1919.

NEW ZEALAND.

DEPARTMENT OF AGRICULTURE, INDUSTRIES, AND COMMERCE.

ANNUAL REPORT FOR 1918–19.

Presented to both Houses of Parliament by Command of His Excellency.

Department of Agriculture, Industries, and Commerce,
Wellington, 17th September, 1919.

MY LORD,—

I have the honour to forward herewith, for Your Excellency's information, the report of the Department of Agriculture, Industries, and Commerce of the Dominion for the financial year ended the 31st March last.

I have, &c.,
W. NOSWORTHY,
Minister of Agriculture.

His Excellency the Earl of Liverpool, Governor-General of New Zealand.

REPORT OF THE MINISTER OF AGRICULTURE.

FOUR successive annual reports have been prefaced by references to the Great War then being fought and the relation of our agricultural industry thereto, and it may be rightly claimed that the spirit shown by the producers in support of the fighting forces overseas was a powerful factor towards the long-deferred but decisive victory since attained. War problems have now given place to peace problems, and the best ability, work, and goodwill of the country are needed for the task of meeting our liabilities without undue strain—a task which, in the main, means winning more wealth from the soil by agricultural production. With the homeward flow of man-power from the fighting fronts too early a start cannot be made in this direction.

The agricultural year under review was marked by considerable vicissitudes as regards climatic conditions. Exceptionally heavy snowfalls over wide areas occurred during the winter, while abnormally low temperatures prevailed during a greater part of the year. Several of the northern and eastern districts of the North Island experienced prolonged spells of droughty weather in the summer and late autumn. Notwithstanding these drawbacks, however, the country as a whole once more showed its splendid capacity by a heavy volume of production, and with good financial returns agriculture in general may be said to have enjoyed a prosperous year.

In regard to crops, it is pleasing to record good cereal yields in the principal grain-growing districts, especially in Canterbury, where three previous adverse

seasons had operated in no small measure to discourage wheat-growing. Although the wheat acreage showed considerable reduction, the greatly increased average yield nearly compensated for that shrinkage. The wheat crop was again controlled officially—on similar lines to the previous year's scheme—reasonable prices being fixed and paid by the Government. In connection with the general question of the wheat-supply and price of bread, the price of flour has been stabilized by moderate support from the Consolidated Fund. Oats, barley, and maize showed a substantially increased production compared with the previous year. Other crops, consisting mainly of roots and fodders for the direct feeding of live-stock, do not call for any special comment here beyond remarking that rape and turnips have been somewhat disappointing in the important fattening district of Canterbury.

Referring to the live-stock position, a very large increase in the 1918 returns brought the sheep-stock of the Dominion to a record figure, but this has been discounted by a heavy fall revealed in the 1919 returns. The factors influencing the decrease may be stated as a reduction in breeding-ewes, a smaller lambing percentage, losses due to the abnormal snowfalls, and increased killings of freezing-stock after 30th April, 1918, which, but for a late season, would have been sent to the works prior to that date, and thus not have appeared in the 1918 returns. However, the flocks are still at a higher level than in any previous year except 1918. Cattle, including the dairy classes, have registered a satisfactory increase. It is regretted, however, to have to record another decrease in swine. Special steps are being taken by the Department to counteract this downward movement by providing instructional and demonstrational facilities to farmers in pig feeding and management on up-to-date lines suited to the altering conditions in the Dominion in relation to dairy by-products, &c.

The animal industries of the Dominion responsible for our great staples of wool, meat, and dairy-produce, together with the important by-products, such as skins, hides, tallow, &c., have enjoyed continued prosperity, although the late make of butter and cheese was curtailed by dry conditions. With the approval of the great majority of producers the Imperial purchase of the export output of these staples was extended to cover the period ending 30th June, 1920. In view of the unsettled conditions prevailing at the close of the war, and which will probably continue for some time to come, this was undoubtedly a wise course to adopt on the part of the producers, while it also co-ordinated with the plans of the food authorities in Britain. The prices for meat and wool remained unchanged, but considerably increased prices were accorded for butter and cheese. Our farmers, especially the wool and meat growers, may be fairly said to have shown very great moderation in regard to the disposal of their produce under the extended contracts.

Although new orchard plantings have been considerably restricted owing to war conditions, the fruitgrowing industry has continued to expand steadily, the local market still proving its capacity to absorb the output. In view of the extent of young orchards coming into production each year, it is hoped, however, that the shipping position will quickly allow of a resumption of export. Poultry-keeping has enjoyed a large measure of success, the industry having adapted itself to the comparatively high prices of cereal foods, and demand being usually ahead of the supply as regards eggs and table poultry. The honey-market has experienced a considerable fall from the extreme values reached in the previous year, but remains at a remunerative level, and the beekeeping industry has every prospect of a maintenance of prosperity. With regard to market-gardening and *petite culture* generally, the steadily increasing urban population of the Dominion affords a market which has frequently given evidence of undersupply. The possibilities of tobacco-growing are receiving attention.

The flax-milling (phormium) industry shows some shrinkage in output, due to several adverse factors, such as fall in price, diseased leaf in some districts, and congested storage. With improvement in conditions, however, great activity is promised. The chief handicap the industry now labours under is the extremely high rates of ocean freight ruling for flax and tow.

Shipping and storage have continued to be an element of uncertainty and anxiety for those industries depending upon refrigeration, and further provision of cold storage has been necessary. Financial assistance has been given in this connection. Satisfactory clearances of butter and heavy reductions of cheese were

made latterly, but meat-stocks continued to accumulate, touching a record figure in this respect. While the position reached a critical stage, it was fortunately found possible to complete the meat-freezing season without any serious dislocation of the industry. There is reason to fear that, owing to inadequate shipping, more or less congestion will prevail for some time to come, and the opinion seems to be gaining ground that another extension of the Imperial purchase, for a period enabling a practical clearance of stocks, would be in the interests of the industry. During the year a better supply of non-refrigerated tonnage enabled good shipments to be made of accumulations of freezing-works by-products, such as tallow and pelts. Wool was also lifted steadily.

A marked feature of present-day agricultural and pastoral conditions lies in the exceptionally high land-values existing, especially in some North Island districts. This provides food for serious thought. It is certainly time that a halt was called, and, notwithstanding the productivity of the better-class land of the Dominion, those investing their resources in it need to have regard to the conditions which may exist in the near future, and realize that undue encouragement of land-gambling is detrimental to the best interests of the farming community.

Agricultural development in all its ramifications must undoubtedly be the Dominion's chief concern for many years to come. Better knowledge, methods and practice, extended resources and facilities, and greater amenities of rural life, all call for study and practical action. Such factors combined with activity in land-settlement—by breaking in new country, developing the potential resources of the poorer unoccupied lands, and further subdivision and improvement of older areas—cannot fail to immensely stimulate production. The Department of Agriculture recognizes its great responsibilities in this respect, and its duty to give a sound lead wherever required. The necessity for co-ordination with other State Departments—Education, Repatriation, Lands, and Forestry—concerned more or less with other parts of the same great field, is also realized. Good understandings have been established with these authorities, and working arrangements are being evolved to avoid overlapping and secure sound results. With regard to returned soldiers, the Department is working in close co-operation with the Repatriation Department, both as regards instruction upon the State farms and joint effort upon special farms established for training purposes. The Board of Agriculture—whose continued valuable advisory assistance is here cordially acknowledged—will also find ample scope for work in connection with questions of post-war agricultural development.

Among the Department's independent activities one line of action which promises excellent results is that of district experimental and demonstrational farms, established and administered by local committees of farmers, &c., under the supervision of and subsidized by the Department. By this means local problems and conditions can be dealt with to the best advantage, co-operation in effort is given full play, and the sustained interest of those concerned is assured. Moreover, the system can be carried out at a relatively small cost. Another means of promoting efficiency and increased production lies in the establishment of a body of agricultural instructors or advisers—men combining scientific training with sound knowledge of farming. The nucleus of such an organization has been formed in the Department, and will be supplemented as rapidly as circumstances allow. Dealing with the younger generation of the countryside—the farmers of the near future—an early development of the system of juvenile cropping and live-stock competitions is projected. Here co-operation between the educational authorities and this Department would be involved.

In regard to the affairs of the Department itself, certain important changes were effected during the year. It was considered desirable by the Government that the position of permanent head should be held by an officer possessing both practical and scientific qualifications. In accordance with this decision the position of Secretary of Agriculture was abolished, and a chief administrative position of Director-General created. Dr. C. J. Reakes, D.V.Sc., M.R.C.V.S., then Director of the Live-stock Division, was appointed to the Director-Generalship, while Mr. F. S. Pope, who had held the position of Secretary, became Assistant Director-General. At the same time a scheme of reorganization, affecting chiefly the Fields

Division and Live-stock Division, was instituted, with a view to greater co-ordination and efficiency in important sections of the Department's work. The main features of these measures are described in the report of the Director-General which follows; and it is confidently hoped that marked benefit will result. Due recognition must be freely given to the faithful and arduous work performed by Mr. Pope during his nine years' tenure of the position of permanent head of the Department, comprising the greater part of the war period with its exceptional difficulties.

From what has been briefly touched upon it will be readily seen that the staffs and resources generally of the Department must be considerably increased, especially on the instructional and scientific side, the strength having hitherto been altogether inadequate to cope thoroughly and consistently with the volume of work calling for attention. It is also highly advisable that heads of branches should be more largely relieved of the burden of detail or routine duties, and set more free to devote their abilities to wider matters. With a well-organized Department and a strong personnel any extra charge on the consolidated revenue would be indirectly repaid manyfold through the increased production of wealth traceable to the services rendered.

Together with full recognition of the good work performed during the year by the officers of the Department generally in their respective branches, a special word of appreciation is due to those members of the staff who have served with the Expeditionary Force overseas. Whether in the front line or performing technical services, they have acquitted themselves with credit to their country. Some will never return, and others will long feel the effects of wounds or sickness. The Department is proud of its roll of honour.

DEPARTMENT OF AGRICULTURE, INDUSTRIES, AND COMMERCE.

WAR ROLL OF HONOUR, 1914–19.

Killed or Died of Wounds.

Emerson, P. T. (Lieutenant).
Flower, W. E. F. (Lieutenant).
Hannah, W. H. (Private).
Holm, J. W. (Private).
Hunter, J. (Private).
Huntington, S. H. (2nd Lieutenant).
Kirkland, J. (Private).
Mansfield, A. B. (Corporal).
Primmer, J. H. (Captain).
Robinson, A. J. (Corporal).
Waugh, G. N. (Captain).
Webb, T. C. (Private).

Wounded.

Bailey, W. (Private).
Bell, P. H. (Private).
Cain, W. G. (2nd Lieutenant), (twice).
Climo, B. P. (Private).
Cullen, T. L. (Private).
Dallas, W. K. (Lance-Corporal).
Edgar, P. M. (Major).
Fraer, A. H. (Gunner).
Gill, A. M. (Corporal).
Howard, E. C. (Captain).
Isbister, R. (Private).
Low, J. (Private).
Lyford, F. A. (Sergeant).
McLew, W. H. (Sergeant-Major), (three times).
Mitchell, G. G. M. (2nd Lieutenant), (three times).
Munro, D. (Major).
Paisley, A. (2nd Lieutenant).
Scott, L. C. (Sergeant).
Spragg, C. R. (Major).
Storey, A. W. (Private).
Toulson, R. L. G. (Private).
Webster, F. R. (Sergeant).
Whitehead, H. G. (Private).
Willis, E. O. (Private).

DECORATIONS.

Distinguished-service Order.

Stafford, J. (Major).

Military Cross.

Paisley, A. (2nd Lieutenant).

Military Medal.

Gill, A. M. (Corporal).
Mitchell, G. G. M. (2nd Lieutenant).

Croix de Guerre.

Blake, T. A. (Captain).

REPORT OF THE DIRECTOR-GENERAL OF AGRICULTURE, INDUSTRIES, AND COMMERCE FOR THE YEAR ENDED 31ST MARCH, 1919.

Wellington, 16th July, 1919.

The Hon. Ministers of Agriculture and of Industries and Commerce.

THE virtual conclusion of the war during the period under review naturally brought great prospective relief from the many handicaps under which the work of the Department had been carried on since 1914. It will, however, be some time before the complete repatriation of our Forces and the removal of the many restrictions due to the war can restore the position fully to normal and allow of unhampered development.

The control of the Department was entrusted to me as from June, 1918, and I thoroughly appreciate the loyal and cordial assistance since rendered by the Assistant Director-General.

REORGANIZATION.

A scheme of reorganization of the Department has been gradually but steadily carried out during the past twelve months, and is now completed so far as the existing personnel is concerned. The establishment of improved services in certain branches, which will be mentioned later, has, however, still to be carried out.

Prior to the present reorganization the Department was subdivided into four main Divisions—viz., Live-stock, Fields, Dairy, and Horticulture. An important point subject to criticism in connection with that system was the fact that two separate sets of Inspectors were carrying out inspection duty on farms and other landed properties, the one dealing with the inspection of live-stock, and the other (forming a considerable portion of the Fields Division) dealing with rabbits and noxious weeds. With a view to increasing efficiency and avoiding duplication of energy the new system provides that only one set of officers, all designated "Inspectors of Stock," carry out these previously separate duties, and already the good results from this change are becoming apparent.

The Live-stock Division is now well established on its new basis. One feature of its rearrangement lies in the abolition of central control as previously existing, and the establishment of four distinct organizations, with headquarters at Auckland, Wellington, Christchurch, and Dunedin respectively. Each of these district organizations is under the control of a District Superintendent, associated with whom is a Principal District Inspector. All the work of the Division in each district is controlled by the Superintendent and the Principal District Inspector, who in turn are responsible to the Director of the Division. The clerical work hitherto performed by the responsible clerical officers designated "District Agents," who were controlled only from headquarters in Wellington, is now brought under the district system, each district having a "District Clerk" appointed, who deals with the accounts, correspondence, &c., connected with the internal working of the district organization, being aided in this by clerical officers stationed, when necessary, at the more important outlying centres. Under this district system officers working in the field are kept closely in touch with their immediate controlling officer, efficiency and thoroughness of work being thereby promoted. Controlling officers are also able to keep closer in touch with the work of each individual and know how that work is being carried out.

The Division is now becoming ready for an expansion of its activities, particularly from the educational and instructional standpoint, and the return of expert officers who have been on active service will facilitate this. An especially notable feature of the work of the trained Inspectors of Stock has been the giving of advice to farmers and assistance of a first-aid nature in connection with the various ailments affecting their stock, in addition to the regular work of the prevention and control of contagious disease. With the reavailability of professional men an extension of the system which was initiated in the Bay of Plenty, of subsidizing capable veterinarians who would be willing to undertake practice in outlying districts, is intended, it being realized that the conservation of the health and the improvement of the quality of our live-stock are of primary importance to the Dominion.

The Dairy Division and the Horticulture Division—the latter handling matters connected with fruit-farming, horticulture generally, and beekeeping—were both practically self-contained, and they are continued as separate Divisions, and are not affected by the reorganization so far as any rearrangement of their functions is concerned. The Dairy Division has done very sound and excellent work, and a gradual expansion of its instructional function, particularly directed to the improvement in the quality of milk and cream sent to dairy factories, is being brought about. It is also proposed to make provision for the carrying-out of special bacteriological work in connection with the dairy industry. The scope of the Horticulture Division is being considerably extended. It is recognized that a great deal of additional work can be carried out with advantage in the direction of aiding fruitgrowers to deal with the various problems of their industry. For the purpose of gaining new information on practical lines the Assistant Director of the Division has been sent to America to investigate the control of disease, methods of marketing, the possibilities of an export trade, and matters connected with fruitgrowing, horticulture, and beekeeping generally.

The keynote of the policy under which the inspection work of the Department is carried out is to secure the co-operation of farmers in conserving and advancing their interests in the matter of their stock and crops, and the increase of production. The Acts which come within the scope of the Department's jurisdiction have to be administered efficiently, but every effort is made to carry out inspection duty on lines of co-operation rather than of compulsion.

The measures taken to merge the inspection of rabbits and noxious weeds with that of stock necessitated the practical disappearance of the Fields Division as such. In order, however, to maintain and extend the part of that Division's former functions dealing with experimental farms, local experimental areas, and fields instruction generally, a new branch is being built up. Pending the appointment of a permanent Director thereto this branch is in my direct charge, aided by the valuable co-operation of Mr. B. C. Aston and Mr. A. H. Cockayne. Special inquiries are being made for the purpose of securing for the position a man of high practical attainments combined with the necessary scientific knowledge, and with both demonstrative and instructional ability. It is realized that it is of the greatest importance to the Dominion to have these duties carried out on sound and progressive lines. On this branch devolves the responsibility not only of conducting the Department's experimental farms and the various experimental areas throughout the country to the best advantage, but also of dealing with agricultural education (apart from scholastic institutions).

Other Developments.

The work of the Department is extending greatly in order to meet the growing desire of the agricultural and pastoral community for expert advice and assistance in all farming matters, and the need for further developing these industries with a view to increasing primary production must necessarily involve a still greater expansion of the Department's services.

The development of a more comprehensive and efficient scheme of general agricultural education is one of the greatest necessities of the Dominion at the present time. As it is, a very great deal of work is being done in this direction—much more, indeed, than the Department sometimes receives credit for. The Ruakura Farm especially is rapidly developing into an educational institution, largely the result of it being utilized for the purpose of training returned soldiers in special branches of outdoor work, also for special classes for teachers and for farmers, these latter being organized and carried out in co-operation with the Auckland Education Board. The Weraroa Farm has been undergoing a reorganization process within itself, and is now undertaking a new departure in educational work in connection with returned soldiers. The Moumahaki Farm has proved of considerable value to farmers in the surrounding district, practical demonstration-work being its special feature.

Steps are now being taken to give effect to a new general policy in connection with the experimental farms. Under this scheme a sufficient area on each farm will be set aside for experimental work planned on lines calculated to elucidate new facts and obtain new information. The remainder will be conducted as a demonstration farm in modern up-to-date methods, and be made profit-earning. Separate accounts will be kept for each branch of the farm, and annual balance-sheets, based on commercial principles, will be furnished. It is considered that the usefulness of these institutions to our farmers will be much enhanced by such means.

There is a strong demand throughout the Dominion for more experimental farms, but this demand has to be considered in connection with the whole question of agricultural education, of which

experimental farms, properly conducted, are one important feature. Such farms alone, however, are not sufficient for the country's requirements in this direction, and a special need lies in the provision of capable advisory officers—men possessing both practical and scientific qualifications, who are able to impress farmers with the value of their knowledge, and thus bring about the adoption of their advice, with a resulting increase in the general efficiency of the farming industry. The present instructional staff is doing excellent work in this direction, but it is intended to strengthen it materially. Two officers of sound educational and practical attainments have already been engaged, and inquiries are being made for others of the right type; these, however, are not easy to secure without depriving other public activities of personnel.

The specific scientific services of the Department have a wide scope of activity. The Chemical Laboratory carries out a great volume of analytical work in connection with soils, manures, food plants and food materials, animal-specimens, &c. The Bacteriological Laboratory (Wallaceville) deals particularly with matters connected with the prevention and the control of live-stock diseases, whether scheduled as contagious diseases or otherwise. Other special features of its activities lie in the examination of specimens of all kinds sent in not only by officers of the Department but by stockowners, and also the examination of milk-supplies. The Biological Laboratory is doing especially good work in seed-testing, and though this is carried out on a purely voluntary basis so far as the senders of samples for testing are concerned, it is of great benefit to pastoralists and agriculturists generally, and undoubtedly goes a considerable way in ensuring that purchasers of seeds secure supplies which are reliable both from the point of view of freedom from serious contamination and in germinating-power. In addition, considerable work is carried out by this section in connection with the identification of plants, and scientific work generally connected with problems affecting animal-food plants, plant breeding and selection, &c. It is intended, as finances allow, to consolidate and further develop these services.

Some Points from the Year's Work.

Appended hereto are the reports of the Directors of the Live-stock Division, Horticulture Division and Dairy Division respectively, the Fields Instruction and Experimental Farms Branch, the Chemist, the Biologist, and the Chief Hemp-grader, also brief statements on the Grain-grading Service, Publications, and Industries and Commerce. These reports give a comprehensive summarized account of the work and position in their respective fields. A few points of special interest may be briefly noticed here.

Live-stock Matters.

The favourable position of the live-stock of the Dominion as regards serious disease has been well maintained. It is very satisfactory to record a reduction in the percentage of condemnations for tuberculosis. Among cattle the largest decrease of condemnations is shown in cows; swine also show a marked reduction. Another good feature is that in no case during the year has the presence of tubercle bacilli been revealed in the analyses of samples of milk taken by the Department's Inspectors from dairies catering for the town supply. Matters connected with cattle-tick (*Hoemaphysalis Bispinosa*) have received much attention, all interests concerned having been met in conference, and it is intended to deal with the parasites by strict control measures, which will be specified by regulations to be issued shortly. It may be again mentioned that tick-fever is not present in New Zealand, and that stringent measures are maintained to prevent its entry into the country.

