... ... ... ... ... | 3,085,351 | 4,356,151 |
| 1916–16 ... ... ... ... ... | 3,147,915 | 3,969,446 |

(NOTE.—The reduction in the number of lambs in 1915–16 is doubtless largely due to the fact that, owing to lack of rain in Canterbury and North Otago, lambs were very backward in becoming fit for slaughter, and consequently a large number which under ordinary seasonal conditions would have been killed before the 31st March were still alive.)

It should be borne in mind, however, that while on the one hand year by year more previously unoccupied land comes under settlement and needs to be stocked, our sheep returns show no noticeable increase in the number of sheep, and last year showed a decrease in the number of breeding-ewes, on the other hand the number of sheep killed shows a slight progressive increase.

The present values of store sheep, which are actually on a level with the values of fats, afford a practical illustration of the fact that the Dominion is understocked with sheep, especially when full consideration is given to the plentiful supply of feed available in most parts of the country.

## ANIMAL DISEASE.

### *Horses.*

No serious disease conditions of any kind have come under notice during the year.

No doubt as a result of the unusual climatic conditions prevailing in Canterbury there occurred on several properties in Canterbury and on two farms in the Wairarapa (where unusually dry weather was experienced) cases of a peculiar nerve disorder among horses, the most noticeable symptom being an exaggerated form of stringhalt. Inquiries show that occasional cases had occurred in previous years on at least two places, far apart, in the North Island. This disorder is well known in Australia, where it usually appears under drought conditions, and is there considered to be dietetic in origin and not infectious. Our own observations point to the same belief. Research work is being carried out in an endeavour to ascertain its real cause, which is not at present exactly determined.

Ringworm was troublesome in horses in the military camps during the winter, it having evidently been introduced by horses bought in country districts. This affection is easily curable if the proper form of treatment, which is simple and effective, be applied with due care and attention.

### *Cattle.*

*Tuberculosis.*—Statistical information as regards the extent of the prevalence of tuberculosis, gained from the records of inspection at the slaughterhouses and abattoirs, shows that the decrease noted last year has not been continued, this being partly due to the fact that a greater number (an increase of 1·39 per cent.) of the bulls slaughtered were found to be affected. The figures for the past three years are as follows :—

| | Number of Cattle examined. | Number found affected in any Degree. | Percentage found Tubercular. |
|---|---|---|---|
| 1913–14 ... ... ... ... | 207,381 | 15,182 | 7·00 |
| 1914–15 ... ... ... ... | 283,217 | 18,759 | 6·62 |
| 1915–16 ... ... ... ... | 308,305 | 22,202 | 7·20 |

It is evident that still more active steps are necessary to get this disease properly in hand. Though the condemnation and destruction of openly affected animals is a necessary feature of repressive measures, the most valuable and most effective in the end would be the co-operation of stockowners with the Department in adopting preventive measures of a practicable and reasonable nature, and I have confidence that this co-operation will be forthcoming.

*Contagious Abortion* has given some trouble, but no special outbreaks of a serious nature have been brought under notice.

*Contagious Mammitis.*—A number of cases of contagious mammitis have occurred, but this troublesome disease is evidently better understood now by farmers, and precautionary methods and proper treatment are adopted to a greater extent than before.

*Blackleg* continues to give trouble in the affected areas in the Waikato district, and the lately gazetted regulations relating to these areas will have to be enforced thoroughly during the coming season. It is desirable that a small additional area contained in Taupo County, immediately over the border of Waipa County, be included in the operation of these regulations, and a recommendation to this effect has been made. In Taranaki the enforcement of the regulations has proceeded smoothly and satisfactorily, and blackleg has given no trouble to farmers, with whom the inoculation of their calves has now become a recognized part of the animal routine of farm operations.

*Malnutrition* has occasionally manifested itself outside the recognized "bush sick" area, usually in the form of so-called "Waihi disease." The internal administration of phosphoric-acid compounds (the simple or the compound syrup of phosphate of iron, for instance) brings about recovery, but the application of phosphate manures to the pastures is the really necessary treatment, seeing that, while preventing the onset of the trouble, it restores the herbage to its proper nutritive value.

*Sheep.*

*Facial Eczema* made its appearance in some areas where a plentiful growth of autumn feed occurred. Had this late-grown feed come away earlier much more trouble from this affection would probably have been experienced; as it was, the advent of early frosts and cooler weather changed the feeding-conditions sufficiently to prevent further trouble. Facial eczema is of dietetic origin and is not infectious. It was fully described in the annual report of 1910.

*Parasitic Gastritis* gave less trouble than usual among hoggets, though some individual stockowners suffered losses.

Altogether very little trouble as a result of disease among sheep came under notice during the year.

*Swine.*

Apart from tuberculosis there is nothing of special interest to record in the matter of disease among swine—a matter for congratulation, seeing that the wrong conditions under which many pigs are kept and fed are calculated to render the animals less resistant to sickness and disease than would be the case were they properly cared for.

*Tuberculosis*, I regret to say, has ceased to show the steady annual decrease in the number of cases met with that has been noted year by year since 1911. During the past year statistics obtained from the examination in slaughter of 169,715 pigs show that practically 1 per cent. more were found to be tubercular than was the case last year. This is not serious, but it indicates the necessity for continuous vigilance in combating this disease of swine. This must be exercised principally in the direction of prevention.

*Bush-sickness Investigation.*

Good progress has been made with this work during the year, and the outlook is distinctly promising. Various experiments at the Mamaku Farm are still in progress and are yet unfinished. Among these are the following:—

(1.) Young cattle (two) grazing upon untreated land, but having chemically treated drinking-water. One of these two animals was placed in the paddock in April, 1915, the other in July, 1915. Both are still in good health.

(2.) Young cattle grazing on untreated land and having free access to a lick containing iron. Commenced 19th October, 1915; all doing well.

(3.) Young cattle of the same age and class as those used for No. 2 grazing upon treated land and having full access to the iron lick. Commenced 19th October, 1915; all doing well.

(4.) Last season's calves, ten in number, born between 1st September and 16th October, 1915, all on treated land, one-half of them having access to iron lick, the other half receiving phosphate of iron in their drinking-water. All these calves, after receiving new milk for a period of fourteen days, and a further period of fourteen days on half new and half skim milk with a small amount of calf-food added, were reared on a mixture of oatmeal 4 parts, crushed linseed 1 part, mixed with separated milk. So far they have done well throughout.

(5.) Eight ewes grazing on a small paddock heavily top-dressed with hydrated iron oxide (20 cwt. per acre). Commenced 5th May, 1915; all doing well.

In addition to the experimental work, grazing operations on ordinary commercial lines have been carried out with profitable results, both as regards cattle and sheep, and it is quite evident that this land, when properly treated, can be profitably utilized for live-stock. (Details were furnished in an article in the Department's *Journal of Agriculture* for November, 1915.)

INSPECTION OF MEAT.

During the year the meat-inspection staff was further depleted through enlistments in the Expeditionary Forces, and, as was necessary in the preceding year, still further appointments of lay Inspectors had to be made. The completion of new meat-export slaughterhouses also necessitated additions to the staff, and with the assistance of these officers and the loyal service rendered by the whole of the officers engaged in this duty the result of the year's work must be considered quite satisfactory. The following new slaughterhouses commenced operations during the year:—

Auckland Farmers' Freezing Company (Limited), Horotiu.
Otaihape Farmers' Meat and Produce Company (Limited), Winiata, Taihape.
Poverty Bay Farmers' Meat Company (Limited), Waipaoa.

The undermentioned additional freezing-works are either projected or in course of erection, and it is anticipated that most of these will be ready to commence next season:—*

Wellington Meat Export Company (Limited), Kakariki, Marton.
Westfield Freezing Company (Limited), Auckland.
Wairoa Farmers' Co-operative Meat Company (Limited), Wairoa.
Borthwick and Sons (Australasia) (Limited), Belfast.
Taranaki Farmers' Freezing Company (Limited), New Plymouth.
North Canterbury Farmers' Co-operative Freezing Company (Limited), Kaiapoi.
Christchurch Meat Company (Limited), Wanganui.
Oroua and West Coast Meat Freezing Company (Limited), Feilding.
East Coast Co-operative Freezing Company (Limited), Tauranga.

* The works of the Oroua Company and the Westfield Company have been completed and have commenced operations since the compilation of this list.

The following are the number of each class of stock slaughtered under direct inspection during the year, 1st April, 1915, to 31st March, 1916: Cattle, 308,305; calves, 33,770; sheep, 3,731,643; lambs, 4,065,100; swine, 169,715.

With the exception of lambs, which shows a decrease of 370,781, the above figures show an increase in the number of each class of stock slaughtered under inspection when compared with the figures for the previous year. The numbers in excess are: Cattle, 25,088, calves, 6,689; sheep, 37,400; swine, 19,225.

The following table indicates the destination of the dressed carcases, those animals slaughtered at abattoirs being principally for local consumption, and those slaughtered at meat-export slaughterhouses being, except in the case of swine, principally for export:—

| | At Abattoirs. | At Meat-export Slaughterhouses. | At Bacon-factories. |
|---|---|---|---|
| Cattle ... ... ... | 96,974 | 211,331 | ... |
| Calves ... ... ... | 19,465 | 14,305 | ... |
| Sheep ... ... ... | 583,728 | 3,147,915 | ... |
| Lambs ... ... ... | 95,654 | 3,969,446 | ... |
| Swine ... ... ... | 50,430 | 23,191 | 96,094 |

At ordinary slaughterhouses the stock killed was as follows: Cattle, 61,342; calves, 1,604; sheep, 286,935; lambs, 25,985; swine, 16,642.

In addition to the above, 32,684 carcases of pigs were killed and dressed by farmers under the exemption clause of the Act, and the dressed carcases were inspected in butchers' shops and small bacon-factories.

### Meat-supplies for the Imperial Government.

The Imperial meat-supply scheme, under which all meat available for export was purchased by the New Zealand Government for shipment to the Imperial Government, has necessitated a considerable widening of the duties of the officers engaged in meat-inspection work. Under peace conditions the duties of Inspectors of export meat were confined to the inspection of meat from a health standpoint, combined with the exercise of control over the export of inferior meat likely to prove unfit for sale after more or less prolonged freezing followed by defrostation.

The course of action adopted in order to place export meat at the disposal of the Imperial Government necessitated that the responsible officer at each meat-export slaughterhouse should be entrusted with the responsibility of certifying that the meat-shipments invoiced to the Government were of the quality described in the shipping documents. Considering the weight of the responsibility suddenly thrown upon the shoulders of the various officers concerned, this duty has been carried out remarkably well.

There were plenty of openings for serious difficulties, as each export company had its own system of grading, and all grades of all companies had to be fitted to the necessarily new classes in the purchasing schedule. But no serious difficulties arose, a general desire being shown by the companies to "play the game," and each point arising and necessitating decision has been settled amicably upon what I believe were its true merits.

Details of the procedure adopted and the conditions under which export meat was taken over were set forth in the *New Zealand Gazette* Extraordinary (No. 32), dated the 3rd March, 1915. This procedure necessitated that practically the whole responsibility of the purchase of the meat and the prices paid for each grade of each company rested upon the officers of the Division, and sufficient evidence of the manner in which the work has been done is afforded by the fact that no adverse criticism of any kind has been received from those responsible for the handling of the meat in London.

### Inspection of Household Milk-supplies.

A further improvement has been effected in the structural and sanitary conditions of dairy-farm buildings, and careful supervision kept over the health of milking-cows. Every effort is made to keep the herds clear of cows suffering from disease and whose milk is likely to be in any way contaminated, the extensive powers in this direction given to Inspectors under the Stock Act and the Dairy Industry Act enabling this to be done without difficulty whenever necessity arises. Lately it became necessary to prosecute certain persons for sending into the city supplies of milk from unregistered dairies. Convictions were obtained, and it is anticipated that this action will have a good effect. Dairy-farmers now more fully realize the necessity for cleanly methods in the collection and handling of milk, and a distinct improvement in this direction has taken place during the past few years.

### Inspection of Slaughterhouses.

The slaughterhouses throughout the Dominion generally are in a satisfactory condition, and a very considerable number of new buildings have been erected in accordance with the requirements of the Slaughtering and Inspection Act. Inspections have been carried out as regularly as possible, though there has been a considerable shortage of staff consequent upon war conditions.

### The Laboratory.

Owing to the shortage of staff resulting from war conditions no original research work has been initiated, unless necessitated by the appearance of unusual and not clearly understood trouble among live-stock. This has enabled the concentration of the energies of the remaining

staff upon the regular work of examining specimens for officers of the Department and for stock-owners, with the result that no cessation or disturbance of this portion of the working routine has taken place.

The pastoral land attached to the Laboratory has proved valuable for the accommodation of horses belonging to the Defence Department which were suffering from contagious diseases (strangles and ringworm), or from serious sickness or injury. The location of the place, within easy reach of Trentham Camp and the remount depot, rendered it very useful for equine-hospital purposes.

A portion of the farm was set apart for the purposes of a series of manurial top-dressing experiments conducted by Mr. Aston, Departmental Chemist, and these are still in progress.

The ordinary pastoral farming operations have had to be somewhat curtailed owing to much of the grazing being utilized for horses, but what was done was satisfactory from a financial standpoint, thanks to the high values ruling for wool and meat, combined with the untiring and conscientious work of the Farm Overseer.

### Quarantine Stations and Quarantine of Live-stock.

New quarantine regulations, under the Stock Act, 1908, for the prevention of the introduction into New Zealand of diseases affecting stock, were gazetted and brought into operation on the 4th October last. Copies of these regulations have been distributed to shipping and trading companies, and others interested in the importation of stock, and the new regulations appear to have been appreciated by all concerned. Since the embargo on foot-and-mouth disease has been modified the importations of purebred stock from Great Britain have been considerable, and the quality of the stock generally has been of a high order.

Interned prisoners of war are still being accommodated at Motuihi Island, Auckland, and Somes Island, Wellington, but there has been no serious inconvenience caused in consequence. At Quail Island, Lyttelton, a very necessary improvement is being carried out—namely, a new rain-catchment and tank system of water-supply. This is being installed by the Department of Public Works.

### Importation of Animal Manures.

The supplies of animal manures from India have increased considerably, while from the Commonwealth of Australia there is a slight decrease, probably due to a shortage of freight. Taking war conditions into consideration, we have been fortunate in having our supplies of animal manures kept up regularly. As regards inspection, the new arrangements in connection with the inspection of manure-sterilizing in India have continued to work in a satisfactory manner, and in the Commonwealth the inspection has also been thoroughly satisfactory.

### Poultry.

The industry as a whole continued to suffer more or less from the high prices of poultry-food, owing to the war. The exceptionally heavy culling-out of unprofitable stock that has taken place, together with the reduced number of chickens reared during the past season, has given the industry a severe test. At one period it was practically threatened with disaster. Poultry-keepers are to be congratulated on the present position of the industry and the manner in which they fought against the trying hard times. These adverse conditions have unfortunately had the effect of compelling many poultrymen to give up business. This was especially noticeable where the management was conducted on wrong lines and the class of stock kept unsatisfactory. On the other hand, properly conducted plants with the right class of stock secured a good margin of profit, this indicating that poultry-keeping when properly managed, even under the above conditions, is a profitable undertaking.

Now that food-values have declined and better prices are ruling for eggs and table-birds, those poultrymen who did not curtail their hatching operations last season will reap a good reward for their labours. Notwithstanding the improved present outlook for the industry it is generally realized by the public that the poultrymen of New Zealand will not be in a position to increase their output and so reduce market prices until they have at least another breeding season's increase to work on. So long as high prices rule for eggs heavy importations will have to be made to satisfy the local demand. This should bring home to the poultrymen the necessity for producing more eggs and preserving the summer surplus for winter use, thus regulating the supplies throughout the year and enabling the disposal of them at a reasonable cost to the consumer.

The effect of the abnormal conditions that have prevailed may yet prove to be not an unmixed evil. It has directed attention in a striking manner to the important work of culling and to the necessity of keeping only good stock under proper management. It has also enforced investigations in regard to feeding for egg-production. Previously it was commonly believed that the inclusion of wheat in the ration of the heavy layer was imperative. Owing to the scarcity and the excessive high prices ruling for this favoured grain, the Department is carrying out feeding-tests at the Milton Poultry-station with the object of demonstrating what results can be obtained from fowls fed on a dietary from which wheat is eliminated.*

* The results of this test for fifty-two weeks ended 28th April, 1916, appeared in the Department's *Journal* for May, 1916.

It is somewhat surprising that more poultry and eggs are not produced in New Zealand. The climate and general conditions are most suitable for the successful rearing of poultry stock. To conduct the business as a sole means of livelihood demands capital, experience, enthusiasm, skill, and a special aptitude which few individuals possess. Where the chief expansion of the industry must be looked for is on the small farm, when conducted as a side line. Already the great proportion of the poultry products of the Dominion comes from the farms, but unfortunately, in too many cases poultry are not looked upon from a business view-point. Poultry-farming in New Zealand is capable of great expansion, and the furtherance of this is the chief object of the work being carried out by the Department. The supply of high-tested stock at a moderate price with the distinct object of encouraging their adoption by farmers and small holders, coupled with the work of poultry instruction, is having a marked effect in bringing about a decided improvement in the class of poultry kept in the country, as well as making the business more profitable to those engaged in it.

One very noticeable weakness in the industry is the wretched manner in which the market for table-poultry is catered for. Much remains to be done before the supply is equal to the demand. Good-conditioned cockerels fetch exceptionally high values, yet the bulk of the poultry that reach the market may be classed as inferior stores. The chief requirement in this respect is the want of proper feeding. With a view to placing this branch of the industry on a better footing, and to demonstrate to the producer the great waste that is taking place by sending unprimed stock to the market, the Department has now fattening-tests in hand. The results will be published in the Department's *Journal* in due course.

During the year the services of the Poultry Instructors have been in keen demand from all parts of the Dominion. Lectures have been delivered, and demonstrations have been conducted on private farms. The greatest number of requests have, however, been for assistance in culling stock. The present work being done by the Instructors must have a telling effect in the near future.

Owing to the abnormal conditions prevailing the Milton Poultry-station shows a slight decrease in the number of eggs and birds sold for breeding purposes during the year. In anticipation of declining values of foodstuffs and a heavy demand for breeding-stock during the coming breeding-season an increased number of stock were reared during the year. Thus farmers and others who have been compelled to dispose of their poultry are given an opportunity of making a fresh start with high-quality stock at a moderate cost.

## Sheep-dipping.

On the whole it may be said that farmers have exhibited a greater appreciation of the practical advantages gained by properly complying with the sheep-dipping clauses of the Stock Act. It is matter for regret that prosecutions for exposing lice-infested sheep in saleyards have still had to be undertaken, but I am glad to state that they have been fewer than in late years. There should be no necessity for these prosecutions, as sheepowners, whether farmers or dealers, should recognize that it is altogether to their own interest to carry out the dipping provisions of the Stock Act efficiently and properly. The sheep-louse and sheep-tick are responsible for the annual loss of a great deal of monetary value to the Dominion, and, while the gradual improvement in methods is satisfactory, it is to be hoped that the time is not far distant when sheepowners will in their own interests systematically settle down to the work of coping effectually with these parasites, and so obviate the necessity for the Department having to prosecute in order to safeguard sensible sheepowners.

