1939.

NEW ZEALAND.

DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT FOR 1938–39.

Presented to both Houses of the General Assembly by Command of His Excellency.

Office of the Minister of Agriculture,
Wellington, 25th July, 1939.

SIR,—

I have the honour to forward herewith for Your Excellency's information the report of the Department of Agriculture for the financial year ended 31st March, 1939.

The report provides a summary of the principal features of the farming year and outlines the activities of the Department in its work of maintaining and fostering the growth of the rural industries. Once again the report shows that the Department has made progress in several important directions, notably in extension of its research and advisory services, and I am convinced that it is in the co-ordination of research and instruction that my Department can be of greatest influence in the furtherance of agricultural and pastoral efficiency.

Our first duty is to approach the farmers' problems in a scientific and systematic manner, and when our investigations have revealed information of value to the primary producer it is then our duty to disseminate that information as widely as possible in a form which can be quickly assimilated and applied. In this policy the Department has already achieved a fair measure of success, and I confidently look for further developments along these lines. Whenever it is possible farm advisory committees are being set up to assist the departmental officers in this work, and I wish to pay a tribute to the work of those committees which have already been established.

On the administrative side the most important innovation has been the setting-up of an entirely new division of the Department called the Animal Research Division, which came into being in March last. The functions of the new Division are to co-ordinate the whole of the animal-research work conducted by the Department and to act in co-operation with other institutions. At present the staff is comprised of thirty-three professional, twenty-nine technical, and fifteen clerical officers, and representations have already been made for the appointment of several other professional and technical officers. The annual loss to farmers through disease among stock is a heavy one, and the Government is determined to take the fullest measures to alleviate the position.

It is estimated that during the current financial year approximately £60,000 will be spent by the Department in prosecuting animal research, and of this amount approximately £20,000 will be spent in salaries. New laboratories are

being erected at Wallaceville and Ruakura. The following are the main problems being investigated by the Division: Facial eczema, sterility, artificial insemination, mastitis, hogget-mortality, cobalt deficiency, dairy-cow nutrition, and pig nutrition, especially in connection with bacon-production. The new Division will also carry out the diagnostic work for the Live-stock Division.

The Animal Research Division is fortunate in having the ready co-operation of farmers, both as individuals and through their organizations. Ruakura has the assistance of a Farm Advisory Committee, and the facial-eczema investigation is being controlled by a management committee comprising three farmers, two officers of the Department of Agriculture, and one officer of the Department of Scientific and Industrial Research. The Department of Scientific and Industrial Research and Massey Agricultural College have collaborated excellently in the investigation of this disease.

In connection with sterility investigations in the Waikato, a small committee, which includes two farmers and one officer of the New Zealand Dairy Board, has been recently established. The Dairy Board is co-operating whole-heartedly in the investigation of all diseases of dairy cattle, and has appointed two of its members to act as a liaison between the Board and the Division.

The Dairy Industry Amendment Act, 1938, providing for universal dairy-farm instruction, is already operating successfully. There are now seventy-seven officers engaged under the scheme, and it is pleasing to note that both the factories and the farmers are giving valuable assistance in this work. It is considered by those competent to judge that these instructors are a valuable adjunct to the industry, and that part of the improvement in the quality of dairy-produce during the 1938–39 season, which was a difficult one for the dairy industry, has been due to the institution of this Dominion-wide service.

Another Act which was brought into operation last year and which has already proved a distinct success is the Remounts Encouragement Act, 1914, whereby a Government subsidy is payable for selected stallions to be used for the breeding of light horses. Although the subsidy has been operating for only one breeding season, one may prophesy from the number and type of stallions for which the subsidy was granted that this legislation is doing much to encourage the breeding of a type of horse which may be required and which was not being provided.