With regard to the bush-sickness investigation, steady progress has been made at the Mamaku Farm in spite of serious hindrances, including the influenza visitation, the conditions arising out of the war, and the shortage or stoppage of ordinary and special supplies, &c. A considerable amount of experimental work has been conducted and valuable experience gained, while the development and revenue-producing side of the farm has received due attention. Double citrate of iron and ammonium (ferri ammon. cit.) has proved a great success as a definite cure, quicker in its action and better than the syrup of phosphate of iron, previously the only known medicinal cure. Experiments are now in progress with a view to the practical application of this discovery in the prevention of the disease, with every prospect of success. Double tartrate of iron and ammonium (ferri ammon. tart.) was also successful so far as the few experiments went. On the other hand, no success was obtained with lactate of iron (ferrous lactate) either in brick form or as a drench; nor with acetate of iron (liquor ferri acetati) as a drench. In continuation of former treatment some of the paddocks were top-dressed with lime or with phosphate, As a result of the year's profit-making operations a number of steers and fat cows were sold off the farm.

During the 1918 session of Parliament legislation affecting live-stock interests was passed by amendments to the Slaughtering and Inspection Act and the Rabbit Nuisance Act. The former measure was amended to give the Dominion Government a strong protective control of our meat industry and trade through a more thorough system of licensing of exporters and meat-works. The other amending Act strengthened the Department's hands for enforcing the destruction of rabbits, and extended the facilities for the formation of local Rabbit Boards among settlers.

Mr. A. R. Young, M.R.C.V.S., was appointed Director of the Live-stock Division in September, 1918, and is carrying out his responsible duties with energy and thoroughness.

The Dairy Industry.

It is now widely recognized that a weak spot in our dairy industry lies in connection with the raw material—the faulty condition of some of the milk and cream received at the factories. The limited inspection practicable with the available staff of Dairy Instructors has been sufficient to reveal the necessity for further improvement as regards the premises, appliances, and practice of many of the milk-suppliers. A great extension of inspection and educative work in this direction, involving a considerable increase of Instructors, is required, and it is necessary to take early action in the matter. A movement bearing directly on this matter lies in the practice of cream-grading at the factories. In part of the Auckland District this system has lately become established, with promising results, and is being extended and improved by experience. The Dairy Division is giving strong support to the movement, and rightly advocating greater differences in price as between the higher and lower grades of cream.

Another system which seems likely to spread among the dairy companies is that of having the testing of the suppliers' milk and cream carried out by officers of official status. The dairy companies and the Department co-operate in the selection of suitable men, who become members of the staff of the Dairy Division, the principal part of the expenditure on salaries being borne by the companies, and the balance, together with travelling-expenses, by the Department. This system has much to commend it, and its extension is hoped for and will be supported.

The developments in the dairy industry as regards dried-milk and other milk-products apart from butter and cheese are being studied by the Department with a view to the general guidance of producers. For the purpose of acquiring first-hand up-to-date information on the subject a member of the Dairy Division, Mr. W. Dempster, is now carrying out investigations in the United States Canada, and Great Britain. With this information available it is hoped to do still better in giving a sound and reliable lead on these matters.

The grading of export butter and cheese has continued with its usual smoothness, as evidenced by the fact that during the year written protests against the graders' decisions were received in only two cases; moreover, on investigation, these particular gradings were fully substantiated. A matter about which a warning seems necessary is that of the water-content of butter. The average of all the samples of butter taken at the grading-stores for this purpose was just over 15 per cent., and there appears to be a tendency to go closer to the safety margin than is conducive to the best interests of the butter industry.

Soils and Fertilizers.

With the easing of staff difficulties due to war conditions, the soil survey of the Dominion has been resumed in charge of the Chemist, and steady progress is anticipated from now on. The system followed will enable very comprehensive data to be recorded, and most valuable practical benefit cannot fail to result in due course.

The Department's campaign in connection with the use of lime has been continued, and accompanied by the opening-up of several fresh sources of limestone by private enterprise. In analyses of soils carried out at the Chemical Laboratory the "lime-requirement" as determined by the Hutchinson-MacLennan method is now included. New point has been given to the liming movement by stressing the economy of phosphates (for some time past in short supply) which could be effected by a judicious use of lime. An interesting investigation on the action of lime in making available reverted phosphates (from previously applied fertilizers) lying dormant in the soil, or checking such reversion, is being put in train by the Chemist at the experimental farms.

Under the reorganization of the Department the work of registration of fertilizers under the Fertilizers Act has been allotted to the Chemistry Section. Steps are being taken to extend the taking of samples and improve sampling methods. The whole of this activity, including analysis, will therefore be consolidated.

Biological.

The organization of the Biology Section has been strengthened and developed in several directions. A special equipment has been provided for plant-pathology work, the officer in immediate charge of this branch having recently had a course of special training at Otago University. One disease of serious economic importance receiving special attention both by field experiments and laboratory-work is that of dry-rot of swedes. Good work has been done in economic entomology, chiefly by studies of the life-history of our most injurious insects, including grass-grubs and army-worms.

Seed-testing has continued as one of the most important activities of the Biology Section, the volume of work carried out during the year constituting an easy record. While the Department's certificates are becoming very general in the seed trade, a small minority of traders are not falling into line on the voluntary basis, and legislation making official testing compulsory is being considered.

STAFF.

I wish to record an expression of thanks to the Directors of Divisions and to the staff in all branches of the Department for duties well done and sound assistance rendered in the important work for which the Department is responsible. With the co-operation of all concerned a further great advance is assured.

THE BOARD OF AGRICULTURE.

This report on the year's work would be incomplete without an adequate personal recognition of the wise and extremely valuable advice given by the President and the members of the Board of Agriculture in connection with experimental farms and other matters during a somewhat strenuous period. It was thoroughly appreciated in every way, and was of great assistance.

APPENDIX.

CONTENTS.

LIVE-STOCK DIVISION.

REPORT OF THE DIVISIONAL DIRECTOR.

The Director-General. Wellington, 4th July, 1919.

I FORWARD herewith my annual report for the year ended 31st March last.

A. R. YOUNG, M.R.C.V.S., Director.

INTRODUCTION.

My appointment to the position of Director of the Division was not made until 1st September, 1918. I have, therefore, not controlled the work as Director during the whole of the year under review, and consequently must confine the annual report, to some extent at least, only in so far as my connection during that period is concerned. In doing so I wish to thank you and the other officers directly connected with me in the direction of the work for the invaluable assistance rendered me in taking over the control of the Division.

The reorganization of the Department, involving the administration of the Rabbit Nuisance Act and Noxious Weeds Act being handed to this Division, necessitated a very great amount of extra work. The procedure required in making certain appointments carrying with them promotion to important positions led to much delay and inconvenience, and the carrying-out of the reorganization proposals were consequently much delayed. Even at 31st March appeals against some of the appointments made some months previously were still pending, resulting in uncertainty regarding the ultimate position. Efficiency has been the one thing aimed at in these appointments, and it is most essential to the Department in the work in which it is engaged that it should not be hampered by the liability of having its plans indefinitely delayed and also disorganized some time after the machinery has been set in motion.

The work of the Division, in common with all other branches, was to some extent disorganized by the influenza epidemic, but with the exception of the late Mr. David Patterson, of the office staff, who succumbed to the disease, I am pleased to say the officers of the Division who contracted the influenza all recovered, and in due course resumed their former duties. In Mr. Patterson the Department lost a most valued and promising officer, and his demise is regretted by all with whom he had come in contact in carrying out his duties in the Department.

I have also to record the death after a somewhat severe and long illness of Mr. C. R. Matthews, Meat Inspector. Mr. Matthews was a faithful and loyal servant of the Department, and his demise is to be regretted. Another officer whose death is also to be regretted is Mr. A. F. Wilson, Fields Inspector, Ohakune, who died in February last, just a few days subsequent to the date of my taking over the officers handed over to this Division under the reorganization scheme.

ANIMAL-DISEASES.

It is a pleasure to record that the Dominion is still free from the more serious diseases affecting stock in other countries, and with regard to those diseases already existing, they have been kept well in hand, no serious outbreak of any disease occurring during the year.

Blackleg.—During the year the regulations defining the boundaries in the Auckland District were amended, it being found necessary to extend the quarantine area somewhat, also to bring some of the "B" area into "A" area in the schedule, with a view to more effectually controlling this disease in that district and preventing its further spread. The measures taken have proved effective, but a few suspicious cases of blackleg have occurred outside the declared area, and it may later be necessary to have the schedule further amended. No alteration has been necessary in the boundaries of the Taranaki District, where inoculation was first made compulsory.

The number of calves inoculated in both districts—Taranaki and Auckland—shows a reduction in both cases when compared with the previous year, this presumably being a result of a greater number of calves being killed at birth. The figures are as under :—

	Calves inoculated, Twelve Months ending 31st March, 1918.	31st March, 1919.
Auckland	106,614	98,881
Taranaki	73,620	53,024

In addition, a number of second inoculations were carried out, the figures being Auckland 10,524, Taranaki 8,241, as compared with Auckland 7,496 and Taranaki 9,075 for the previous year. As usual, all the vaccine used was prepared at the Veterinary Laboratory, and the result has been eminently satisfactory.

Contagious Mammitis.—This still continues to be troublesome, particularly in dairying districts, and 253 specimens of milk from suspected cases were received at the laboratory for examination. This examination showed 30·4 per cent. to be affected with contagious mammitis, 36 per cent. with non-contagious mammitis, the remainder giving no evidence of mammitis.

Contagious Abortion.—This trouble has not been any more in evidence than formerly, and where the treatment recommended by the Department has been adhered to good results have almost invariably followed. In most cases where contagious abortion makes its appearance in a herd considerable loss occurs to the owner, and it behoves all dairymen, if this loss, which in addition to being an individual one is also national, is to be avoided, to carry out preventive measures. The treatment is simple and inexpensive, and the little trouble involved would be well repaid. It is to be regretted that the experimental work which was being carried out with a preventive vaccine was brought to an abrupt end through the herd (a private one) which was under the test being sold, and the animals scattered before the officer concerned was made aware of it. Up to that time the outlook for a successful result was promising, though it was realized that the procedure necessary for preparation of the vaccine and for its application was cumbersome and inconvenient when viewed from a practical working standpoint.

Tuberculosis.—It is somewhat satisfactory to note that the condemnations for this disease, as obtained from the results of the inspections of stock slaughtered at meat-export works, abattoirs, and bacon-factories, show that a slight reduction has taken place in the case of all classes of cattle and swine when compared with the previous year. A most encouraging feature as regards the cattle statistics is that the largest decrease is in the cows, which show a decreased percentage of 1·51, bullocks and heifers showing 0·98, and bulls 0·72 of a decrease; while swine show the very satisfactory reduction of 2·02, excluding those examined in butchers' shops, which are killed and dressed by farmers, the percentage of which, however, also shows a slight reduction on last year's figures. The number of cattle condemned by Stock Inspectors on the farms or in the yards as being affected with tuberculosis also shows a slight reduction on the previous year's figures. These are as follows: In 1918–19, 2,914 were condemned for tuberculosis; in 1917–18, 2,942 were condemned for the same disease.

Actinomycosis.—A number of cases of actinomycosis have come under the notice of officers, particularly in the South Island, where an unusually large percentage of the cases have occurred.

Cattle-tick.—During the past season considerable attention and consideration has been directed to this pest. Two very representative meetings of farmers, auctioneers, and others were held in Auckland, which were largely attended. The whole question was discussed at considerable length in all its aspects, and it was decided at the first meeting not to definitely fix a quarantine area until information could be gathered as to the extent in which the parasites had actually spread. During the six months following a large amount of available information was collected, and it was found that the original suggestion regarding a quarantine area would be likely to be impracticable. A further meeting was therefore called, at which, after careful consideration and discussion, it was recommended that the idea of quarantining a given district be abandoned. This was practically due to the extreme difficulty which would have existed in securing a workable scheme at any boundary which might have been fixed. The alternative was to place cattle-tick in much the same category as lice in sheep—that is to say, in any district or place where cattle-ticks were found that place would at once come under the operations of comprehensive regulations to be drawn up for this purpose. These regulations have now been drafted and submitted for approval and amendment, if necessary, pending which no compulsory action has been taken with regard to the eradication of the pest, but every endeavour has been made to secure this by the spread of information amongst the settlers in the affected districts, and by the erection of cattle-dips subsidized by the Government. One of these is in course of erection at Oakleigh. It was considered advisable to have this dip completed and in working-order before commencing to erect others, as it may be found that many improvements could be effected that did not show up until after the dip was in working-order. Mr. H. Munro, who was sent to Queensland to investigate the Queensland tick, has been stationed as Principal District Inspector in the Auckland Province. It may therefore be reasonably expected that the spread of this pest will be arrested, and that a decided reduction of its activity may be anticipated in the near future.

Live-stock Statistics.

Sheep.—The returns of sheep in the Dominion as at 30th April, 1918, showed an increase of 1,267,916 as compared with the previous year, the North Island accounting for 191,150 and the South Island for 1,076,760 of this increase. This could not, however, be regarded as a wholly genuine or lasting increase in the flocks, as it was to some extent at least accounted for through the very backward season experienced, particularly in the South Island, delaying the normal slaughterings up to that period and bringing them into the period immediately following, which, as anticipated, showed a considerable increase in the number slaughtered. The following table shows the number of sheep in the Dominion for the stated years:—

Year.	Stud and Flock Rams (Two-tooth and over).	Breeding-ewes.	Other Sheep.	Lambs.	Total.
1913	313,690	12,521,036	4,371,257	6,985,827	24,191,810
1914	321,869	12,920,176	4,377,936	7,178,782	24,798,763
1915	315,251	12,615,341	4,652,681	7,318,148	24,901,421
1916	316,131	12,892,767	4,682,298	6,896,954	24,788,150
1917	329,230	13,260,169	4,530,471	7,150,516	25,270,386
1918	325,111	13,022,034	5,295,269	7,895,888	26,538,302

Cattle.—The cattle enumeration taken in January, 1918, showed an increase of 294,235 head as compared with that of the previous year. The following table shows the numbers of the respective classes :—

Year.	Bulls (all Ages).	Dairy Cows.	Other Cattle.	Total.
1908	30,170	591,617	1,151,539	1,773,326
1911	40,870	633,733	1,345,568	2,020,171
1916	50,858	750,323	1,616,310	2,417,491
1917	49,930	777,439	1,747,861	2,575,230
1918	51,935	793,215	2,024,315	2,869,465

Swine.—The number of swine in the Dominion as revealed by the last enumeration showed a further marked reduction, a perusal of the figures for the last four years indicating a steady decrease. The figures are as follows : 1911, 348,754 ; 1916, 297,501 ; 1917, 283,770 ; 1918, 258,694.

Horses.—An enumeration of the horses in the Dominion taken in January, 1918, showed an increase of 4,450 as compared with the previous year, the figures being 378,050 and 373,600 respectively.

Slaughter of Stock for Export.

The arrangement whereby all beef, mutton, and lamb available for export is purchased by the Imperial Government has continued, and the later arrangement whereby the Imperial Government agreed to advance up to 75 per cent. of the value of all meat stored and waiting shipment has been of great value to producers and exporters alike. Owing to the prices being fixed for the duration of the agreement the fat-stock market has remained steady, but, unfortunately, the scarcity of shipping, causing the stores to become full, has produced some inconvenience through the inability of the meat-export companies to accept all the fat stock offering. This has not, however, been very serious, and the Dominion has benefited distinctly through the arrangement made originally in March, 1915, and continuing with the more advantageous concessions and increases granted from time to time.

As will be seen from the following table, a very substantial increase has taken place in the number of cattle, sheep, and lambs slaughtered at meat-export works (principally for export) during the twelve months ended 31st March, 1919, compared with the previous twelve months' slaughterings :—

	31st March, 1919.	31st March, 1918.	Increase.
Cattle	218,871	211,319	7,552
Sheep	3,690,152	2,968,269	721,883
Lambs	2,845,413	2,609,134	236,279

One additional meat-export slaughterhouse, that of the Wellington Meat Export Company, at Kakariki, near Marton, was completed during the year, and slaughtering operations commenced before the close of last season. Further additional cold-storage accommodation was provided by several of the companies.

Inspection of Meat.

The inspection of meat at meat-export slaughterhouses, abattoirs, and bacon-factories was again carried out with extreme difficulty, owing to war conditions causing fully trained Inspectors available to be insufficient for requirements, and had not these Inspectors met the position and willingly rendered increased service—sometimes at great inconvenience—the Department could not have had these duties carried out so satisfactorily and efficiently as they have been.

The following are the numbers of each class of stock slaughtered under direct inspection during the year 1st April, 1918, to 31st March, 1919 : Cattle, 307,816 ; calves, 18,872 ; sheep, 4,170,524 ; lambs, 2,928,892 ; swine, 121,040. With the exception of swine, which show a decrease of 16,199, these figures show an increase when compared with the corresponding period of last year as follows : Cattle, 17,666 ; calves, 4,392 ; sheep, 752,942 ; lambs, 253,746. It will be noted from this that an increase of over a million has taken place in the combined slaughterings of sheep and lambs.

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

	At Abattoirs.	At Meat-export Slaughterhouses.	At Bacon-factories.
Cattle	88,945	218,871	..
Calves	14,547	4,325	..
Sheep	480,372	3,690,152	..
Lambs	83,479	2,845,413	..
Swine	44,879	56,625	19,536

At ordinary slaughterhouses the stock killed was as follows : Cattle, 47,541 ; calves, 1,426 ; sheep, 210,481 ; lambs, 21,424 ; swine, 11,405.

In addition, 23,515 carcases of pigs killed and dressed by farmers under the exemption clause of the Slaughtering and Inspection Act, and sent in to butchers' shops and small bacon-factories, were inspected by departmental officers.

Compensation paid for Stock condemned.

During the year 3,667 head of cattle were condemned and ordered to be destroyed for disease, under the provisions of the Stock Act. The compensation paid amounted to £11,549 18s. 9d., being at the rate of half the market value as fixed at the time of condemnation. Compensation paid for animals condemned at meat-export slaughterhouses, abattoirs, bacon-factories, &c., on slaughter, under the provisions of the Slaughtering and Inspection Act, amounted to £10,888 2s. 10d., making the total compensation paid during the year under the Acts named £22,438 1s. 7d.

Importation of Breeding-stock.

The number of stud animals (excluding dogs) imported into the Dominion during the year and dealt with under the quarantine regulations were—4 bulls (2 being returns from the Sydney Show), 2 trotting and 2 thoroughbred stallions, and 14 swine. Shipping difficulties were undoubtedly responsible for the numbers imported not being considerably greater, and I quite anticipate that when shipping again becomes somewhat normal a large number of animals, particularly cattle, will be imported.

Inspection of Dairies supplying Milk to Towns.

The inspection of dairy herds and premises from which the supply of milk for domestic use is drawn has been carried on as usual during the year, and every effort has been made to maintain such a standard as would ensure a clean and healthy supply of milk from the licensed premises. That the efforts of the Department in this respect are successful I have no doubt whatever, and am quite satisfied that in the majority of cases of adulteration or uncleanliness detected in milk being vended such has taken place subsequent to its leaving the licensed dairy premises. I admit that there are unsatisfactory dairymen (producers), but they are a small minority, and the general experience has been that any reasonable requirement of the Inspector is willingly carried out.

Careful clinical examinations of the animals in the respective herds are regularly made by the Inspectors, and in this manner all animals affected with disease are weeded out, and any suspects are submitted to the tuberculin test. In addition to this, samples of milk from herds supplying the principal centres with milk were collected by the Inspectors, as has been the custom, and sent to the laboratory for examination for tubercle bacilli. It is satisfactory to note that the examination in no case revealed the presence of this disease.

The Wallaceville Laboratory.

During the year the work of the Department's laboratory at Wallaceville was continued on much the same lines as previously. The vaccine used throughout the areas affected with blackleg for the purpose of inoculating all calves was prepared at the laboratory by the acting officer in charge and the assistants, the number of doses sent out during the year amounting to 204,100, being slightly less than the number sent out the previous year.

Milk-samples examined biologically for tuberculosis numbered 79, all giving negative reactions; those examined for mammitis, a total of 253, showed 30·4 per cent. affected with contagious mammitis, 36 per cent. with non-contagious mammitis, and 33·6 per cent. gave no evidence of mammitis.

In connection with general work a large number of varied specimens were dealt with.

The manufacture of medicinal licks in brick form for treament of bush sickness and similar affections was started, a total of 566 "bricks" being made; also 6 gallons of ferrous lactate used for similar purposes to the medicinal licks. Experimental work was carried out with various calf-foods and material suspected of poisoning stock, none of the experiments showing the suspected materials to be injurious. Two sheep-dips received practical tests as regards their efficiency, one of these being the "Anconia" sheep-dip, the result of this test being used as evidence by the Crown against the proprietor of this so-called dip.

Experimental work was also carried out with foot rot in sheep, different agents and different strengths of the same agent being used. Owing, however, to the limited number of affected sheep which could be dealt with, further experiments are still necessary before reliable new results can be available.

The principal experimental work carried out on the laboratory farm has been to test the effect of manures applied to pastures in regard to the production of mutton. The practical side of this branch of work was directly under the Farm Overseer's control, Mr. B. C. Aston, Chemist, being responsible for the scheme.

Importation of Animal-manures.

The importation of animal-manures from India and Australia has again been affected through the dislocation of shipping and the embargo placed upon export by the Commonwealth. Certainly the quantity which arrived from Australia was considerably more than that of the previous year, but it was still much below the normal, while that from India amounted to only 1,800 tons, being a third of the quantity which arrived during the previous year. The following report from the Inspector of Manure-sterilizing, Sydney, is interesting as regards the position and future prospects of obtaining our usual requirements from the Commonwealth:—

The number of manure-works licensed under the New Zealand Stock Act regulations during the past twelve months under review was five. All of these with the exception of the Gladstone Meat-works, of Queensland, are situated in New South Wales. The names and particulars of the licensed mills are as shown at the foot hereof.