## Wool.

The close of the 1914–15 wool season was marked by an extremely high level of values, especially in regard to crossbred wool. During the winter months the usual sales of crutchings were held, and the demand from Japan sent prices up to hitherto-unknown values in the trade. Prior to the opening of the wool season 14d. to 15d. was being paid for the better class of crutchings free from seed. The export of crossbred wool being then permitted to the United States of America, competition of American buyers was felt at the earlier sales of November and December. Extreme prices were paid for the best half-bred and Romney wools, half-bred reaching 21½d., crossbred and Romney wool selling up to 19¾d. At the November sales in Wellington a few lots of choice Southdown wool were bought for Japan at the record prices of 23d. to 24½d. per pound in the grease. Exports to America ceased during January, but the market had so hardened for all descriptions of wool that although American competition was withdrawn from the sales values for ordinary coarse and medium crossbred were considerably above the earlier sale prices, while the wools most in favour with the American buyers maintained their value.

The trade was brought to a halt in the latter end of January, owing to the shortage of ocean freight space, and sales were delayed considerably in consequence, but were renewed under altered conditions—viz., buyers to delay payment until shipping documents were available. The Wellington sale of 14th February constituted a record for the Dominion, totalling 39,000 bales. In the latter part of February to March prices declined to the extent of 1d. to 1½d. per pound for crossbred wool, finer sorts falling about 1d. per pound. Of late, however, values have shown a tendency to harden. There still remains a considerable quantity of wool to dispose of, and some 17,000 bales are set down for the 2nd June sale at Wellington, by which time it is expected that sufficient shipping-space will be in sight.

The condition of the North Island wools was good, being sound and well grown. On the average they were probably rather heavier in grease than last season. Many of the South Island

wools showed the effect of the dry season, the earlier wools from the Canterbury Plains being extremely earthy, with considerable waste. The total quantity sold at local auction sales this season to date is 315,000 bales, and there is a further quantity of approximately 25,000 bales awaiting sale in the various centres of the Dominion.

The ruling prices at the Dominion auction sales for the past season and the four preceding seasons are as follows :—

| — | 1912. January. | 1913. January. | 1914. January. | 1915. January. | 1916. January. |
|---|---|---|---|---|---|
| | d. | d. | d. | d. | d. |
| Superior merino combings .. | 11½–13½ | 13–14 | 12–14½ | 12–13 | 15–17¼ |
| Medium to good merino .. .. | 9–11 | 10½–11½ | 9¾–11½ | 9½–10½ | 12½–14½ |
| Inferior merino .. .. .. | 7¼–8½ | 9–9½ | 8½–9½ | 7¾–8¼ | 11–12 |
| Superior half-bred .. .. | 11½–13¼ | 13–14¾ | 12–14 | 13¼–14¾ | 18½–21 |
| Medium to good half-bred .. | 9–10¾ | 10½–12¾ | 9¾–12 | 11½–13 | 16½–18¼ |
| Inferior half-bred .. .. | 7¾–8½ | 10–11 | 9–10 | 9–10½ | 13½–15½ |
| Superior crossbred .. .. | 10¼–11¾ | 12–13¼ | 10½–12 | 12½–14 | 18–19¾ |
| Medium to good crossbred .. | 8–10 | 10¼–11½ | 9–11 | 11½–13 | 16–17¾ |
| Inferior crossbred .. .. | 6½–7¾ | 8½–9½ | 7¾–9 | 9–10¼ | 12½–15¼ |
| Lincoln and Leicester .. .. | 7½–10 | 10–11½ | 8¾–10½ | 11–12¾ | 15–17½ |
| Lambs, good .. .. .. | 9½–11 | 11½–12½ | 11–13 | 13–14 | 16–18¾ |
| Lambs, medium .. .. .. | 7½–9½ | 9¼–10½ | 9–10¾ | 11½–12½ | 13–15½ |

The exports of wool during the past seasons ending 31st September were as under :—

| Year. | Quantity. lb. | Value. £ |
|---|---|---|
| 1908 ... ... ... ... | 163,934,462 | 5,716,373 |
| 1909 ... ... ... ... | 187,619,181 | 5,914,695 |
| 1910 ... ... ... ... | 194,472,934 | 7,954,527 |
| 1911 ... ... ... ... | 184,854,145 | 7,152,682 |
| 1912 ... ... ... ... | 189,570,691 | 7,011,541 |
| 1913 ... ... ... ... | 195,353,533 | 8,349,882 |
| 1914 ... ... ... ... | 196,499,896 | 8,167,279 |
| 1915 ... ... ... ... | 208,908,118 | 10,425,172 |

## Fat Stock.

The meat-prices fixed in March, 1915, for purchase on behalf of the Imperial Government are still in force, and these have largely had the effect of controlling the fat-stock market. Exceptionally high prices have been ruling throughout the Dominion. Market reports for March show that bullocks ranged from £12 to £20, wethers from 25s. to 41s., hoggets from 17s. to 28s., and lambs from 20s. 6d. to 30s. 6d.

## Hides, Sheep-skins, and Tallow.

### *Hides.*

The present values of sound ox-hides are 11½d. per pound and cow-hides 10¼d. per pound, the average prices for the year being 11d. for ox and 10⅛d. for cow hides. Early in February, owing to an embargo having been placed on the export of all ox and cow hides over 45 lb., the heavier weights immediately fell to 10d. and 9d. respectively, the lighter weights, however, continuing to maintain their former prices.

### *Sheep-skins.*

Notwithstanding the partial embargo on sheep-skins, values have been fairly well maintained: this is attributable to some extent to the increased value of pelts. Values of combing crossbred skins, per pound, are,—

| | 1913. | 1914. | 1915. | 1916. |
|---|---|---|---|---|
| Medium crossbred ... ... | 8½d. | 8¾d. | 11d.–11½d. | 10¼d.–10¾d |
| Fine crossbred ... ... | 9d. | 9d. | 11d.–11½d. | 10½d.–11¼d. |
| Coarse crossbred ... ... | 8¼d. | 8½d. | 10½d.–11¼d. | 9¾d.–10½d. |

### *Tallow.*

Tallow has continued to advance steadily during the past twelve months, present prices being: Prime mutton, 45s. per hundredweight; prime beef, 44s.; good mixed, 40s

# FIELDS DIVISION.

REPORT OF J. BROWN, B.Sc. Ag., N.D.A., DIRECTOR.

Wellington, 19th May, 1916.

The Secretary of Agriculture, Industries, and Commerce.

I FORWARD herewith a report on the work of the Fields Division for the year ended 31st March, 1916. It may be noted that my tenure of the directorship covered nine months only of the period under review, my appointment dating from 1st July, 1915.

J. BROWN, Director.

## THE AGRICULTURAL YEAR.

Viewing the position in a broad way, the average farmer has every reason for congratulation on, and very little cause to complain with, the results of the past season. With the gradual rise in stock and produce values since the beginning of the year, and favourable weather-conditions throughout the greater part of the Dominion, satisfactory returns have been obtained and every encouragement received to make the best out of the land. Certain disabilities have been encountered — higher prices for implements, fencing-material, sundry stores, seeds, and manures. In many cases this has simply meant doing without, or with less, for the time being. To know how to economize without depriving himself of actual necessities is one of the first lessons which the farmer has to learn. So far there has not been apparent any serious reduction in the supply of labour for the prosecution of farm-work, excepting it be in a curtailment of bushfelling operations.

While the general conditions have been good, the season in the North Otago district, and to a lesser extent in the major part of Canterbury, has been extreme in character and exceedingly unfavourable to crop-production and to pastures. The situation in these districts has been aggravated by the fact that the past season is the second successive season in which abnormally dry conditions have prevailed. The situation became acute in North Otago in February, 1916. Since then (up to date of writing) free railage and other concessions to settlers have been in continuous operation.

## EXPERIMENTAL FARMS AND FARMS OF INSTRUCTION.

### *Ruakura Farm of Instruction.*

The result of this year's work, it is hoped, has furthered the interests of both the farmers and the Department. Several new experiments have been undertaken, while others which were in progress have reached completion.

One experiment which has evoked considerable interest from farmers is the growing and harvesting of red-clover seed. An area of 10 acres was devoted to this experiment, and the resultant crop is heavy. Only a small quantity has yet been threshed, the bulk being stacked to allow of further drying. The amount threshed was just sufficient for farm requirements for this year's grass-seeding. The return from this crop is estimated at £16 16s. per acre.

A fine sample of mangel-seed has also been harvested, but nothing was accomplished in the way of saving swede-seed, as Rhizoctonia attacked the roots after planting and nullified the results of this experiment.

Taken all round the season's crops are quite up to the average, and in the cases of grass, clover, and lucerne hay they are well above the average. Mangels, potatoes, and turnips felt a dry period after the new year considerably, but the mangel crop is far from being light, and before the end of the growing period a heavy crop of roots will be secured.

Oats made an excessive growth of straw, to the detriment of grain-development. Wheat did particularly well, the crop ripening early and yielding plump, well-matured grain.

Heavy crops of ryecorn were harvested from the swamp lands, but barley only produced a light crop. Scotch tares were amongst the most profitable crops grown, as, apart, from the return in seed-value, they proved beneficial to the land in a series of rotations. Another profitable crop was the rape, the success of the fat-lamb experiment being solely dependent on this crop. It is also one of the best preparatory crops for grass-seeding.

All classes of live-stock are in good condition, and one of the main objects during the year has been to improve the breeds. The stock carried during the year shows an increase over the previous year, as also does the cash receipts from sale of same.

Cow-testing was carried on throughout the whole season, and thirteen Shorthorn cows were registered in the heard-book of the Waikato Dairy Shorthorn Association. The latest importation of two milking Shorthorn bulls added considerable value to the dairy stock, and already a number

of calves by these sires have been reared. Thirty Shorthorn heifer and twenty-nine bull calves, all by Darbalara milking Shorthorn bulls from good cows, have been reared this year. The demand for these bulls is very keen, and every one fit for service during the coming year is sold. With Jersey bulls the demand is not up to the usual standard.

The flock of Southdown sheep shows a good return, and all rams available were disposed of at satisfactory prices.

The herd of Berkshire pigs has been increased owing to the unsupplied demand for stud boars and sows in pig.

In the Poultry Section all work has been carried out as usual, and with fair success, considering the present unsettled condition of the country and the comparatively high price of feed. All the stock is in good condition, and laying well for this time of the year. In February last a thorough inspection was carried out, and undesirable classes of birds culled out. Black Minorcas put up the best average as layers, with White Leghorns, White Rocks, and Black Orpingtons next in order. Among the ducks the Indian Runners and Pekins showed splendid returns, but the Aylesburys gave poor returns. Owing to the hatching season being commenced a month earlier than the usual time, and white diarrhœa attacking several batches, the number of chickens does not quite equal those raised during the previous year. The quality and vigour were, however, up to the standard of former years.

Among the improvements carried out on the farm were the building of a residence for the Poultry Overseer, living-rooms for the Apiarist, erection of piggeries, and alterations to sheep-yards. These were all executed by the farm staff.

### *Weraroa Experimental Farm.*

The operations at this farm during the year have been largely of a routine nature, the main effort having been towards an increased production with a minimum of attention directed towards experimental work. A prolonged spell of very wet weather greatly impeded the preparation for crop during winter and spring. The land was most of the time in a sodden condition, with the result that feet troubles were more than usually prevalent amongst the sheep flocks.

The cereal crops, which were seeded eventually under these trying conditions, made a rank forced growth of straw, which lodged badly and reduced the harvest very considerably. Oats yielded in consequence not more than 30 bushels per acre of inferior grain, with a tremendous amount of rubbishy straw. Wheat yielded about 30 bushels, of which a relatively small proportion was first-quality grade. During the late summer and autumn the weather-conditions changed to the opposite extreme, pastures dried up, and the root crop suffered, but recovered later on so far as to prove a satisfactory crop.

The milking herd has done exceedingly well, the returns per head being considerably higher than the previous year, while the young stock have been brought forward to the end of the year in vigorous and thrifty condition. A considerable falling-off in the demand for Holstein bulls was experienced this year, while yearling Shorthorns were in demand at the annual sale. The average price yielded for Holstein yearling bulls was 26½ guineas, and for Shorthorn yearling bulls 29 guineas.

Some improvements have been effected during the year. Additional accommodation for six learners has been erected, and a milking plant and engine have been installed. Urgently required improvements, such as shearing-shed and yard and piggeries have not yet been undertaken.

The water-supply has again given cause for anxiety. During the last three months of the year the supply obtainable from races and wells has been barely sufficient for the needs of stock, and has fallen far short of what is required for dairy and homestead purposes. The failure of the water-supply has been an annual occurrence, and it seems as if it would yet be necessary to obtain an extension of the Levin Borough water system to meet the needs of the farm.

Mr. James Drysdale resigned his position as Manager at Weraroa in March, 1916, in order to take up a more remunerative position as Manager of the Prison farms at Waikeria and of the adjoining mental-hospital farm at Tokaanui. Mr. Drysdale's management of the Weraroa Experimental Farm dates from August, 1905. At that time the greater portion of the farm was heavily covered with timber and stumps. Its development from that condition was a fit task for one of Mr. Drysdale's experience, energy, and resource. Throughout its formative years under Mr. Drysdale's care the farm has made worthy contributions to the science and art of dairy-farm management in the North Island. He has had the satisfaction of seeing it cleared and improved, and for the most part cultivated and brought into a condition which will permit of advanced experimental work being undertaken. During his tenure of the managership he was mainly instrumental in the establishment of the excellent Holstein and Shorthorn herds, which have progressed most satisfactorily under his care. The good wishes of the Department for his success in his new undertaking have certainly been well merited.

An extensive scheme of fresh experimental work has now been designed for Weraroa, and has already been initiated.

### *Moumahaki Experimental Farm.*

Climatic conditions throughout the year could almost be termed ideal, and, although most people complained about the dry autumn, little cause for complaint arose at Moumahaki.

The general health of the live-stock has been good, pastures have yielded a fair amount of herbage throughout, and consequently cattle have grown and fattened well. Heavy rains during

the early spring militated against the sheep, especially with regard to the condition of the wool, which was light compared with previous years. Cattle purchased for fattening brought more than double the price paid for them twelve months previously.

The Ayrshire dairy herd is rapidly gaining popularity. All bulls bred during the past year have been sold, some to breeders who had previously selected from this herd. Inquiries for purebred heifers are continually being received, but at present the demand for these cannot be met.

The Ryeland and Border Leicester flocks are rapidly springing into prominence, and at the recent Hawera and Wanganui shows some of their numbers gained premier honours.

Special attention is now being given to the Berkshire breed of pigs, and although the demand for these is not at present very large it is fairly regular. During the year numerous breeders have returned to make selections from this herd.

Owing to the lack of land horse-breeding is somewhat confined, nevertheless several useful horses are being raised on the farm, and some very promising foals are now being weaned.

Rotation of crops has been the means of increasing the fertility of the land at Moumahaki, which, owing to the light nature of the soil, would quickly deteriorate but for systematic cropping. This year's mangel crop is equal, if not superior, to any yet grown on the farm, and the same may be said of the potatoes and carrots. A larger area than usual was devoted to wheat-growing. Two varieties, Thew and Solid-straw Tuscan, were grown. The former, an early variety, will yield well on threshing, but unfortunately the latter was attacked by blight, and will consequently yield a poor crop. Gisborne, Bevans, and Black Russian barleys were grown. The area in oats was considerably curtailed, and the crop, a good one, will be used for chaff. Vetches were grown in the rotation of crops. Seed of this is eagerly sought for by dairymen, and a considerable quantity is sold them for use in the production of green fodder.

The lucerne crop has proved that this plant can be grown to economic advantage by all farmers. Experiments are now in progress to determine the carrying-capacity per acre of this plant. This season some fields were grazed five times, in addition to providing 3 tons per acre of hay.

During the winter 12 acres of new land was stumped and ploughed, and 12 acres of similar land broken up the previous year has been thoroughly cultivated and laid down in experimental plots of permanent grass.

A considerable amount of time was spent in preparing specimens of farm-produce for exhibition, and displays of same were made at five shows in various parts of the Dominion.

In the horticulture section the work has been chiefly of a maintenance character, due to the fact that the labour conditions have prevented sufficient help being obtained for carrying out experimental work. Good results have been obtained with tomatoes, and the interest taken and numerous inquiries asked regarding cultivation, merits of varieties, and the ability of these varieties to resist disease has been considerable. The outstanding merits of one variety, Danish Export, obtained by the Department from Denmark, have fully justified its importation. The same may be said of the culinary peas, the outstanding variety being Laxtonia. A number of varieties of squashes and pumpkins imported from America were given a trial, and the best of these will be distributed from time to time.

Plant-breeding operations have been to a large extent devoted to the improvement of grasses and forage plants by selection. Forty-five pots of twice-selected single plants of Italian rye-grass have recently been planted. New types giving greater stooling habits, thus producing more feed, and also freedom from rust, are under observation. About 1,000 plants of various strains of red clover are being tested, and attention is beng paid to selections of Scotch vetch, carrots, lucerne, and culinary peas. Work in connection with cross-fertilization of potatoes, providing seed for next year's work in raising new and improved breeds, and also hybridization of potatoes with Solanum Nigrum to get a disease-resisting potato, is in progress.

The number of visitors and inquiries answered by letter shows a large increase over the previous year.

*Ashburton Experimental Area.*

Operations on this area were commenced in May, 1915. Before that date the whole of the area was in very old pasture, composed almost entirely of couch-grass (*Poa pratensis*). As ground was urgently required for continuing the work of testing and selecting imported cereals, 45 acres were ploughed and worked up in the best way possible short of summer fallowing. This area was used for growing the cereals in question. Unfortunately the season proved to be quite extreme in character, there being a marked deficiency in rainfall throughout the whole growing period. The result was that, although an opportunity was afforded to mark down varieties adapted to dry conditions, the general result was far from being satisfactory. Sufficient crop was, however, harvested to provide seed for extended planting on this and on other areas next season.

In addition to the above area, 13 acres 1 rood 12 perches was broken up during winter and thoroughly worked up till November for the eradication of couch, and subsequently sown in turnips, which likewise suffered from the dry conditions, but made a good recovery in February, 1916, and turned out quite a satisfactory crop. This, however, was merely a preliminary crop for conditioning the land, and was not planted with any experimental object.

A further 16 acres has been entirely summer-fallowed for the eradication of couch, and there remains 18 acres to be similarly dealt with to complete the entire areas, which is to be devoted to experimental purposes.

Gorse hedges have been eradicated and old fencing removed so as to provide an uninterrupted stretch of land for plot work. It will thus be seen that the season's work has been exclusively of a preparatory nature, and it will probably be another year before it can be considered that the programme of experiments is fairly on the way.