During the year the Department of Agriculture has co-operated fully with the Internal Affairs Department, the Health Department, and the Otago Medical Research Committee in the campaign against hydatid disease. The Department has issued a new bulletin on the subject, and the departmental exhibits at agricultural shows have included informative and instructional demonstrations pointing the way to the eradication of this disease. In this work the Department has had the whole-hearted co-operation of the Otago Medical Research Committee, which has placed an officer in charge of the exhibit and has also contributed material and data.

During the past three years concentrated efforts have been directed at the control of noxious weeds, with particular application to ragwort, and these efforts are being continued during the present year. The work, which is on a scale much in excess of anything previously in operation, has been undertaken in co-operation with the Labour Department and the County Councils which have adopted the scheme. Generous allocations for labour and material have been granted, and there is no doubt that there has been a substantial improvement in the ragwort position. The scheme is not confined to unoccupied Crown and Native lands, but also provides for the clearing of individual farms menaced by this weed. The expenditure under the scheme for each of the last three years is as follows: 1936–37, £31,500; 1937–38, £74,200; 1938–39, £65,000.

Recently a committee was set up to inquire into the lime industry, which for some years has been in an unsatisfactory state. A departmental Committee made a preliminary investigation, which brought to light certain facts serious enough to warrant the setting-up of an investigational and advisory committee

representative of the lime-manufacturers, the farmers, and the Government. This committee is now conducting its inquiry, and it is charged with the following duties :—

(1) Investigating the more efficient production of lime and the organization of the agricultural lime industry generally :

(2) Recommending more efficient methods for the distribution and marketing of agricultural lime :

(3) Investigating and reporting on the most efficient and equitable manner in which Government assistance, if granted, could be utilized so that *bona fide* farmers may secure the maximum benefit therefrom.

(4) Investigating the prices charged for agricultural lime and the quality of such.

It is anticipated that as a result of this committee's investigations it will be possible to place the lime industry of the Dominion on a sound basis.

These are the salient features of the Department's activities. The accompanying statement by the Director-General of Agriculture and the reports of the various heads of the various Divisions of the Department cover a wide range of subjects. The staff of the Department has done excellent service, of which I record my full appreciation.

I have, &c.,

W. LEE MARTIN,

Minister of Agriculture.

His Excellency the Governor-General.

REPORT OF DIRECTOR-GENERAL.

Wellington, 24th July, 1939.

THE HON. THE MINISTER OF AGRICULTURE,—

Weather conditions have made the agricultural year a very trying and difficult one for farmers. The cold, wet spring, followed by a prolonged summer drought in the main producing districts, has been extremely unfavourable for both agricultural and pastoral production. These adverse conditions have been reflected markedly in a shrinkage of butterfat-production, which was about 13 per cent. lower than in the previous year, which in turn showed a 5-per-cent. fall on the 1936–37 season, partly due to the facial-eczema outbreak.

The fact that cows in milk have dropped during the past three years by over sixty thousand is being used as an argument that dairying is on the decline. Such, however, is not really the case. The major part of the decrease has been brought about through heavier culling, particularly of dry cows, than previously, and, provided climatic conditions in the coming seasons are favourable, the total production should show no falling away from our peak year.

A feature of dairying in New Zealand during recent years has been the comparative abandonment of any special summer-feed provision by means of special green-feed crops. It has been considered that a bettering of the winter feed-supply and an almost complete reliance on grass-management during the milking-season is economically sounder than any extended reliance on summer crops. In normal seasons this contention is probably sound, but such a system will always result in a serious lowering of production in a long, dry summer.

THE SHEEP INDUSTRY.

The sheep returns of the 30th April, 1939, show that sheep have decreased by 500,000 during the year. This has erroneously been taken to indicate that the sheep industry is tending to decline. The real position of the industry can be satisfactorily measured only by rise or fall in the number of breeding-ewes, and the latest returns show an appreciable increase in breeding-ewes, which have reached a figure approximating 20,000,000.