I am pleased to be able to report that the buildings, appliances, and surroundings generally of the licensed premises are on the whole satisfactory, and that the requirements of the regulations have been very fairly complied with. As in previous years, one of the principal dangers to be guarded against is the contamination of the manure after sterilization by other animal material. This is met with at mills in which drying-machines are not installed and where changes in the workmen are continually being made.

Supply of Raw Material.—During a number of months of the year when this State was badly affected by a long and severe drought great numbers of cattle and sheep were from this cause rushed into the markets, thus materially increasing the supply of bones and refuse from the local canning-works. Since the partial breaking-up of the drought in January a very limited supply of stock has come from the country; in consequence of this all the local meat-packing works have lately been compelled to close down. Regarding the other source of supply—dry country bones—this has shown a material decrease of late, notwithstanding the very high price now paid (£6 per ton at railway-station). The price of this class of bone is regulated entirely by the Colonial Sugar Company, who must, at any cost, obtain from 60 to 80 tons per week for the preparation of bone char.

Shipment of Manure to New Zealand.—The total quantity of animal-manure shipped to the Dominion was 26,391 bags, weighing 1,902 tons. Although these figures are almost double those of last year, they are much below those of pre-war times. The causes of the decreased exportation are as follows: (1) Impossibility of obtaining shipping-space; (2) result of the Commonwealth embargo placed against the exportation of fertilizers (still operative); (3) the growing increase of the use of fertilizers within the Commonwealth; (4) decrease in the supply of raw material. A return to normal conditions will doubtless remove the two first-mentioned causes, but not the remaining ones; more fertilizers will be required each year in Australia for local use, and the source of the supply of bone, &c., will not increase in the same ratio as the requirements. It seems very doubtful, therefore, if New Zealand will again be able to rely upon obtaining the quantity imported from here in the past—some 7,000 tons per annum.

Animal-hair.—Messrs. D. Lee and Sons, of Botany, were the only exporters of animal-hair this year. Their works at Botany were regularly visited during the preparation and treatment of these shipments. I at all times found this firm anxious to fully comply with the requirements of the regulations dealing with this product.

Assistance.—I wish to record the good work done by my assistant at Botany, Mr. J. Pearson, who carried out his duties in a very efficient and faithful manner. My thanks are also due to the State Chief Inspector of Stock, Mr. S. T. D. Symonds, M.R.C.V.S., for valuable assistance on many occasions.

List of mills.—Following is a list of mills in Australia working under a New Zealand license during year ended 31st March, 1919:—

License No.	Name of Mill.	Licensee.	Location.
1	Metropolitan	M. O'Riordan and Sons	O'Riordan Street, Alexandria, Sydney.
3	Excelsior	M. Gearin and Sons	Old Botany Road, Mascot, Sydney.
4	Pyramid	Patôn, Burns, and Co.	O'Riordan Street, Mascot, Sydney.
6	Riverstone Meat-works ..	B. Richards and Sons (Limited)	Riverstone, N.S.W.
7	Gladstone Meat-works ..	Gladstone Meat-works ofQueensland (Limited) ..	Gladstone, Queensland.

Sheep-dipping.

Although some apprehension existed as to whether the supply of dip-mixtures would be sufficient for requirements, it is satisfactory to report that the representations which were made by the Government through the High Commissioner ensured a sufficient supply for the season's requirements.

In addition to the "Anconia" dip, which was proved to be quite ineffective for the purpose of eradicating lice and ticks from sheep, there is evidence of other inefficient dips being placed on the market, and the gazetting of regulations, as proposed, to ensure that none but dips proved on analysis to be effective will, I am sure, be a step in the right direction and be welcomed by all concerned.

A number of prosecutions have again had to be instituted for exposing sheep affected with lice in public saleyards. This, in my opinion, is a serious offence, and I am satisfied that in the interests of sheepowners as a whole and of the sheep industry it should be reduced to a minimum. Offenders in this respect would be well advised to take warning.

Poultry.

Although very little if any substantial progress has been made in the poultry industry during the year, it has no doubt held its own better than was anticipated under the adverse conditions it has had to stand against. The influenza epidemic, coming as it did when the breeding operations were in full swing, had a serious effect. Not only did it mean that hatching and brooding operations had to be greatly curtailed throughout the country, but, in addition, heavy mortality took place among the young birds that were already hatched, owing to their owners being unable to give them the necessary attention. Obviously, on account of the shortage of pullets, which must be chiefly depended upon to lay in the winter, fresh eggs are commanding, and will continue to command, record prices during the winter months.

It is gratifying to note that the large demand continues for settings of eggs and birds for breeding purposes from the Department's poultry-stations, and it is to be regretted that this demand cannot be adequately met owing to the limitations of the present plants. No doubt many of the orders come chiefly from those who previously conducted poultry-keeping on a small scale, but were compelled for a time to go out of the business owing to the high cost of food and the inferior laying-qualities of their stock. The high price of foodstuffs which has ruled for several years may yet prove a blessing in disguise, if for no other reason than that it has forced poultry-keepers to realize the necessity of keeping none but tested laying-strains. During the year food-prices have ruled at a high level of value, but so have eggs. Many poultry-keepers who conduct the business on sound lines declare that the margin of profit over cost of production has given them a better return for the labour spent on their fowls than existed before.

During the year Mr. E. C. Jarrett, Overseer of the poultry section at Ruakura Farm, was appointed as a Poultry Instructor, and has now taken up his duties in the Auckland District. Arrangements are also being made to obtain the services of Mr. L. C. Cocker, of Christchurch, as an additional Instructor, and to locate him in the Wellington District. So great has been the demand for the services of the

Instructors for culling stock, mating breeding-birds, and giving general advice, also for judging at poultry shows, that it has been impossible to anything like comply with all the requests made. It is hoped, however, that with the additional assistance provided the future demand will be met. Mr. Brown, Chief Poultry Instructor, was for some considerable time laid aside with illness, having been subjected to a severe attack of influenza, but it is satisfactory to record that he has so far recovered as to be able to resume his duties with his characteristic enthusiasm and thoroughness.

Rabbits and Noxious Weeds.

The scheme of reorganization instituted in the Department and recently brought into effect has made this Division responsible for the administration of the Rabbit Nuisance Act and the Noxious Weeds Act. As, however, the duties appertaining thereto were not wholly taken over until after the end of January, I am not in a position to say anything regarding the past year's operations under these Acts, and therefore append hereto a report by the Assistant Director of the late Fields Division under the headings of "Rabbits" and "Noxious Weeds" respectively.

As you are aware, the Rabbit Nuisance Act was recently amended in the direction of reducing the acreage specified in the original Act as necessary before the formation of a ratepayers' Rabbit Board could be possible. This amendment should be of considerable assistance where the destruction of the pest is desired to be seriously undertaken by the settlers, as, provided the majority of the ratepayers comprises at least ten, any area of from 2,000 acres upwards may be constituted a Rabbit Board district on a petition signed by the majority of the ratepayers in the district affected being received.

A further amendment made was by repealing the penalty sections of the Act, and substituting a new section increasing the maximum fine for a first conviction and imposing a minimum fine for each subsequent conviction. Greater powers are also given under the amendment to the Inspector. While it is admitted that the powers given may be drastic, the country, as regards the rabbit pest, has become in such a condition partly, I fully believe, through the weakness of the clauses so repealed—that more drastic powers had become absolutely necessary if certain districts were not to be given over entirely to the rabbit.

While it was necessary that greater powers as stated should be provided, it is not to be accepted that the Act will be administered in other than a strictly fair and impartial manner and with the utmost discretion. The rearrangement of the inspectorial staff provides for direct district control and supervision from the four chief centres, and the officers appointed to control these districts are officers who can be relied upon to carry out their duties with absolute fairness, and bring their own practical knowledge and sound common-sense to bear in the control of both the Rabbit and the Noxious Weeds Acts. The landowner who carries out his obligations in controlling these pests to the best of his ability will have nothing to fear from the Department, but an energetic forward movement has become imperative, and I trust that future results will clearly show that good work can be done without unduly harassing the land occupier, and to his ultimate good and the good of the Dominion.

REPORT BY THE ASSISTANT DIRECTOR OF THE LATE FIELDS DIVISION ON RABBITS AND NOXIOUS WEEDS.

Rabbits.

Unfortunately, it cannot be said that the state of the pest has shown any improvement or diminution, but rather there has been a very decided increase both in the North and South Islands. Several causes have been accountable for this, and scarcity of labour, owing to war conditions, has principally been put forward by dilatory owners and others as one of the main causes for this increase. Still, it is always to be noticed that at a certain time, when trapping for export and canning becomes payable, men can be found in numbers to take up the work of destruction. In Central Otago freezing and canning works have been established, and as these no doubt bring in a large amount of revenue locally they are naturally looked upon as a benefit by all and sundry. Consequently owners find a great difficulty in procuring men at the proper time for laying poison. The latter do not care to enter on such work, preferring to wait a few months, when they know they can make much larger wages by trapping. Many owners appear to make this want of procuring men a strong excuse for not attending to their rabbits, but at the same time they do not hesitate to accept a bonus from interested parties for the right of trapping their lands. This has also a serious effect on other kinds of labour on account of the high wages made. The controversy of trapping *versus* poisoning and other ways of destruction still continues, and it is often suggested that the export of carcases and skins of rabbits should be strictly prohibited. It is a question for consideration, but difficult to bring into equitable practice on account of heavy vested interests. Landowners seem slow to see the vast harm done to their properties by allowing the pest to become numerous, and they fail to recognize that it would be far more payable and pleasing to have clean properties, and have beef and mutton and other produce growing on the same land on which the herbage is now being eaten out and polluted by rabbits.

Certainly enormous numbers of rabbits are destroyed by trapping, and it would, on superficial judgment, appear that such would be a good course to pursue, but it has been decidedly shown that the reverse is the case. Poisoning by phosphorized pollard or oats, and the use of strychnine, is still recognized by experienced owners as being the cheapest and most effective means of dealing with the pest. Where this can be and is supplemented by other means and by a system of wire netting the pest speedily becomes a thing of the past. However, the price of netting is now so prohibitive that

few can afford the expense. The question of supplying netting to farmers under some easy terms of repayment is worthy of consideration when opportunity occurs. Destroying cover and burrows is also a material help. The natural enemy, when unmolested, is reported to be doing good work, especially in the high country in Otago. Its operations tend to drive the rabbits on to the lower country, where they are more easily dealt with. Farmers and landowners have now had a long experience of the various modes of rabbit-destruction, but there are many districts where the matter is sadly neglected. Even in districts where good work has been done and rabbits reduced to a minimum owners get a false sense of security and think the pest is under for good, and are apt to then neglect it, till they find it is again assuming large proportions, with the result that this neglect takes a long time to rectify. The alarming increase of the pest in all parts has, however, brought landowners to a sense of their position and to the seriousness of the trouble, and considerable agitation to take more effective measures and also the framing of amendments to the Rabbit Act have been the result. The new Act provides for heavier penalties in cases of neglect, and the powers of an Inspector are increased. This, it is certain, will not be abused, and will give the Inspector greater confidence in administering the Act. Most of the Inspectors are now experienced, and carry out their often unpleasant duties with zeal, tact, and discretion. The amendments to the Act also provide for the forming of ratepayers' Rabbit Boards over smaller areas, and this will probably prove beneficial.

In some parts local committees have been in existence for some time, and these have done excellently, this system tending to more simultaneous and constant work. The war has had a serious effect in the inspection and administration work carried on by the Department, as so many officers had been drawn into the ranks. No doubt this has had an indirect effect on the increase of rabbits, as in several districts a considerable time elapsed before vacancies could be filled.

The district of the Hawke's Bay Rabbit Board continues to be kept well under control and shows good results, and the efforts of the East Coast Rabbit Board have been well maintained. The powers of an Inspector under these Boards are not actually greater, but greater support is rendered him by the landowners generally and his superior officers and the members of the Boards.

Sales of phosphorized pollard, &c., from the departmental depots have greatly increased, proving that the articles turned out are of good quality. The amount of phosphorized pollard distributed from the different depots amounts to between 250 to 300 tons per annum. This is sold to customers at practically cost price to the depot. Some 5 tons of phosphorized oats and 432 lb. of phosphorized wheat were also manufactured for rabbit and bird poison. The buildings and plants for dealing with this work are quite inadequate and require immediate alteration and enlargement.

Noxious Weeds.

The difficulties attending the administration of the Noxious Weeds Act do not decrease, and it is becoming more and more apparent that the Act cannot be administered in its present form with an equal degree of severity in every district or against every individual. As it stands, much has to be left to the discretion of the Inspector, but this discretion is apt to be abused. In some districts so much discretion has been used that weeds seem to have got hopelessly out of control, simply because those administering the Act have not carried out their duties in a judicious manner even tempered with a certain amount of discretion. Inspectors are somewhat handicapped by the wording of the present Act, in that certain powers were taken from them when the words " to the satisfaction of the Inspector " were deleted. These should again be inserted. The decision is left to a Magistrate, but in most cases he is not in a position to judge except by weight of evidence, and there are always other and extenuating circumstances of which he is not aware and which an Inspector does not care to ventilate. The Noxious Weeds Act is an unpopular one on account of the opinion that coercion is implied and may be harshly used by an Inspector, but this seldom or never happens. Still, the Act was framed for the public good, and, although opponents may say otherwise, it has justified its place on the statutes and should remain there. If beneficial amendments can be made, by all means this should be done; but otherwise the Act, even in its present form, can be administered in such a manner as to show good results Shortage of labour has for some seasons past doubtless been the cause of a partial standstill in the usefulness of the Act. Inspectors generally have been alive to this and the consequent difficulties under which landowners have been placed, and have not strictly pressed its requirements. It has often been suggested that the administration of the Act should be placed in the hands of local bodies, but it is very questionable if such is feasible or practicable. Members of these bodies are often so situated that it would probably press hardly on themselves, and they would therefore be disinclined to carry out the provisions of the Act against themselves. It is found that in cities, boroughs, and townships there is great trouble in having weeds attended to, and these are a constant menace to adjoining properties and districts. All classes of weeds are found growing in them, and they are equally a source of contamination as are country districts.

Some town and borough authorities have appointed their own inspectors. These officers stand in a different position to a departmental Inspector. They are confronted by many conflicting interests, which does not tend to efficient work. Instances are known where the departmental Inspector, who has still the supervision of the work, has had to approach these authorities and ask that their inspector show more zeal and activity.

From every point of view it will probably be found that the Act can be more judiciously handled, and with less fear of outside interference and prejudice, by a Government officer than by any other method. Lately a suggestion was put forward by a local body, which appeared to be a very good one, providing for the work being carried out by local committees. It seemed very workable, but there are flaws to be found in it. Weeds are not easily confined. There are so many means of distribution. Rabbits may be confined by wire netting, but not so weeds. This Act must be a penal one, leaving it to the administration to say whether it should be made strictly so or not. There are

many owners who for their own sake and credit will keep their lands clear, and there are others who will not do so except under stress. The former are detrimentally affected. A law has to be made to protect the latter against themselves. The intentions and requirements of the Act are well known to all landowners, except that they may not be aware of what weeds are declared in their particular districts. The Act has been the subject of such endless controversy that no owner can plead ignorance. The nature of weed desired to be cleared is generally endorsed on the "Reminder Notice" by the Inspector. All are expected to know the law. This is a point emphasized by Magistrates from the bench. It has been suggested that the country might be divided into belts and dealt with according to the requirements in each—in one belt the Act to be strictly enforced, in a second a certain amount to be done, and a third little to be insisted on. This would be unworkable. It would not be advisable to even have a purely departmental arrangement of classifying. Owners and occupiers would not agree to this.

Legislation is required to deal in some way with absentee properties, which are to be found in every inspectorate and generally become overgrown with weeds that are never attended to, and are consequently a source of annoyance to adjoining owners and to Inspectors. In some instances notices have been posted on the properties, and after a time the weeds cleared under the Act by the Inspector, but the difficulty is in recovering the cost, even if the owner might be found. The Act also requires amending to provide for the control of weeds on foreshores and river-margins—that is, where there are strips of land between a foreshore and a public road, or between a river or creek and a public road. Harbour Boards and County Councils or Road Boards nearly always disclaim liability in such cases.

Noxious weeds on Crown lands are still a cause of great annoyance and irritation to the public, and the position in this matter demands attention.

Local bodies sometimes make an apparent mistake in declaring the whole of the Third Schedule. It becomes unworkable. They should therefore have the power to withdraw certain weeds from the operation of such schedule when considered advisable.

DAIRY DIVISION.

REPORT OF THE DIVISIONAL DIRECTOR.

The Director-General. Wellington, 29th May, 1919.

I FORWARD herewith the annual report of the Dairy Division for the year ended 31st March, 1919. I desire to acknowledge the able assistance received from Mr. W. M. Singleton, Assistant Director, in connection with the control of the year's operations.

D. CUDDIE, Director.

THE SEASON.

The prospects for a profitable dairying season for the first months of the period under review were by no means favourable, owing to the inclemency of the weather conditions prevailing. The spring, following upon a somewhat severe winter, was late, and the weather at that time being cold and wet the supply of milk to cheese and butter factories was considerably less than that at the corresponding period of the previous year. To a more or less extent this applied to all dairying districts throughout the Dominion. In the district north of Auckland, however, the unfavourable spring was succeeded by a lengthy period of exceptionally dry weather, attended with a consequent shortage of grass, which materially curtailed the quantity of milk produced in that locality for the whole season. In fact, in this particular district the season has been one of the shortest on record.

In the Province of Taranaki there was a heavy mortality of dairy cows, due to the lack of sufficient feed for these animals during the winter and early spring months. Even many of those that survived were in such a low condition owing to semi-starvation that they gave considerably less milk for some time after the season began. As the year progressed, however, the weather conditions greatly improved; feed became plentiful in the majority of the districts, and continued in abundance throughout the summer months. Thus the production of milk again became normal, and held out well towards the end of the season.

The low atmospheric temperature experienced for the first half of the season no doubt interfered with the production of milk to a considerable extent. At the same time, it was beneficial in respect to the flavour of the milk and cream delivered for the manufacture of cheese and butter.

When it is remembered that the industry has been carried on under abnormal conditions, including a shortage of skilled help on the farms and also in the factories, owing to so many employees being absent from New Zealand with the Expeditionary Force, together with the serious epidemic of influenza which swept over the land at the height of the season, it is gratifying to be able to record a good dairying season.

EXPORTS.

Although the production of butter during the year was less than for the previous year, the quantity exported shows an increase over last year's figures of 172,110 cwt. This is accounted for by

the fact that shipping-space was provided during the year for the large quantity of last season's butter in store on 1st April, 1918, together with practically the whole of the year's exportable surplus, the quantity in store at 31st March last being little more than enough for the local winter-trade requirements. Cheese, however, showed an increase both in production and exports, the total shipments being 129,300 cwt. in excess of last year's figures.

The following tables show the quantities and classes of dairy-produce exported from the various grading-ports. Where not otherwise specified the figures refer to the year ended 31st March, 1919.

Creamery Butter for United Kingdom.

Port.	Total Packages.	First Grade.	Second Grade.	Third Grade.
Auckland	610,205	555,900	53,202	1,103
Gisborne	15,363	15,363	..	..
New Plymouth	101,017	100,087	930	..
Wanganui	20,074	18,864	1,210	..
Patea	1,336	1,285	51	..
Wellington	105,413	101,433	3,853	127
Lyttelton and Timaru	34,180	33,662	518	..
Dunedin	18,039	17,820	219	..
Totals	905,627	844,414	59,983	1,230

Whey Butter for United Kingdom.

Port.	Total Packages.	First Grade.	Second Grade.	Third Grade.
Auckland	9,449	1,716	7,733	..
New Plymouth	9,172	6,315	2,857	..
Wanganui	1,602	424	1,178	..
Patea	10,086	7,304	2,782	..
Wellington	12,727	11,305	1,355	67
Lyttelton	273	184	89	..
Dunedin	1,564	1,223	338	3
Totals	44,873	28,471	16,332	70

Dairy Butter for United Kingdom.

Port.	Total Packages.	First Grade.	Second Grade.	Third Grade.
New Plymouth	475	256	191	28
Totals	475	256	191	28

Milled Butter for United Kingdom.

Port.	Total Packages.	First Grade.	Second Grade.	Third Grade.
New Plymouth	99	39	60	..
Wanganui	374	62	312	..
Wellington	3,057	2,614	443	..
Totals	3,530	2,715	815	..

Butter for Australia and South Sea Islands.

Port.	Total Packages.	First Grade.	Second Grade.	Third Grade.
Auckland	2,938	2,934	4	..
Totals	2,938	2,934	4	..

Butter for Vancouver.

Port.	Total Packages.	First Grade.	Second Grade.	Third Grade.
Auckland	25,255	25,255	..	..
New Plymouth	1,773	1,773	..	..
Wellington	737	737	..	..
Totals	27,765	27,765	..	..

Total Quantity of Butter exported.

Port.	Creamery.	Whey.	Dairy.	Milled.	Totals.
Auckland	638,398	9,449	..	..	647,847
Gisborne	15,363	..	..	..	15,363
New Plymouth	102,790	9,172	475	99	112,536
Wanganui	20,074	1,602	..	374	22,050
Patea	1,336	10,086	..	..	11,422
Wellington	106,150	12,727	..	3,057	121,934
Lyttelton	34,180	273	..	..	34,453
Dunedin	18,039	1,564	..	..	19,603
Totals	936,330	44,873	475	3,530	985,208

Cheese for United Kingdom.