The work of cultivation has been done under arrangement with an adjoining farmer, Mr. John Hunt, who has carried out all work entrusted to him in a very satisfactory manner. It was not possible, of course, to push forward the preparations to the extent desired owing to the dryness of the season, which rendered part of the land unploughable during the greater part of the summer.

When the area shall have reached to a stage which will permit of the greater part of the experimental work outlined to be undertaken it will be necessary to appoint a working overseer and to provide the necessary team and implements.

### Learners at Experimental Farms.

The demand for positions as learners on experimental farms still keeps up, with the result that many lads have to wait for some months before their time for appointment comes. Extra accommodation for six learners has been provided at Weraroa, and these positions are now full. With the exception of a few isolated cases, these boys are found to be good workers and show considerable interest in all duties they undertake. The system of training is undoubtedly an excellent one from the point of view of turning out young men practically skilled in farm-work. It is highly desirable, however, that one of the farms should be more completely staffed and equipped so as to provide for further education and training of young men after undergoing the fundamental apprenticeship to actual farm-work.

### Co-operative Experiments, etc.

Despite the fact that many of our experimenters have gone to the front, the co-operative-experiment movement has been well supported by the farming community. Since this movement was started in the Dominion several marked advances have been made in general-farming practice. Notably among these are—

The more general practice of providing a larger supply of food for stock during the winter months by the use of the plough.

The more general practice of providing summer feeds for dairy cows during the dry season.

A more extended knowledge of fertilizers and their uses among the farming community.

Greater inclination to experiment and depart from the beaten track, even by farmers not directly connected with co-operative experiments.

Fuller recognition as to the necessity of adequate cultivation, and also an inclination to place some belief in the benefits of rotation, and also of green-manuring on the lighter classes of soils.

An ever-growing belief in the value of lucerne as a forage crop, and in the fact that there are very few descriptions of soils which cannot by proper preparation be fitted to grow this invaluable feed.

An awakening to the necessity and to the benefits to be derived by a fuller use of the faculties of observation in connection with the daily work of the farm.

A better understanding of the value of lime.

#### *North Island.*

During the season 1,185 experimental plots were put in in the North Island. 139 new lucerne plots were sown down in districts extending from Wellington to the far North of Auckland. It is a very noticeable fact that the number of farmers applying for experiments of maize has greatly decreased during the past few years, whereas the applications received for lucerne have increased. A large number of farmers are now planting lucerne on their own account, and in visiting many farms it is very interesting to see small areas of lucerne of all ages, usually starting with the original co-operative experiment.

A considerable number of crops were grown for ensilage, many of which were used by Mr. W. Dibble, of the Division's field staff, for giving demonstrations in the making of stack ensilage. Ensilage demonstrations were given at Aorangi, Cheltenham, Apiti, Thames, Stratford, Ngaere, Ashhurst, Hawera, Mangere, Hastings, Clive, East Tamaki, West Tamaki, Papatoetoe, Maungatapere, Tokatoka, Otaki, and Moutoa. Lectures on ensilage subjects were given at Hastings, Cilve, Waipukurau, Puketapu, Waipawa, Raupo, Ruawai, Mititai, Te Kopuru, Hoanga, Manakau, Kohukohu, Waimanakau, Opononi, Herekino, Haitaia, and Tokatoka.

As regards school experimental work, special supervision has been given in connection with the Palmerston North plots and those of the New Plymouth High School. A few other schools have been supplied with seed, material, and advice.

*Marton Plots.*—The rotation scheme has been put in hand, and very satisfactory crops have been grown. The area subsoiled would appear likely to grow some big crops in the near future should the details of the scheme be properly carried out. The best clover crop has returned in

its first season over £14 value of hay, besides some grazing; while the lowest plot of clover yielded hay to the value of £9 5s. 6d. per acre. This is taking the weights off the press and reckoning the hay at £3 10s. per ton in the paddock in truss.

*South Island.*

In the South Island 160 farmers have co-operated with the Department, the total number of experimental plots being 2,848. Among the larger or special experiments being conducted in the South Island are the following:—

*Run 938J Tarras, Morven Hills, Central Otago.*—The area dealt with during the year was made up as follows: Wheat, 20 acres; selected grasses (ten varieties in plots), 12 acres; oats for horse-feed, 30 acres; lucerne (four varieties), 5 acres.

On account of the dry season in the early part crops were light. Seed from several of the different grass and other plots were secured this season. Lucerne has done particularly well in all plots, indicating that special consideration should be given to the growing of this crop in the district. Small quantities of seed from individual plots have been harvested this season. The shelter-belts of trees were looking fairly well at close of year under review.

The Lands and Survey Department is now taking over this run for subdivision.

*Manuka-scrub Area between Rivers Eyre and Waimakariri.*—No. 1 area: This area, which consists of 5 acres, was broken up and sown with a variety of legumes in 1913–14, which were afterwards ploughed under. In 1914–15 the area was set out as follows: ½ acre planted with fruit-trees; 3 acres sown with a mixture of grasses (there being two mixtures each sown on 1½ acres); 1½ acres sown with twelve varieties of lucerne. Both the grasses and lucerne came away well.

No. 2 area: The decision to grant this further area was arrived at in May, 1915. After being fenced, scrubbed, and cultivated, there was sown thereon in December, 1915, eleven different grass mixtures and a manurial test of turnips, comprising eleven plots. Lime was also applied in plots in different quantities per acre.

Owing to difficulties in securing the effective co-operation of the owner of the land on which the experiments have been conducted it has been decided to abandon these demonstration areas.

*"Moss Banks," Catlin's River.*—This class of country, the soil of which is of an unproductive character, stretches along the foreshore of the Catlin's River in the Owaka district. An area was dealt with during the year under review for the purpose of discovering the best means of bringing it into profitable use. A report on the work and results will be published in due course.

*Pakihi Lands (West Coast of South Island).*—Wood's Pakihi: This area consists of 6¼ acres, on which experiments were initiated in December, 1913. In 1914–15 the area was sown with oats and root and fodder crops, which were successful, and proved a revelation to the settlers. In May, 1915, a drainage scheme was completed, after which the area was ploughed and well worked. On the 9th February, 1916, the whole area was sown down with a grass mixture which is giving promise of being a success.

Sergeant's Hill (Westport Domain): This area, consisting of 1 acre, was taken in hand in 1913. One half-acre was sown with grass in 1914–15 and proved a most successful experiment. The other half was further cultivated during the present year, and sown down with a mixture of grasses. These experiments indicate that the pahikis can be brought into profitable use by cultivation and liming and surface drainage by means of throwing the soil into narrow lands.

*Forest Lands, Westland.*—Rotomanu: The area of 3½ acres sown the previous year with oats, barley, &c., not having done well, these were ploughed under and the land sown with a mixture of grasses. The individual grass plots, comprising the remainder of the total area of 5 acres, did well.

Moana: The grasses sown on 2½ acres during October, 1915, proved very successful. A further area of 3 acres of bush was felled and burned, and on the 20th February, 1916, was sown down with a mixture of grasses.

Poerua: The lucerne variety test sown in 1914–15 did not succeed. It was decided to plough, cultivate, and sow oats and tares, which were afterwards ploughed under. In December, 1915, a variety test of maize was sown with the idea of eventually making into ensilage. A fair crop of maize was grown, and was made into ensilage under the direction of Mr. Dibble, a number of farmers being present to be taught how to make stack ensilage. Mr. Dibble also lectured on ensilage at Rotomanu.

SAND-RECLAMATION EXPERIMENTS.

During the past year little actual work has been done in this direction, owing to more pressing services engaging the time of the officers chiefly concerned, but steps have been taken to provide for more systematic experimentation in the future. After continued negotiation a reserve, forming part of the sand area of Orewa Bay, a few miles north of Auckland Harbour, has recently been handed over by the Lands Department. It is the intention to here test various sand-arresting plants and sand-grasses, and to propagate material of suitable varieties for transference to sand areas on either coast of Auckland Province. The area will thus form a testing-station as well as a nursery for sand-reclamation plants. A little has already been done in this direction. The advisability of securing and establishing similar areas elsewhere is under consideration. These areas will act as bases from which the larger sand-drift problem can be systematically attacked.

### Local Agricultural Problems.

Several local problems, including the North Auckland gum lands, the pumice lands of the Taupo Plateau, and the depleted country of the Mackenzie and Central Otago Plains, have been under investigation for the past few years.

Owing to considerations arising out of the war, no work has been undertaken in furtherance of these investigations during the year except to obtain some grazing records from plots previously established. Generally speaking, it has now been fairly well decided, as the result of work previously undertaken, as to which the various processes of treatment, cropping, and grassing that should be accorded to the respective areas. In future work ought to be in the direction of abandoning to a large extent the small trial-plot system in favour of the adoption of a system of farming on a scale which would permit of an adequate income to the settler, the object being to collect economic data for the information of intending settlers. In other words, the work hitherto undertaken has indicated possible lines of improvement of each area and modes of farming them, and it now remains to decide by actual trial which system will pay, and which will pay best.

### Advice to Farmers.

In connection with the advisory work and other activities which bring its officers into intimate contact with the farming community, this Division is in a position to realize very to face. To produce the maximum result with the minimum expenditure he must carefully consider and give due place to a multitude of factors, and in this connection the services of the Division's officers have been very freely extended during the year. From the headquarters of the Division, as well as from the experimental farms and from district offices, an immense amount thoroughly the many exigencies and difficulties which a striving agriculturist is called upon of correspondence relating to crop-production has been maintained with the agricultural public, and yet the demand for information is far from being satisfied. Throughout New Zealand there exists a keen desire on the part of farmers to have more expert instructors in their midst. This is a desire which every effort should be made to meet.

At headquarters and throughout the country a very considerable share of the duties imposed by this service has been sustained by the Agriculturist, Mr. A. McTaggart, M.S.A. He has lectured on up-to-date agricultural methods to appreciative bodies of farmers in practically all sections of New Zealand. Instructive articles on various agricultural subjects have been written by him from time to time for the *Journal of Agriculture*, and advice to farmers by letter and by personal interview have been freely accorded. He has also conducted soil and limestone surveys in various parts of the Dominion, and is to be credited with the discovery of extensive deposits of soft limestone the importance of which to the agricultural community cannot be overestimated.

While particular reference is made to the work of this officer, who has commenced what we hope will prove a very honourable and useful career in his chosen profession in New Zealand, it is not in the least intended to underrate the faithful and ungrudging services which has been rendered for years to the Department and the country by the Fields Instructors and Inspectors throughout New Zealand. In connection with the experimental and advisory work in particular, Fields Instructors Macpherson and Baylis, with their assistants Messrs. McCulloch and Dibble, have done pioneer service, and have contributed in no small measure to the progress of arable-land farming in the Dominion.

### Fertilizers.

The number of vendors who have registered brands is 400. During the year thirty-six samples of fertilizers were taken for analysis.

### Educational Displays.

During the year displays were made at Invercargill, Dunedin, Palmerston North, Christchurch, Hawera, and smaller displays at Tapanui, Blenheim, and Westport. These displays, besides being general agricultural demonstrations, set forth the activities of the Department. Farmers are keenly interested in the exhibits, and their educational value is beyond question.

### Rabbits and Noxious Weeds.

#### *Rabbits.*

Unfortunately rabbits have shown a decided increase during the past twelve months. This is particularly noticeable in many parts of the South Island, where, owing to the very dry season and absence of rains, breeding-conditions have been most favourable. Scarcity of labour brought about by war conditions has to some extent nullified the efforts of farmers in coping with the pest, although this cannot be taken as a general reason for the increase. In some instances a few unscrupulous persons have taken this reason as an excuse, and have taken absolutely no steps whatever to destroy.

In the North Island, although increases have been noted in some localities, the position is not nearly so serious as in the South. The country operated upon by the East Coast Rabbit Board is in a very clean condition. In certain parts of the Auckland Province local committees, formed for the purpose of taking simultaneous and constant action against the rabbit, have done much good. These committees are practically all in the district controlled by Fields Inspector Rowan, Auckland, and that officer is to be congratulated on the enthusiasm he has aroused amongst settlers and the consequent good work done.

Poisoning with phosphorized pollard is still recognized to be the cheapest, quickest, and most effective means of coping with the pest. Fumigating with carbon bisulphide is now becoming prohibitive to undertake, owing to the short supplies of this article and the consequent high prices ruling. Much useful and permanent work can be done by erecting netting-fences, destroying burrows, and clearing scrub and cover generally. The sale of phosphorized pollard from the departmental depots has been greatly in excess of that of the previous year.

### *Noxious Weeds.*

Here again the shortage of labour has to some extent prevented the best of work being done in clearing noxious weeds. General weather-conditions have been very favourable for the growth of weeds, and in most cases they thrived and matured early.

Fields Supervisor Ross reports that a surprising amount of good work, which adverse critics do not recognize, has been done in his district. There has been a great gain in settled areas, and much has been done to keep virgin country clean. The Wairoa County is, however, in a bad condition, and must remain so until an officer who has not also to carry out the duties of Inspector of Stock is appointed.

In Supervisor Deem's district the majority of settlers continue to do good work in the destruction of blackberry by means of ploughing. Angora goats are also to some extent instrumental in controlling this weed. Californian thistle is fairly well controlled on agricultural land, but on pastoral lands, where it has a very strong hold, little or nothing has been done with it. Rust (*Puccinia suaveolens*) is doing a lot in many parts of this district in the control of this weed. Ox-eye daisy is increasing on dairy lands, especially where the pasture is running out.

In the South Island Californian thistle is becoming more prevalent. Ragwort, too, unfortunately requires a good deal of labour where cutting is resorted to, and owing to the favourable climatic conditions in the South this season it made rapid growth after the first cutting, and required further attention. Sweetbrier, gorse, and broom have not received a great deal of attention owing to the shortage of labour, and more latitude had to be allowed in consequence.

Several alleged "weed-destroyers" have been given trials during the year, but none of these have done all that was claimed for them.

## New Zealand Hemp.

The report furnished by the Chief Hemp Grader (Mr. W. H. Ferris) on the work of his branch of the Division during the year is attached, as follows:—

The hemp industry during the year ended 31st March, 1916, must be regarded as most satisfactory not only as far as the output was concerned, but also for the highly remunerative prices obtained by the millers during the whole of the season.

*Prices.*—In April, 1915, the price of good-fair grade hemp was quoted at £25 10s. per ton f.o.b. During May and June the price advanced to £32 per ton, and although in August and September it fell to £26, in October it advanced again to £29 10s., and steadily increased during the months of November, December, January, and February to £39 per ton. In regard to tow, never before in the history of the hemp industry have higher prices been received for this by-product, first grade having ruled approximately at £14, second grade, £13, and third grade at £11 per ton respectively. For stripper-slips the average price quoted was £7 10s. to £8 per ton, which must be considered very satisfactory.

*Quality of Hemp.*—I regret to have to record that the quality of the fibre produced during the year does not compare favourably with that produced during the previous year. The proporton of fine grade was only 1·01 per cent., as compared with 2·8 per cent. for 1914–15; while good-fair was only 25·36 per cent., as compared with 34·53 per cent. for the previous year. The percentage of good-fair in the Auckland District was only 10 per cent., low-fair, common, rejected, and condemned grades claiming 50 per cent. of the fibre produced there. As usual practically all the fine grade of fibre was produced in the Wellington and Marlborough Districts.

The cause of the drop in the quality of fibre may be attributed to two reasons. Firstly, several large flax areas in the Manawatu were badly affected with the grub pest, millers being thereby prevented from turning out a high grade of fibre. Secondly, high prices ruled for our low grades of fibre, this generally encouraging many millers to accept low-grade contracts, as a greater output can be obtained by them and at a less cost of production.

*Quality of Tow.*—Although a large number of millers do their utmost in turning out a good quality of tow, it is to be regretted that many millers do not exercise sufficient care in dealing with this by-product. In glancing through the tables attached it can easily be seen that the millers in the Auckland and Southland Districts still continue to supply the greatest portion of third-grade and condemned tow, the percentage of these in the districts named being 73 per cent. and 56 per cent. respectively. Although the percentage of first-grade shows a slight increase over last year, unfortunately third-grade and condemned show an increase of 6 per cent. The cause of the fall in the quality of tow is practically the same as in the case of hemp—namely, high prices ruling for inferior grades; and as long as many millers continue to receive high prices for an inferior article they will continue to turn out the latter without any regard for the benefit of the industry as a whole. It may also be mentioned here that many of these millers only resume operation when prices are exceedingly high, and consequently they are of no real benefit to the industry.

*Quality of Stripper-slips.*—The quality of this by-product has improved considerably, largely for the reason that manufacturers will not purchase an inferior grade.

*Machinery.*—Messrs Suttie and Wynyard, who have been experimenting for some time past with an improved automatic scutcher and tow-shaker, have now installed a machine in one of the chief mills at Foxton. So far it is giving every satisfaction, and as the scutching of hemp is one of the miller's chief troubles, it is to be hoped that the machine will be a great success. Several other millers of an inventive turn of mind have also been experimenting for some time past in improving our present strippers, and during the year it is quite likely that some very important improvements may be announced.

### *Grading Statistics.*

The total number of bales of hemp graded throughout the Dominion during the year was 138,275, as compared with 82,989 for the previous year, an increase of 55,286 bales. During the same period 38,889 bales of tow were graded, as compared with 23,374 for the previous year, an increase of 15,515 bales. Of stripper-slips 5,875 bales were dealt with, as compared with 1,482, an increase of 4,393 bales.