The fall of 500,000 sheep in our flocks can be accounted for by the fact that owing to the bad lamb-fattening season in 1938 an unusually large number of lambs were carried forward, and have this season swelled our normal killings of wethers both for local and export trade by over 500,000. The most serious position which has arisen with regard to export mutton and lamb is that during the past season the United Kingdom has imposed a quantitative restriction which is less than our export killing and is less than a breeding-ewe population of 20,000,000 is likely to produce in a favourable year.

At present New Zealand's quota is fixed in the vicinity of 190,000 tons, and with our present ewe flocks a normal export kill would represent about 10,000,000 lambs, 1,000,000 wethers, and over 1,000,000 aged ewes, which is in excess of 190,000 tons.

The sheep population of the United Kingdom is passing through a cycle of expansion, and in Great Britain it is felt that a sheep population of 27,000,000 should be aimed at and, if possible, maintained. If this is achieved it is considered that the combined tonnage of Home-killed and imported mutton and lamb will be too great to maintain remunerative prices for the Home-killed supplies; accordingly the present British policy is to restrict importations, and at the same time subsidize the British output through price insurance. This endeavour to foster British production must necessitate, for a period at least, some alteration in our marketing.

So far as export lamb is concerned there is no need for any apprehension that increasing quantities cannot be satisfactorily marketed within the quota limits, but a very serious position has arisen, and will continue to exist in the export of aged-ewe mutton. This class of meat is the least wanted in Great Britain, and some method must be arrived at whereby this class of mutton is reduced to make full room for expanding lamb exports. At the same time it will be essential to adopt some formula of equalization based on total killings in order that the reduction in aged-ewe exports does not bring about an unreasonably low price for breeding-ewes, one of the major sources of income for sheep-breeders. Apart from any question of restriction in exports, and this is viewed as temporary rather than permanent, the fact that old-ewe mutton in Great Britain is rapidly coming into the unwanted class necessitates a complete readjustment in our marketing. Much has been said in recent times about the necessity of further improving the quality of our export lamb. It is agreed that every effort should be made in this direction, but a visit to England rather dispels the idea that our competitors are in any way threatening our supremacy in quality.

The wool-clip this season was moderately heavy. The number of sheep shorn was greater than ever before, and the yield was a record, but as the price was approximately 1d. per pound lower the aggregate return was about the same as last year, between £9,000,000 and £10,000,000. A very disturbing feature of the prices has been the low return for fine wools, which have been, if anything, a little lower than coarse wools.

The future ahead of fine wools is not promising. No doubt prices will rise beyond their present low level, but whether or not the high prices of the past will ever be again realized depends largely on the future of staple fibres, the production of which is increasing enormously. One point is perfectly clear: the total world's supply of wool is not now anything like sufficient for the total requirements of goods which at one time were manufactured entirely from wool. Thus substitutes have become a necessity in world trade. However, the fact that staple fibres by themselves are not suitable for replacing woollen goods in their entirety makes it apparent that the full production of the world's wool is in no danger of oversupplying the market. One does not infer, however, that wool substitutes will not check wool-prices, and this check is more likely to be felt in the fine than in the coarse wool trade. The matter is one of particular significance to our mountain-sheep industry, where the returns are almost wholly derived from fine wools and where the returns per sheep are low.

The Pig Industry.

With a drop in butterfat-production during the past two seasons of over 16 per cent. it is not surprising that the total weight of pig-meat produced this year shows a distinct decline of several thousand tons. This reduction, however, is not viewed as in any way permanent, and the stage is well set for considerable development in our pig industry. Prices are satisfactory and are likely to remain so, and the prospects for expanding consumption of both frozen baconers and frozen porkers on the British market are extremely good.