Port.	Total Packages.	First Grade.	Second Grade.	Third Grade.
Auckland	118,225	104,123	13,975	127
New Plymouth	114,745	110,849	3,775	121
Wanganui	12,813	11,596	1,217	..
Patea	142,008	134,561	7,447	..
Wellington	180,071	165,310	13,673	1,088
Lyttelton	16,915	16,388	527	..
Dunedin	30,067	28,236	1,791	40
Bluff	64,170	62,326	1,835	9
Totals	679,014	633,389	44,240	1,385

Cheese for Australia and South Sea Islands.

Port.	Total Packages.	First Grade.	Second Grade.	Third Grade.
Auckland	161	142	29	..
Totals	161	132	29	..

Total Quantity of Cheese exported.

Port.	Packages.
Auckland	118,386
New Plymouth	114,745
Wanganui	12,813
Patea	142,008
Wellington	180,071
Lyttelton	16,915
Dunedin	30,067
Bluff	64,170
Total	679,175

Total Weights of Butter and Cheese exported.

Countries exported to.	Butter.	Cheese.
	Cwt.	Cwt.
United Kingdom	477,252	970,020
Other countries	15,352	230
Totals	492,604	970,250

Quantities of Butter exported for the Years ended March, 1918, and March, 1919.

Port.	1917–18.	1918–19.	Decrease, 1918–19.	Increase, 1918–19.	Net Total Increase, 1918–19.
	Packages.	Packages.	Packages.	Packages.	Packages.
Auckland	362,697	647,847	..	285,150	..
Gisborne	5,138	15,363	..	10,225	..
New Plymouth	90,766	112,536	..	21,770	..
Wanganui	6,286	22,050	..	15,764	..
Patea	5,199	11,420	..	6,223	..
Wellington	117,698	121,934	..	4,236	..
Lyttelton and Timaru ..	36,576	34,453	2,123	..	..
Dunedin	16,627	19,603	..	2,976	..
Totals	640,987	985,208	2,123	346,344	344,221

Quantities of Cheese exported for the Years ended March, 1918, and March 1919.

Port.	1917–18.	1918–19.	Decrease, 1918–19.	Increase, 1918–19.	Net Total Increase, 1918–19.
	Packages.	Packages.	Packages.	Packages.	Packages.
Auckland	89,339	118,386	..	29,047	..
New Plymouth	83,865	114,745	..	30,880	..
Wanganui	8,357	12,813	..	4,456	..
Patea	112,607	142,008	..	29,401	..
Wellington	155,156	180,071	..	24,915	..
Lyttelton	13,776	16,915	..	3,139	..
Dunedin	20,572	30,067	..	9,495	..
Bluff	66,203	64,170	2,033	..	..
Totals	549,875	679,175	2,033	131,333	129,300

Quantities of Butter and Cheese forwarded to Grading-stores for Grading.

Port.	Year 1918–19.		Year 1917–18.	
	Butter.	Cheese.	Butter.	Cheese.
	Cwt.	Cwt.	Cwt.	Cwt.
Auckland	245,504	192,680	258,216	156,373
Gisborne	5,676	..	5,155	..
New Plymouth	44,702	214,040	57,384	161,087
Wanganui	8,164	17,300	7,785	16,361
Patea	4,496	240,390	6,810	239,549
Wellington	64,706	292,077	75,042	277,174
Lyttelton	22,460	31,300	21,761	27,000
Timaru	1,833	..	500	..
Dunedin	12,695	46,471	15,076	43,572
Bluff	..	109,932	..	120,259
Totals	410,236	1,144,190	447,729	1,041,375

Cheese Industry.

The number of cheese-factories in the Dominion now totals 390. Of this number 260 are located in the North Island and 130 in the South Island.

Arrangements have already been made for the building of several additional factories in time for the opening of next season. In addition to this extension it has been found necessary to enlarge a number of the existing factories in order that the owners may be in a position to cope with a larger quantity of milk in the almost immediate future.

For some time past dairy companies, as a general rule, have decided to provide buildings of brick or concrete where new premises have been required, and during the year some splendid factories of this nature have been completed, practically all of which have been designed after consultation with one or more of the Division's Instructors.

When the separation of whey was first commended for the recovery of butter-fat lost in the process of cheesemaking it was the common practice to install large whey-tanks lined with tinned steel to hold the whey prior to its being skimmed, but as these tanks have to be placed below the floor-level of the factory it was found that many of them leaked and became insanitary, and subsequently had to be condemned. To get over this difficulty recourse was had to the building of suitable concrete tanks and lining them with white glazed tiles closely cemented together. Where properly constructed these tanks have proved very satisfactory for the purpose. Quite a number of these receptacles were installed during the year; also tiled drains for conveying the whey to the tanks.

Frequent inspection of the majority of the cheese-factories during the season disclosed the fact that only a small number were not filling the requirements as regards approved sanitation, and in these cases the owners were called upon to make the needed alterations without delay.

In contrast to the decrease in the quantity of butter manufactured for the year, it is pleasing to be able to record a further development in the production of cheese. The total quantity of this produce received for shipment amounted to 1,144,190 cwt., being an increase of 9·8 per cent. over that for the same period of the preceding season.

Quality of Cheese.

Since the introduction of the system of pasteurization, as applied to the manufacture of cheese, became more general amongst the factories there has been a noticeable improvement in the quality of the finished product. This has been more apparent when the produce has been held in store for a long period, necessitated by the continued shortage of shipping-space brought about as the result of war conditions. Many of the factories formerly making cheese of indifferent quality have been successful in raising the standard of the produce to an unexpected degree, maintaining a much more uniform quality from day to day then ever before. It is estimated that 29,000 tons of cheese have been made from pasteurized milk for the year; and, while all factories have not been successful in doing good work by means of this process, it can be said that where every attention has been paid to the details of the method as laid down by the Instructors of the Division good marketable cheese of the highest grade has been made.

The season now closed was exceptionally favourable for the production of cheese of good quality up to the end of December, but from then onwards there was a marked falling-off in this respect, owing to the effect of the warmer weather on the condition of the milk as received at the factories, more particularly at those situated in the North Island. Many of the consignments of cheese which subsequently came forward for grading were of lower quality, showing irregularity in flavour as well as in body and texture. In some instances the cheese were poorly made, being open and loose in body. Others were showing over-acidity, while some were faulty in the opposite direction. The produce from factories here and there gave the impression that the makers were doing their utmost to obtain the highest possible yield from a given quantity of milk, irrespective of the effect upon the quality of the cheese. Such a precedure is, of course, very harmful not only to the factory concerned, but to the New Zealand cheese industry as a whole, because no buyer is satisfied with the purchase of cheese of this class.

The experience of the year has again emphasized the need for further improvement in the cheese from many of the factories. At some of these the milk received has not been carefully handled on the farms, thereby giving rise to flavours of an objectionable nature in the produce. More care, or a wider knowledge of the process of manufacture, is also required on the part of a number of the men in charge of this class of work.

Packing and Finish of Cheese.

While, generally speaking, the packing of cheese for the oversea market has been all that could be desired, it is to be regretted that there has been a considerable laxity in this respect on the part of a section of those engaged in the industry. On several occasions factory-managers have not carried out the terms of sale to the Imperial Government, by persistently packing the cheese before it had been on the shelves for the fourteen days specified in the contract of sale. It was found that the only remedy for this omission was to refuse to accept such consignments on behalf of the Imperial Government.

Another practice frequently noticed was the overfilling of the cheese-hoops, thus making the cheese too large for the crate used, and leaving no room for air-circulation or even the insertion of the necessary scale-boards. In such cases the ordinary battens used were of insufficient length, resulting in the weakening of the crate. Here, again, it was found necessary to refuse acceptance of these consignments until the packing was properly attended to.

Roughness in the finish of many cheese was not uncommon, due to carelessness in bandaging and dressing the cheese prior to removal from the hoops. This neglect carried the penalty of a loss in points under the heading of "Finish."

Cool Storage of Cheese.

The cool storage of cheese has shown a further advancement during the year, and, fortunately, space has been available at the various refrigerated stores in the North Island for all cheese received for grading, with the exception of a small portion of the large quantity dealt with at the Port of Wellington. In Canterbury the whole of the year's supply of cheese has been treated in a similar manner. The cheese received from the factories in Otago and Southland has been held in specially constructed buildings, which can be maintained much below ordinary summer temperatures and low enough to prevent deterioration of the produce for a reasonable length of time while awaiting shipment. It would, however, be more satisfactory if mechanical refrigeration were provided at the Dunedin and Bluff stores in order that the temperature of the cheese could be regulated in accordance with the conditions now obtaining at other grading-ports. The total capacity of cool stores, including those in use in the southern districts, is 600,000 crates of an average net weight of 160 lb. each; and the quantity actually in store at all ports at 31st March last was 474,754 crates.

The temperature aimed at in the refrigerated stores was 45° to 50° F., but where sufficient cooling-power has been supplied the range of temperature has been lower. Experience has shown that better results are obtained when the cheese is held at 36° to 40°, which prevents the development of cheese-mites, and also regulates the growth of mould. Unfortunately, 13,000 crates of cheese were damaged by a breakdown in the system of cooling at one of the temporary grading-stores in the North Island. At all other stores the work in this connection was well done. The mite pest became so troublesome at several of the stores that it was found necessary to fumigate the buildings with carbon bisulphide for the purpose of destroying this pest. With one exception the fumigation was successful; but as the cause of the failure in this instance is known, it can be avoided in future when treating other compartments, some of which are to receive attention at an early date.

In view of the heavy stocks of the season's cheese now on hand and the probability of a large portion of this still being in store when the new season opens at the beginning of August next, it seems essential to consider the question of providing some extra storage accommodation for cheese. Shipping-space is, unfortunately, far short of the requirements, and no less than twenty-five vessels, each carrying approximately twenty thousand crates of cheese, will be required to convey the present stock to the market. It is too much to expect that these cargoes can be moved in the time desired to make room for the whole of next year's output of cheese. Furthermore, it is obviously the duty of the producers to see that the interests of the buyers of the produce are protected in regard to its safe preservation while it is in their possession.

Butter Industry.

Creamery Butter.

It will be seen from the table of figures included in the report that the production of creamery butter has decreased by 8·3 per cent. as compared with the total quantity for the preceding year. This reduction is due to several causes, such as further quantities of milk being manufactured into cheese, the preparation of an increased quantity of whole-milk powder, and the effects of unfavourable weather for a portion of the season in the butter-producing districts. Present indications point in the direction of a further reduction in the amount of butter to be made in future as long as the market prices procurable for cheese rule higher than those for butter. If, however, the movement to establish factories for drying skim-milk on a large scale develops as anticipated there will be a corresponding increase in the quantity of butter manufactured for export.

With regard to the quality of the butter which came forward for grading and export during the year, it has to be admitted that this was not quite up to the standard of that received during the 1917–18 season. Moreover, the percentage of second-grade was higher than usual at the Port of Auckland, where the quantity dealt with is now larger than at all other grading-ports added together. Numerous consignments when opened for examination at various grading-ports proved to be defective in flavour, and showed unmistakable evidence of having been manufactured from faulty cream. While some of this butter was so inferior as to make its classification into second-grade a matter of no doubt whatever, a large portion could not be so classified on the basis of the existing standard for grading. Therefore it had to be accepted as the lowest-scoring first-grade, which is by no means a satisfactory article to the average consumer. On the other hand, the majority of the factories sent forward regular consignments of good butter which were sound in flavour and of uniform quality. As a general rule the butter was well made, the body and texture showing careful workmanship on the part of the makers. It was noticed, however, that at several of the larger factories the makers continued to overwork the butter, thereby spoiling the body and texture in their attempt to incorporate the maximum amount of water in the finished article.

This and other defects were brought under the notice of those responsible from time to time, and in cases where the defects were of a mechanical nature no difficulty was experienced in demonstrating the method which should be applied for correction; but where the flavour of the butter was found to be unsatisfactory it was not always possible to effect a remedy, owing to the cream being wrongly handled prior to its delivery at the factories. This phase of the year's operations is referred to in another part of the report.

Whey Butter.

The manufacture of whey butter is now recognized as one of the profitable branches of the cheese industry, and at many of the factories modern plant and machinery have been provided for this purpose. At the smaller factories, however, the companies have usually contented themselves with the installation of separating machinery only, preferring to dispose of the whey-cream to a cheese or butter factory of larger dimensions.

It is to be regretted that the making of whey butter does not, as a rule, receive close attention on the part of the factory-managers responsible for the quality of this product. A little more care on their part would result in an article of better flavour and firmer body, and one that would command a higher price on the open market. A large number of the consignments received for export have been inferior in quality, which could easily have been avoided by following the well-known methods of practical buttermaking.

The quantity of whey butter of all grades received at the grading-stores for the year amounted to 16,280 cwt.

Percentage of Water in Butter.

With a view of enforcing the terms of the Dairy Industry Amendment Act, 1915, which makes it an offence for owners to forward to any grading-store butter which contains more than 16 per cent. of water, or exports or attempts to export any such butter, the graders have collected 1,930 samples for analysis during the period covered by this report. With the exception of those consignments showing a fractional excess of water and which were returned to the factory, consignments of this nature were reconditioned under the direction of officers of the Division, and at the owners' expense. Several prosecutions were also laid against offending dairy companies, and fines inflicted by the Magistrate, ranging from £5 to £10, together with payment of costs of the proceedings.

It is rather significant that the average water-content of samples taken for the year shows an increase over that of the preceding year, the average for 1918–19 being 15·09 per cent. There appears to be over-anxiety on the part of certain companies to incorporate as much water as the law will allow, and in this attempt some consignments are bound to be above 16 per cent., as the test for water made at the factories is not always thoroughly reliable. It is, of course, impossible for the graders to take samples from every consignment of butter which reaches the grading-stores, as this would entail too large an amount of extra work. Moreover, it is not desirable to interfere with the contents of the packages by taking the numerous samples which such a procedure would mean. Nevertheless, it is most important to prevent the export of any butter which does not conform with the law in this respect, and it would seem essential to ask for heavier penalties for these offences, in the hope that it would have the effect of making the dairy companies more careful in this branch of their work.

Casein.

The preparation of casein from skim-milk, and to a lesser extent from buttermilk, has been continued during the year. The quantity of the former dealt with amounted to 486 tons, and that of the latter to 60 tons, representing an increase of 165 tons compared with the quantity handled during the previous season. In all, thirty-five precipitating-stations have been in operation, several of which were only opened towards the end of the year. One important factor in connection with the commencement of new precipitating-stations on a somewhat extensive scale in the Waikato district has been the reopening of a number of skimming-stations which were formerly closed down by the introduction of the home-separation system. If the market price for casein remains at a payable level no doubt an additional number of skimming-stations will be reopened, and this in turn will have a beneficial effect in the direction of improving the quality of the butter manufactured as compared with that made from home-separated cream. As it has been reported that dairy-farmers are now finding that the feeding-value of the casein-whey returned to them is much greater than expected, others are now more likely to support the establishment of casein-factories.

The quality of a portion of the casein graded for export has been all that could be desired, but, unfortunately, the remainder was more or less indifferent and irregular in quality. A want of uniformity in casein is a very serious fault from the buyer's point of view; therefore there is less demand for an article of this nature. The principal reason for the lack of uniformity is the delay which takes place between the time of the preparation of the curd and its arrival at the drying-station. This causes the development of fermentation, and results in an inferior solution from the finished product. The remedy, of course, is to have the drying-station located in a central position and at no great distance from the source of supply.

The Instructor who attends to the casein-factories has devoted a great deal of time to advising those interested in this branch of the work, and also to giving practical demonstrations in preparing the product from skim-milk and buttermilk. The advice given, however, has not always been carried out in detail so far as the treatment of the buttermilk is concerned. Consequently the product cannot be expected to create a demand for further quantities of this material.

Dried Milk.

It is safe to say that no topic in regard to dairying has been so frequently discussed of late as that of the dried-milk industry and the proposed establishment of additional factories for its extension. The dairy-farming community, more particularly in the Waikato district, has given this question a great deal of consideration, and many have expressed a desire to support the movement rather than continue to furnish supplies of milk or cream to either cheese or butter factories. Even the price of land and dairy stock have risen in certain localities in sympathy with the prospects of higher prices being obtained for milk-powder. The factories already established have received larger supplies of milk for drying than formerly, resulting in a total production of 3,200 tons for the year, practically all of which has been packed under the trade name of "Glaxo" and sold to the Imperial Government at 1s. 4¼d. per pound.

At the end of the 1917–18 season three of the larger dairy companies operating in the Auckland Province decided to send their respective managers to the United States and Canada as a delegation to make exhaustive inquiries as to the wisdom of building and equipping several large factories on the most modern system for the production of milk-powder. These delegates have since returned, bringing with them, it is said, the fullest information as to the method adopted for the treatment of

milk in the countries visited. It is also understood that the New Zealand rights for certain processes in the making of powdered milk have been secured by the companies concerned.

The building of three additional dried-milk factories in the Waikato is already under way, and provision is being made to treat large and increasing quantities of milk. The immediate intention is to prepare skim-milk powder only, as it is claimed that a higher net return can be procured by separating the whole milk for the manufacture of butter and then drying the skim-milk, for which a good demand is believed to exist.

It is obviously impossible to forecast what extra profits, if any, will ultimately be obtained from the sale of milk-powder as against that of other dairy-produce, as everything depends upon the market price of these products, together with the cost of preparing them for the market.

This matter is of such importance, however, that the Department must be prepared to give instruction and advice to those engaged, or about to engage, in the drying of milk, on similar lines to that adopted regarding other branches of dairying. Hence the necessity for sending an officer abroad to gather full information on the subject, as recently arranged.

Grading of Dairy-produce.

One of the most important activities of the Division is the grading and classification of all butter and cheese intended for export. It calls for the closest attention, for not only does the decision arrived at by the grader determine the price to be paid to the owner of the produce, but the manufacturer is practically compelled to accept the official grade-note as an intimation of the need for improvement when faults or irregularities are detected in any consignment at the time of examination.

In view of these facts it will be recognized how essential it is to maintain a uniform system of grading at all shipping-ports in the Dominion. Every effort has therefore been made to compare the grading as between the different ports as frequently as possible, and these comparisons have proved that the decisions of the graders are made upon a uniform basis, thus protecting the interests of sellers and buyers alike, as well as doing much towards the regulation of a more equal quality in the products from the various factories.

During the year only two written protests regarding the classification of dairy-produce by the graders were received at this office, and when these were investigated it was found that the consignments referred to had been correctly classified by the officer concerned.

The grading of casein has also been continued by an officer of the Division in accordance with the arrangements formerly made with the manufacturers.

Table showing the Grading-points scored by the Butter and Cheese graded throughout New Zealand for the Year ended 31st March, 1919.

Grading-points.	Butter.		Cheese.	
	Number of Boxes.	Percentage.	Number of Crates.	Percentage.
76	116	0·0150	..	..
77	204	0·0263	90	0·0111
78½	414	0·0574	1,217	0·1507
80	116	0·0150	54	0·0066
81½	20	0·0025	..	..
82	146	0·0189	495	0·0613
82½	240	0·0310	270	0·0334
83	469	0·0606	520	0·0644
83½	481	0·0622	433	0·0536
84	2,884	0·3730	2,143	0·2655
84½	3,017	0·3902	3,348	0·4148
85	5,262	0·6806	7,132	0·8837
85½	9,400	1·2158	9,795	1·2136
86	23,285	3·0117	19,714	2·4427
86½	6,444	0·8335	12,998	1·6105
88	8,573	1·1088	31,309	3·8794
88½	23,089	2·9812	38,368	4·7540
89	45,277	5·8549	78,449	9·7204
89½	55,702	7·2047	94,093	11·6588
90	86,286	11·1667	123,611	15·1924
90½	87,434	11·3091	118,473	14·6791
91	109,715	14·1910	96,362	11·9400
91½	90,691	11·7304	68,297	8·4625
92	78,077	10·0988	52,722	6·5326
92½	41,865	5·4150	26,968	3·3415
93	41,277	5·3389	16,511	2·0458
93½	22,978	2·9720	3,268	0·4049
94	21,576	2·7907	411	0·0509
94½	7,676	0·9928	..	..
95	5,246	0·6785	..	..
95½	135	0·0187	..	..

Timber for Butter-boxes and Cheese-crates.

In many instances dairy companies have had great difficulty in procuring sufficient and regular supplies of suitable packages for butter and cheese, the sawmillers in certain districts being either unwilling or unable to furnish the quantities of white-pine needed for this purpose. When the timber was eventually secured it was frequently unseasoned, and therefore unsuitable for immediate use.

In the past this shortage of white-pine has been attributed to the unrestricted export of this timber to the Commonwealth of Australia, where large quantities are still being used for the making of butter-boxes and other requirements of the timber trade, but from the 6th August, 1918, some restriction has been placed on the export of timber generally, which is fully explained in the *Gazette* notice of that date. It is believed that the Board of Trade now has the matter in hand with a view of regulating supplies of the timber needed in New Zealand, and no doubt due consideration will be given to the question of maintaining larger quantities of white-pine wherever practical, thereby prolonging the period over which this most useful timber will be procurable. It is, of course, well known that the supply of white-pine timber is within measurable distance of being exhausted. It is therefore advisable that the utilization of timbers other than white-pine be carefully considered, and that such timbers be thoroughly tested with regard to their suitability.