The following tables give full particulars of the gradings during the year ended 31st March, 1916, the totals and percentages for the previous year being also quoted for comparison :—

*Table of Hemp graded (Bales).*

| Grading-ports. | Fine. | Good-fair. | Fair. | | Common. | Rejected. | Condemned. | Total. |
|---|---|---|---|---|---|---|---|---|
| | | | High Point. | Low Point. | | | | |
| Auckland .. .. | 17½ | 2,190 | 9,024 | 8,719 | 1,906 | 274 | 86 | 22,216 |
| Foxton .. .. .. | .. | 15,997 | 20,677 | 8,526 | 1,363 | 386 | 81 | 47,030 |
| Wellington .. .. | 349 | 10,290 | 29,900 | 9,678 | 1,269 | 417 | 70 | 51,973 |
| Napier .. .. .. | .. | 537 | 229 | .. | 11 | .. | .. | 777 |
| Picton .. .. .. | 803 | 580 | 135 | 62 | .. | .. | .. | 1,580 |
| Blenheim .. .. | 233 | 1,705 | 319 | 94 | .. | .. | .. | 2,351 |
| Lyttelton .. .. | .. | 74 | 16 | .. | .. | .. | .. | 90 |
| Bluff .. .. .. | 4 | 2,281 | 6,049 | 1,321 | 46 | .. | .. | 9,701 |
| Dunedin .. .. | 1 | 1,411 | 946 | 196 | 3 | .. | .. | 2,557 |
| Totals for year ended 31st March, 1916 | 1,407 | 35,065 | 67,295 | 28,596 | 4,598 | 1,077 | 237 | 138,275 |
| Percentage .. .. | 1·01 | 25·36 | 48·67 | 20·69 | 3·33 | 0· 8 | 0·17 | .. |
| Year ended 31st March, 1915 | 2,339 | 28,642 | 37,061 | 11,933 | 2,420 | 488 | 89 | 82,989 |
| Percentage .. .. | 2·8 | 34·53 | 44·72 | 14·32 | 2·93 | 0·58 | 0·107 | .. |

*Table of Tow graded (Bales).*

| Grading-ports. | 1st Grade. | 2nd Grade. | 3rd Grade. | Condemned. | Total. |
|---|---|---|---|---|---|
| Auckland .. .. .. | 26 | 2,096 | 5,258 | 741 | 8,121 |
| Foxton .. .. .. | 3,450 | 5,329 | 1,434 | 39 | 10,252 |
| Wellington .. .. .. | 2,756 | 7,031 | 1,958 | 279 | 12,024 |
| Napier .. .. .. | 71 | 13 | 63 | .. | 147 |
| Blenheim .. .. .. | 701 | 795 | 25 | .. | 1,521 |
| Picton .. .. .. | 96 | 599 | 12 | .. | 707 |
| Lyttelton .. .. .. | 448 | 648 | .. | .. | 1,096 |
| Bluff .. .. .. | 243 | 1,406 | 2,355 | 213 | 4,217 |
| Dunedin .. .. .. | 16 | 559 | 200 | 29 | 804 |
| Totals for year ended 31st March, 1916 | 7,807 | 18,476 | 11,305 | 1,301 | 38,889 |
| Percentage .. .. | 20·06 | 47·3 | 29·5 | 3·3 | .. |
| Year ended 31st March, 1915 | 4,577 | 12,284 | 5,871 | 642 | 23,374 |
| Percentage .. .. | 19·50 | 52·64 | 25·11 | 2·75 | .. |

*Table of Stripper-slips graded (Bales).*

| —— | First Grade. | Second Grade. | Condemned. | Total. |
|---|---|---|---|---|
| Year ended 31st March, 1916 .. .. | 719 | 4,910 | 246 | 5,875 |
| Year ended 31st March, 1915 .. .. | 259 | 1,223 | .. | 1,482 |

# HORTICULTURE DIVISION.

## REPORT OF T. W. KIRK, DIRECTOR.

Wellington, 9th May, 1916.

The Secretary of Agriculture, Industries, and Commerce.

I HAVE pleasure in forwarding herewith the annual report of this Division for the year ended 31st March, 1916.

T. W. KIRK, Director.

### INTRODUCTION.

The work coming within the scope of this Division has been energetically carried out during the past year. The following are the principal activities dealt with by this branch of the Department:—

(1.) Instruction in fruit and vegetable production, inspection of orchards, vineyards, and gardens, and affording information as to the most up-to-date methods of controlling diseases and insect pests; also giving advice as to suitable varieties of fruit, vegetables, &c., to plant.
(2.) Demonstrations and instruction in the grading and packing of fruit and in pruning and spraying.
(3.) Testing new brands of spraying-compounds for the purpose of ascertaining their efficacy under local conditions.
(4.) Affording advice on the preserving of fruit and vegetables, both for commercial and domestic purposes.
(5.) Advising on tree-planting, giving information as to the most suitable varieties of trees to plant, both for shelter and timber purposes, in different localities.
(6.) Control of the horticultural stations at Te Kauwhata, Tauranga, and Arataki.
(7.) Inspection of all imported fruit, vegetables, plants, bulbs, &c., at the ports of Auckland, Wellington, Christchurch, Dunedin, and Bluff; also inspection and grading of all locally grown fruit, plants, vegetables, &c., intended for export.
(8.) Giving advice on the growing of grapes, both outdoor and under glass, the control of pests and diseases, and on the making of wines.
(9.) Affording information on beekeeping generally and production of honey for market.
(10.) Inspection of apiaries and instruction in up-to-date methods of controlling disease.
(11.) Grading of honey for export.

### THE FRUIT INDUSTRY.

Orchard planting is still making rapid development. The area actually planted in commercial orchards during the year was 3,588 acres, being an increase of 286 acres on the previous year's figures, and bringing the total acreage under fruit for the whole of the Dominion up to 45,687 acres.

The following figures show the area planted during the 1915 planting season in each Orchard Instructor's district:—

| | Acres. |
|---|---|
| Whangarei | 145 |
| North Auckland | 500 |
| South Auckland | 30 |
| Poverty Bay | 58 |
| Waikato and Bay of Plenty | 67 |
| Hawke's Bay | 150 |
| Taranaki | 5 |
| Manawatu and Wairarapa | 40 |
| Hutt | 23 |
| Nelson | 1,577 |
| Marlborough | 180 |
| North Canterbury (including Westland) | 170 |
| South Canterbury | 43 |
| Otago | 600 |
| Total | 3,588 |

The following figures, showing the total area under orchards throughout the Dominion, will give a good idea of the rapid strides that have been made in orchard planting during the last five years:—

| | Acres. |
|---|---|
| 1910 | 31,769 |
| 1911 | 35,839 |
| 1912 | 36,967 |
| 1913 | 38,797 |
| 1914 | 42,099 |
| 1915 | 45,687 |

The continued dry weather experienced last season seriously affected the crop of stone-fruit in most districts throughout the Dominion. In the Auckland District particularly peaches and plums were scarce, and as a consequence high prices were obtained for those lines which came on the market. The apple and pear crop generally was a fair average one. In the Canterbury District late frosts did a good deal of damage to the apple crop. In the Otago District, however, all classes of fruit bore heavy crops, apricots being exceptionally heavy.

The dry weather also seriously interfered in some districts with the planting of new orchards, it being impossible to prepare the land. In some cases newly planted trees did not make much headway, more particularly where thorough cultivation was not carried out.

Insect pests such as codlin-moth, red spider, &c., were more numerous than usual, necessitating extra spraying being carried out to keep them under control. With the exception of powdery mildew, the fungus diseases were a good deal less in evidence, the continued dry weather being against their development. In some localities in the North Island peaches and nectarines suffered to a great extent from attacks of ripe-rot, which caused considerable loss both to the grower and retailer.

The calls made on the Instructors for personal instruction in the many phases of the fruit-growing industry are rapidly increasing each year. This is very satisfactory, as it is a good indication that growers are evincing a keener desire to work on more up-to-date lines. At the same time, however, these requests are interfering considerably with the proper carrying-out of the orchard-inspection work. As mentioned in my last report, it is very necessary that Inspectors be appointed as soon as possible to assist the Instructors in the more thorough execution of their duties, as the districts are at present in most cases far too large.

### *Fruit-markets.*

The Inspectors report that a great improvement is noticeable in the class of fruit now offered to the public, and greater care and attention is being given to the grading and packing. Topping or facing is becoming less conspicuous, although there are a few unscrupulous growers who still persist in this dishonest practice.

The prices realized last season were, generally speaking, satisfactory to the growers.

### *Export of Fruit.*

Last year 62,164 cases of fruit, the bulk of which were apples, were exported to South America. This was a decrease as compared with the quantity shipped the previous year, due to the disorganization in shipping arrangements caused by the great war.

The following figures show the quantities of fruit exported from the Dominion during the last five years:—

| Export Season. | Cases. |
|---|---|
| 1910 ... ... ... ... ... | 5,647 |
| 1911 ... ... ... ... ... | 6,031 |
| 1912 ... ... ... ... ... | 14,869 |
| 1913 ... ... ... ... ... | 33,000 |
| 1914 ... ... ... ... ... | 67,964 |
| 1915 ... ... ... ... ... | 62,164 |

A great deal of the Orchard Instructors' time is taken up during the export season with the inspection of all fruit intended for export. They report that a steady improvement is taking place in the grading and packing and general get-up of the packages. One of the chief faults is loose packing. This was noticeable in several lines which were being transhipped at Wellington last season. Fruit which becomes loose in the cases is much more liable to bruising than that firmly packed. No doubt as time goes on this defect will entirely disappear.

### *Panama Pacific Exhibition.*

Several consignments of apples and pears were forwarded during the year to the above Exhibition. The majority of the fruit arrived in good condition, considering that it was carried in the ship's vegetable-chamber, no cool-storage accommodation being available. Winter Nelis pears carried splendidly and realized very good prices, some lines making as high as 15s. 7d. per crate. The Department's exhibit of honey attracted a great deal of attention.

### *Fruit for Exhibition in England.*

Sample cases of apples and pears were forwarded to the High Commissioner, London, at regular intervals during the year. These were for the purpose of affording a practical illustration of the class of fruit this Dominion is capable of producing and with a view of extending our trade. The apples arrived in good condition, but the pears in a number of instances opened up in bad order. As in the case of the Panama Exhibition fruit, these consignments were not carried under ideal conditions, the ship's vegetable-chamber being the best available. Very satisfactory prices were realized for the sound fruit, and a display of apples made at the Royal Horticultural Society's Show, Westminster, was awarded the Banksian Silver Medal, the judges commenting very favourably upon the quality of the fruit.

### *Pruning and Spraying Demonstrations.*

The usual practice of giving practical demonstrations in pruning and spraying was carried out during the winter months by the Orchard Instructors. This work is done in conjunction

with their orchard-inspection duties, &c. These demonstrations are most useful and highly popular, and the requests for such are increasing rapidly each year.

*Apple Grading and Packing Classes.*

These classes are now being established on a sound footing and are well patronized, a number of candidates having already qualified for the departmental certificate in grading and packing. This is an excellent means of demonstrating up-to-date methods in the grading and packing of fruit, two of the most important factors to be observed in building up an export trade.

*Co-operative Fruit-testing Plots.*

An additional six of these plots were planted during the year. This makes a total of sixty-five of these experimental areas (three of which have been abandoned) that have now been established in various localities throughout the Dominion. Besides demonstrating what varieties of fruit are suitable for different districts, these plots are also very useful for carrying out practical demonstrations in up-to-date methods of pruning, spraying, cultivation, &c.

*Central Packing-sheds and Cool Stores.*

As mentioned in my last report, the establishment of central packing-sheds is a matter of urgent necessity, particularly in those districts where large quantities of fruit are handled and exported.

Facilities for the cool storage of fruit are receiving more attention. A store with a capacity of 24,000 cases is now in course of erection at Motueka Wharf, and another capable of accommodating 10,000 cases has been erected at Nelson Port. Several similar cool stores have also been erected privately. There is no doubt that all the cool stores will be taxed to their utmost this year, owing to the export of fruit being interfered with through the disorganization of shipping arrangements caused by the war.

*Testing New Spraying-compounds.*

Testing new brands of spraying-compounds that have recently come on to the market in the Dominion has been continued during the past season. These tests are for the purpose of ascertaining the reliability of these specifics in the control of orchard pests and diseases. The Department is thus able to advise fruitgrowers what brands give the best results. It is usual to give any new specific a two-years trial before arriving at a definite conclusion regarding its efficiency or otherwise. Particulars of these tests, when complete, are published in the Department's *Journal* for the information of fruitgrowers and others.

*Orchard Pests and Diseases.*

As already mentioned, fungus diseases were not so prevalent as usual. This was due to the continued dry weather experienced right through the fruiting season. The weather was, however, favourable to the spread of insect pests such as codlin-moth, leaf roller caterpillar, red-mite, &c., and extra spraying had to be resorted to to keep these pests in check.

An unusual disease appeared in several districts during last season. Investigation showed that two fungus diseases were present on the affected trees. It is considered that the heavy rain which followed a very dry period resulted in impairing the vitality of the trees to such an extent that they were unable to stand much water, either on the surface or incorporated in the soil. Further investigation is being carried out.

A continued improvement is noticeable in the methods adopted for the control of orchard diseases. There are, however, still a number, chiefly small growers, who will not take the trouble to look after their trees, and as a consequence are a source of danger to those who keep their orchards clean. A number of persons who would not comply with the provisions of the Orchard and Garden Diseases Act were prosecuted during the year.

HORTICULTURAL STATIONS.

The control of the horticultural stations at Te Kauwhata, Arataki, and Tauranga was handed over to this Division as from the 1st September, 1915. A full report has been furnished on the general condition of these stations, together with recommendations as to their future development.

*Te Kauwhata Horticultural Station.*

The main work at this station during the past year has been the continuation of the preparation and planting-out of small fruit-farms for disposal to settlers. The wet and unseasonable spring militated greatly against all outdoor work.

There was no new work undertaken in the shape of experiments, &c., as it was necessary to reduce expenditure to a minimum owing to the war. Tests were carried out to determine the action of artificial manures on new land, and further trials were made with different varieties of potatoes.

During the season approximately 140 tons of wattle-bark were crushed and disposed of, and a further 270 tons stripped and harvested. There is every indication that local bark will be in good demand and prices consequently higher this year.

The wines manufactured at this station are now becoming well known, and the demand is increasing rapidly each year. The quantity sold last year was nearly twice as much as that disposed of in the previous year. A plant for the making of unfermented wine has been installed and a small quantity made.

*Arataki Horticultural Station.*

Work on this station has been considerably hampered for want of skilled labour, four of the young men having joined the Military Forces, two of them being valuable assistants.

The dry season experienced, following a phenomenally dry one the previous year, interfered to a great extent with general horticultural work. As a result of these conditions early apples, although of fine appearance, were very soft and practically worthless, going bad in a few days after picking. Owing to injury by severe frosts experienced the previous year a number of varieties of grapes did not bear fruit this season. Exceptionally heavy crops of fine fruit were, however, gathered from some of the vines that bore.

Several acres of maize were sown, and the crop proved very valuable for cattle-feed on account of the great scarcity of grass.

The exhibit sent from this station to the Hawke's Bay autumn show was the finest yet put up, and attracted a great deal of attention.

A number of improvements and extensions to buildings have been carried out during the year.

*Tauranga Horticultural Station.*

The retirement of the late Manager (Mr. Berridge), and the considerable delay that occurred before the new manager was finally appointed, interfered greatly with the carrying-out of experiments and the general working of this station. Good headway has, however, since been made, and several improvements are well in hand.

The fruit crop was a very light one, stone-fruits especially. The chief cause was no doubt the very dry seasons experienced in 1913 and 1914, when the trees carried exceptionally heavy crops.

Visitors have taken a great interest in the lucerne crop. Lucerne is a most valuable fodder plant for this light and porous land, as grasses become quite dried up before the summer is far advanced. Comparative tests with different varieties of sweet-potatoes are being carried out. A number of plants are being tried for green-manuring purposes.

## Hops.

The quantity of hops exported during the year was 4,425 cwt., valued at £17,742. The following figures show the quantity and value of hops exported from the Dominion during the last four years:—

| | Cwt. | Value. £ |
|---|---|---|
| Year ended 31st March, 1913 ... ... ... ... | 2,340 | 20,698 |
| ,, 1914 ... ... ... ... | 5,152 | 26,430 |
| ,, 1915 ... ... ... ... | 3,216 | 20,786 |
| ,, 1916 ... ... ... ... | 4,425 | 17,742 |

## Imported Fruit.

The following figures show the quantities of fresh fruit and fruit-products imported into the Dominion during the year ended 31st March, the previous year's figures being also quoted for comparison:—

| | 1915–16. | | 1914–15. | |
|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. |
| | | £ | | £ |
| Fruit, fresh, dutiable .. .. | 3,115,103 lb. | 33,334 | 3,013,597 lb. | 43,857 |
| ,, ,, free .. .. .. | 19,504,349 lb. | 120,066 | 19,224,047 lb. | 125,582 |
| ,, bottled and preserved .. | 178,297 doz. | 39,301 | 175,886 doz. | 35,192 |
| ,, dried .. .. .. | 13,227,036 lb. | 200,102 | 11,694,696 lb. | 167,287 |
| Lemon and orange peel in brine .. | 857,657 lb. | 5,638 | 511,720 lb. | 3,519 |
| Fruit-pulp and partially preserved fruit | 55,565 lb. | 950 | 31,557 lb. | 463 |
| Totals .. .. .. | .. | 399,391 | .. | 375,900 |

## Inspection of Imported Fruit, Plants, and Vegetables.

The inspection of all fruit, plants, &c., imported into the Dominion has been carefully carried out by the Fruit Inspectors at the gazetted ports of entry in the Dominion—viz., Auckland, Wellington, Christchurch, Dunedin, and Bluff.

The bulk of fruit shipments arrived in good order and condition. Several consignments of bananas opened up in an overheated condition, which caused considerable loss to the importers. A number of lines had to be fumigated at the various ports owing to being infected by scale, mealy bug, &c. It was also found necessary to condemn and destroy a few consignments of oranges owing to fruit-fly infection.

The following is a summary of all fruits, plants, &c., imported and inspected at the ports of entry in the Dominion during the year, the previous year's figures being also given for comparison:—

| Port of Entry. | Fruit. | | | | Plants, Vegetables, &c. | | | Grand Total of Packages. |
|---|---|---|---|---|---|---|---|---|
| | Total. | Destroyed. | Fumigated. | Reshipped. | Total. | Destroyed. | Fumigated. | |
| 1915–16. | Cases. | Cases. | Cases. | Cases. | Packages. | Packages. | Packages. | |
| Auckland .. | 311,483 | 840 | 5,735 | 170 | 14,071 | 6 | .. | 325,554 |
| Wellington .. | 137,522 | 662 | 2,252 | 474 | 21,026 | 9 | .. | 162,548 |
| Christchurch .. | 69,806 | 851 | 673 | 575 | 1,824 | 10 | .. | 71,630 |
| Dunedin .. | 55,932 | 515 | 628 | 249 | 5,085 | 28 | 1 | 61,017 |
| Bluff .. .. | 7,346 | 6 | 57 | 40 | 1,735 | .. | .. | 9,081 |
| 1914–15. | | | | | | | | |
| Auckland .. | 344,097 | 136 | 10,214 | 30 | 11,894 | 5 | 4 | 355,991 |
| Wellington .. | 159,336 | 427 | 5,014 | 587 | 13,565 | 6 | 25 | 172,901 |
| Christchurch .. | 63,858 | 105 | 1,625 | .. | 1,813 | 1 | .. | 65,671 |
| Dunedin .. | 69,952 | 29 | 1,621 | 35 | 3,648 | .. | 11 | 73,600 |
| Bluff .. .. | 7,160 | 30 | 242 | .. | 1,543 | .. | .. | 8,703 |

## Viticulture.

The Vine and Wine Instructor estimates the area under vineyards to be 454 acres, while there are 825 vinehouses throughout the Dominion. The yield of grapes grown under glass was 515,350 lb., representing a value of £25,767. Satisfactory prices were realized for good well-grown fruit.

The quantity of wine produced during the year is estimated at 95,000 gallons, which, at a conservative estimate of 2s. 6d. per gallon, represents a value of £11,875. The demand for good wholesome light wines is steadily increasing.

## The Beekeeping Industry.

This industry is increasing steadily each year. Unfortunately, owing to the very dry season again experienced, the honey crop in the Auckland, Canterbury, and Otago districts was a very light one. In the Southland District, however, where the climatic conditions were much more favourable, a phenomenal yield was secured—in fact, the crop was a record one, and the quantity of the honey first class. The prices ruling for honey are very satisfactory.