On my recent visit to Great Britain I paid particular attention to this trade, and, provided we can supply the type of carcass required, there should be no difficulty in developing an expanding trade, particularly in baconers. The introduction of the present baconer-grading system is welcomed by British curers, and it is giving considerable satisfaction, as it enables purchases to be made with reliance that deliveries will be up to the required standard. However, one note of warning must be sounded: the overfat baconer has a very limited and restricted market in the United Kingdom, and with the expansion of the industry every effort must be made to reduce rather than increase this type of carcass. Provided a reasonably long and reasonably lean carcass is produced, there is no fear that expanding production in New Zealand cannot be satisfactorily marketed in the United Kingdom. The frozen baconer is popular with curers, and, although only a small proportion of them at present handle appreciable quantities, expanding numbers of suitable export pigs will cause many more to become regular buyers of our exports.

In reviewing the prospects for our meat-export business it can be said that the future for both pigs and chilled beef is extremely favourable. Apart from appearance, the meat quality of our baconers and chilled beef is highly satisfactory and the avoidance of overfatness in the pig and the improvement in the bloom and external appearance in our chilled beef are the two major factors in the attainment of an expanding and stable market for these products. Regular rather than intermittent delivery is also essential, and in the baconer industry the successful wintering over of growing store pigs is necessary.

The work of the District Pig Councils, which were brought into being through the utilization of the pig levy for instructional purposes, has been excellent, and these Councils, with their instructional supervisors, are of the greatest value in developing modern pig management throughout the Dominion.

Beef Industry.

It is pleasing to note that considerable expansion is taking place in beef cattle in New Zealand. An increase of over 200,000 beef cows within the past three years has taken place, due largely to the developing chilled-beef industry. If this expansion can be continued and thus improve the ratio between cattle and sheep on much of our sheep-breeding country, particularly in the North Island, it will be of great advantage.

Probably the weakest feature of sheep-breeding country in the North Island has been that the employment of cattle in sufficient numbers to enable the country to be improved for sheep and at the same time limit pasture deterioration has been too expensive. With an improvement in beef prices, both for store and fat animals, this expenditure is likely to be considerably reduced. If this can be done and our run-cattle stock augmented, one of the greatest problems in hill-country-land

utilization will be solved. Two factors stand out clearly in our grassland farming economy—the first is that full use is not yet being made of top-dressing of grassland with artificial fertilisers and lime where such practices are practicable; the second is that cattle are not being fully utilized in the improvement of pasture where top-dressing is impracticable because of topography or transport.

Animal Research.

During the year extensive animal research has been carried out by the Department of Agriculture, particularly in connection with facial ezcema, mastitis, sterility in cows, and hogget-mortality, and many valuable results have been secured. The visit of Dr. C. S. M. Hopkirk, Officer in Charge of the Wallaceville Animal Research Station, to Europe and America has enabled him to bring back the latest knowledge from the main research organizations in the countries he visited, and this should be of extreme value.

On my return to New Zealand I decided that it was essential in order that animal research, particularly from the disease standpoint, should be intensified, that the whole of the Department's facilities for this work should be co-ordinated. Accordingly a new Division has been created, including in it all personnel and facilities available within the Department. Dr. J. F. Filmer has been appointed Acting Director of the Division, and both the Wallaceville Veterinary Laboratory and the Ruakura State Farm have been made special animal research stations. The chemical section has also been incorporated in the Division.

The Division has on its staff twelve veterinarians and twenty-nine other technical officers. The staff is still short of a number of specialist officers, particularly in the field of genetics, parasitology, and pathology, but it represents a team of workers under one control which should give great service to the country. In addition, it has the advantage, which is absolutely essential, of assistance from the field staffs of the Live-stock and Fields Division.

Animal research, particularly along the line of disease research, must have full and complete liaison with those concerned with live-stock and their management. Therefore the closest contact must be maintained between the field staffs of the Department and the new Division, and special care is being taken to ensure this direct and vital co-ordination.

A full programme of work is already under way, and although many of our serious animal-disease problems are similar to those of other countries, where much research has and is being carried out, the conditions surrounding them in New Zealand are in many ways dissimilar, and must be prosecuted here rather than relying on oversea work and experience.

Departmental.