It may be mentioned here that a trial of Southland beech timber for butter-boxes was made during the year under the control of the Division, the necessary wood being supplied by the Lands and Survey Department. Every care was taken when making the trial, and a portion of the same churnings of butter was also packed in the ordinary white-pine boxes in order that a comparison could be made in any variation in the quality of the contents. The respective packages of butter were examined on three occasions at intervals of two months, and at the end of the period it was found that none of the butter showed any signs of deterioration as the result of being packed in the boxes made of beech timber. The trial was therefore considered entirely satisfactory and the wood found to be suitable in every way.

The Southland beech timber has been used for the manufacture of cheese-crates for a number of years, and is replacing white-pine to a considerable extent in the southern districts. Although beech timber is somewhat heavier and not quite so attractive in appearance as white-pine, the crates made from the former are considered satisfactory by the various dairy companies using them.

A number of butter-boxes of a design calculated to effect a great saving in the amount of timber required have been submitted to the Division to be tested. These packages appear to possess a considerable amount of merit in this respect, and, providing they are found to be of sufficient strength to stand the handling which takes place between the factories and the market, dairy companies will probably make use of them. It is expected that a trial of these special boxes will be made at an early date.

Sale of Butter and Cheese to the Imperial Government.

Early in the year meetings of representatives of all dairy companies and dairy-factory proprietaries were held at various centres for the purpose of discussing the question of disposing of the year's output of butter and cheese to the Imperial Government. At these meetings delegates were selected to meet at a conference in Wellington at a later date to further consider the matter and elect committees. The delegates from the cheese-factories met on 23rd April, and, after conferring with the Prime Minister, a Dominion cheese committee with full power to act was set up to carry on negotiations. A similar procedure took place on 9th May in connection with the delegates representing the butter-factories, a Dominion butter committee being also constituted and given full power to take whatever action deemed necessary.

On 25th June, 1918, an intimation was received from the Dominion cheese committee and the Dominion butter committee stating that the producers had decided not to sell this season's output of cheese at less than 10¾d. per pound f.o.b., and the output of butter at a lower price than 196s. per hundredweight on the same terms. It was then ascertained that the Food Ministry in London could not see its way to purchase more dairy-produce in New Zealand than could be shipped within a reasonable time, owing to the difficulty which had arisen as the result of serious shortage in refrigerated steamers.

A month later cable advice was received to the effect that the Food Ministry was not yet prepared to make a definite offer for dairy-produce, but stated that the Imperial Government would probably agree to purchase both butter and cheese for a period covering twelve months after the war. At this time the position in regard to shipping was improving. Further cables were despatched and received. On 19th October the National Dairy Association received cable advice from its London representative to the effect that the Food Ministry was unwilling to consider a price beyond 181s. for butter, owing to the producers in Australia having accepted 175s. per hundredweight for their butter. The price offered for cheese was 10¾d. per pound.

The butter and cheese committees again met in Wellington on 28th October, when a lengthy discussion took place with the Prime Minister, Minister of Agriculture, and Minister in Charge of the Imperial Government Supplies Department, the committees eventually deciding to accept 10¾d. per pound for cheese f.o.b., the sale to be for a period of two years; but the butter committee still held out for 196s. per hundredweight for butter. Subsequently a cable was received by the Government from the High Commissioner stating that the Food Ministry was treating the offer of butter and cheese as one, instead of separately, and also that it was considered 181s. a reasonable price for butter, and that no higher offer could be made.

A further conference took place between the committees and the Prime Minister on 11th November, when it was agreed to accept 181s. for butter under protest, with a request that the

purchasers accept the risk of insurance from factory-door, and also pay storage charges after twenty-eight days. A reply was received pointing out that the Food Ministry would not accept the risk of insurance from factory-door, but was willing to pay any storage charges incurred for a period over two months.

Finally a cable was received from the High Commissioner stating that the Food Ministry agreed to purchase the exportable surplus of butter and cheese for two years at 181s. per hundredweight for butter and 10¾d. per pound for cheese, both f.o.b., first-grade, with a reduction in price in each case for a lower grade similar to that which applied to the contract for the previous season's supply. The Food Controller also agreed to buy whey, dairy, and milled butters and dairy cheese at a reasonable reduction on the above-mentioned prices for first-grade similar to those obtained in the purchase of the previous season's output. On further representation being made regarding the price for whey butter, this was increased to 162s. 4d. per hundredweight for first-grade—namely, 2d. per pound below that of creamery butter.

While it may be contended that the producers have received a high price for both butter and cheese, it is desired to point out that the butter-producers will not receive the full benefit of the prices obtained, as an agreement was arrived at with the New Zealand Government that the butter required for sale within the Dominion would be supplied at 1s. 5d. per pound in bulk at the factory-door, thus enabling the consumer to procure supplies from the retailer at 1s. 8d per pound. This arrangement involved the formation of an equalization fund, whereby all exporting factories have to contribute a portion of the price received from the Imperial Government toward adjusting the price of butter sold in New Zealand as fixed by the Dominion Government. The terms of sale to the Imperial Government are, however, more advantageous than those obtaining last year, in that storage on all produce after two months is paid by the Imperial Government, and that advance-payments up to 90 per cent. in value are made available on all produce which has been in store fourteen days.

The delay in completing negotiations referred to above caused considerable inconvenience to dairy companies, and also delayed the issue of the "working arrangements," containing full details regarding the scheme, until the season was nearly over.

Condition of Milk and Cream received at Factories.

It is again necessary to draw attention to the question of effecting some improvement in the flavour and condition of a large portion of the milk and cream delivered to factories for the manufacture of dairy-produce. For some years past there has been a decided increase in the quantity of ill-flavoured and inferior cream produced under the system of separating it on the farms, familiarly known as the "home-separation system." In a lesser degree the same might be said of the whole-milk supply. Owing, however, to the daily delivery of the latter product during the greater part of the season, it does not show the same extent of deterioration as compared with cream, which is usually held on the farm for several days all the year round. The causes of this inferiority are well known to many of those connected with the industry, and therefore need not be detailed in this report. It is sufficient to say that a large portion of the milk and cream is produced under such conditions, and allowed to come in contact with dairy appliances on the farms which are so unclean and unwholesome as to be totally unfit for the handling of any food product, let alone one so susceptible to contaminating influence as the valued product of the cow. The personal inspection of many dairy-farm premises and milking appliances, separators, &c., by the Instructors of the Division during the past year has again revealed a deplorable want of attention on the part of some owners to the ordinary laws of cleanliness. In fact, there were instances where a shocking state of affairs was discovered which could no longer be allowed to continue. Nothing short of immediate condemnation of such appliances can be agreed to.

Unfortunately, the control exercised by the Division over conditions of this nature is altogether inadequate, for the simple reason that the officers available for this class of instruction or inspection are too few in number. A wider and far-reaching extension of this branch of the work is without doubt most urgently required, in order that the dairy industry of the country may be carried on under conditions which will ensure the manufacture and export of products equal to—and, if possible, even better than—those of our competitors.

Grading of Cream.

Ever since the system of home separation became general it has been a matter of extreme difficulty to manufacture butter of the best quality and which might be expected to realize the highest market price. During recent years the separation of cream on the farms has been undertaken in practically every dairying district in the Dominion, and bids fair to entirely supersede the whole-milk delivery system, except at the factories where casein is prepared from the skim-milk, or where facilities will be provided for the preparation of skim-milk powder. It is well known that much of the cream skimmed on the farms is treated by the owners in such a way that it becomes contaminated as the result of unclean separators and dairy utensils, or when stored on the farm under conditions which are far from being sanitary. When these defects are accentuated by failure to cool the cream, and the product is delivered to the factory only every second or third day, and sometimes at even longer intervals, the quality is so inferior that it is impossible to make anything but a secondary butter from this class of cream.

Many remedies have been suggested as a means of overcoming this serious menace to the industry, and the one which appears likely to be most successful is the grading of the cream on arrival at the factories, and the payment of same according to grade. So far, the grading of cream on a systematic basis has been confined mainly to the Auckland Province, where a number of factories have adopted it. At the outset a difference of only ½d. per pound of butter-fat was allowed as between first- and

second-grade cream, but this narrow range of value has not been the means of stimulating a greater degree of care on the part of the owners. A number of the factories have therefore increased this difference in price to 1d. per pound of butter-fat. A further disparity in price would seem advisable, but the dairy companies are not yet willing to take such a step.

The Instructors in buttermaking have advocated the grading of cream on the basis of awarding points according to quality, and this method has already been attended with a measure of success, more especially where a premium has been paid for the cream scoring 92 points and over, with a slightly lower rate for ordinary first-grade, and a still lower rate for second-grade cream.

While there is no doubt at all about the beneficial effect of cream-grading generally, it remains to be seen whether the pointing system can be successfully extended. During the year several cream-grading conferences were held and attended by a large number of factory-managers along with Instructors of the Daily Division, the object being to gain further experience and also ensure a greater degree of uniformity in the work.

Personally, I am convinced that cream-grading on approved lines, and the payment of a sufficiently low price for poor quality, together with a proper system of instruction in the handling of cream on the farms, would be the means of greatly improving the quality of creamery butter made in New Zealand. The sooner such a system can be introduced the better it will be for all concerned.

Testing of Milk and Cream.

The testing of milk and cream samples has received the usual attention by Instructors of the Division, and the efforts thus made to minimize any dissatisfaction amongst suppliers with the testing as carried on by factory-managers have apparently been successful. The reports submitted by Instructors who have attended to the checking of this work at the factories go to show that more care is taken to prevent inaccurate testing than formerly. All glassware and other appliances used at the factories were generally found to be of the best obtainable, and in no case were any serious irregularities detected.

Acting on a suggestion from this office, the directors of one of the largest dairy companies in Taranaki recently decided to hand over the whole of the testing of suppliers' composite milk-samples to an officer of the Division, and as one of the staff was already engaged in the testing of dairy herds on behalf of the company's milk-suppliers it was agreed that he should take up this additional duty. Inquiries have been received from other dairy companies regarding the appointment of official milk-testers, and so long as the parties concerned are willing to meet the necessary expenditure, including that of the salary of such an officer (within certain limits), it is considered that appointments of this nature should be encouraged.

Dairy Instruction.

Those engaged in the manufacture of dairy-produce have taken full advantage of the assistance rendered by the Department in employing a permanent staff of Dairy Instructors, whose help and advice is available when required. Following the usual custom, these officers have spent the major portion of their time at the cheese and butter factories. The success which has attended the instruction imparted to those in need of it has been in a large measure due to the co-operation of the men in charge of the factories and the officers concerned. When it was found that the quality of the produce being manufactured was below the average, one or more days were spent in locating the cause of the defect, and then giving a demonstration as to the manner in which the fault could be overcome. On many occasions it was found only necessary for the officer to call at the factories and to offer suggestions to alter the process of manufacture, which when adopted gave the desired result.

Apart from the ordinary instruction in the manufacture of butter and cheese, a great deal of time was occupied in dealing with the numerous branches of dairy-factory work, including the arrangement, control, and running of dairy machinery. When called upon, or where it was considered advisable, the Instructors conferred with the chairman and directors of dairy companies to discuss important matters in relation to the industry. As a general rule, the advice and recommendations of the Instructors were accepted. It is worthy of note that many thousands of pounds are spent annually by dairy companies for the purpose of giving effect to the recommendations of the Instructors regarding improvements and additions to dairy-factory buildings and their equipment. In this way the majority of these dairy factories in the Dominion are kept more up to date and in a better sanitary condition than would otherwise be the case.

It is desired to mention that only a very limited amount of instruction in respect to the care of milk and cream and the cleaning of milking-machine and other dairy utensils could be undertaken amongst the farmers, the sole reason of this being the small number of Instructors employed. More work of this nature is urgently needed.

Testing of Dairy Cows.

The certificate-of-record system of testing purebred cows has evidenced an extension this year that is somewhat surprising in view of the scarcity of labour and the fact that the Armistice had not been signed when most of the entries were received. The number of breeders co-operating with the Division in this work represents an increase of one-third over that of the preceding year. The prospects for the ensuing season warrant the assumption that a further increase will be evidenced. This work is enabling dairy-farmers to select bulls more intelligently, and cannot fail to have a direct bearing on the production of the average dairy cow in New Zealand. Its influence must be towards an increased production, which is so essential to this Dominion at the present juncture.

Mr. J. Donald's purebred Friesian, Westmere Princess Pietertje, established a new milk and butter-fat record during the year not only for her class, but for her breed and the Dominion as well. Her record of 24,199 lb. milk and 939·78 lb. butter-fat gave her the position of champion of New Zealand and leader of the junior four-year-old Friesian class.

Herd-testing Associations.

The association testing of cows in dairy herds has been continued by the Division at Kaupokonui, Joll's, Okitu, Kia Ora, Cheltenham, Woodville, and Riverbank, and newly undertaken at Ngaere, Hawera, and Te Rehunga. In addition to this, private employees of a number of dairy companies have done a considerable amount of testing. It is expected that when more labour is available extension of the work of testing dairy herds will be forthcoming. The figures available suggest that in addition to purebred cows some seventeen thousand cows in ordinary dairy herds have been on test during the past season. The dearth of labour on dairy farms is reflected in the decrease which has occurred when this number is compared with the 26,700 on test during the 1917–18 season.

STAFF.

This report would be incomplete without some reference to the good work done by the officers of the Division during the course of a busy year. It is therefore desired to mention that all officers connected with the technical activities of the divisional work have taken a keen and lively interest in their respective duties. Their efforts to assist those engaged in the dairy industry have been attended with a large measure of success, and have evidently been appreciated by the producers. The clerical officers have also given close and prompt attention to their duties throughout the year, thereby greatly contributing toward a united effort to render efficient service to the country.

HORTICULTURE DIVISION.

REPORT OF THE DIVISIONAL DIRECTOR.

The Director-General. Wellington, 13th May, 1919.

I HAVE pleasure in submitting the annual report of this Division for the year ended 31st March, 1919

T. W. KIRK, Director.

INTRODUCTION.

The work coming within the scope of this Division has been carried out during the year as well as was possible considering the altered conditions caused by the Great War. 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, gardens, and nurseries, 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; cool storage; advances under the Fruit-preserving Industry Act.
(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.) Registration of all orchards and nurseries in the Dominion.
(8.) Orchard-tax: Issuring of tax-demand notices, &c.
(9.) Inspection of all imported fruit, plants, vegetables, 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.

(10.) Viticulture and winemaking: Giving advice on the growing of grapes, both outdoor and under glass, the control of pests and diseases, and on the making of wines.
(11.) Affording information on beekeeping generally, and the production of honey for market.
(12.) Inspection of apiaries, and instruction in up-to-date methods of controlling disease.
(13.) Grading of honey for export; registration of honey-export brands.
(14.) Registration of apiaries.

Fruitgrowing Industry.

The fruit season has been rather an unusual one. Particularly late frosts were experienced in some districts, while the climatic conditions in the spring were very favourable for the development of black-spot. Later on the conditions improved, so much so that the losses from brown-rot in stone fruits were very much less than last year. The crops were on the light side, but prices on the whole were good.

Owing to shortage of labour the area planted in new orchards during the year was less than in previous years. The total area now in fruit throughout the Dominion is estimated at 50,192 acres. The following figures show the area planted during the 1918 planting season: Whangarei, 25 acres; North Auckland, 125 acres; South Auckland, 10 acres; Poverty Bay, 14 acres; Waikato and Bay of Plenty, 8 acres; Hawke's Bay, 30 acres; Taranaki, 10 acres; Manawatu and Wairarapa, 35 acres; Nelson, 200 acres; North Canterbury, 75 acres; South Canterbury, 5 acres: total, 537 acres.

Summary showing Number of Acres planted in Orchards in each Provincial District since 1911.

District.	Total Acreage, 1911.	1912 Increase.	1913 Increase.	1914 Increase.	1915 Increase.	1916 Increase.	1917 Increase.	1918 Increase.	Grand Total, 1918.
Auckland ..	12,106	318	335	513	800	395	425	182	15,074
Hawke's Bay ..	2,425	130	120	150	150	75	60	30	3,140
Taranaki ..	998	60	40	23	5	5	10	10	1,151
Wellington ..	3,763	75	105	101	63	60	40	35	4,242
Marlborough ..	563	40	50	312	180	100	100	..	1,345
Nelson ..	5,474	1,098	1,055	1,550	1,577	1,325	400	200	12,679
Canterbury ..	4,313	280	320	303	213	130	300	80	5,939
Otago ..	1,312	360	500	350	600	300	200	..	6,622
Totals ..	33,954	2,361	2,525	3,302	3,588	2,390	1,535	537	50,192

The advice and assistance given to fruitgrowers and soldiers by the officers of the Division is much appreciated, as is evidenced by the large number of requests that are received for lectures, demonstrations, and personal instruction.

The Orchard Instructors, besides enforcing the provisions of the Orchard and Garden Diseases Act, are actively engaged in the following work: Giving instruction in fruit-production, suitable varieties of fruit, planting, and the practical control of insect pests and diseases; the inspection of nurseries; holding public demonstrations in pruning and spraying fruit-trees; and the grading and packing of fruit.

The work of the Horticulturist to the Division is greatly valued, and besides embracing correspondence dealing with all branches of horticultural work it covers a wide field, such as the naming of specimens of fruits, plants, weeds, grasses, flowers, and identifying insects and plant-diseases (in cases not dealt with by the Biologist).

Export of Fruit.

Owing to the war no fruit was exported during the year under review. It is hoped that arrangements will be made for regular shipments next season, as with the large number of new orchards coming into bearing, combined with a normal season, there will be more fruit than the local market can absorb. The crops this year have been below the average, and with the increased cool storage provided by means of the Fruit-preserving Industry Act the local market has been able to cope with the supply. This is not likely to be the case next season with anything like an average crop. Regulations dealing with the export of fruit have been prepared and will be gazetted in time to deal with the export next season. The following figures show the number of cases of fruit exported in each export season up to 1916, when exporting ceased: 1908, 1,236; 1909, 191; 1910, 5,647; 1911, 6,031; 1912, 14,869; 1913, 33,000; 1914, 67,964; 1915, 62,164; 1916, 19,246.

Fruit-markets.

The season was a particularly difficult one for the control of black-spot. A concession was made this season and fruit infected with this disease allowed to go under permit direct from the orchard to the by-product factories. This has certainly brightened the sample on the markets. The same standard of inspection exists throughout the main centres of the Dominion. It was apparent that growers had not taken such systematic measures this season to keep the diseases under control, no doubt owing to light crops. However, on the whole, the sample of fruit has been bright and well packed. It was found necessary to condemn a number of consignments badly infected with disease.

Apple Grading and Packing Classes.

This useful branch of the Orchard Instructors' work has been continued, as far as possible, in all the main districts These classes will be extended so as to place clearly before growers the standards required in the export and local-market regulations governing the grading and packing of fruit. Since these classes were inaugurated six first-class certificates in fruit-grading have been issued, and seventeen persons gained first-class certificates in fruit-packing, and one a second-class certificate in the same subject.

Certificates in Pruning and Spraying.

Examinations in pruning and spraying are held each year in the different centres. During the past year some fifteen persons sat for examination. Of these, four secured first-class certificates, and three second-class. Up to the present time fifty-five first-class and eleven second-class certificates have been issued by the Department.

Demonstrations by Orchard Instructors.

Continuing their usual practice during the winter months practical demonstrations in up-to-date methods of pruning and spraying were given during the year by the Orchard Instructors in their respective districts. These demonstrations are duly advertised in the local papers, and as a rule are largely attended by fruitgrowers and others, who greatly appreciate the valuable advice thus given.

Co-operative Fruit-testing Plots.

Only one new co-operative fruit-testing plot was planted during the year, as it is considered that in most districts sufficient of these plots have now been established. Since 1910 sixty-six of these experimental areas have been planted in different localities throughout the Dominion. A number had, however, to be abandoned owing to the owners having died and to other causes, leaving a total of fifty-seven in operation.

The results obtained from some of the older-planted areas have been published in the Department's *Journal* from time to time, and serve as a valuable guide as to what varieties are best suited to different localities.

Spraying and other Experiments.

With the wide range of climatic conditions experienced in the Dominion it is recognized that the experiments undertaken in any one district will act only as a guide in another district where different conditions prevail, and should not be implicitly followed. Not only have the horticultural stations been utilized for this work, but experiments have been undertaken on a fairly large scale in private orchards in co-operation with the fruitgrowers' associations. The latter orchards have been used more as demonstration plots, and have served a very useful purpose. The more intricate and delicate spraying experiments have been reserved for the stations. Experiments for the control of brown-rot were made a leading feature of this work during the season. A different phase of control was tested in eight private stone-fruit orchards, as well as being the leading feature at Arataki Horticultural Station. A full report covering this series of experiments is being published in the *Journal*.

Arataki Horticultural Station provides a splendid field for testing the numerous new spraying-compounds that are annually being put on the market. Tests on a large scale were also conducted at this station for the control of orchard-diseases. Some of these were—Control of red mite and testing various brands of oil in connection therewith; control of woolly aphis on orchard-trees and nursery stock; control of leaf-curl and dieback of peach; control of plum-rust. Besides these tests special spraying experiments at the cluster-bud stage were undertaken for the control of black-spot and red mite.

At the Tauranga Horticultural Station and in two lemon-orchards in the Auckland District spraying experiments for the control of verrucosis and lemon-scab were made.