The demand for practical information on up-to-date methods of apiary management has increased considerably, and as a result a marked improvement is noticeable in the control of disease, &c. A further decrease in the number of box hives being used is also very apparent.

The number of apiaries visited and colonies inspected by each Apiary Instructor during the year are as follows:—

| | Apiaries. | Colonies. | | Apiaries. | Colonies. |
|---|---|---|---|---|---|
| Auckland Instructor ... | 280 | 5,737 | Christchurch Instructor | 371 | 4,437 |
| Wellington Instructor ... | 503 | 7,522 | Dunedin Instructor ... | 599 | 6,928 |

In connection with the above figures it must be taken into account that many of these apiaries had to be visited twice, and in some cases three times, in order to ascertain if the instructions left by the Instructors had been carried out.

A number of demonstrations and lectures on beekeeping generally have been given during the year by the Instructors in their respective districts. That keen interest is taken in these is evidenced by the large attendance on each occasion.

The supervision of the apiary at the Ruakura Farm of Instruction has been handed over to this Division. Experimental work at this apiary is well under way.

### *Export of Honey.*

The regulations governing the export of honey from the Dominion are now in force, and the industry is now being placed on a sound footing. No honey can be sent out of New Zealand until it has been graded and the provisions of the regulations otherwise complied with. This will ensure a uniform article being exported—a very necessary matter, especially where the building-up of a new industry is concerned.

The official statistics show that 2,390 cwt. of honey, valued at £6,067, was exported during the year under review. This is a slight decrease in quantity as compared with the previous year's figures, which is no doubt due to the continued dry weather experienced in many localities. The prices realized were very satisfactory. The bulk of the honey was graded by the Apiary Instructors before shipment.

The following are the quantities graded by each Instructor for the year ended 31st March, 1916: Auckland, 635 cwt.; Wellington, 1,062 cwt.; Christchurch, 400 cwt.; Dunedin, 193 cwt.

It was found necessary to reject a number of cases on account of rusty tins, bad cases, and poor condition of the honey. No doubt such defects as these will gradually disappear as the requirements of the regulations become more widely known.

## Publications.

The preparation and revising of bulletins on matters connected with the fruitgrowing industry, &c., and the writing of suitable articles for publication in the Department's *Journal* has taken up a good deal of time.

## Staff.

The resignations of two or three officers necessitated several transfers being carried out, which interfered to a great extent with the work of the Division, and a large amount of extra work fell on the other officers during the considerable period which elapsed before the vacancies were filled. I am pleased to be able to report that one and all have carried out their duties in a satisfactory manner.

# DAIRY DIVISION.

## REPORT OF D. CUDDIE, DIRECTOR.

Wellington, 19th May, 1916.

The Secretary of Agriculture, Industries, and Commerce.

I SUBMIT herewith the annual report of this Division for the year ended 31st March, 1916. In presenting this report I wish to acknowledge the assistance rendered to me throughout the year by Mr. W. M. Singleton, Assistant Director, in connection with the work of the Division.

D. CUDDIE,
Director of Dairy Division.

### THE SEASON.

Happily for the dairy industry in New Zealand many years have come and gone without bringing anything in the nature of general adverse climatic conditions. The year under review has in this respect been no exception to that rule—in fact, it has been one of the most profitable seasons ever experienced for the majority of farmers engaged in this important industry.

It is, however, to be recorded that the absence of sufficient rain in Canterbury and North Otago districts during the year materially affected the growth of feed for stock, consequently the production of milk was considerably reduced in these areas. Then, too, some of the districts on the east coast of the North Island were for a time similarly affected, although to a lesser extent. Nevertheless it can be said that practically all other districts where dairying is carried on extensively have been favoured with a remarkably good year for the production of milk. The Auckland, Taranaki, and Southland dairy-farmers may be mentioned as being the most fortunate of all in this connection.

On the other hand, this highly favourable season has not been without its disadvantages. For example, the average summer temperature was above normal during the busier months, and found the majority of farmers unprepared with facilities for the proper cooling of their milk and cream. Therefore these supplies reached the dairy factories in a condition unsuitable for the manufacture of cheese and butter of the best quality, the result being readily detected when the produce was graded prior to shipment. To make matters worse, the unavoidable delay in shipping large quantities of cheese, owing to the shortage of cargo-space due to the war, caused heavy deterioration in quality, as well as an excessive loss in weight by shrinkage.

Another drawback to the industry during the season has been the extreme difficulty of obtaining sufficient help on the farm, and also in many of the dairy factories, owing to such large numbers of experienced men joining the Expeditionary Forces. Both farms and factory-managers, although greatly inconvenienced on this account, have not complained, but the standard of quality in cheese and butter has to some extent been lowered thereby. Yet, even when allowance is made for these and other minor disadvantages, it can be affirmed that the year has been one of prosperity for all concerned.

### BUTTER AND CHEESE PRICES.

For the past year the prices obtained in the British markets for New Zealand butter and cheese reached the highest average value since the dairy industry began, the next highest average being that for the preceding year. If we take the High Commissioner's weekly table of London prices as the basis of calculation it is found that the average value of butter and cheese works out at 150s. and 88s. per hundredweight respectively, which represents an increase of 20 per cent. in the value of the former and an increase of 17·33 per cent. in the value of the latter when compared with the average prices received for the year 1914–15. Compared with the season 1913–14 the market rates for the period under report equal a rise of 29 per cent. for butter and 39·7 per cent. in the case of cheese.

These higher values are unquestionably due mainly to causes governed by the war. Supplies of butter to the English market from Denmark have been considerably less than usual owing to the higher prices offering for butter in Germany. The interference with shipping greatly reduced the quantity of butter reaching England from Siberia. The embargo placed upon the export of butter by the French Government, and the disastrous drought experienced in the Commonwealth of Australia were also operating in favour of higher prices for butter on the market of Great Britain. The prices for cheese were influenced principally by the large quantities required by the British War Office for the use of the Army, the remainder being insufficient to meet the demands of the ordinary trade.

It should be remembered, however, that the expenses incurred in the marketing of dairy-produce from New Zealand have increased since the outbreak of war, freight on butter being 50 per cent. and that of cheese 37½ per cent. above normal rates, with additional charges for marine insurance amounting to 33⅓ per cent., and a war risk of 21s. per cent.

## Exports.

Of the total quantity of butter and cheese exported during the year under review, by far the major portion was shipped direct to the United Kingdom. Forty-three vessels were engaged in carrying this produce to the Home markets.

The total quantity of butter exported for the year was 396,419 cwt., a decrease of 7,425 cwt., or 1·8 per cent., over that of the preceding period. This may be accounted for owing to the quantities held in cold stores throughout the Dominion at the end of the year being very much greater than on the same date of last year. The value of the butter, however (based on London prices), shows an increase of £449,118, owing to the very much higher prices ruling. Cheese exports show an increase of 90,141 cwt., or 11·9 per cent., over the figures for the previous year. Values were also considerably advanced for cheese, the increase (taking London prices) amounting to £887,567. Butter and cheese thus show a combined increase in value of £1,336,685.

The following tables show the classes and quantities of dairy-produce exported during the year from the various grading-ports and the London market values of the produce:—

### Exports for Year ended 31st March, 1916.

*Creamery Butter for United Kingdom.*

| Port. | Total Packages. | First Grade. | Second Grade. | Third Grade. |
|---|---|---|---|---|
| Auckland | 416,537 | 402,456 | 13,965 | 116 |
| New Plymouth | 118,629 | 117,238 | 1,372 | 19 |
| Wanganui | 8,397 | 7,825 | 572 | .. |
| Patea | 4,058 | 3,598 | 413 | 47 |
| Gisborne | 6,943 | 6,943 | .. | .. |
| Wellington | 126,195 | 123,096 | 3,050 | 49 |
| Lyttelton and Timaru | 9,396 | 9,361 | 35 | .. |
| Dunedin | 6,189 | 6,094 | 95 | .. |
| Totals | 696,344 | 676,611 | 19,502 | 231 |

*Whey Butter for United Kingdom.*

| Port. | Total Packages. | First Grade. | Second Grade. | Third Grade. |
|---|---|---|---|---|
| Auckland | 2,203 | 864 | 1,339 | .. |
| New Plymouth | 4,397 | 2,584 | 1,813 | .. |
| Wanganui | 61 | 31 | 30 | .. |
| Patea | 7,514 | 4,718 | 2,660 | 136 |
| Wellington | 2,329 | 456 | 1,873 | .. |
| Dunedin | 321 | 265 | 56 | .. |
| Totals | 16,825 | 8,918 | 7,771 | 136 |

*Dairy Butter for United Kingdom.*

| Port. | Total Packages. | First Grade. | Second Grade. | Third Grade. |
|---|---|---|---|---|
| New Plymouth | 1,164 | 877 | 281 | 6 |
| Wellington | 12 | 10 | 10 | 2 |
| Totals | 1,176 | 887 | 291 | 8 |

*Milled Butter for United Kingdom.*

| Port. | Total Packages. | First Grade. | Second Grade. | Third Grade. |
|---|---|---|---|---|
| Auckland | 716 | 230 | 439 | 47 |
| New Plymouth | 138 | 114 | 21 | 3 |
| Wanganui | 311 | 278 | 33 | .. |
| Wellington | 1,269 | 953 | 316 | .. |
| Dunedin | 776 | 756 | 20 | .. |
| Totals | 3,210 | 2,331 | 829 | 50 |

*Butter for Australia, South Africa, and South Sea Islands.*

| Port. | Total Packages. | First Grade. | Second Grade. | Third Grade. |
|---|---|---|---|---|
| Auckland .. .. .. .. | 35,650 | 35,646 | 4 | .. |
| New Plymouth .. .. .. | 8,216 | 8,216 | .. | |
| Gisborne .. .. .. .. | 200 | 200 | .. | .. |
| Wellington .. .. .. .. | 14,504 | 14,484 | 20 | .. |
| Lyttelton and Timaru .. .. .. | 460 | 460 | .. | .. |
| Dunedin .. .. .. .. | 268 | 268 | .. | .. |
| Totals .. .. .. .. | 59,298 | 58,274 | 24 | .. |

*Butter for Vancouver.*

| Port. | Total Packages. | First Grade. | Second Grade. | Third Grade. |
|---|---|---|---|---|
| Auckland .. .. .. .. | 15,595 | 15,595 | .. | .. |
| New Plymouth .. .. .. | 400 | 400 | .. | .. |
| Totals .. .. .. .. | 15,995 | 15,995 | .. | .. |

*Total Quantity of Butter exported from all Grading-ports*

| Port. | Creamery. | Whey. | Dairy. | Milled. | Totals. |
|---|---|---|---|---|---|
| | Packages. | Packages. | Packages. | Packages. | Packages. |
| Auckland .. .. | 467,772 | 2,203 | .. | 716 | 470,691 |
| New Plymouth .. .. | 127,245 | 4,397 | 1,164 | 138 | 132,944 |
| Wanganui .. .. | 8,397 | 61 | .. | 311 | 8,769 |
| Patea .. .. .. | 4,058 | 7,514 | .. | .. | 11,572 |
| Gisborne .. .. | 7,143 | .. | .. | .. | 7,143 |
| Wellington .. .. | 140,699 | 2,329 | 12 | 1,269 | 144,309 |
| Lyttelton and Timaru .. | 9,856 | .. | .. | .. | 9,856 |
| Dunedin .. .. | 6,457 | 321 | .. | 776 | 7,554 |
| Totals .. .. | 771,627 | 16,825 | 1,176 | 3,210 | 792,838 |

*Cheese for United Kingdom.*

| Port. | Total Packages. | First Grade. | Second Grade. | Third Grade. |
|---|---|---|---|---|
| Auckland .. .. .. .. | 54,363 | 49,882 | 4,481 | .. |
| New Plymouth .. .. .. | 107,344 | 100,673 | 6,604 | 65 |
| Wanganui .. .. .. .. | 10,379 | 8,724 | 1,655 | .. |
| Patea .. .. .. .. | 173,413 | 165,182 | 8,231 | .. |
| Gisborne .. .. .. .. | 525 | 525 | .. | .. |
| Wellington .. .. .. .. | 127,785 | 120,576 | 7,209 | .. |
| Lyttelton and Timaru .. .. .. | 9,667 | 9,134 | 533 | .. |
| Dunedin .. .. .. .. | 23,141 | 22,612 | 529 | .. |
| Bluff .. .. .. .. | 73,983 | 72,156 | 1,824 | 3 |
| Totals .. .. .. .. | 580,600 | 549,466 | 31,066 | 68 |

*Cheese for Australia, South Africa, South Sea Islands, &c.*

| Port. | Total Packages. | First Grade. | Second Grade. | Third Grade. |
|---|---|---|---|---|
| Auckland .. .. .. .. | 998 | 917 | 81 | .. |
| New Plymouth .. .. .. | 183 | 59 | 124 | .. |
| Wellington .. .. .. .. | 5,335 | 4,554 | 781 | .. |
| Lyttelton and Timaru .. .. .. | 58 | 58 | .. | .. |
| Dunedin .. .. .. .. | 3,334 | 3,291 | 43 | .. |
| Bluff .. .. .. .. | 1,302 | 1,282 | 20 | .. |
| Totals .. .. .. .. | 11,210 | 10,161 | 1,049 | .. |

*Total Quantity of Cheese exported from all Grading-ports.*

| Port. | Packages. |
|---|---|
| Auckland ... ... ... ... ... | 55,361 |
| New Plymouth ... ... ... ... | 107,527 |
| Wanganui .. .. ... ... ... | 10,379 |
| Patea ... ... ... ... .. | 173,413 |
| Gisborne ... ... ... ... ... | 525 |
| Wellington ... ... .. ... ... | 133,120 |
| Lyttelton and Timaru ... ... ... ... | 9,725 |
| Dunedin ... ... ... ... ... | 26,475 |
| Bluff ... ... ... ... ... | 75,285 |
| Total ... ... ... ... | 591,810 |

*Quantities and London-market Values of Butter and Cheese exported from New Zealand for the Year ended 31st March, 1916.*

| Countries exported to. | Butter. | | Cheese. | |
|---|---|---|---|---|
| | Weight. | Value. | Weight. | Value. |
| | Cwt. | £ | Cwt. | £ |
| United Kingdom .. .. .. | 358,772 | 2,690,790 | 829,429 | 3,649,487 |
| Other countries .. .. .. | 37,647 | 282,352 | 16,014 | 70,461 |
| Totals .. .. .. | 396,419 | 2,973,142 | 845,443 | 3,719,949 |

*Summary.*

| | Weight. Cwt. | Value. £ |
|---|---|---|
| Butter exported ... ... | 396,419 | 2,973,142 |
| Cheese exported ... ... | 845,443 | 3,719,949 |
| Total ... ... | 1,241,862 | 6,693,091 |

*Table showing Quantities of Butter exported from the Various Ports for the Years ended March, 1915, and March, 1916.*

| Port. | 1914–15. | 1915–16. | Increase. | Decrease. | Net Decrease. |
|---|---|---|---|---|---|
| | Packages. | Packages. | Packages. | Packages. | Packages. |
| Auckland .. .. | 421,239 | 470,691 | 49,452 | .. | .. |
| New Plymouth .. .. | 145,386 | 132,944 | .. | 12,442 | .. |
| Wanganui .. .. | 7,275 | 8,769 | 1,494 | .. | .. |
| Patea .. .. .. | 13,447 | 11,572 | .. | 1,875 | .. |
| Gisborne .. .. | 2,237 | 7,143 | 4,906 | .. | .. |
| Wellington .. .. | 162,482 | 144,309 | .. | 18,173 | .. |
| Lyttelton and Timaru .. | 35,345 | 9,856 | .. | 25,489 | .. |
| Dunedin .. .. | 20,278 | 7,554 | .. | 12,724 | .. |
| Totals .. .. | 807,689 | 792,838 | 55,852 | 70,703 | 14,851 |

*Table showing Quantities of Cheese exported from all Ports for the Years ended 31st March, 1915, and March, 1916.*

| Port. | 1914-15. | 1915–16. | Increase. | Decrease. | Net Increase. |
|---|---|---|---|---|---|
| | Packages. | Packages. | Packages. | Packages. | Packages. |
| Auckland .. .. | 17,105 | 55,361 | 38,256 | .. | .. |
| New Plymouth .. .. | 87,211 | 107,527 | 20,316 | .. | .. |
| Wanganui .. .. | 6,629 | 10,379 | 3,750 | .. | .. |
| Patea .. .. .. | 151,826 | 173,413 | 21,587 | .. | .. |
| Gisborne .. .. | 245 | 525 | 280 | .. | .. |
| Wellington .. .. | 145,436 | 133,120 | .. | 12,316 | .. |
| Lyttelton and Timaru .. | 12,227 | 9,725 | .. | 2,502 | .. |
| Dunedin .. .. | 28,567 | 26,475 | .. | 2,092 | .. |
| Bluff .. .. .. | 79,465 | 75,285 | .. | 4,180 | .. |
| Totals .. .. | 528,711 | 591,810 | 84,189 | 21,090 | 63,099 |

GRADING OF DAIRY-PRODUCE.

*Table showing Quantities and Score-percentages of Butter and Cheese graded throughout New Zealand during Year ended 31st March, 1916.*

| Grading-points. | Butter. | | Cheese. | |
|---|---|---|---|---|
| | Number of Boxes. | Score-percentages. | Number of Cases. | Score-percentages. |
| 76 | 10 | 0·0001 | 4 | 0·0008 |
| 77 | 8 | 0·0001 | 23 | 0·0036 |
| 77½ | 8 | 0·0001 | 9 | 0·0015 |
| 78 | 115 | 0·0014 | 71 | 0·0118 |
| 78½ | 131 | 0·0016 | 48 | 0·0079 |
| 79 | 60 | 0·0008 | 14 | 0·0023 |
| 80 | .. | .. | 53 | 0·0088 |
| 81 | 81 | 0·0010 | .. | .. |
| 81½ | 177 | 0·0020 | 121 | 0·0200 |
| 82 | 53 | 0·0006 | 146 | 0·0242 |
| 82½ | 78 | 0·0009 | 139 | 0·0230 |
| 83 | 226 | 0·0027 | 408 | 0·0676 |
| 83½ | 378 | 0·0044 | 197 | 0·0326 |
| 84 | 609 | 0·0072 | 1,143 | 0·1894 |
| 84½ | 826 | 0·0098 | 1,663 | 0·2756 |
| 85 | 4,234 | 0·0499 | 4,733 | 0·7844 |
| 85½ | 4,285 | 0·0506 | 7,456 | 1·2357 |
| 86 | 11,880 | 1·4020 | 13,908 | 2·3051 |
| 86½ | 3,072 | 0·3626 | 7,380 | 1·2231 |
| 87 | .. | .. | 244 | 0·0404 |
| 88 | 15,898 | 1·8762 | 28,269 | 4·6852 |
| 88½ | 22,310 | 2·6341 | 29,795 | 4·9381 |
| 89 | 51,490 | 6·0768 | 60,739 | 10·0667 |
| 89½ | 47,318 | 5·5843 | 81,000 | 13·4247 |
| 90 | 77,058 | 9·0942 | 104,326 | 17·2758 |
| 90½ | 67,598 | 7·9777 | 108,127 | 17·9207 |
| 91 | 87,715 | 10·3519 | 66,101 | 10·9553 |
| 91½ | 87,893 | 10·3729 | 36,271 | 6·0114 |
| 92 | 99,488 | 11·7413 | 23,950 | 3·9694 |
| 92½ | 61,606 | 7·2706 | 15,946 | 2·6428 |
| 93 | 52,181 | 6·1583 | 7,382 | 1·2235 |
| 93½ | 51,838 | 6·1178 | 2,016 | 0·3341 |
| 94 | 45,859 | 5·4122 | 1,304 | 0·2161 |
| 94½ | 17,714 | 2·0906 | 279 | 0·0462 |
| 95 | 24,828 | 2·6942 | 100 | 0·0165 |
| 95½ | 7,469 | 0·8815 | .. | .. |
| 96 | 2,836 | 0·3369 | .. | .. |

THE BUTTER INDUSTRY.