The annual reports of the various Divisions which accompany this report give a good indication of the ramifications of the Department and the volume of work carried out by its officers. It has been an exceedingly busy year for the Department, and I want to express my thanks and appreciation to the whole of the staff for the excellent manner in which they have performed their duties, and particularly to thank them for their loyal co-operation during the eight months I was absent in Europe.

A. H. Cockayne, Director-General of Agriculture.

ACCOUNTS DIVISION.

REPORT OF L. C. SCOTT, ACCOUNTANT.

In recent years expenditure has been expanding steadily, but 1938–39 is the first year to show a *net* expenditure in excess of £1,000,000. Although budgeted position provided for a net expenditure of £966,113, the actual net figure was £1,078,426. Minor departures from the budgeted position were necessary to meet expanded or reorganized activities, and the only instance of material expenditure in excess of appropriated figures was in connection with the fruit industry. The "overseas" and "local market" guarantees entailed financial assistance beyond the figures in the appropriations to the extent of £43,904 (overseas) and £8,530 (local market) respectively.

As usual, the availability of departmental finance has been a real "limiting" factor in the achievement of agricultural progress, in that restrictive accountancy influence has been applied to the fullest practical extent in regulating activities, whether normal or abnormal, within the planned (or budgeted) financial provisions. The co-operation from executive officers directing expenditure facilitated restrictions necessary to offset financial adjustments to meet minor abnormal requirements and thereby minimized the liability of any irritating effects which restrictive accountancy influence must otherwise engender.

It was expected that the increasing trend of the past few years in railage of lime and fertilizers would be maintained, but this did not eventuate in that the upward trend in lime was of a comparatively minor nature (about 5½ per cent. on the previous year's cost) and the trend in fertilizers receded (about 3 per cent. on the previous year's cost). Taken together, the cost of the railage concessions are almost the same as for the 1937–38 year.

Credits from various sources were budgeted to yield £287,330, but only £162,379 came to hand. The shortage was due almost entirely to the fact that receipts in connection with noxious weeds and assistance to fruit-industry schemes did not materialize.

A summarized statement of the vote follows :—

——	Expenditure appropriated.	Paid out.	Revenue appropriated.	Received.
	£	£	£	£
Administrative services	510,929	501,530	124,080	121,501
Payments under statutes	109,000	102,711	3,000	2,616
Miscellaneous advances, &c.	633,514	636,564	160,250	38,262
Totals	1,253,443	1,240,805	287,330	162,379
Less credits-in-aid	287,330	162,379	..	..
Net totals	966,113	1,078,426	..	..

From the above it will be readily appreciated that the overspent effect of the vote is more apparent than real.

In the examination of receipts (£162,379) and payments (£1,240,805) resulting in the net excess of payments (£1,078,426) it is interesting to note that "Administrative services" called for payments totalling £501,530 and yielded £121,501 credits (net being £380,029); that "Payments under statutes" required £102,711 and yielded credits of £2,616 (net being £100,095); and that "Miscellaneous advances, grants, subsidies, &c.," cost £636,564 with credits of £38,262 (net being £598,302). As usual, the vote outgoings have been, comparatively, much more substantial than incomings. There are, however, other receipts (£110,565) not covered by vote figures (Nauru and Ocean Islands, £35,344; Slaughtering and Inspection Act, £58,884; Dairy Industry Act, £2,370; Orchard and Garden Diseases Act, £8,578; Orchard-tax Act, £2,331; sundry, £3,058).

Administrative Services.—The major expenditure factor is remuneration for personal services (£322,584), and for the efficient functioning of those personal services locomotion (£63,822) is essential. Other working-expenses (£115,124) have not been excessive for the proper maintenance of operations embracing three large farms and many small areas, two extensive laboratories, a seed-testing station, a publication section, numerous grading-services, and a number of research and demonstrational services, together with provision of office accommodation, telephones, stationery, and staff transfers necessary in connection with a staff of 1,015 persons (exclusive of casual labour).