Other experiments: In private orchards the following experiments have been conducted by the Division: Manurial, including liming and green crops; pruning; and interpollination of plum-trees. Reports on the experiments are published in due course.

Grading of Fruit-trees.

Regulations governing the sale of fruit-trees according to the grade assigned have been gazetted, and will be put into operation this lifting season. This is a matter of considerable importance, as it will ensure that the purchaser of fruit-trees will be supplied with the class of tree he desired and in accordance with the grade ordered.

Fruit-preserving Industry Act.

The assistance given under this Act is being taken advantage of to a large extent, and several cool stores and packing-sheds have been built, and others are in course of erection. To date advances have been made to some twelve companies, representing a total amount of £75,000.

Orchard-registration and Orchard-tax.

During the year some 7,500 commercial orchards were registered and £1,897 collected in orchard-tax. Under the Orchard-tax Act passed in 1916 all occupiers of orchards from which fruit is sold or intended to be sold are required to pay a tax each year calculated at the rate of 1s. per acre or part of an acre, with a minimum charge of 2s. 6d. All moneys collected are paid over to the New

Zealand Fruitgrowers' Federation (Limited), to be expended on proper lines in the furtherance of the interests of the fruitgrowers of New Zealand.

Registration of Nurseries.

During the year under review 414 nurseries were registered, representing £418 in fees. This is the third year that the nursery regulations have been in force, and considerable good has resulted in controlling the spread of diseases.

Horticultural Stations.

Te Kauwhata.

The season on the whole has been a very successful one considering the very wet winter and early spring. The fruit crops were good, both apples and pears bearing heavily. The grape crop was lighter than usual owing to the wet weather experienced when the vines were in bloom. The trees on the four fruit-farms have made good growth and look very promising. The lucerne plots have done remarkably well. The autumn-sown plot still stands out superior in every respect. In addition to the continuation of spraying experiments some useful manurial experiments were conducted. The demand for the wine manufactured at this station still keeps up, as is evidenced by the fact that it was found necessary some months ago to discontinue the bulk sales.

Arataki.

A portion of an adjoining commercial orchard, as well as the whole of the orchard at the station, was utilized for spraying experiments. A block of seven varieties of peaches was planted last winter for an experimental pruning-area. The grass-garden is now established and creating a great deal of interest. The vegetable trials have been continued, and some useful results have been published. The control of brown-rot after the fruit is picked and packed will form a feature of the experiments during the coming season.

Tauranga.

An area of about 7 acres has been set aside for citrus trees. As the district is well suited to citrus-culture, it is proposed to make this work a strong feature of the station's activities. The block was partially planted last spring, and will be completed this season. Pruning, stock-testing, as well as testing varieties, form part of the scheme. An experimental apple and pear area of about 4 acres was planted last winter for variety, pruning, spraying, and manurial tests. A system of continuous green-manuring is now adopted at this station to conserve moisture in place of deep summer cultivation. Good results are already apparent.

Experimental Orchard, Canterbury.

The Department has leased a property of 8 acres in Harewood Road, Papanui, Christchurch, for experimental purposes. It comprises 4 acres of established apples and pears from twelve to twenty years old. It is proposed to work this as far as possible on commercial lines. The control of black-spot and red mite will form a feature of the experiments. Manurial and spraying tests on tomatoes and potatoes will also be conducted. This orchard should prove of great value to the fruitgrowers of Canterbury.

Investigation of Fruit Industry in America.

Mr. J. A. Campbell, Assistant Director of this Division, left the Dominion in March to investigate the fruit industry in Canada and the United States. He will be in America during the whole of the growing and harvesting season, and will make full investigation and inquiries in connection with cool storage, marketing—particularly the co-operative systems—and the working of the compulsory grading regulations, pruning, control of insect pests and diseases, and all other matters relative to the industry. The information acquired will be published, and should be of very great value to the industry.

School of Horticulture.

This is a matter which has demanded attention for some considerable time. Further representations have been received from fruitgrowers' associations and others again urging the establishment of a properly equipped school of horticulture. Owing to the lack of housing-accommodation at the horticultural stations there are no means at present of imparting knowledge in the various branches of horticulture to even a few cadets. It is hoped something will be done in connection with this important matter at an early date, as at present there is an entire lack of facilities in this Dominion for the study of horticulture, and this lack is retarding various branches of the industry.

Hops.

According to figures supplied by the Customs Department, 2,294 cwt. of hops, valued at £12,830, were exported during the year. This shows an increase in value of £3,289 as compared with the previous year. The following figures show the quantity and value of hops exported from the Dominion during the last six years ending 31st March: 1914, 5,152 cwt., value £26,430; 1915, 3,216 cwt., value £20,786; 1916, 4,425 cwt., value £17,742; 1917, 4,449 cwt., value £17,708; 1918, 2,134 cwt., value £9,541; 1919, 2,294 cwt., value £12,830.

Imported Fruit.

The following figures supplied by the Customs Department show the quantity of fresh fruit and fruit products imported into New Zealand during the year. The previous year's figures are quoted for comparison.

	1918-19.		1917-18.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Fruit, fresh, dutiable	1,381,061 lb.	20,249	3,239,090 lb.	33,537
,, ,, free	18,808,525 lb.	135,464	21,420,386 lb.	143,457
,, bottled and preserved	147,380 doz.	59,821	237,672 doz.	75,660
,, dried	8,070,001 lb.	221,105	11,026,996 lb.	288,502
Lemon and orange peel in brine	115,626 lb.	2,100	484,228 lb.	3,623
Fruit pulp and partially preserved fruit ..	67,686 lb.	1,532	162,494 lb.	2,978
Totals	..	440,271	..	547,757

This shows a big falling-off in the importations, due chiefly to the disorganization caused by the Great War.

Inspection of Imported Fruit, Plants, and Vegetables.

The Fruit Inspectors stationed at the ports of inspection—Auckland, Wellington, Christchurch, Dunedin, and Bluff—report that the bulk of the fruit, vegetables, &c., came to hand in good condition. Several lines, however, from Fiji, Cook Islands, and Australia arrived in more or less bad order. Bananas from Fiji especially have been of very poor quality, in many instances being only half-grown. There has again been a big decrease in the total number of packages imported at all the ports with the exception of Wellington, which shows an increase as compared with the previous year. The reduced figures are due to war conditions, and also to the influenza epidemic, which greatly disorganized shipments from the islands. A great improvement is noticeable in the quality and packing of the fruit from the Cook Islands, particularly bananas, the cases being well filled and honestly packed. The condemnation of fruit for fly infection was confined to only one or two lines. A number of consignments infected with scale and mealy bug required to be fumigated before being allowed to land.

The following is a summary of all fruit, vegetables, plants, &c., examined at the different ports of entry during the year, the previous year's figures being also quoted for comparison:—

Port of Entry.	Fruit.				Plants, Vegetables, &c.			
	Total.	Destroyed.	Fumigated.	Reshipped.	Total.	Destroyed.	Fumigated.	Grand Total.
1918-19.	Cases.	Cases.	Cases.	Cases.	Packages.	Packages.	Packages.	Packages.
Auckland ..	345,816	145	106	20	51,518	2	..	397,334
Wellington ..	103,716	626	243	..	60,417	..	..	164,133
Christchurch ..	27,389	55	130	..	468	8	..	27,857
Dunedin ..	9,764	114	207	..	6,876	1	..	16,640
Bluff	6,328	..	84	..	941	..	..	7,269
1917-18.								
Auckland ..	446,507	55	2,868	3	19,189	2	6	465,696
Wellington ..	93,429	929	178	126	28,650	11	1	122,079
Christchurch ..	34,882	18	40	..	1,563	18	200	36,445
Dunedin ..	20,944	184	61	..	7,722	1	..	28,666
Bluff	6,531	25	33	..	796	..	..	7,327

Vineyards and Vinehouses.

There has been no alteration in the area under vineyards, which stands at 454 acres. The Acting Vine and Wine Instructor reports that owing to unseasonable weather experienced the vintage in all parts of the Dominion was quite a month late. Although the grape crop was lighter, the fruit was in fine condition owing to the favourable autumn experienced, and should result in a good sample of wine being made. It is estimated the yield of wine will be 48,000 gallons, about one-fifth less than that of 1918. At a conservative estimate of 4s. per gallon this represents a value of £9,600.

The number of glasshouses in the Dominion is 850. The inclement weather experienced during the growing season has also affected the grape crop under glass, which is estimated at 457,405 lb., a considerable decrease as compared with the previous year. This crop, based on 1s. 3d. per pound, represents a value of £28,588.

Inspection of vineyards and vinehouses has been carried out during the year.

Beekeeping Industry.

The beekeeping industry is still making satisfactory progress. Notwithstanding that the past season has been a very erratic one for the beekeeper, a good average honey crop has been gathered in the different districts. Although prices have dropped on the Home market, the returns obtained are still very satisfactory, and should remain so for some time to come.

The Apiary Instructors have been kept busy during the year on inspection-work, honey-grading, demonstrations, &c. Very satisfactory work continues to be done by the majority of the honorary apiary inspectors, and their services, which are voluntary, are much appreciated. The appointment of two Apiary Inspectors, one at Christchurch and the other at Dunedin, has been of great assistance to the Apiary Instructor in charge (Mr. E. A. Earp), who has the whole of the South Island to supervise.

Experiments.

Experimental work has been continued at the Ruakura Apiary in co-operation with the beekeeper in charge, Mr. A. B. Trythall. The experiments include tests with different makes of hives; quantity of wax that can be produced by a colony worked for that purpose only; testing different makes of cappings-melters. In connection with the wax-production experiment three large hives were used. These each produced on an average 2½ lb. wax. The tests will be tried another season away from the main apiary, and it is anticipated better results will be obtained.

Queen-rearing Apiary, Tauranga.

Good progress is being made with the establishment of the queen-rearing apiary at the Tauranga Horticultural Station. A beekeeper in charge was appointed in October last, and since then the apiary has made rapid headway, there being now about 140 colonies with seventy-seven purely mated queens. These queens have been mainly raised from two Italian queen-bees kindly donated by Mr. W. Lenz, the well-known apiarist of Masterton. In order to expedite the work a number of queens were obtained from the Ruakura Apiary, and these have since been replaced. An Australian-bred queen has also been procured to encourage the production of large numbers of drones. The queens thus raised should provide the basis of a good strain of bees. At the end of the year a total of 202 queens had been raised, 84 being pure, 31 mismated, and 87 untested. A supply should be available for distribution next spring.

Registration of Apiaries.

The number of persons who have registered to date is 5,503, representing a total of 59,427 hives.

Full publicity has been given as to the requirements of the regulations, but notwithstanding this there are still a number of persons who have failed to register, and it is evident more drastic steps will require to be taken in the matter.

Export of Honey.

According to the Customs figures 6,619 cwt. of honey, valued at £32,018, was exported during the year. This represents a big increase both in quantity and value as compared with the previous year. This is no doubt due to the large accumulations of honey held up in the grading-stores for want of shipping-space being got away during the year, and to the high prices ruling at Home. The following figures show the quantities of honey exported from the Dominion during the last five years ending 31st March: 1915, 2,456 cwt., value £4,763; 1916, 2,390 cwt., value £6,067; 1917, 1,572 cwt., value £3,554; 1918, 2,819 cwt., value £7,991; 1919, 6,619 cwt., value £32,018.

The Apiary Instructors, who have been kept very busy with the grading of honey, report that, generally speaking, the bulk of the lines were in good condition; a few, however, had to be rejected on account of bad packing, leaky tins, and fermentation.

Staff.

The carrying-out of the work of the Division during the year has again been handicapped through the absence of permanent officers on active service. Now that the war is over it is hoped, with the return of those still absent, that matters will soon return to a more normal condition. I have much pleasure in reporting that all officers, both temporary and permanent, have under the unsettled conditions carried out their duties satisfactorily.

FIELDS INSTRUCTION AND EXPERIMENTAL FARMS BRANCH.

Instructional Work, and the Lesser Experimental Areas.

Notwithstanding various handicaps, including the labour shortage, a considerable amount of useful experimental and demonstrational work was carried out in the various districts under the Fields Instructors. Much of the activities of these officers also consisted in advising farmers in field operations either by personal visit or correspondence, the calls on their services for this purpose being numerous, and in this special attention has been given to soldier settlers. A subject, for instance, on which much information was sought and given was that of catch-crops, rendered necessary by the general failure or poorness of the turnip crop, especially in the South Island. With this and other special duties the Instructors had a strenuous year. A brief summary of the work is here given; special accounts or reports concerning much of the experimental work have been published in the Department's *Journal*.

In the Auckland District the newly established plots on the Puwera gum land experimental area were further developed with grasses and forage plants, and a larger adjoining piece of land is being broken in. The Albany area maintained its function as an excellent demonstration of the capabilities of gum land. The Department also joined co-operatively with the Auckland Education Board and the local Farmers' Union in a scheme of experiments in pasture-formation on another class of gum land near Dargaville, these tests being still in progress. Sand-drift-control work was continued at Rangi Point, Hokianga, and at Orewa, near Waiwera. At Orewa a new nursery has been stocked with young marram-grass plants and lupins—the latter for seed-growing purposes—and the general results so far have been successful. Among lucerne-growing tests may be mentioned a very promising one at Te Teko, Bay of Plenty, on land typical of a large area covered by pumice or wind-borne ash from the Tarawera eruption.

In Hawke's Bay various experimental work was continued in conjunction with the Hawke's Bay Farming Development Association, and further experience gained in relation to several local problems.

In the Poverty Bay district a variety test of wheats was carried out in co-operation with the Hon. W. D. S. MacDonald and son, at their farm near Gisborne. Heavy yields of high-quality grain were obtained, and useful data secured for wheat-growing, which is ordinarily very little practised in this district.

Experimental work in the Taranaki District chiefly centred round the Stratford Model Farm, subsidized and supervised by the Department. The tests consisted of variety and manurial trials with root and fodder crops, also top-dressing of pasture. The demonstration afforded by this farm is already proving of distinct value to settlers in the district, the up-to-date methods adopted being followed by many. The cropping reports submitted at the executive committee's monthly meetings and published in the local Press keep farmers in touch with the institution, while the annual meeting gives an opportunity for the exchange of ideas and the making of suggestions. Another farm area which is to be operated and subsidized on similar lines to those of Stratford has been organized at Manaia and taken over by the Waimate West County Council. The principle under which these farms are conducted is a sound one, and it should be adopted elsewhere.

The important problem of how best to deal with the regrassing of unploughable bush-burn country that has reverted to fern and second growth generally is being studied in connection with the necessity for dealing with this question in the Whangamomona district of Taranaki and elsewhere. It is hoped to take definite practical steps in this direction before long.

Operations at the Marton Experimental Area during the 1918–19 season consisted chiefly in the testing of varieties of wheat and oats, and feeding-tests with fodder crops. A lucerne stand was also laid down and some turnip-seed raised.

In Canterbury lucerne-growing continued to be a leading feature of the field activities, and a number of farmers made a commencement with the crop. The question of pastures has also received some attention, and needs more. At the Ashburton Experimental Area, worked in co-operation with the local High School Board, cereal tests were a prominent feature, the season being favourable for these crops. Root- and forage-crop trials were also continued. Considerable attention was devoted to various methods of lucerne-cultivation, manuring, &c., and some useful data secured.

Ensilage-making with specially grown crops—various cereals and tares—was the most noticeable item at the Gore Experimental Area in Southland, and new pasture-formation also received attention. During the year the Department took over an area of about 60 acres at Winton for experimental and demonstrational purposes, mainly in connection with the investigation of dry-rot in swedes and its control. Other special areas of swedes were sown at Gore, Fairfax, and Brydone, and these are also being kept under close observation with a view to elucidating this serious trouble.

Experiments and demonstrations on the forest and pakihi lands of the west coast of the South Island have been followed up, and further observations made on local agricultural problems. The pastoral development of this part of the Dominion demands more attention. A continuous service has been given to this district by the resident Fields Instructor with headquarters at Hokitika.

An important economic investigation commenced during the year is that of the montane tussock-grassland—mainly in the South Island—with a view to steps being taken for the improvement of the

immense pastoral areas showing more or less retrogression. The conduct of the investigation has been entrusted to Dr. L. Cockayne, F.R.S. Some of the branches of the subject now engaging his attention deal with botanical nomenclature and segregation of component plant races, relative palatibility of the various species of the grassland, the question of burning the tussock, depletion of the grassland, the rabbit question, distribution of danthonia, surface sowing, and cultivation. Steps are being taken to practically test a number of points in the investigation by observation enclosures, &c., in Central Otago, while a fresh series of experiments will be instituted at the Department's area on the Earnscleugh Run, near Clyde.

The Experimental Farms.

Central Development Farm, Weraroa.—Field-cropping operations at this farm were on usual lines and presented no features of special note. The lately established plant-breeding section was further developed, useful improvement-work being done on a number of grasses, fodder plants, potatoes, &c. The various herds of purebred and crossbred dairy cattle were well maintained at strength, eighty cows and heifers being in milk in the flush of the season. At the close of the year the stock records showed the following numbers of the various breeds kept: Friesians, 113; Shorthorns, 48; Red Polls, 29; Guernseys, 7; grade Jerseys, 21; and Guernsey-Jersey crossbreds, 8: total, 226. Sheep numbered 1,268; pigs, 109; and horses, 25. Improvements to buildings comprised the erection of commodious bull-pens, rearrangement of piggeries, &c. Owing to adverse circumstances the training scheme for student assistants and learners, instituted in 1917 in connection with this farm, was not continued at the expiry of the two-years course, but several of the students have been absorbed into the service of the Department. The conscientious objectors quartered on the farm during the latter part of the war have been replaced by returned soldiers for training purposes, and provision is being made for accommodating a greater number.

Ruakura Farm of Instruction.—This farm has still further assumed the functions attaching to its designation by instruction to various categories of trainees—boy "learners," apiary students, and returned soldiers—besides providing for a teachers' farm school, various school camps, classes, &c., in co-operation with the Auckland Education Board, and receiving numerous organized visiting parties of farmers and others. The need for additional accommodation and equipment has been recognized, and as part of the proposal special residential quarters for returned soldiers are being built on the farm. In regard to farm operations, a full cropping scheme was carried out, with excellent demonstrational results generally. The feature on the live-stock side is the Milking Shorthorn herd, which has been greatly developed in quality and numbers, standing during the year at about three hundred head, including young stock. The policy has been to retain and raise most of the young female stock in preference to buying in. The Jersey herd promises to be greatly improved by the progeny of the bull, Golden Swan, specially purchased two or three years ago. In sheep, the Southdown stud flock has been well maintained. The Berkshire pigs show further improvement, and new piggeries in course of construction will provide much needed facilities. All these classes of stock have been in great demand by private buyers, and the revenue from this source has constituted a record for the farm. The horticulture section continued useful work in plot testing of grasses, fodders, and vegetables, the raising of farm and garden seeds, the propagation of shelter and ornamental trees for use on the farm, and the maintenance of the fine orchard. The poultry section again distributed large numbers of high-class breeding-birds and settings of eggs of utility breeds, and afforded good instructional facilities in this branch of rural industry. A large proportion of the foodstuffs for the poultry was grown on the farm in connection with the general cropping scheme. The apiary experienced a record year on the instructional side; the experimental features were continued on much the same lines as in the previous twelve months. Queen-rearing operations were actively carried out, and large numbers sold, as also nucleus hives, but the demand by the public far exceeded the supply. The energy and practical ability displayed by the Farm Manager deserves commendation.

Moumahaki Experimental Farm.—In spite of unusual labour difficulties Moumahaki has been efficiently maintained throughout the period. Exceptionally heavy crops of cereals, peas, &c., were secured at the past harvest. The cropping scheme, together with the extensive areas of lucerne, enabled full stocking to be practised throughout the year. The dairying side of the farm was curtailed by a considerable reduction of the Ayrshire herd effected at a special auction sale. In sheep, the Ryeland stud flock continues to be a feature, and the demand for breeding-stock from the flock cannot be fully met. The excellent type of Berkshire pigs raised on the farm has met with a ready sale. Altogether the year has been a good one in regard to sales of stock, 1,700 fat sheep and lambs having been disposed of in addition to fat cattle.

CHEMISTRY SECTION.

REPORT OF THE CHEMIST.

The Director-General. Wellington, 16th May, 1919.

I FORWARD herewith the annual report of the Chemistry Section for the year ended 31st March, 1919.

B. C. ASTON, F.I.C., Chemist.

The difficulty in carrying out the work has been increased owing to the conditions prevailing due to the war, the influenza epidemic, and the shortage of shipping.

SOIL INVESTIGATIONS.

Several visits have been paid to the Department's Weraroa Farm and the Manawatu district, and samples of soil collected from every type possible have been received at the laboratory for analysis. The soils of the Weraroa Farm have been sampled in detail from each paddock. A number of soils collected in the district were in connection with the "yellow-leaf" disease in flax. This disease, after waxing in importance, appears now to be waning with equal rapidity.

The Gisborne flats, at Poverty Bay, were visited in April, 1918, in answer to a request from the Poverty Bay branch of the Farmers' Union. Officers of the union had previously decided what areas of country were typical of the district, and samples of soil were drawn from these and analysed. The results were published in an article in the *Journal* for October, 1918, entitled "Notes on some Poverty Bay Soils." The fact is brought out that the River Waipaoa brings down large quantities of silt which contains an appreciable quantity of carbonate of lime, and hence when the river floods, as it frequently does, the land is improved in lime-content although crops may be destroyed.