*Creamery Butter.*

The reputation which New Zealand holds as a country where creamery butter of the best quality is made has been maintained for many years. This good name has been built up as the result of strenuous effort on the part of a section of the producers, backed by practical assistance rendered by the State. It is safe to say that so far as the establishment of a uniform system of manufacture goes, the New Zealand method is not excelled by any and equalled by few countries where the art of buttermaking is a specialized business.

The experience of the past year has again demonstrated the principle of the success attained when what is known as the "whole-milk" system is practised. Those dairy companies whose supply of raw material consists mainly in the delivery of milk either to the central creamery (butter-factory) or to the skimming-stations have almost without exception turned out a product which would bear comparison with the best article made in any country that might be named—truly a superfine product, which if sold on its merits, with the advantage of an all-the-year-round supply, would hold its own in competition with any other. Unfortunately the production of this class of butter is steadily but surely declining in New Zealand. It is almost superfluous to ask the reason why, for the answer is obvious to all who are well acquainted with the change that has and is still taking place from the whole-milk system of delivery to that of separating the cream on the farm. The year now closed has amplified in no mistaken manner the danger of accepting cream separated on the farms and held there for two or more days under conditions which, to say the least, are so harmful that no perishable foodstuff could pass through the process

without being more or less spoiled. That much good cream is received from many farms is not denied, and to the owners all credit is due. If the same remark could be applied to other farms the ground for criticism of this sort would be non-existent. But the age of the cream in many cases is not its worst fault. The real trouble lies much deeper than that. Improper cleansing of the utensils, including mechanical milkers, separators, and the premises where the cream awaits despatch to the creamery is the major cause of inferior butter. Large quantities of cream tainted in flavour and unfit for the production of first-class butter thus reach the factories, and these supplies are not rejected, on account of the competition existing between dairy companies and dairy-factory proprietors. Only when a delivery may have reached the stage of decomposition is it rejected.

To remedy the general defects in the cream accepted an ingenious process of treatment is resorted to at the factory—namely, the neutralization of the acidity by means of an alkaline agent, which is made effective by the application of a high pasteurizing temperature. This treatment is only a partial success with much of the cream, and the result is a butter low in grade, which cannot be expected to stave off the margarine danger of replacement. One district in particular has worked up an unenviable distinction for its butter as the direct influence of the method in vogue—namely, the wrong method of home separation. To prevent misunderstanding let it be said that there is a right method of home separation, which is practised on many farms without injury to the product. There is no getting away from the fact that the wrong method of handling the cream on the farms is seriously lowering the quality of our butter, and, further, it has been very marked in certain districts during the year.

The position in regard to the butter industry of the Dominion at present is simply this: the quality in some districts is gradually going back—it has gone back considerably during the past year—and thus the industry as a whole is being affected by a reduction of the general average. Unless some united action is taken whereby the cream separated on the farms is handled with more care and sent forward to the creameries at shorter intervals, and the element of unhealthy competition minimized, it means a further drop in the quality, followed by a reduction in the market value of the New Zealand butter.

Space will not permit a detailed reference to the manner in which the threatened loss may be averted, but a brief statement on the question is given in the section of this report dealing with the need of instruction at dairy farms.

### *Whey Butter.*

It is now the custom at cheese-factories to provide machinery for skimming the whey immediately after the liquid leaves the cheese-vats, in order to save the small percentage of butter-fat left in the liquid. Some of the dairy companies elect to put in whey-separating appliances only, and to dispose of the whey cream to one of the butter-factories at a price agreed upon. Others, again, prefer to provide a complete buttermaking plant for this purpose, including the essential refrigerating machinery for regulating the temperature of the cream and water and for keeping the butter cool after it is made.

Where every care is taken in handling the whey in a thoroughly clean and sanitary condition, and an approved process of manufacture is closely followed out, a really good article has been made, and one which may always be expected to command a ready sale at good prices. Owing, however, to the careless manner in which this branch of cheese-factory work has been carried out by some of the manufacturers, a product of inferior quality and of low market value has been the result. A rather common fault has been the neglect to keep all the appliances—more especially the whey-tanks and piping for the conveyance of the whey—in a scrupulously clean condition. In fact, the Instructors of the Division have, in the worst cases of the kind, found it necessary to call upon the dairy companies to thoroughly cleanse all the appliances used for this purpose under threat of stopping the work altogether, which course never failed to have the desired effect.

During the year 16,825 boxes of whey butter were graded for export, making a total of 8,412 cwt. The decision arrived at by the Department to insist upon all such butter being branded with the words "whey butter" was carried into effect during the year. This was found necessary in order to protect the interests of other classes of butter made in New Zealand. It does not, however, appear that any difficulty has been experienced in disposing of the product on account of this new brand, and there has been practically no opposition to its introduction by any of the companies concerned.

### *Butter for Military Camps and Transports.*

One of the additional duties allotted to the Division towards the end of the year was the purchase of supplies of butter for the military camps and transports. A quantity considered sufficient to fill the requirements of the Defence Department from the expiry of the then-existing contracts up to the end of August next was secured. The prices paid were equal to f.o.b. export value, and, with the exception of two consignments, all the butter was bought direct from the dairy companies. Only first-grade butter of uniform quality was accepted. Since these purchases were made there has been an advance in the market price of butter.

It may be mentioned here that dairy-produce used at the military camps is inspected from time to time by an officer of the Dairy Division, who is qualified to pass judgment on the class of produce supplied. This arrangement was made by request of the Defence authorities as a further protection against the delivery of inferior produce.

## The Cheese Industry.

### *General Position.*

As the result of the steady and increasing demand for additional supplies of cheddar cheese on the British markets, together with the highly remunerative prices procurable, a further extension of this branch of the dairy industry in the Dominion has to be recorded. This development is in no sense due to the unprofitable nature of the kindred butter industry, for the manufacture of first-class butter has of late been bringing in higher returns than ever before. It is due entirely to the phenomenally high values obtainable for cheese as compared even with the good prices returnable for butter; and just as long as dairy companies engaged in the production of cheese can pay out to their milk-suppliers a price for butter-fat which is from 2d. to 3d. per pound above that paid to those who dispose of their supplies for the making of butter, this rapid expansion of the cheese industry may be expected to continue. This alone is the reason why so many of the dairy companies during the last five or six years have turned their attention to the making of cheese instead of butter. Actuated by the same influence, the settlers in new districts where the nature of the country is favourable have preferred to make cheese. The registration of fifty-eight new cheese-factories has been effected for the year. Of this number, thirty have been provided by dairy companies formerly producing butter, and the remainder have been made up by the organization of new dairy companies especially for cheese-manufacture, also from the enterprise of proprietary owners. This brings the total number of cheese-factories which have been in actual operation during the year to 379. The Auckland Province heads the list with the establishment of twenty-seven new cheese-factories within the last twelve months.

With few exceptions the buildings and equipment provided for the increased business of cheesemaking has been entirely satisfactory, and only in a few instances has the registration of the premises had to be withheld pending alterations or additions required to comply with the regulations governing this factor of the industry. Many of the buildings erected have been of concrete or brick in place of the wooden structure which was so common a few years ago, the settlers now recognizing the wisdom of providing factories on which the minimum of depreciation has to be allowed for, and also the additional advantage of making it easier to maintain buildings of this class in good sanitary condition.

Taking it altogether the cheese industry of New Zealand is established on a sound commercial basis. The profits now being made are most encouraging to those concerned, and the outlook for the future can at the least be accepted as hopeful. At the moment there is only one serious menace to future success, and that is the falling-off in quality of this product, a matter which is dealt with under the heading that follows.

### *Quality of Cheese.*

Of the total quantity of cheese exported for the past year a large percentage was found to be of good quality, sound in flavour, and showing first-class workmanship in its manufacture. But compared with the product of the preceding year it has to be admitted, however reluctantly, that the average quality of our cheese for the past season has considerably declined. The main fault has been under the heading of flavour. Ill-flavoured cheese were altogether too numerous in many consignments, more especially in the product made in the North Island. Nothing would be gained by naming any particular province as being on the lowest rung of the ladder in this respect, for many cheese defective in flavour were produced in all districts where the industry has been established. Even the South Island cheese districts have not been altogether free from depreciation in quality as compared with the previous season.

Another detrimental feature noticed in many of the cheese shipments was that of irregularity in body and texture, a fault which is almost as damaging to the sale of the product as that of an objectionable flavour. What is known as openness in the body of cheese was extremely prevalent in the product of a large number of the factories, and reached its worst stage during the height of the season, when the largest quantity was being made. Weakness in body, a blemish which was almost unknown in New Zealand cheese when the industry was of smaller dimensions, made its appearance in quite a number of the consignments from certain factories. One would like to believe that in all cases this lack of the necessary firmness was not due to an attempt to obtain a higher yield on the part of the maker by retaining a larger amount of moisture in the cheese, but the evidence available does not permit the acceptance of this view.

All the faults enumerated above, and many others of minor importance, have been brought under the notice of those directly interested through the usual channel of the grade-notes representing the individual consignments. That, together with the prompt assistance given by the Instructors as far as time and the number of men available would permit, has been the means of checking the downward tendency in many cases, and also in materially raising the standard of quality in many others.

As would naturally be expected, the opinion formed regarding the quality of the season's cheese by officers of the Division at the time of grading bears a close relation to the views expressed by the Inspector of New Zealand Dairy-produce in London in his weekly reports of all the produce he has examined.

In offering some criticism on the season's make of cheese it has been borne in mind that the exceptionally high atmospheric temperatures prevailing from December to March, the delay in shipping, and the shortage of labour, both on the farms and in the dairy factories, must be allowed for.

*Cool Storage of Cheese.*

Why cool storage has not been used more extensively in New Zealand for cheese awaiting shipment is difficult of explanation. It is sufficient to say that the reason does not lie in the want of advocates, for it has been persistently recommended year after year by the Dairy Division and others. However, "we are not as those without hope," because the cooling of cheese under modern conditions has already been established at the Port of Auckland for a number of years, and has recently been altered and brought up to date there. At New Plymouth, where large quantities of cheese are handled, something has also been done, although here the requirements were not fulfilled at the time most needed during the past season. On representations being made from the Division this omission was rectified in some measure, but only after large quantities of cheese had left the stores in a heated condition. The position at Patea, where all the cheese from the South Taranaki district is graded, was also unsatisfactory as regards cool storage. The accumulation of cheese caused by the shortage of shipping-space, and the absence of sufficient storage space for the heavy daily arrival of consignments, made it impossible to regulate the temperature of the cheese-chambers as desired. The West Coast Refrigerating Company at Patea, however, fully recognized the importance of providing better facilities for dealing with the cheese, and a start was made some time ago to increase the accommodation; but much delay occurred in obtaining delivery of the steel required in the construction of the building, which, it is now hoped, will be ready for next season.

Wellington, being the central shipping-port for cheese, and having as yet no cool store for this product, the past season here has been one of great difficulty. To relieve the congestion at other ports huge quantities of cheese had to be held for many weeks in the ordinary wharf-sheds of the Harbour Board. The bulk of cheese transhipments during the months of December to March had been overheated prior to arrival, and remained at a temperature of 70° and over until placed on board the Home steamers. The butter-fat in many thousands of cheese was found to be in a semi-liquid condition, and in some cases leaking from the produce. Both the cheese and packages were stained or discoloured and presented a very bad appearance, and the loss sustained must have been enormous. In many cases the shipping companies refused to load the cheese unless they were furnished with letters of indemnity against claims for the damaged cargoes.

The cheese graded at Wellington was practically all dealt with in the Harbour Board's cheese-store. Little of this was overheated prior to arrival, consequently it suffered less in appearance, but the temperature was little below that of the cheese in the ordinary wharf-sheds. Fortunately the Harbour Board has definitely decided to enlarge the cheese-store, and has also placed an order for the necessary refrigerating plant to control the temperature of the building. When completed the extension of the store will provide a capacity for cooling about 300 tons daily and accommodation for approximately 40,000 crates of cheese.

The damage to cheese in the North Island caused by overheating has been very serious indeed: the bad flavours were greatly accentuated, and the body became rough and mealy or more or less spoiled.

The dairy companies of Southland are to be congratulated on having made arrangements with the Bluff Harbour Board to provide a suitable cool store for cheese in time for the season's output. This store has been found to answer the purpose admirably, and proved a great boon to the industry in that part of the Dominion.

*Transhipment of Cheese.*

In order to ensure some regularity of despatch in shipments of cheese to the English market it is necessary to collect transhipments in Wellington from New Plymouth and Patea, and occasionally from Dunedin and the Bluff. These transhipments are unfortunately always carried as ordinary cargo in the coastal steamers, no provision whatever being made to regulate the temperature in the ships' holds; consequently the cheese brought to Wellington, more especially the transhipments from New Plymouth and Patea, frequently arrive in a most unsatisfactory condition. In the warm weather the cheese are much overheated, the rinds becoming greasy and soft, thereby creating serious damage to the produce, and any previous cooling which the cheese may have undergone before loading on the coastal steamers is rendered almost valueless, to say nothing of the additional loss incurred by dairy companies in meeting the prior charge for cool storage.

The number of damaged transhipments of cheese which have arrived in Wellington in the course of the past season was greatly in excess of that of the previous year, this being brought about by the hot weather experienced from December to March. Until such time as the dairy companies take up this important question with the shipping companies concerned, and until arrangements are made for the carriage of the cheese at lower temperatures, the produce cannot be delivered to the Home steamers in good order and condition. It requires no superior wisdom to enable one to see the harmful effect which must take place to the cheese under the present obsolete system. Nor indeed is it reasonable to expect that the reputation of New Zealand as a cheese-producing country will not suffer loss on this account.

Our system of transportation in regard to cheese between the New Zealand and English ports is conducted in the most approved manner, the temperature of the cheese-chambers being regulated at from 45° to 50°. Surely, then, it is incumbent upon those engaged in the industry to provide similar facilities for transhipments on the coast of New Zealand.

*Cheese for the Imperial Government.*

After negotiations regarding price, &c., extending over two months the New Zealand Government was requested near the end of October by the Imperial authorities to requisition for Army purposes 15,000 tons of cheese from the producers, at 7¼d. f.o.b., to be delivered in monthly quantities from October to the end of May.

It fell to the Dairy Division to apportion the total quantity of cheese which each dairy company and cheese-factory proprietor would have to supply in order to fill this large order. Acting with the authority given under the War Regulations Amendment Act (No. 2), requisitions bearing the name of the Hon. Minister of Defence were posted to all cheese-factory owners, stating the total quantity of cheese to be supplied, together with the terms of purchase. A covering letter from the Prime Minister dealing with the same matter was enclosed with the form of requisition. Subsequently all dairy companies were advised from month to month as to the quotas of cheese which must be sent forward for shipment on behalf of the Imperial Government, first-grade cheese only being accepted.

The Dairy Division was responsible for the quantities of cheese being supplied in accordance with the requisitions referred to, the grading of the cheese, and the checking of the weights of each company, all other matters pertaining to the shipping of the produce and payment for same being attended to by the Officer in Charge of the Imperial Supply Branch. Up to the end of March 9,881 tons of this cheese had been shipped, and a further quantity of 2,061 tons were in store awaiting shipment.

The dairy companies as a rule readily agreed with the terms of the arrangement, and where delays occurred in despatching the full amount requested the shortage has been or is now being made up. Some adjusting of the quantities had to be made in the case of those factories where the output of cheese showed a falling-off owing to drought or other causes, but, apart from these essential adjustments, all producers of cheese intended for export were asked to furnish a *pro rata* share of the season's cheese-production.

This transaction being on such a large scale created a great deal of extra work for the various Dairy-produce Graders at the respective ports where the cheese was received, but with the willing assistance of the officers of the Division nothing more than minor difficulties arose, which were easily overcome. The correspondence carried on between this office and the dairy companies in connection with the purchase of the cheese assumed large dimensions and took up a great deal of time, as many of the dairy people did not appear to read the instructions laid down for their guidance. Little friction, however, was created, and it can be said that all the arrangements made have been carried through with a minimum of delay.

*Supply of Rennet.*

The possibility of a shortage in the supply of rennet for cheesemaking is a question of the utmost importance and one calling for immediate attention, for if such a thing should happen it would certainly mean a stop in the manufacture of cheese, with attendant serious consequences.

As the usual supplies have been drawn mainly from Denmark and Sweden, and in small quantity from England, it was considered that the ramifications of the war might easily prevent supplies reaching New Zealand. The position was considered early in the season, and with a view of drawing attention to the subject an article was published in the Department's *Journal* pointing out the necessity for taking some action to guard against a possible shortage, special reference being made to the question of saving the raw material to ensure a source of supply. Prior to then a communication had been sent to the Inspector of New Zealand Dairy-produce in London, asking him to obtain as much information as possible regarding the preparation of rennet, with a further request that inquiries be made regarding the chances of securing an experienced man to undertake the work in the event of such assistance being required. The reply, however, to both these questions was rather indefinite, owing to the difficulty of obtaining such information.

Later on we were informed that an ample supply of rennet could be expected to arrive in New Zealand for next season from the firms already engaged in the trade. It turns out, however, that there is now some risk of the orders not being filled because of the firms in question being unable to obtain the usual supply of vells for that purpose, owing to quantities being held up in Petrograd because of the war. It is even now doubtful whether these supplies will be released or not, although we are informed that the High Commissioner in London is doing all he can in that direction.

In view of the uncertainty of the position it has been decided to take definite action almost immediately for the purpose of discussing this question and making some preparation for a supply in New Zealand.

*Pasteurization of Milk for Cheesemaking.*

The extension of the principle of pasteurization as applied to the milk for cheesemaking has engaged the attention of a number of dairy companies during the past season, and it would seem that the innovation is likely to extend in the near future. The number of pasteurizing plants in use amounts to fifty, the majority being in the Taranaki District, and a further three are now being installed.

With a few exceptions this change in the system has proved thoroughly successful, more especially in regard to the improvement in the flavour of the cheese made from pasteurized milk. To give one example: a factory which last year had the low average grade of 86·684 points, and was second-lowest in a group of fifty-one factories, succeeded in turning out this year cheese

with an average grade of 91·564 points, and reached fifth-highest place in order of merit in the same group. Other instances could be quoted to show the benefit of the system.