Payments under Statutes.—Compensation for diseased live-stock (£41,748), subsidies for destruction of rabbits (£29,963), subsidies to encourage production of "remounts" (£4,000), and grants for educational purposes (£27,000) give a total of £102,711, which is in rather marked contrast with £115,124 for the working-expenses of the administrative services.

Miscellaneous Advances, Grants, Subsidies, &c.—The payments under this section have been heavy and wide in their distributive incidence. Carriage of lime, fertilizers, and farm-produce absorbed £362,330; assistance to fruit industry, £162,514; noxious weeds eradication, £75,205; Hawke's Bay flood assistance, £11,783; assistance to pig-industry, £8,077; and numerous small grants, &c., £16,655.

Although a very material volume of the work of the Accounts Division has been in direct relationship to the actual monetary requirements of the Department, statistical and investigational problems of indirect monetary significance have required considerable attention. Costs were compiled and submitted for the consideration of the Committee which dealt with the 1938–39 season's guaranteed price for butterfat. A report on many aspects of the meat-freezing industry required association with action arising out of problems presented therein; a similar but less exacting association has prevailed in connection with lime production and distribution. Two senior officers have been called upon to undertake extensive confidential compilations, and the calls for general statistical data have been material and steady in volume. There appears to be a steadily increasing demand for the monthly *Produce Notes* issued by the Investigational and Statistical Section. These activities, coupled with the volume of work involved under the scheme whereby the fruit industry received monetary assistance on realizations from fruit marketed in the Dominion, prevented development of many desirable avenues of statistical exploration more closely related to primary agriculture.

Steps in co-operation with the Editor to achieve circulation pre-eminence for the *Journal of Agriculture* throughout the Dominion have also involved work for my Division. The efforts, however, have been successful, and the wide circulation of the *Journal* is now an assurance that a measure of permanence has been added to many of the intangible aspects of departmental service.

I have received from my staff and officers associated with general accountancy matters throughout the Dominion another year of hearty support and co-operative effort, and I desire to record an acknowledgment of my indebtedness to all concerned.

LIVE-STOCK DIVISION.

REPORT OF W. C. BARRY, M.R.C.V.S., DIRECTOR.

The work of the Live-stock Division during the year under review has been of a particularly onerous nature, owing to the very severe and extensive outbreak of so-called "facial eczema" in sheep and cattle in several parts of the North Island in the Months of March, April, and May, 1938. This severe outbreak of disease caused a transfer of field officers necessitating the concentration of an advisory service in the more severely affected areas, so that all possible assistance might be given to farmers to enable them to cope with the disease. At the best, a very heavy mortality ensued, particularly in the Waikato district, where dairy herds and sheep flocks were acutely affected. The matter required particular attention in the freezing works, as well as in the field, so that special care was necessary to safeguard the quality of meat being exported at the time of the disease.

To deal adequately with an investigation into the disease a special research organization was set up in the Waikato. This investigation is being prosecuted by a team of workers, with the co-operation of farmers' representatives, under the chairmanship of Dr. Filmer.

During the year five additions to the veterinary staff were made possible through the return of graduates who had been studying abroad under the system of veterinary bursaries now in operation. Although this addition of staff has improved the position, there is still a need for further veterinary assistance to deal with the routine of field-work and meat-inspection, as well as meet the needs of veterinary research into animal-health problems in the Dominion.

The operation of the Remounts Encouragement Act during the past year and the coming into force of the Stallions Act, 1939, will make further demands on the field veterinary staff. However, it is hoped that the operation of these two Acts will do much to foster horse-breeding and fill what was considered to be a much needed want in this class of live-stock production.

The additional accommodation being provided at the Wallaceville Laboratory is very necessary for the added staff at this centre. During the greater part of the year the Officer in Charge, Wallaceville, has been overseas on a visit of inspection and inquiry into veterinary research work in other countries.

Health of Live-stock.

HORSES.