The soils from the Stanley Brook district, Nelson, which also had been visited at the request of the local branch of the Farmers' Union during the previous year, were analysed. The results showed that all the soils would probably respond to liming at the rate of 2 tons of carbonate of lime per acre.

Applications for soil investigations to be undertaken were received during the year from the North Auckland Development Board, Kaitaia (March, 1918), and the Oparure (Te Kuiti) settlers (February, 1919). It will probably be found possible that some assistance may be given in soil-survey work by the Thames School of Mines, the Director of which has conferred with the writer on the matter.

While it is intended to deal with applications for soil research strictly in the order in which they are received, a complete soil-survey of the whole Dominion has been commenced. It will be continued as soon as the working staff is sufficiently strengthened by the return of officers from abroad.

Abnormal Soils.—A sample of soil from the Ida Valley, Central Otago, was received from the Public Works Department in connection with the irrigation-work being carried on there. The sample was a scraping of a white efflorescence of the surface. It was found to be similar in composition to other samples previously analysed from the Maniototo Plain containing 2·7 per cent. of soluble salts, of which 2·1 was sodium sulphate (Glauber salts) and 0·6 per cent. sodium chloride. The former constituent has also been found in the estuarial muds of the reclaimed land near Invercargill. This is probably due to the interaction with the sodium chloride of the sea-water and the sulphides of the silt after oxidation.

Siliceous Earths similar to diatomaceous earths recorded in last report have been sent in from localities near Wairama Run, Morrinsville; and Whangapoua, Hauraki Peninsula.

LIMES AND LIMESTONES.

About the same number of limestones and limes have been analysed as in the previous year. An interesting feature was the number of soft samples which, if present in suitable quantities, could be applied to the soil direct without any intermediate grinding or other treatment, in the same manner in which chalk is used in England. Samples from Whetukura, Ormondville (86·5 per cent), Ohutu (96 per cent.), and Mauriceville were sufficiently pure and fine to ascertain their value for putty-making, putty-powder being now generally imported. But only one of these showed sufficiently good results to warrant further trials, and these will be carried out if a supply of the material can be obtained. Samples of soft limestone (85·5 and 87·5 per cent.) were also received from Gladstone, Wairarapa, and these could similarly be used on the land without any previous treatment. Another source of cheap limestone is the screenings from limestone-quarries, for which the Railway Department charges private individuals 2s. per yard (approximately 1 ton) on truck at the quarry. A truck holds a maximum of 6 tons, and the haulage of the truck from the main line at Te Kuiti is 3s. per truck. The crude limestone is not carried free for the first 100 miles as commercial lime is

carried, but a charge is made according to scale. About 300 tons of the screenings containing 80 per cent. calcium carbonate is produced annually, and the following is the mechanical composition :—

Passed 1 in. mesh, retained on $\frac{3}{16}$ in.	8·7
,, $\frac{3}{16}$ in. ,, ,, $\frac{1}{16}$ in.	30·5
,, $\frac{1}{16}$ in. ,, ,, $\frac{1}{30}$ in.	26·8
,, $\frac{1}{30}$ in. ,, ,, $\frac{1}{60}$ in.	16·3
,, $\frac{1}{60}$ in. ,, ,, $\frac{1}{90}$ in.	5·8
,, $\frac{1}{90}$ in. ,, ,, $\frac{1}{120}$ in.	1·4
,, $\frac{1}{120}$ in. ,, ...	10·5
	100·0

This may be compared with the fineness of the commercial ground limestone from Napier of 81 per cent. of carbonate of lime, as follows :—

Retained on $\frac{3}{16}$ in. sieve	0·3
Passed $\frac{3}{16}$ in., retained on $\frac{1}{16}$ in.	15·3
,, $\frac{1}{16}$ in., ,, $\frac{1}{30}$ in.	33·3
,, $\frac{1}{30}$ in., ,, $\frac{1}{60}$ in.	33·1
,, $\frac{1}{60}$ in., ,, $\frac{1}{90}$ in.	11·6
,, $\frac{1}{90}$ in., ,, $\frac{1}{120}$ in.	2·0
,, $\frac{1}{120}$ in.	4·4
	100·0

Many samples of limestones from Martinborough have been received and analysed. Some of these were high in carbonate-content (77 to 93 per cent.), and were so soft that they could be used as chalk on the land without previous drying or grinding.

Samples of ground sea-shells are being put on the market in the North, at Whitianga, Mercury Bay. The samples analysed contained 92 and 93 per cent. of carbonate of lime, and the fineness was as follows :—

Residue on $\frac{1}{15}$ in. sieve	4·8
Passed $\frac{1}{15}$ in. sieve, retained on $\frac{1}{30}$ in.	65·3
,, $\frac{1}{30}$ in. ,, ,, $\frac{1}{60}$ in.	17·8
,, $\frac{1}{60}$ in. ,, ,, $\frac{1}{90}$ in.	4·8
,, $\frac{1}{90}$ in. ,, ,, $\frac{1}{120}$ in.	2·2
,, $\frac{1}{120}$ in. ,, ...	5·1
	100·0

A number of limestones have been tested from the Murchison district, and were found to be nearly all hard limestones of very variable composition—from 18 to 90 per cent.

This year has witnessed the starting of two limestone-supplying companies in the Nelson Province. One of these is to rely on direct water-power for grinding the stone—the cheapest kind of power possible to obtain. The Nelson soils which have been tested show a general lime-requirement of from 2 to 3 tons of carbonate of lime per acre, so that there should be every prospect of success in the venture—a farmers' co-operative one.

An interesting sample of quicklime made by " burning " sea-shells with wood in an open cut in the hill at Doubtless Bay was received, and had the following composition : Calcium oxide (CaO), 12·74 per cent. ; calcium hydrate (Ca $(OH)_2$), 53·25 per cent. ; calcium carbonate ($CaCo_3$), 26·16 per cent. ; siliceous matter (sand, &c.), 7·14 per cent. ; iron and aluminium oxides (Fe_2O_3, Al_2O_3), 0·63 per cent. ; magnesia (MgO), &c., 0·08 per cent. : total, 100 per cent

An article on " The Limestones of New Zealand : Further Analyses " was published in the *Journal* for August, 1918, while an article on the " Liming of Pumice Soils " appeared in the November, 1918, issue. The former article merely places on record the results of the analyses of samples, but the latter discusses the lime-requirements of pumice soils, and shows that all require liming according to the Hutchinson-MacLennan method of testing This conclusion bears out the results of pot tests published in a previous article. The application of these laboratory findings is likely to be substantiated in the field by any carefully conducted experiments, though it is probable that the good results arrived at in pot trials under glasshouse conditions would require a much longer period to show in the field, owing to the altered conditions. It is also possible that a much finer grinding of the limestone will be desirable for pumice than for ordinary soils. The concordance of the pot trials with the Hutchinson-MacLennan tests is conclusive evidence that lime carbonate under certain conditions is extremely beneficial to pumice soils.

Phosphates.

Closely connected with the supply of phosphate is the use of lime. An article was written for the February, 1919, issue of the *Journal* entitled " Economizing Phosphates." In this it was pointed out that by using more ground limestone farmers could economize on the phosphates required to produce the usual results. Many farmers in the North are year after year applying phosphates, only a limited amount of which is effective, owing to the alteration of the available phosphate to unavailable phosphate which takes place in the soil. Theory indicates that by applying suitable

amounts of limestone the quantity of phosphate yearly required will be much lessened, as the lime hinders or prevents the change from taking place in the phosphates. In this connection, when time permits, it is intended to take up the study of the soil in the individual paddocks at the State farms to ascertain whether land which has been highly manured with phosphates in the past, and which still responds to phosphates, cannot have the dormant phosphoric acid awakened by the application of suitable lime dressings.

No further shipments of Ephos phosphate or basic slag have arrived during the year.

The possibilities of the guano deposit on Green Island, Dunedin, have been considered. This phosphate contains 20 per cent. of phosphoric acid, combined with lime, alumina, and iron; but the difficulties of transporting supplies from the island are great, and the fact that the phosphoric acid is in combination with iron and alumina considerably discounts the possibilities of its success as a soil-dressing. The question of securing from other islands phosphate having a similar high percentage of iron and aluminium phosphate was considered, but no recommendation could be made.

Several phosphatic fertilizers (K/360/3) manufactured from fish-refuse were analysed for the Chief Inspector of Fisheries The best of these only contained 5·5 per cent. nitrogen and 10·6 per cent. phosphoric acid, while others contained less than one-half of these constituents. The hope of manufacturing a useful phosphatic fertilizer from fish-scrap should certainly be encouraged, although any fertilizer from fish-scrap is liable to be rather overburdened with nitrogen.

Potash.

A good deal of attention has been devoted to the saving of wood-ashes at sawmills with the view to their subsequent utilization as a source of potash by either fertilizer-mixers or farmers. This and other attempts to bring the producers of waste products containing potash into touch with those requiring potash met with very feeble support from the former. Several truckloads of wood-ashes have been sold, but the chemical composition of the ash did not come up to expectations based on the analysis of samples upon which the ashes were bought.

The importance of utilizing by-products of the timber industry is not generally realized. In the case of wood-ashes it is likely that the value will sink as soon as more concentrated salts of potash, owing to cessation of war, become available. If the waste from phormium-mills is ever utilized one of the by-products will probably be an ash high in potash, which will be available for mixing with fertilizers, especially superphosphate. The possibility of making a commercial potash fertilizer from New Zealand seaweed is too remote to warrant entertaining it. A sample of potash stated to be manufactured from New Zealand kelp was forwarded by the Marine Department (K/172), but was found to contain only 5·41 per cent. of potash (K_2O) soluble in water.

Potassium nitrate (nitre) from India was considered as a source of the small amount of potash required for New Zealand, but the export was not permitted by the Imperial authorities.

Samples of wool-refuse analysed contained (K/151) 1·4 per cent. and (K/178) 3·44 per cent. of potash. Another sample of a fertilizer (K/585–6) produced by the treatment of daggy wool contained 3·3 to 3·5 per cent. nitrogen, 4 to 4·5 per cent. potash, and 1·45 per cent. phosphoric acid, and would be a useful fertilizer for market-gardeners, but the nitrogen, being present largely in the form of small wool-fibres, is in a very unavailable condition.

As potash is recovered from the flue-dusts of cement-factories in America, all the Portland cement companies in New Zealand were circularized in April, 1918, and the matter explained and offers made to analyse samples of the dusts. The replies of the companies indicated that although some of them had considered the matter, the prospective saving was not sufficiently attractive to warrant any works installing potash-recovery plants. The fourth article on "Potash in Agriculture" was published in the *Journal* for May, 1918.

Fertilizer Importation.

The publication of the returns from the Customs Department has been continued in the *Journal*, with the innovation that they have been published quarterly instead of annually. An article dealing with the year's returns was published in the July, 1918, *Journal*.

Fertilizers analysed under the Fertilizers Act.

Sixteen samples of commercial fertilizers were analysed for Inspectors under the Act, compared with twenty-one analysed during the previous year. It has now been arranged that special officers shall be utilized for the sampling of fertilizers under the Act, as it is work that should only be entrusted to those specially fitted therefor.

Deficiency Diseases in Stock.

Further reports from farmers have been received as to this class of disease in stock. At Kaitoke, on a farm lying on the slopes of the Rimutaka Range, it is reported that neither calves nor lambs can be reared on certain portions of the property. An extraordinary statement of the owner is that basic slag at the rate of 3 cwt. per acre makes no difference in the appearance of the herbage. The soils (J/322–3) have been analysed, and are silty soils, but while there was no outstanding deficiency of nitrogen, phosphoric acid, or potash, there was a decided deficiency of lime, the Hutchinson-MacLennan method showing that nearly 5 tons of carbonate of lime are required per acre. The lime-magnesia ratio of the hydrochloric-acid extract is unbalanced, a peculiarity I have noticed in other soils in which deficiency diseases develop in the vicinity of the Wairarapa Valley (see *Journal*, 15th November, 1910, page 222). A well-known Masterton runholder reports that there is a belt of poor country, which naturally grows nothing but scrub, running right through the range to the eastward and roughly parallel to the Wairarapa Valley.

Bone-nutrition troubles in sheep have been reported from Pongaroa, Horoeka, and Pahiatua soils on hilly country. All of these soils show an unbalanced lime-magnesia ratio. There was in some cases twice as much magnesia as lime. The general indication in all these cases is to lime heavily, but it is extremely desirable that the matter should be more closely investigated by means of field experiments. A further complaint of sickly hoggets at Kaitawa is being investigated.

Some field experiments with sheep have been initiated at Glenhope, Nelson, on an area of land on which a deficiency disease develops, and interesting results may be expected in due course.

Bush Sickness.

The chemistry work in connection with bush sickness has been continued in the experimental manufacture of licks of various composition in brick form, and the administration of organic iron drenches. The installation of the brickmaking plant at the Wallaceville Laboratory has proved a success from the first, the advantages not only being that the composition of all the bricks is absolutely controlled by departmental officers, but there is no tiresome and often dangerous delay in executing orders, and the cost of the brick is considerably reduced.

The drenching of stock with syrup of phosphate of iron, hitherto the only known medicinal cure for bush sickness, has been further supplemented by the knowledge that double citrate of iron and ammonium is equally efficaceous and, moreover, quicker in its action. An article was written jointly with the Director-General on the subject for the *Journal* (April, 1919, issue), entitled "Curative Treatment of Bush Sickness by Iron-salts." At a critical time in the experiments the influenza epidemic visited this country and disorganized the work at the farm, hindering the experimental work.

Methods for exterminating Rabbits.

The various methods for exterminating rabbits have been reviewed during the year, and the supply of suitable poison is still the subject of investigation. The difficulty of obtaining supplies of poison has been accentuated by the disorganization of the shipping trade between Australia and New Zealand, and the fact that one poison—carbon bisulphide—is an undesirable cargo.

Mortality in Stock due to Poison.

Mortality in stock due to poison occurs with the usual frequency. The evidence in one case in which sheep were concerned threw strong suspicion on the dipping-composition used, but the specimens sent were too fragmentary to enable any satisfactory decision to be reached. In two other cases arsenic and lead were respectively isolated, and the mortality was referable to carelessness in leaving substances containing these poisons within the reach of stock. Lead paint is, however, such a universally used preservative that the most careful pains should be taken by farmers to guard stock from it and from substances painted with it.

Poisonous Plants.

A series of articles on poisonous plants has been commenced in the *Journal* (June and July, 1918). In this series it is hoped to refer to all the known poisonous or medicinal plants of the Dominion.

Dairy-industry Work.

Twenty-one samples of butter intended for export were examined for the Dairy Division. Of these, nineteen were found to contain more than the legal quantity of water (16 per cent.), and the export of butter containing more than this amount thus prevented.

The analysis of potable waters for dairy factories has been continued. Samples of preservatives for the Dairy Division have also been analysed. The supply of colouring-matter from anatto-seeds has been looked into. The anatto of commerce used for colouring cheese is derived from the pulpy matter (the arils) surrounding the seeds of a lilaceous plant (*Bixa orellana*). Anatto is one of the few dyes which will dye vegetable fabrics directly—that is, without the use of a mordant. There was probably a great demand for anatto during the war, which would leave a surplus on the market of the seeds containing a very small proportion of the colouring-matter on the cuticle.

Work for Horticulture Division.

The analysis of spraying-compounds has been continued.

Experiments have been conducted with thick honey, which is produced from manuka and other plants in quantity, and which cannot be extracted from the comb by the ordinary centrifugal methods. A method was devised in the laboratory of successfully filtering this honey, but opportunity has been lacking of testing the method on a factory scale.

A report has been made at the request of the Board of Agriculture on the soil of the Tauranga Horticultural Station (M/246 and J/58). Samples of wine have been analysed to determine the amount of tartar which could be obtained as a by-product in the manufacture. It was found that the quantity produced would be too small to profitably recover, thus bearing out the previous annual report.

Advisory Work.

The abolition of the Fields Division of the Department and the distribution of the work previously administered by that Division has thrown a share of additional work on to this Section. A course of lectures on chemistry was given to the student assistants at Weraroa. The field experi-

mental work and research, and the organization of the staff to carry it out, has been the subject of many consultations, and has taken my attention from the laboratory work. The student assistants who were trained at Weraroa have now all been provided for.

Industrial Research.

A number of samples of tanning-barks have been collected and analysed. Articles on indigenous tans and vegetable dyestuffs were published in the Department's *Journal* for June and July, 1918, and in the *Journal of Science and Technology* for September and November, 1918. These articles have excited much interest, and the fact that brilliant and other useful colours can be obtained from a New Zealand shrub has been successfully demonstrated. Articles dyed by these colours have been publicly exhibited. The chemistry of the colouring compounds which have been isolated from the bark of the plants of the genus Coprosma, however, remains to be worked out.

The production of lanoline, potash, and other by-products from wool has been inquired into, and the leading firms dealing in wool have been circularized in connection with methods for saving by-products. A report and recommendation have been furnished to the Director-General on the matter.

By request a suggestive report was prepared and submitted showing the direction in which new industries might be expected to develop in New Zealand. Many of these industries, it was pointed out, were dependent on the supply of cheap power for their success. The inauguration of a national water-power scheme would do much to supply the incentive to capitalists to establish new industries.

Miscellaneous Samples.

Among the miscellaneous samples which have an interest was a specimen of dolomite limestone (J/657) from a seam at Tuku, Chatham Islands, which contained 55 per cent. of calcic carbonate and 39 per cent. of magnesic carbonate. As there has been some inquiry lately for dolomite in connection with iron-furnaces this occurrence at the Chathams may have some value.

The Japanese radish which had been cultivated at the Weraroa Farm was analysed, but specimens were found to have a very low dry-matter content, as follows :—

Root No.		Weight of Root.	Dry Matter. Per Cent.
K/109.	1	11 lb. 2 oz.	5·2
	2	10 lb. 2 oz.	5·0
	3	7 lb. 4 oz.	4·6
	4	6 lb. 12 oz.	5·1
	5	5 lb.	4·8

These results compare very unfavourably with turnips or mangolds, assuming that the feeding-value is proportional to the dry-matter content.

BIOLOGY SECTION.

REPORT OF THE BIOLOGIST.

Central Development Farm, Weraroa, 18th July, 1919.

The Director-General.

I herewith submit my annual report for the year ended 31st March, 1919.

A. H. Cockayne, Biologist.

General.

The work of the year 1918–19 was considerably handicapped by the depletion of my staff due to military requirements. The majority of the work carried out was therefore mainly of a routine nature, there being few opportunities to carry on anything of a definite investigational character. There are many problems in applied botany and applied agricultural zoology having a most intimate bearing on agricultural development in New Zealand. In order, however, to carry any of these out to a definite conclusion they must be made the main work of trained investigators. It may be argued that much of the work required to be done can be carried out experimentally on the experimental farms and demonstration areas, but this assumption is wholly fallacious. Nearly the whole of the educational work of these farms and farm areas must of necessity be on demonstrational lines, rather than being directed towards the finding-out of the fundamental scientific truths that are involved in the elucidation of many of our agricultural problems.

Specimens received.

As in past years, a very large number of specimens, both botanical and zoological, have been received and reported on. This work occupies a very considerable portion of my time. In all cases an effort is made to make the replies as practical as possible, and in order that this can be satisfactorily carried out correspondents should in all cases clearly indicate what type of information they require with regard to the specimens sent.

Apart from the examination of specimens, a great deal of correspondence on all phases of agriculture has had to be undertaken.

Seed-testing.

During the year 4,900 samples were tested for germination and purity. This represents the largest number that has been dealt with in any one year since the work was taken in hand. Nearly the whole of the samples are received from seed-merchants, and this gives a good indication of the value placed on testing by the seed trade. The majority of the leading firms now deal only in tested seeds, and this has had a remarkable effect in raising the average quality of seeds sold. The majority of the seeds tested are those of grasses, clovers, and farm crops other than cereals. Very few cereals are tested for germination, although it is significant that at the seed-testing stations in Great Britain cereals, especially wheat and oats, represent the bulk of the seeds tested.

This development of the use of tested seeds has been secured without the adoption of any seed-control legislation, and were it generally followed by all merchants there would be little necessity for the passing of any legislative measures controlling the sale of seeds. Unfortunately, certain merchants still persist in selling very inferior seed without in any way detailing its quality with regard to germination and purity. An accurate knowledge of the quality of the seed sown is one of the most potent factors in successful crop-production, and in consequence it should be made obligatory for all sellers of seed to state the purity and germination of the seed they offer their customers. Many of the crop-failures occurring both in annual crops and the more permanent pasture ones can be directly attributed to the use of seed the quality of which has not been known by the farmer at the time of sowing.

During the year the prices of all agricultural seeds have been exceedingly high. With the exception, however, of certain classes of seed that are not usually grown in New Zealand, the prices were on the whole lower than that for similar seed in other parts of the world. The lack of labour, coupled with high prices, had a very considerable effect on restricting the amount of bush-burn sowings, and it is probable that not more than 100,000 acres were added to the total acreage under this type of grass land. This is a very considerable drop from the quarter of a million acres which has been the yearly average for many past years. In addition to a falling-off of bush-burns a great deal of succession growth of fern and scrub has been burnt and not properly sown down, owing to the abnormal price of grass and clover seed. This is a disastrous policy to adopt, and unless the ground can be adequately sown the cleaning-up of such country by burning alone should not be carried out.

Seed-growing.