At the beginning of the season two of the Instructors carried out some preliminary experiments in the treatment of milk by this process, which enabled them to pass on the information thus obtained to the factory-managers who were starting the new work. When this system was first introduced considerable difficulty was experienced in obtaining as close a body in the cheese as was desired, but the experience of the Instructors has helped in a large measure to overcome this disadvantage, and many cheese clean in flavour and close in body were made at the factories where pasteurization of the milk has been adopted.

Dairy companies generally are much interested in what has already been accomplished, and many of them have shown their confidence in the process by placing orders for the necessary machinery, which is to be installed before the opening of another season. The new method is particularly applicable in those districts where the flavour of the milk is causing anxiety at the factories, for it has been clearly demonstrated that the proper application of heat to the milk and the rapid cooling of same involved in the process effectually drives off some of the objectionable flavours found in the raw material, thereby producing a cheese which will retain its keeping-quality for a longer time.

There need now be no hesitation in recommending the principle of pasteurization as relating to the manufacture of cheese, and where faults in the flavour of the milk are common dairy companies would be well advised to procure the necessary appliances and proceed with the work without delay.

## Casein.

The preparation of casein in New Zealand, which was commenced on a small scale some years ago, has not yet shown much development.

Prior to the outbreak of the war practically the whole of the casein prepared in New Zealand was marketed in Germany. With the close of this market it appeared as if the preparation of casein in the Dominion would have to be discontinued for a time, but fortunately it was found that sales could be effected in England, and all the casein exported during the past year has been sent to that market, where good prices have been realized.

The decrease in the supply of casein from France, together with the prohibition of exports from Denmark, are factors which made higher prices available in England, but apart from these influences there has been a remarkable increase in the demand owing to this product being used for technical purposes. It is claimed that this demand is steadily increasing, and that the present remunerative prices are likely to continue. There were altogether 162 tons of this product exported during the year, and the quality has been reported by the users as being excellent and in every way suitable for the requirements of the trade.

In view of the favourable outlook for casein, there is likely to be a considerable increase in the production for next year, and some attention is now being given to the extraction of casein from buttermilk The Instructor of the Division who attends to casein work has carried out some experiments in connection with buttermilk, and it was found that the quality of the casein saved was very satisfactory indeed.

The New Zealand Casein Company, Wanganui, is the only concern at present devoting attention to this minor industry, but provision has been made for handling large quantities of casein at its central drying-station. The cost of erecting the necessary buildings and providing the plant for precipitating the green curd being somewhat inexpensive, a number of dairy companies have been induced to enter into an agreement for the disposal of the green casein, which is forwarded by rail to the drying-station.

While it is not expected that the casein industry will ever assume large dimensions in New Zealand, there is reason to believe it has now reached a stage where it will continue to be profitable, and thus ensure support from those dairy-farmers who find it convenient to dispose of their skim-milk and buttermilk for the preparation of casein.

## Shipment of Dairy-produce.

Owing to the reduced number of ships trading to New Zealand and available for carrying dairy-produce to the Home markets much inconvenience has been caused to shippers. This shortage, of course, was due very largely to the war. From the very beginning of the shipping season considerable uncertainty as to cargo-space created much anxiety amongst the dairy companies and factory-proprietors. It subsequently turned out, however, that the butter offering for shipment was accepted with little or no restriction. This export was therefore continued with almost the same regularity as in normal times. On the other hand, there was considerable delay in regard to the shipment of cheese. As the season advanced stocks began to accumulate at the different grading-ports, more particularly in Wellington, where at one time there were awaiting shipment over 45,000 crates.

The stores used for holding the cheese at the various ports became much congested, and in Taranaki it was found necessary to advise the dairy companies not to forward any more cheese until the accommodation had been reduced. Even in these stores a quantity of the cheese remained for over two months, and as the congestion prevented the proper circulation of cold air where it was available the cheese suffered considerably. In some cases much discoloration took place.

Then, again, at those factories where the cheese had to be held as instructed, many of the curing-rooms are of the old-fashioned type, no provision whatever being made for regulating the temperature. When the hot weather arrived the temperature in some instances rose to

85° F., with disastrous results to the cheese. At those factories only in which provision had been made for holding the cheese in better order was the loss sustained brought down to a minimum.

These conditions of congestion obtained right through the season. The stock of cheese held in New Zealand at the time of writing is still large, and it is expected that it will not be cleared until well on towards the beginning of next season.

While many of the dairy companies were forced to incur increased expenditure in addition to the losses incidental to holding the cheese for a longer time than usual, the majority of them accepted the position as being unavoidable and made the best arrangements they could under the circumstances. It is believed that everything was done by those responsible to expedite the despatch of the cheese with as little delay as possible, no blame being attachable to any one, and the shipping companies concerned did their best to meet the situation with the ships available.

## Dairy Instruction.

The number of officers constantly engaged in giving instruction to butter and cheese manufacturers was ten, and in addition four others devoted a portion of their time to this duty. The total aggregate number of days spent at cheese and butter factories by these officers amounted to 957. Apart from the instruction afforded on such occasions, the officers paid a total of 1,098 visits to the factories in the course of the year.

The efforts made by the men engaged in this work were almost invariably successful, although in some cases it was found that only temporary improvement was effected in the produce, due to the non-compliance with some essential part of the process recommended by the Instructor. This was usually followed up by a return visit to the factory and a further demonstration of the manner in which the work should be conducted. As each Instructor had his own group of factories to supervise, it was found possible to keep in close touch with the work all through the season, except in the more isolated districts, which also received some attention. The advice of the Instructors was frequently sought by the directors of dairy companies in regard to almost every phase of the work, and in many cases board meetings were attended for that purpose.

The formation of dairy companies and the building and equipment of factories also engaged the attention of the Instructors where required, and was much appreciated by those settlers who were concerned in establishing dairy factories in their districts.

## Urgent Need for Instruction at Dairy Farms.

The one great weakness in the dairy industry of New Zealand is and always has been the improper treatment which the milk receives at the hands of a number of the producers, and since the beginning of the home-separation system the same can be said in regard to cream. The introduction of milking-machines, which are yearly increasing in number, has made this difficulty much more acute. To put the matter briefly, the lack of cleanliness in the dairy premises and dairy utensils and appliances on the farms is the direct cause of much inferior cheese and butter being made. This hindrance has now become not only a serious bar to progress, but a real menace to the welfare of factory dairying in the Dominion.

In the course of their duties during the year the Instructors have noticed an abnormal amount of inferior milk and cream being delivered to the factories. On many occasions the farms from whence these supplies came were visited for the purpose of locating the cause of inferiority, when it was almost invariably found that either the ordinary dairy utensils, cream-separators, or milking-machines had not been kept thoroughly clean. In many instances the conditions were so bad as to be almost unbelievable unless they had actually been seen. In such cases the owners were, of course, immediately called upon to cleanse the appliances or abandon their use as directed by the Instructors, and as a general rule this was done with alacrity by the farmers after the faults had been pointed out to them in a reasonable manner. Owing, however, to the small number of Instructors in comparison to the number of farmers in need of advice of this kind, only a small proportion of the work requiring immediate attention could be undertaken. It will therefore be seen that a very grave danger threatens the industry, which if allowed to go on without further attempt at reform must inevitably result in an ultimate loss both to the producers and to the country as a whole. Only those who are in intimate touch with dairying are aware of the present unsatisfactory state of affairs in this respect. It has not yet been fully realized by many of the farmers themselves, and the unusually high prices being obtained for our butter and cheese at present are misleading, in that complaints about the quality of the produce are always few when the market demand is keen.

The main reason for the inferiority in the milk and cream supplies to factories is undoubtedly due to the lack of knowledge on the part of the farmers who are responsible. They require practical instruction from men who will impart the necessary information in an acceptable manner. Such instruction to be effective must be given on the farm, and this is the remedy recommended for the somewhat alarming drop in the quality of our butter and cheese.

Questions may be asked as to the cost of such a programme and where the money is to come from. The answer is that the dairy industry is now sufficiently established to bear the whole of the expense incurred by the Government in carrying on the excellent system of grading butter and cheese for export. Dairy companies and factory-proprietors might well be asked to pay a charge of this work. The revenue thus saved would provide a sum of money equivalent to the necessary expenditure required for the employment of a sufficient number of Instructors to cope

with the need for the assistance on the farms indicated above. In the opinion of the writer, the transfer of the expenditure as suggested would prove to be a most profitable investment both for the Government and the dairy-farmers.

In the past our efforts have been mainly directed to the instruction of the factory-managers. This has been successful, but it is now being nullified to some extent by the absence of instruction on the farm. The means of supplying it are at hand, and should be used to save the industry from loss before it be too late. In no other way can it be expected to overcome the weakness of impurities in the supply of much of the milk and cream delivered to the dairy factories throughout the Dominion.

### Milk and Cream Testing.

The testing of milk and cream samples has received a great deal of attention from officers of the Division during the past season in the factories and also in the testing-room connected with the Dairy-produce Grader's office in Wellington.

Many applications from dairy companies have been received for the assistance of the Instructors in connection with the testing of the factory samples, in order to alleviate discontent which has arisen on the part of some of the suppliers, who have expressed dissatisfaction with the tests allowed to them by the factory-manager, the dairy-farmers concerned having stated a desire for an official and independent test. On receipt of such applications immediate attention was given to this work, the officer attending at the factory on the usual testing-day, when all those who wished were invited to attend. On such occasions the whole process of the Babcock method was thoroughly explained to those present, and when desired they were also given the opportunity of reading the percentages of butter-fat in the samples.

In other cases the Division was asked by the directors of dairy companies to make a report on the efficiency or otherwise of the testing as carried out by their managers. The procedure then was for the officer to carefully note how the samples of milk or cream were dealt with, and to check the reading after the manager had given his decision. A report was then submitted to the board on the work done, and included a criticism of any weakness which may have been detected. With a few exceptions, however, it was found that the factory-managers were thoroughly conversant with the testing system, and that they carried out this duty with care and exactness. A great deal of misunderstanding was thus cleared up between the dairy-factory directors, milk and cream suppliers, and the men in charge of the factories.

At the Wellington testing-station many samples were put through the Babcock machine, and the results reported to the senders. The majority of the samples were, of course, sent in for the purpose of checking the factory tests, and in this way the work of the Division appeared to give general satisfaction.

On several occasions the men engaged in dairy-factory work came to Wellington for the purpose of receiving some lessons on the testing of milk and cream, and all evidenced a keen interest in the tuition afforded by our officers.

### Herd-testing.

It is evident that the dairy-farmers of New Zealand have not yet in large numbers realized the immense benefits to be derived from the systematic testing of the individual cows in their herds. At the same time it is true that a good many have taken advantage of the co-operative associations which have been organized for this purpose. Why many more have not accepted the opportunity of following their example is somewhat difficult to understand. The reason would seem to be that the economic principle underlying this field of progress has not been fully appreciated by those who hold aloof from the movement. The number of active herd-testing associations for the year, however, shows an increase, and the extended effort has been most noticeable in the Province of Taranaki. Associations were formed at Okaiawa, Lowgarth, Tikorangi, Bell Block, Flankley Road, and Warea, and were continued throughout the season with fair support from the members.

One of the most successful organizations for herd-testing is that established by the Kaupokonui Dairy Company, in Taranaki. It has now been in operation for four years, and is still being carried on with much vigour amongst the farmers in that district, where some of the best-producing herds in the Dominion may now be seen as the result of the methodical system in vogue. The Kaupokonui Company was the first to engage an official herd-testing officer, and entered into an agreement with the Department of Agriculture in making the appointment. The company agreed to pay into the Public Account an amount equal to the officer's salary, the man employed being a member of the Dairy Division. In addition to meeting this expenditure the company has paid out of its general fund the total cost of running the herd-testing work, thus making the scheme free to all milk-suppliers who desired to have their cows tested for production.

At the beginning of last season the Joll Co-operative Dairy Company, of Okaiawa, a neighbouring concern, followed the example of the Kaupokonui Company, and agreed to pay for the services of an official herd-tester. Another officer of the Dairy Division was accordingly appointed to this position on similar terms. At the commencement many of the milk-suppliers agreed to enter their herds for testing, and the work gave promise of much interest amongst the farmers. While a fair number of cows have been dealt with under this organization, and the work carried on without intermission through the season, a number of the farmers found it impossible to continue owing to the scarcity of labour on the farms. The work done, however, has been successful, and it is believed that more support will be forthcoming next year.

A number of herd-testing associations have also been conducted in the Auckland Province, several associations being under the control of one man, while others have each engaged the whole time of the man appointed for this duty. In the Gisborne district the testing of dairy herds on a systematic basis was commenced this season under the direction of the local Dairy Instructor, and has been attended with considerable success. Some herd-testing has also been carried on in the Wellington Province.

Apart from the organized associations a very large number of cows have been tested by dairy-factory managers throughout the North Island, and a number of dairy companies have offered every inducement for the suppliers to send in their samples of milk regularly for testing, allowing the farmer to make up his own figures after taking from time to time the weights of milk produced by each cow in his herd. A small herd-testing association was conducted during the year at one of the cheese-factories in Marlborough, as the result of the efforts of the local factory-manager, and is to be continued next year under a sound working arrangement.

While the herd-testing movement in New Zealand has not made the progress which its importance demands, it is believed that the near future will see a considerable extension in this direction.

### Certificate-of-Record Testing of Purebred Dairy Cows.

The testing of purebred dairy cows continues to be recognized as an important feature of the Department's dairy endeavour. During the year under review the work has become more firmly established, and many owners who had not previously tried this system of testing are now included in the list of testing breeders. Each year's work adds to the number of certificate-of-record cows, and at the present some 485 cows have produced records on which their owners have received certificates. These records include instances of exceptionally high productions, despite the fact that the requirements regarding regular calving are so exacting that few breeders are inclined to strive for abnormal yields.

During the year many of the preceding year's class leaders have been superseded. Amongst the Friesians three new class leaders appear, and of these Manor Beets Daughter II of Ashlynn is the most outstanding. As a senior three-year-old this cow has a credit of 18,733·9 lb. milk, containing 863·51 lb. butter-fat. This is the highest New Zealand record to date, and the fact that it is held by an immature cow makes it all the more creditable. Of the new Jersey leaders, Lady of Collingwood's record as a four-year-old has claimed considerable attention, when on her third consecutive year's test she produced 736·07 lb. of butter-fat. This places her as leader of that class.

Certificates granted during the year number 179. Many of the cows were milked 365 days. The average time that elapsed between the calving at the commencement of the test and the commencement of the next lactation season was just thirteen months. These 179 cows produced in their season an aggregate of 1,716,551·40 lb. milk, containing 77,239·65 lb. butter-fat, representing an average yield per cow in 345 days of 9,589·67 lb. milk, containing 431·51 lb. butter-fat.

Each year's work directs attention to dairy sires whose daughters are qualifying on production. As many as twenty-nine sires now have four or more C.O.R. daughters from separate dams. As a sire's number of C.O.R. daughters increases, and as more sires qualify through such daughters, more knowledge is available to breeders and others as to what strains best satisfy the demands of utility.

### Staff.

During an exceedingly busy year all officers of the Division have shown a keen sense of duty and attention to the work allotted to them, and it has been a source of pleasure to be associated with so many who were both willing and anxious to give their best in the service.

# CHEMISTRY SECTION.

## REPORT OF B. C. ASTON, F.I.C., CHEMIST.

Wellington, 12th May, 1916.

The Secretary of Agriculture, Industries, and Commerce.

HEREWITH I forward the annual report of the Chemistry Section for the year ended 31st March, 1916.

B. C. ASTON, Chemist.

### THE WORK GENERALLY.

During the past year the work has much increased. A large amount of my time has been taken up in consultation with the other officers of this Department and other Departments, and with the public generally. I have attended conferences of the Board of Agriculture, of the Council of Agriculture, and of the Farmers' Union, and given advice when desired.

I may here reiterate that the policy always followed in regard to the analysis of samples for the public is that in ordinary circumstances no work is undertaken that is likely to benefit the individual only. Hence, for instance, analysis of fertilizers for farmers and of soils for land agents are not undertaken. The testing of limestones and suspected phosphates is undertaken when opportunity offers, but is not allowed to take precedence of the other more important work of the Laboratory.

The consideration of the fertilizers best suited for different lands has engaged a large share of attention. From letters from time to time received from farmers the advice given appears to be valued by the farming community.

### PHOSPHATE-SUPPLY.

As early as 1913 I had pointed out the importance of the Red Sea deposits of phosphate to New Zealand, and my visit to England in 1914 led to the acquisition of further information and to my acquaintance with the owners of the field, before whom I placed the figures relating to the consumption of phosphatic fertilizers in New Zealand. On my return to the Dominion in November, 1914, I advised obtaining a trial supply of Red Sea phosphate to test its suitability for New Zealand soils, the supply of basic slag being practically cut off. Nothing having been done, a representative of the owners visited New Zealand in June, 1915, and appointed agents. Returning troopships were used (freight being paid) to import the phosphate from Egypt, and this was misconstrued by some to mean that the Government were importing and selling the fertilizer—an entirely erroneous conception.

The owners of this phosphate, with the imprimatur of an eminent English agricultural chemist, claim that their product is a substitute for basic slag, than which it is more efficient. The fertilizer imported has been thoroughly well distributed over the Dominion, and public opinion, fortified by field trials, is likely to give a more authoritative pronouncement than any academic statements of laboratory experiments. The statement which has been circulated, that the fertilizer which was imported into New Zealand only contains 1 per cent. of phosphoric acid soluble by the English 2-per-cent. citric-acid official method, is thoroughly misleading and untrue. The statements concerning the composition of the fertilizer issued by the owning company have been verified by at least three analytical chemists in New Zealand, one of whom is the author of this report, the other two being independent professional men.

I would point out that there are other African phosphate deposits, and it should be possible for any co-operative farmers' association to become owners of one.

The search for phosphate in New Zealand is still being continued by the Geological Survey, by the Dominion Museum Director (a skilled geologist), and by sundry amateur and professional prospectors in the country, to whom specimens of phosphate rock and pamphlets have been sent as in previous years. A large number of reputed phosphate rocks have been received during the year from various sources, but only one, collected by Dr. Thomson in the Clarence Valley, proved to be phosphate. This contained 23·94 per cent. of tricalcic phosphate.

I have arranged with the Director of the Dominion Museum to show a collection of phosphates from all parts of the world in a glass case, in which they can be seen on application. To these have been added the specimens received from the Panama Pacific Exhibition.

Analyses of several samples of phosphate have been made in connection with an offer to sell to the Government certain phosphate islands, and a report has been submitted on the composition and market value of the phosphate.