The health of horses has remained in a very satisfactory position, no serious disease or losses of an epidemic nature having been recorded during the year. An occasional outbreak of strangles was recorded, and the incidence of joint-ill in foals appears to be below other years. A few deaths were reported, and attributed to the effects of ragwort poisoning.

Owing to the dry spell of weather during February and March cases of horses being affected with "staggers" were fairly common in several districts. No deaths are recorded.

Horse-breeding.—It is reported that a decline in heavy-horse breeding is evident in several districts. The use of tractors has been more general on several farms, and it appears as if the younger men on farms to-day are more suited to mechanical power than to dealing with teams of horses. On the other hand, the scarcity of labour on the farm and the necessity of having the work carried out expeditiously may be the main cause of the decline in breeding. No doubt much work is now carried out by contract, and this may account for some of the increase in mechanical traction.

During the year the Stallions Act was passed and will be in operation during the next breeding season. This measure has been introduced with a view to ensuring the soundness of draught stallions used for breeding-purposes. In time the Act should do much to improve the breeding of sound stock, which in its turn should encourage an increase in breeding generally, both for home supply and for export to Australia.

In regard to the breeding of light horses, the Remounts Encouragement Act of 1914 was made operative during the year. This act provides for the payment of a subsidy to owners of selected and approved stallions in the various districts. Owners of approved mares are enabled to avail of the use of the subsidized stallions at reasonable fees as a result of the subsidy. Much organization work was carried out through the active interest taken in the Act by the New Zealand Racing Conference, and special thanks are due to the Secretary (Mr. H. R. Sellers) for his interest and assistance in carrying out the work during its first year of operation. The Act has had the support of the New Zealand Trotting Conference and other kindred live-stock bodies, and in its first year of operation a very satisfactory position eventuated. Altogether a total of thirty-two stallions were subsidized. In some districts difficulty was experienced in obtaining a suitable stalllion, and in five districts two stallions were selected to cover the area involved. Three stallions were rejected under the Act on account of unsoundness.

In addition to those already mentioned, thanks are due to the members of the District Remount Committees, who supervised the operation of the scheme in their districts. The scheme may be said to be well initiated and should result in a crop of foals of a suitable type. The scheme should also encourage more interest in horse-breeding on rational lines and should in the course of a few years eliminate nondescript breeding.

It is hoped that the two Acts referred to will revive horse-breeding and stimulate an interest in the horse among the young people of the country. There appears to be a decline in the entries of horses at many of the agricultural and pastoral shows, and this decline may be arrested by such a stimulus.

CATTLE.

Diseases scheduled under the Stock Act.

Tuberculosis.—The number of cattle condemned under the Stock Act for tuberculosis during the year amounted to 6,791 head, being 5,932 condemned on clinical symptoms and 859 reactors to the tuberculin test. In each case compensation was paid in accordance with the provisions of the Act. The tuberculin test was applied to 14,780 cattle, of which number 859 reacted, giving a percentage of 5·8.

In a severely infected herd, reactors to the tuberculin test three years ago showed a 20-per-cent. infection, two years ago the reactors were 8·14 per cent., and this year the reactors have dropped to 1·4 per cent. The tuberculin test is of very great value as a diagnositc agent in the detection of infected animals. Provided all the animals on a farm are tested at regular intervals, and provided care is taken to see that fresh infection is not brought in from outside, there should be no difficulty in cleaning up centres of infection.

The total number of cattle, exclusive of calves, examined at the various abattoirs and meat-export slaughterhouses was 504,426, an increase of 3,839 on last year's figures. Of these, 38,203, or 7·57 per cent., were found to be affected with tuberculosis in varying degrees, a large percentage being only slightly affected.

This indicates an increase of 0·19 per cent. infection amongst cattle slaughtered in these premises.

So far as the tuberculin-testing of herds is concerned, the position is a voluntary one. It is, however, interesting to note that 13,754 cattle were tested at the owner's request.