The irregular supplies of certain agricultural seeds due to lessened production in other countries affected by the war have given considerable prominence to the desirability of what may be termed special seed-growing in New Zealand. An effort was made to induce farmers to save considerable amounts of turnip-seed, the production of which has hitherto not been attempted in the Dominion. Many of the crops that were grown have turned out highly satisfactory so far as yield is concerned, but merchants are generally adverse to purchasing locally raised turnip-seed without an adequate guarantee that the cropping characters of the seed are satisfactory. Tests that have been made of locally produced seed show that the bulbing-qualities are quite as good as are those of imported seed, but there is always the danger that unless proper supervision has been exercised the seed produced will be unsatisfactory. As far as turnip-seed production is concerned, very excellent crops were produced in Central Otago, and that district appears to be admirably situated for the purpose.

The question of special seed-raising in New Zealand does not depend at all on the ability to produce seed of the very best quality, as this has been abundantly proved, but on whether the costs of production are sufficiently low to compete successfully with imported seed. There is, however, no doubt that a very considerable extension in agricultural-seed production could be made in New Zealand, especially with regard to those crops the imported seed of which is not only always dear but is often of inferior germination quality.

Again, there appears no reason why New Zealand should ever be an importer of grass or clover seeds, as these crops do not require the large amount of labour involved in the growing of many other types of seed crops, and their yield and quality compare more than favourably with similar crops grown in any other part of the world.

Plant Pathology.

In the early part of this calendar year my assistant, Mr. R. Waters, returned to the laboratory from his military duties and took charge of the plant pathological work. A small laboratory has been equipped for this work.

The etiology of the yellow-leaf disease of flax (*Phormium*) has been the subject of considerable study. It has been shown that a fungus attacking the young rootlets and causing a general rotting of the roots is one of the main factors involved. It, however, appears as if this fungus causes destruction only when the plants have been weakened by adverse soil conditions. A peculiar feature noted now for two seasons is the regular recovery of affected plants during the late autumn and winter

months, followed by a recrudescence of the disease the following summer. The winter recovery this year, however, set in much earlier and was more general than last, indicating perhaps that the disease is on the wane. The effect of artificial manures on yellow-leaf development is being studied, but so far these do not appear to have any marked effect.

The dry-rot of swedes, a fungus disease that is rapidly making the production of satisfactory swede crops in certain parts of New Zealand almost impossible, is being studied, and several sets of field experiments in the Southland District have been instituted. A striking feature of these experiments is the fact that large quantities of rapidly acting manures, such as superphosphate, apparently increase the disease. Swedes that grow slowly, on the other hand, apparently suffer far less than those which grow rapidly. In general, soft and Aberdeen turnips are not seriously affected, and it was thought that perhaps the dry-rot attacking these types of turnips might belong to different species. Inoculation experiments, however, have shown that swede dry-rot is capable of infecting all classes of turnips and swedes. An interesting point which has been discovered is that the disease is also found on the leaves, so that the name "phoma" is not applicable to the causative fungus. In general, dry-rot appears epidemically in crops from about the end of May onwards, but the slow growth of pure cultures and the slowness with which lesions are developed on inoculated material indicates that field infection may take place much earlier in the autumn than is generally thought.

Considerable attention to certain apple-rots has been given, and a new species of Botrytis has been shown to cause rapid rotting of apples, especially from the eye end, together with copious development of small sclerotia. Inoculation with mycelium of this Botrytis always results in a rapid rot being set up, but spores appear to be quite incapable of causing infection, a not unusual condition in certain species of this group.

On the whole, the year was not marked by any very special outbreaks of plant-diseases, and, in general, nearly all the regular garden and crop diseases were later in appearing than usual. This was especially the case with regard to rust and potato-blight.

Economic Entomology.

During a considerable portion of the year Mr. D. Miller, Entomologist, was lent to the Department of Internal Affairs in order to conduct an investigation on mosquitoes in the Auckland Province, and therefore his services have only been partly available.

The work undertaken during the year, apart from advisory and other matters connected with specimens sent in, has been mainly in the direction of careful studies of the life-histories of certain of our most notable injurious insects, such as the grass-grub and allied subterranean insects, the codlin-moth, and the various lepidopterous larvæ generally termed army-worms. The weakness of applied entomology in New Zealand is the fact that very little reliable life-history work has been carried out. In consequence one is apt to rely on work carried out in other countries, and this is often found quite unreliable for our New Zealand conditions.

During the year two insect pests hitherto more or less unknown in New Zealand—namely, the pear-bud mite (*Contarinia piri*) and a species of leaf-hopper belonging to the genus Europasca have been extremely destructive. It is interesting to note that both these pests have been equally injurious both in well-cared-for and more or less neglected orchards. This indicates that the general system of insect-control ordinarily adopted will have to be modified in order to repress them satisfactorily.

Many valuable data with regard to grass-grub have been collected, and with the adoption of certain methods of laying down and management this insect should not cause any great damage on ploughable grass land.

Student Instruction.

A complete course of instruction extending over the year was given to the student assistants in residence on the farm. The main subjects dealt with were agricultural botany, agricultural zoology, and general agronomy.

The system of student-assistant training that was instituted here two years ago, and has now been dropped in the meanwhile, was carried out with the greatest difficulty owing to the lack of permanent teachers. If at any time the training of students up to, say, the educational requirements of the New Zealand University B.Sc. in agriculture is again attempted a full staff of teachers will be absolutely necessary. So far as the Biology Section is concerned, however, it should not be utilized in this direction. The many problems on which it touches are necessarily viewed very largely from the scientific or, at least, the fully trained farmer's standpoint. The dealing of agriculture from a pedagogical or ordinary vocational standpoint is not attempted, and the teaching that it can give is quite unfitted for junior students. This Section could, however, do very useful work in agricultural education in New Zealand by taking into the laboratory from year to year students who had finished their educational training and fitting them for research, using them later as assistants in working out definite agricultural problems. Later on such students should prove valuable in the agricultural-instruction branch of the service, as they would have the requisite knowledge of local practice that is so essential in the carrying-out of agricultural investigation.

HEMP-GRADING SERVICE.

REPORT OF THE CHIEF HEMP GRADER.

The Director-General. Wellington, 14th April, 1919.

ATTACHED please find annual report for the year ended 31st March, 1919.

W. H. FERRIS, Chief Hemp Grader.

Although the quantities of hemp and tow received for the year show a fairly large decrease compared with the previous year (when record prices were ruling), the output and the prices obtained must be regarded as satisfactory. The recent epidemic (during the months of November and December) was responsible for a decrease of at least 9,000 bales. The closing-down of the Opuhi mill of four strippers (owing to diseased leaf in the swamps) helped materially to decrease the Foxton returns. Congestion in the grading-stores at Auckland and Bluff, owing to the shortage of shipping during the year, compelled the merchants to discontinue buying, with the result that many of the smaller mills had to cease operations.

The average prices obtained for our fibre are as follows: Hemp—Good-fair £42, high-fair £40, low-fair £38, and common £30 per ton respectively; tow—First grade £7, second grade £6, third grade £5 per ton. The total value of the hemp, tow, and stripper-slips produced in the Dominion for the year was approximately £1,062,465.

Notwithstanding that high values ruled, the quality of most of the hemp graded in the Dominion during the year was of a disappointing character. Especially is the position unsatisfactory when it is remembered that the milling plant has been greatly improved during the last few years, thereby making it possible to produce a much freer and better-coloured fibre. The principal cause of the decline in quality is, in my opinion, poor stripping, due either to a desire to strip more fibre than the stripper is capable of treating effectively, to careless work on the part of the stripper-keeper, or to the employment of inexperienced men. In many cases the phormium-leaf has been merely split owing to the stripper not being maintained at the correct set. For the same reason much of the hemp has been bruised and thereby reduced in strength. The stripping being bad, after-processes have failed to correct the weakness. Where the vegetable-matter has not been properly removed from the fibre no system of washing or bleaching will ensure a good colour. In numerous cases where the stripping had been satisfactory the fibre had to be graded down owing to the poor scutching, and bad scutching is often more serious from the cordage-manufacturer's point of view than poor stripping. The latter may leave considerable vegetable-matter adhering to the fibre, and may cause it to have a poor colour, but the fibre will not be knotted or towy. Of course, it is impossible to properly scutch fibre bruised in the stripping process, as the more such fibre is scutched the worse its condition becomes.

It is not forgotten that some mills have very poor leaf to deal with—leaf from which nothing but a low grade of fibre can be produced—but these mills are excluded from the above remarks. Some of the largest and best mills in the Dominion, having a good leaf to deal with, are turning out unsatisfactory fibre. During the past few seasons the percentage of low-grade fibre has been very high, which is without doubt due to the high prices ruling, as well as the unsatisfactory milling-work.

Previous to the present boom the general standard of our fibre was very good. Certainly only the best mills were working at the lower values, but these were intent on aiming at quality rather than quantity. Now, as in the previous boom-time, the position is reversed, and everything is apparently being sacrificed to quantity. More money may be made by a heavy output of low-grade fibre which can be sold at a high price, but it is doubtful if it is more profitable even now than milling a superior article, and it is certainly against a permanent demand for phormium, the reputation of which is being imperilled by the present short-sighted policy. There is a good demand for good-fair fibre, but very little of this quality is available, a matter for great regret, as good-fair has been our standard quality for binder-twine. If this grade is not obtainable cordage-manufacturers will be compelled to use other fibres for this purpose to our disadvantage. Australian binder-twine manufacturers prefer our good-fair to manila, but as the former is not available they are being forced to use manila.

A very bad feature of some lines coming forward is that, evidently with the idea of utilizing every scrap of fibre, some of the hanks are "faced" with good fibre, giving the hank the appearance of being of decent quality, but when the hank is opened for inspection it is found to contain hemp of a very inferior quality. To millers who make it a practice of "facing" their hemp no consideration is shown by the graders, the hemp being severely graded down. The only district that turned out a good quality of fibre during the past season was the Marlborough District, practically the whole output being either fine or good-fair; the percentage of good-fair at the chief grading-ports was very disappointing.

The quality of tow for the past season, especially at the ports of Wellington, Foxton, and Picton, was exceptionally good, chiefly on account of the automatic scutchers and tow-shakers used. The quality at the ports of Auckland and Bluff is still very inferior, the proportion of first grade at Auckland having been only 2 per cent., and at Bluff nil. The large decrease in stripper-slips is due to the low prices offering for this by-product and shortage of shipping.

As usual, a number of requests were received from millers for instructional visits. These were attended to as promptly as circumstances would permit, and in nearly all cases with good results to the millers, who took a keen interest in the work.

Grading Statistics.

The following tables give particulars of the gradings during the year ended 31st March, 1919, the Dominion totals and percentages for the previous year being also shown for comparison in the three first tables. Owing to congestion in stores no grading was carried out at Blenheim during the year under review, all the Marlborough output being dealt with at Picton and Wellington.

Hemp (Bales).

Grading-port.	Superior.	Fine.	Good-fair.	High-fair.	Fair.	Common.	Rejected.	Condemned.	Total.
Auckland	..	1	3,085	12,925	10,518	2,704	105	57	29,395
Napier	..	..	690	610	195	3	..	..	1,498
Foxton	..	..	2,722	21,820	7,404	825	259	15	33,045
Wellington	..	174	4,245	31,306	14,745	1,242	157	6	51,875
Lyttelton	..	96	114	15	..	..	..	..	225
Blenheim	..	..	..	..	..	..	..	..	..
Picton	..	300	345	37	..	..	..	..	682
Dunedin and Bluff ..	..	..	949	6,257	11,243	1,502	75	27	20,053
Totals, 1918–19 ..	..	571	12,150	72,970	44,105	6,276	596	105	136,773
Percentage ..	..	0·41	8·92	53·32	32·23	4·61	0·43	0·08	..
Totals, 1917–18 ..	..	580	12,485	79,742	56,385	11,520	1,756	350	162,818
Percentage ..	..	0·35	7·66	48·92	34·71	7·07	1·07	0·21	..

Total decrease in 1918–19, 26,045 bales.

Tow (Bales).

Grading-port.	First Grade.	Second Grade.	Third Grade.	Condemned.	Total.
Auckland	99	1,717	1,931	286	4,033
Foxton	1,596	3,247	535	15	5,393
Wellington	3,889	3,805	407	57	8,158
Picton	426	83	10	..	519
Lyttelton	259	305	..	..	564
Dunedin and Bluff	..	1,712	1,047	127	2,886
Totals, 1918–19	6,669	10,869	3,930	485	21,553
Percentage	30·0	50·0	18·0	2·0	..
Totals, 1917–18	6,445	17,343	11,071	1,641	36,500
Percentage	17·55	47·58	30·33	4·54	..

Total decrease in 1918–19, 14,947 bales.

Stripper-slips (Bales).

Grading-port.	First Grade.	Second Grade.	Condemned.	Total.
Wellington (1918–19)..	..	599	..	599
Totals, 1917–18	226	1,855	24	2,105

Decrease in 1918–19, 1,506 bales.

Percentages of Hemp graded at the various Grading-ports.

Grading-port.	Superior.	Fine.	Good-fair.	High-fair.	Fair.	Common.	Rejected.	Condemned.
Auckland	..	..	10·50	44·00	35·60	9·20	0·35	0·19
Foxton	..	..	8·23	66·00	22·00	2·50	0·78	0·45
Wellington	..	0·33	8·20	60·30	28·40	2·40	0·30	0·01
Napier..	..	..	46·13	40·90	13·00	0·20	..	..
Picton	..	44·00	50·50	5·50	..	..	..	..
Lyttelton	..	42·70	50·70	6·60	..	..	..	..
Dunedin and Bluff	..	..	4·70	31·28	56·20	7·50	0·37	0·17

Percentages of Tow graded at the various Grading-ports.

Grading-port.	First Grade.	Second Grade.	Third Grade.	Condemned.
Auckland	2·40	42·55	47·60	7·55
Foxton	29·50	60·20	9·90	0·27
Wellington	47·70	46·70	5·00	0·60
Picton	82·00	15·50	2·50	..
Lyttelton	45·90	54·10	..	..
Dunedin and Bluff	..	59·30	36·30	4·40

GRAIN-GRADING SERVICE.

THIS service was maintained on the same voluntary lines as previously. During the greater part of the year the Chief Grain Grader, Mr. A. W. Smith, was mainly engaged in connection with the sampling and distribution of cargoes of Australian wheat forming part of the Government purchase, his services being lent to the New Zealand Wheat-controller for this purpose. In regard to the Government purchase of the local wheat crop, provision was made in the regulations for disputes as to quality, &c., to be determined by a Government grader appointed for the purpose by the Board of Trade, and some work was carried out in this connection.

Assistance was given by the Chief Grain Grader to trade organizations in formulating grades and standards for grain, chaff, potatoes, and onions. During the year an amalgamation of the North and South Island associations was effected under the name of the New Zealand Grain, Seed, and Produce Merchants' Federation. In terms of sale formulated by this body a section was embodied making the Government grader's certificate of quality final. This has resulted in a greater demand than formerly for these certificates. An effort was made by the federation to secure the adoption of a uniform system of standards, but so far this has not been fully adopted by the local associations.

PUBLICATIONS.

ACTIVITIES in connection with publications have been well maintained during the year. The circulation of the *Journal* has continued to expand and further penetrate every locality in the Dominion. Much testimony is received as to its appreciation by the agricultural community and readers generally, while increasing notice is given to it by scientific periodicals abroad. During the year the name of the publication was slightly amended by adopting the prefix "New Zealand," thus making its full title *The New Zealand Journal of Agriculture*. The object was to distinctly connect the name with this Dominion, and to bring the publication into line in this respect with similar State journals at home and abroad. It may be mentioned, in passing, that the *Journal* does not seek to enter into competition with the private agricultural press; as an official publication and organ it necessarily has its own sphere and method.

Although the acuteness of the paper position has been somewhat eased as regards supply, the price of paper has continued to rise, and printing activities have had to be largely governed by considerations of economy—this applying specially to the less essential publications. However, a considerable number of new bulletins or revised editions of existing ones have been issued during the year, and this form of literature has continued in steady demand. Among miscellaneous publications issued was a reprint of the summary of the American official report on the meat-packing industry in the United States, large numbers of which have been distributed for the information of our producers and traders.

An expression of thanks and appreciation is due to the *Journal* contributors for their valued co-operation. The Editor also desires to acknowledge the good service of the Government Printing Office in connection with the Department's publications generally.

INDUSTRIES AND COMMERCE.

THE Industries and Commerce Department, established in 1894, was combined with the Department of Agriculture in 1909, and since then its name has been incorporated with the designation of this Department.

In New Zealand, where the dominant industries are those of the land and where outward commerce centres almost entirely upon the products of the land, it is impossible to dissociate the Department of Agriculture from Government activities connected with these, and the extensive work of the Department in this respect is principally set out in the preceding parts of this report. In addition, however, a considerable volume of work has been done bearing upon commercial matters connected with other industries.

A main feature of this activity may be described as intelligence work covering the broad field of New Zealand industries and trade generally, especially in the securing of information for New Zealand producers and merchants regarding present or potential markets for our produce in overseas countries, and in aiding and assisting in overcoming difficulties brought about by shortage of shipping facilities. It has also included the furnishing of information regarding the trade and industries of the Dominion to overseas inquirers, some of whom were contemplating opening up business connections here or coming to the country to establish themselves in business.

The Department has kept in regular touch with the High Commissioner in the receiving of information regarding market conditions in Great Britain, this information (unless confidential) being at once disseminated among those interested. The High Commissioner has also been kept regularly advised as to shipments from New Zealand and export trade matters generally.

One feature of the year's work which is specially deserving of note lies in the frequent applications made for financial assistance to individuals or newly formed companies desirous of developing new processes for dealing with raw material produced in the Dominion, or with natural products from which marketable material might be manufactured. Instances of this are furnished by processes for treating seedy wool, for preparing flax-fibre and utilizing flax-waste, for extracting commercial alcohol from waste material, for producing kauri-gum oil from peat, &c. All these matters received the best attention possible in the circumstances, but the experience of a few months' contact with questions of this kind has shown that if the Government is to assume responsibilities of this nature it would be in the best interests of the Dominion if a properly constituted organization were established to devote its entire attention to them in a thorough and businesslike way. Such an organization need be only a small one, but it cannot be properly successful unless it has the direct aid of the best scientific and commercial knowledge available in the country.

In view of the fact that our meat, butter, cheese, wool, &c., are still under sale to the Imperial Government, trade in these important foodstuffs and raw materials is of course confined to the markets controlled by the Imperial authorities. Many inquiries have been received from other countries for these goods, and it is anticipated that with the lifting of the commandeer opportunities will arise for our own trade extending to many markets which were not open to us in pre-war times.

New Zealand is at present ably represented in Australia by a Trade Commissioner stationed in Melbourne, whose duties include the watching of the Dominion's interests generally throughout the Commonwealth, and reporting to headquarters on all matters which have any bearing on the trade of this Dominion. His office is largely used by the public and mercantile community as a convenient source of reference in regard to the multitudinous matters which are always cropping up in connection with the trade and interchange of Australia and New Zealand respectively. The New Zealand Government Agent at Sydney also deals with many commercial matters on behalf of the Dominion, and in this has done much good work.

Local business men at San Francisco and Vancouver respectively are very moderately subsidized to attend to New Zealand trade matters at these ports, and have from time to time furnished valuable information. In view of the rapidly growing interchange of trade between this Dominion and the Pacific Coast of North America, the time has arrived when serious consideration must be given to an extension of these services on sound business lines.

The alteration of the shipping route with the United Kingdom from Cape Horn or Magellan Strait to the Panama Canal has severed the connection that this country enjoyed for many years with South American ports, and we have in consequence temporarily lost the trade in stud sheep and fresh fruit that was steadily developing. Frequent inquiries have been instituted with a view to ascertaining if this trade can be resumed by occasional steamers, and later inquiries are as to whether by transhipping our products in the Panama Canal zone to lines of steamers trading to South American ports from the east and west coasts of North America the trade can still be carried on in some way, though necessarily at a serious disadvantage by comparison. The possibility of entering into trade relations with the countries of Central and South America adjacent to the Panama Canal is also receiving attention. Every effort should be made to restore the direct-trade connection,

In view of the fact that Australia does not contribute to the subsidy paid to the steamship company running the Vancouver and San Francisco steamer services, merchants in the Dominion are anxious to secure better facilities for the trade handled by these vessels, and this matter needs consideration when the contracts are renewed in the near future. The question of a flat rate of freight between the Pacific Coast and all ports in the Dominion is also one calling for attention. The class of steamers engaged in the San Francisco run has, owing to the necessities of the war, been below the standard of efficiency necessary in a service of this kind. The release of better-class passenger-liners from war work will, however, soon be effected, enabling a more satisfactory class of vessel to be put into this service. The difficulties in this direction experienced by the contracting company during the war are realized.

A representative commercial mission from France, headed by General Pau, visited New Zealand during January last and made extensive investigations in regard to fostering trade with that country. Special facilities were placed at the disposal of the mission to study the requirements of this market as regards imported material, and also to obtain a full knowledge of the extent and the quality of our exportable products. It is anticipated that a considerable share of the trade previously handled by Germany will in the future pass into French channels. The French Ministry of Revictualling has followed up this inquiry, and practical assistance has been rendered along the lines of their requirements. A full and comprehensive report on New Zealand trade was prepared by this Department for the mission, and printed as a separate document.

In conclusion, thanks are due to the departmental officers who have assisted in carrying out the industries and commerce work, which is altogether extraneous to the legitimate functions of a Department of Agriculture, and for which no additional staff existed, though it demanded time and attention.

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