### Potash-supply.

The shortage of potash salts owing to the main source of supply—Germany—having been cut off, and the export from Spain of recently discovered potash prohibited by the Spanish Government, may not be expected to influence New Zealand agriculture unduly for the few years that the war can last. In the meantime such direct substitutes as wood-ashes, stock-urine, stable manure, and flax-waste can be used where obtainable, and indirect potash fertilizers (which liberate potash from soil silicates), such as common salt, sodium sulphate, lime, and sulphate of lime (gypsum), may be used where direct substitutes are unobtainable. Laboratory experiments are still in progress with a view to discovering a direct substitute. Many analyses of wood-ashes have been made. (For further information see articles in the Department's *Journal* for July and October, 1915.)

### Lime and Limestone.

The supply of cheap lime has occupied much of my attention, and I am pleased to report that the idea of developing the soft-limestone deposits of the Dominion is now receiving a thorough trial. Acting on my suggestion, the Fields Division of the Department and the Geological Survey have devoted some time to locating and drawing attention to the matter. The owner of one deposit of soft limestone in an arid region, after breaking up the freshly dug material on a floor, passing it through a rough screen, and, bagging it, has disposed of some 500 tons. The portion rejected by the screen, but of the same chemical composition, is thrown on one side and is carted away in bulk at a cost of a few shillings a ton by the farmers adjacent to the works. A sample of this was found to readily disintegrate when pressed between two boards, and would therefore weather readily on the land, especially after a few frosts.

Since my last report deposits of a very high grade of soft limestone have been located in the Wairarapa and at Taihape. In the former case I am assured by a reliable observer that the deposits are extensive, although unfortunately not near a railway. I hope when a convenient occasion offers to report more fully on both of these. The results of the samples analysed were highly encouraging. Further information on the subject will be found in those articles in the *Journal* dealing with this matter and with fertilizers generally, where the value of wood-ashes as a source of lime is also pointed out.

A large number of samples of limestone have been received from farmers and from officers of the Fields Division, and have been reported on as to their suitability for agricultural purposes. Included in these may be mentioned papa, which is merly a sedimentary deposit containing a little more carbonate of lime than usual in New Zealand soils. It is not likely to prove of any great value as a soil-dressing.

Richer than papa in carbonate of lime are the deposits of shells often found on coastal mud-banks or raised beaches, and several inquiries have been received with regard to this source of lime. Whether it would be profitable to use such deposits as limestone dressings must depend on the local conditions. Except for those farms very near the deposits it is doubtful if they could be profitably utilized.

Advice has been given to lime-manufacturers as to the requirements of farmers, and visits have been paid to various limeworks, including those at Te Kuiti, Mauriceville, Ward, and Manawatu Gorge, Woodville, Napier, and the Wairarapa deposits. Much time has been spent in consultation with various firms and with the officers of the Public Works Department concerning limestone-reducing machinery. As a result of my advice a prominent South Island firm has installed grinding-machinery for producing agricultural ground limestone. As to the precise form of machinery necessary for reducing limestone to a state suitable for agricultural purposes no general advice can be given, as the advice is likely to vary according to the stone it is desired to treat. Some stones appear excessively hard, but with very simple machinery, absorbing low power, are reduced very easily when thoroughly dried. Some limestones require no grinding, and may be applied as dug from the face; other limestones are so hard that it required heavy machinery; lastly, the siliceous limestones are hardest of all, and require the finest grinding to promote efficiency of the product.

A well-known firm which is agent for a pulverizer figured in the *Journal* has made the liberal offer to install their machinery, and take it away without charge if the production is not up to guarantee in quality and quantity. Where the stone is suitable for this machine no doubt the offer would be repeated. This machine is already installed in New Zealand, and could be seen by those interested.

At present the most favourable result with this machine has been obtained with a Canterbury limestone, which on a conservative estimate, including all possible charges, costs 4s. per ton to reduce to a powder, 86·5 per cent. of which passed through a sieve of twelve meshes to the linear inch—a satisfactory result.

Many complaints have been received from farmers concerning the difficulty, sometimes the impossibility, of obtaining supplies of lime or limestone, and of the cost of same, which might be due either to the initial price, the cost of cartage, or the freight in excess of the 100 miles free railage.

To those who contemplate erecting expensive reducing machinery I would, however, utter the warning that discoveries of soft limestone which need little or no pulverizing are becoming so common that it is likely to reduce the price which may be obtained for agricultural limestone (carbonate of lime).

The composition of limes and limestones sold to farmers has been the subject of some inquiry, and a report has been prepared which will shortly be submitted.

### Soil Investigations.

Inquiries into certain types of soil have been continued, and the following have received attention, a number of analyses of samples having been personally collected with care.

Littoral (sea-coastal) soils have been investigated in connection with the Live-stock Division and its improvement of the soils of the quarantine islands, Motuihi (Hauraki Gulf) and Somes Island (Wellington Harbour), also in connection with the Lands Department on reserves (Kapiti Island). This information, added to much already acquired, will, it is hoped, hasten the preparation of a report on this type.

Another type under investigation is the swamp soils of Waikato, and an article is in preparation describing a successful method of treatment.

The Marlborough soils, possessing great diversity in climate and composition, have engaged my attention at some length. The Director of the Dominion Museum has been closely associated with me in this, and a number of rocks (limestones, dolomites, banded flints, and reputed phosphates) and soils derived from these are in course of examination. One of the samples collected has already proved to be a rich phosphate. A soft useful limestone has been located in the Awatere Valley. I am convinced that the Marlborough Province, where suitable for lucerne-growing, will take great strides in closer settlement within the next few years; in spite of liability to drought it has marvellous recuperative power, and there is no part of New Zealand which scientific advice could be productive of better results.

### Field Experiments.

The Director of the Fields Division has been supplied with all the information in my power to aid him in drawing up schemes for experimental work. A comprehensive scheme, on similar lines to the Cockle Park experiments in England, was submitted and approved for the purpose of ascertaining the effect of variously top-dressing pastures on the live weight of sheep. Although intended to be carried out in several districts, it was only found possible to institute the scheme at the Wallaceville Laboratory farm, but owing to the dry summer of 1915–16 little information is expected to result therefrom this year. As however, the experiments are to be carried on for several years, valuable results may be looked for in the future. One of the most important results expected will be the effect of basic slag, which is now unobtainable on account of the war, compared with substitutes such as Ephos and other phosphates to which lime has been added. The soils of the Wallaceville farm have personally been carefully sampled and analysed.

### Fertilizers and the Fertilizers Act.

During the year, as the result of analyses of twenty-two samples of imported bonedust collected at the wharf, four were found to be deficient in nitrogen compared with the analysis forwarded with them. There was evidence that the standard of bonedust sent was being lowered. Exporters in other countries sending fertilizers to New Zealand should be warned that although their wares are up to guarantee, any attempt to excessively dilute them and so trade on the ignorance of the farmer may be met with publication of complete analyses in such manner as the Secretary for Agriculture may think fit. The attention of farmers should be drawn to the fact that there is nothing in the Fertilizers Act to prevent the excessive dilution of fertilizers by such substances as limestone, sand, gypsum, and other rocks if the percentage of the fertilizer constituent (nitrogen, phosphoric anhydride, and potash) are correctly stated in the invoice certificate. Farmers should therefore study closely the percentages of these fertilizer constituents before purchasing a fertilizer.

The advisability of amending the Fertilizers Act has been considered and a report submitted.

Several fertilizer manufacturers have sought advice, which has been freely given, as to the source of supplies or methods of manufacture.

### Deficiency Diseases.

Chemical research in these obscure stock-diseases has progressed but slowly, owing to the increasing difficulty of visiting areas, remote from Wellington, where the outbreaks from time to time occur.

At the Mamaku Experimental Farm the work of experimenting with various pasture top-dressings and medicinal treatment of animals goes steadily forward on lines already indicated. There has been a fair demand from the public for the medicinal bricks supplied by the Department. Some farmers are reported to be putting sulphate of iron in the drinking-water with encouraging results. A cheap preparation of phosphate of iron made in this laboratory for application in this manner is now being experimented with. The iron-deficiency theory of the disease has received further confirmation by the fact that eight ewes have remained healthy for eighteen months and become fat on pasture which has only been dressed with spent iron oxide from gasworks. From a letter received from a farmer there appears to be some ground for the opinion current in the district that if cattle have access to tutu-bushes (*Coriaria ruscifolia*), which contains a powerful poison, they do not suffer from bush sickness.

Several visits have been paid to the experimental farm at Mamaku, and verbal and written reports have been furnished to the Director of the Live-stock Division on the results of the visits. A district in the South Island where a curious form of deficiency disease has developed has also been visited at the request of the Director and a report furnished.

### Toxicological.

Carelessness in allowing stock to have access to food contaminated by posion, to stray paint-tins containing poisonous paint, to fences recently painted with white-lead paint, or to pastures treated with arsenical weed-killer has resulted in many deaths hitherto, and this year was no exception. Two cases of arsenical poisoning—one in horses and one in cattle—one case of lead and arsenic together, and one in which stock have been poisoned by yew, have been demonstrated in the Laboratory this year.

Analyses of some stock-foods which were reputed to have caused deaths in stock have been made. In one case there was some suspicion that an excessive quantity of saccharine food containing potash salts may have caused death in young calves.

A case of heavy mortality in pigs fed on dairy by-products containing small quantities of alkaline salts was investigated, and the Director of the Live-stock Division was advised to carry out experiments to test whether death could be caused by these.

New Zealand poisonous plants yearly provide some interesting cases of stock-poisoning. The ngaio (*Myoporum laetum*), a common tree usually found near the sea-coast, has this year accounted for many deaths. Care should be exercised in allowing cattle access to recently felled ngaio trees or branches broken off by gales, especially in droughty years, when anything green will be greedily devoured. The flowers have been suspected in the case of mortality among young chickens, the mother being penned beneath ngaio-trees in flower. Some chemical work has already been done with a view to isolate and examine the poisonous principle, but this is another research which has been pushed aside for the present.

Several cases of mortality in poultry have been submitted for investigation, but unless a number of the crops and gizzards are sent it is almost hopeless trying to obtain definite chemical or botanical evidence of poisoning in such small animals.

### Butter for Export.

Numerous analyses of butters for export have been made for the Dairy Division, especially for the percentage of water. As a result many prosecutions have been undertaken by the Department under the Dairy Industry Act, and substantial fines imposed on careless manufacturers. The analyses were made subsequent to preliminary tests by the Dairy-produce Graders, whose results have always been confirmed.

### Tannin Barks of New Zealand.

Samples of mangrove-bark (*Avicennia officinalis*) tested for tannin at the request of the Lands Department showed merely a trace to be present, a result which I subsequently found is borne out by Baker in his recent word on "The Australian 'Grey Mangrove' (*Avicennia officinalis* Minn.)."

Several inquiries having been received regarding the tannin-content of New Zealand trees and the possibility of New Zealand becoming a tannin-producing country, the matter is being looked into, and already some valuable material for a report has been collected.

### Other Work for the Department's Officers.

Additional work for the Live-stock Division consisted in selecting and purchasing fertilizers for farms and experimental plots, and medicines for stock; investigations in compounding new stock-medicines, suggesting treatment and advising regarding bone-sterilizing work, and other matters generally; advising and supplying dressings to combat grass-grub; analysing and advising on patent and proprietary medicines for stock; examining waters used for drinking purposes for stock.

Additional work for the Fields Division consisted in frequent advisory letters; additions to the native-plant collection at Ruakura Farm; analyses of soils, fertilizers, and insecticides for Ruakura Farm; analysing soils for the Fields Instructors (which it is not proposed to continue).

Additional work for the Dairy Division was analysing waters for dairy factories; testing Babcock ware for the Division and for merchants; inspecting various dairy-factory plants with the Director of the Division with a view to determine cause and remedy for corrosion of milk and cream vats of tinned plate (copper or steel). The matter has been investigated from various aspects, and after inspecting the vats used in other industries and subject to similar risk of corrosion, a report was submitted to the Director in which the experimenting with more heavily tinned plated vats or glass-enamelled lined vats was advocated. A most interesting point elucidated was that pasteurized milk corroded the vats worse than non-pasteurized fluids. Many samples of cream and milk have been examined in connection with dairy administration. Several samples of parchment paper used in wrapping butter have also been analysed with regard to their suitability for that purpose. Instruction in determining ash in casein samples has been given to Dairy Division officers, and samples of casein have been analysed for quality. Analyses of butters for preservatives and other substances added in process of manufacture have also been made and advice given thereon.

Work for the Horticulture Division was reporting on spray diagram and examination of sprays for fruit-trees. I have also reported to the Director several matters which concern his

Division brought under my notice when absent in England and America. At the Director's request a paper on honey was prepared for the Beekeepers' Conference and subsequently published in the *Journal*. A supply of crude-creasote distillate has been obtained for testing its effect as an insecticide. Analysis of water for watering plants, to determine whether there was anything present inimical to plant-growth, has been made.

### Work for the Department's Journal.

Sixteen articles written by myself have been published in the *Journal* during the year. In these may be found fuller information on some of the subjects mentioned in this report.

### Work for other Departments.

*Public Works Department.*

At the District Engineer's request an examination of the deposit which was found to be blocking the mains supplying the Parliamentary Buildings was found to be some low form of life. On submitting a specimen to Professor H. B. Kirk (Victoria College) he pronounced it to be a polyzoa (*Palludicella Efrenbergi* of Van Beneden). It was recorded by the late Mr. A. Hamilton (Trans. N.Z. Inst., Vol. 35, 1902, p. 262) from the Ross Creek reservoir, the source of the Dunedin water-supply. The writer says, "No doubt the larger water-mains (Dunedin) contain masses of these polyzoa. . . . Both *Palludicella* and *Plumatilla* were found choking the water-pipes of the city of Hamburg, and were considered as having an unfavourable influence on the water-supply, as providing a nidus for undesirable germs." Allman found that this species was "eminently a lover of obscurity," being only found under arches or places where direct sunlight does not penetrate, like so much else "made in Germany."

The Director of the Geological Survey has been supplied with various information as to the chemical composition of substances or of the occurrence and composition of minerals and rocks.

Advice has been given to the Chief Electrical Engineer in matters relating to the manufacture of fertilizers, but I regret I was unable to visit Canterbury as desired. I understand that this officer is now prepared to advise firms desiring to install plants for grinding phosphates on the best way to proceed.

*Lands and Survey Department.*

For the Superintendent of Scenic Reserves analyses of samples of sand and sand-dunes at Rangitikei and Waikato Heads showed that every mineral constituent necessary for plant-growth was present in fair amount, the amount of lime soluble in hydrochloric acid being high for a New Zealand soil. The analyses show that every element is present to make the establishment of vegetation on the dunes a success if correct methods are employed.

The Nurseryman in Charge, North Island, has been given information regarding fertilizers and suitable treatment of seed-beds, and has favourably reported on the results.

*Defence Department.*

The examination of the water-supply of the transports and hospital ships has been continued, 291 samples being tested. The soils of the Trentham Camp were in August personally sampled to different depths, and subjected to a thorough mechanical analysis for the information of the Trentham Camp Commission, in order to aid the Commissioners in their conclusions as to the suitability of the site selected for a camp.

### Staff.

I have to express my appreciation of the manner in which the members of the staff have carried out their arduous duties under difficulties due to war conditions during the past year.

# BIOLOGY SECTION.

## REPORT OF A. H. COCKAYNE, BIOLOGIST.

Wellington, 26th May, 1916.

The Secretary of Agriculture, Industries, and Commerce.

I FORWARD herewith a summary of the work carried out by this Section for the year ended 31st March, 1916.

A. H. COCKAYNE, Biologist.

### GENERAL ROUTINE WORK.

The usual large number of specimens, both botanical and zoological, have been dealt with during the year. This work naturally occupies the major portion of the time of the Section, and its importance in disseminating botanical and zoological information to the primary producers of the Dominion is very considerable. As has been usual in past years, information with regard to grasses and pasture plants has been especially demanded.

### SEED-TESTING.

During the year 2,700 samples of agricultural seeds have been tested for purity and germination. This shows a decline of 500 samples on those received during the previous twelve months. This reduction is due almost entirely to the European war. The usual large number of small lines of Continental origin were notably absent, as, of course, was to be expected. During the past five years over 10,000 samples have been tested free of any charge. This gratuitous system has now been abandoned so far as seed-merchants are concerned, and the small fee of 1s. per sample for germination and a similar amount for a purity analysis is now charged. It is extremely gratifying to report that the seed-merchants have welcomed this decision to place seed-testing on a business footing. It is hoped that even with the small fees that are being charged this branch of the Section's activities will become quite self-supporting. So far as farmers are concerned no charge is made.

In August a female assistant, Miss H. Jensen, was appointed as seed-analyst, and after a preliminary training has given general satisfaction. A system of reporting progress-germination by means of post-cards has been adopted, and these are largely being used in the seed trade in the buying and selling of agricultural seeds. Mr. E. B. Levy is in supervision of the seed-testing work, and has performed his duties with great credit.

### GRASS AND CLOVER EXPERIMENTS.

In collaboration with the Fields Division a very large series of experimental plots have been laid down at Ruakura, Moumahaki, and Weraroa. These experiments, which comprise some 1,600 plots, have as their objective the complete study of the life relations of pasture plants. From this work our knowledge on the formation of pastures, both temporary and permanent, should be greatly increased. The planning and preparation of these experiments have entailed a very large amount of work, and the proper carrying-out of the various lines of investigation that are intended will prove a great tax on the time of this Section as well as to members of the Experimental Farms' staff. In New Zealand, where grass is the supreme crop, the necessity for careful scientific investigation on pasture plants is apparent, and up to the present the methods adopted in pasture formation have been almost entirely empirical.

### NEW ZEALAND FLAX DISEASES.

In February, 1916, Mr. David Miller, the well-known New Zealand entomologist, was appointed temporarily to conduct a complete investigation of the diseases of *Phormium tenax* in the Dominion. The great ravages caused by certain insects and diseases rendered it imperative from the millers' standpoint that some method of control should be devised, and it is hoped that the detailing of a special man with this single purpose in view should lead to extremely important results. Much preliminary work has already been done, and several very promising lines of investigation have presented themselves.

## Special Investigations.

During the year a considerable amount of investigation work was carried out in the following subjects: Foxtail grass midge; nervous derangement in horses; frost effect on wheat crops; the dying of young fruit-trees; the conversion of fern land into grass; fumigation for the control of subterranean insects; the weed-seed content of soils; the winter spores of Californian thistle rust; the identification of grasses and clovers from their seed-leaves; control of chaff-mite; weevil in barley; pollen-grain investigations; studies in the biology of weeds; botanical survey of pastures. As these investigations become completed, more or less popular accounts are prepared for publication in the Department's *Journal*.

## Work for Journal.

During the year twenty articles, comprising 126 pages of letterpress and over eighty original illustrations, have been prepared by the Section and published in the departmental *Journal*. In this connection the excellent drawings by Mr. E. H. Atkinson and the botanical photographs by Mr. E. B. Levy are worthy of special mention. It is hoped that the weed articles of Mr. Atkinson and those on seeds and seed impurities by Mr. Levy will be later incorporated into separate manuals on these subjects.

***Approximate Cost of Paper.***—**Preparation, not given; printing (2,750 copies), £34.**

By Authority: Marcus F. Marks, Government Printer, Wellington.—1916.

*Price 1s.*]