It appears necessary to give some protection and credit to owners who have eradicated the disease from their herds by repeated annual testing. The initiation of an accredited herd scheme would be an acknowledgment of the efforts of those owners who have endeavoured to supply milk from healthy stock, and an incentive to other owners to follow. The voluntary testing of herds supplying milk for human consumption does not go far enough, and from a public-health aspect it is recommended that all herds producing for town milk-supply should be tested and, if possible, accredited.

Actinomycosis (and Actinobacillosis).—During the year 732 animals were condemned for this disease. Many animals were successfully treated for the disease during the year by the regular dosing with potassium iodide as recommended in selected cases. Advanced cases of the disease, with bone structure involved, do not readily respond. In the case of run cattle, dosing is impracticable in many cases. In other cases, owners are loathe to carry out the necessary repeated dosing.

Malignant Growths.—The number of animals condemned was 145, compensation being paid in accordance with the Stock Act.

Anthrax.—The Dominion remains free from this disease.

Blackleg.—The number of calves vaccinated against this disease in the affected areas were Taranaki, 8,295, and Auckland, 21,924, making a total of 30,849. This shows a decrease of 5,001 on last years' figure, and would indicate that the number of outbreaks this year is less. Control by vaccination continues to give satisfactory results.

Cattle-tick (Hæmaphysalis bispinosa).—On account of the dry and favourable season in the North, ticks were plentiful on stock in the early part of the season. No clean areas have been infected, and no serious spread of the parasite has taken place.

Johne's Disease.—Unfortunately, it has to be recorded that new farms have been found infected with this disease in both the Taranaki and the Waikato districts. Although the disease was confirmed on a further eleven farms in Taranaki, it is important that only one case each has occurred on many farms in this district. Previously affected farms in Taranaki have shown no new cases since 1937 on nineteen farms, no new cases on twenty-five farms since 1936, no new cases on seven farms since 1935, and no new cases on four farms since 1934. In this district the position is rather hopeful and reassuring, and it is possible that a fair measure of control can be exercised. The percentage of reactors to the Johnin test in Taranaki is also low, and this again is a hopeful sign for the ultimate eradication of the disease in this district.

The position in the Waikato is very different, and here the disease presents many disturbing problems in regard to control and eradication. During the year Johne's disease was found on eight additional farms in this district. A feature of the disease in this district is that, once a clinical case is diagnosed on a farm, many animals appear to soon become sensitized to the diagnostic agent, and the percentage of reactors does not decline even after repeated testing. This is a very disturbing feature which is not hopeful from a control or eradication point of view. In this district other measures than testing would appear to be necessary, and in non-pedigree herds some measure of cross-breeding may offer the best prospects of success. This suggests itself from the fact that grade animals appear to be more resistant than pedigree animals.

Research into many aspects of the disease is needed to clarify the position, as the difference in incidence between the two districts of Taranaki and Waikato, and between these and clean areas is hard to follow.

Non-scheduled Diseases.

Mastitis.—This disease continues to occupy one of the prominent places in the diseases attacking the dairy herds in the Dominion. Although further research and investigation has been carried out and this work must continue, it is being recognized by many farmers that good general shed management is a prime factor in control.

The test sets which were sold to farmers with a view to the early detection of infected animals are not being used as freely as they should. It is recorded that a big percentage of farmers are not

using the sets at all. This disease calls for the full co-operation of every one if a reasonable measure of control is to be obtained, and, as the disease primarily concerns the stockowner, every effort should be made to assist. As a cause of herd depletion and culling and thereby increasing the cost of replacements and maintenance, the disease is of prime importance.

The research work into the disease is being directed along several lines, and with the co-operation of the farming community and the Herd-testing Association it is hoped that further valuable information will be obtained.

Contagious Abortion.—This disease is still prevalent on many dairy-farms, but owing to various factors the disease does not cause extreme losses. Many owners are not aware of the extent of infection in their herds, and if a small number of animals lose their calves the owners think they are dealing with a non-contagious form of the disease. This is all to the good, as in the absence of an eradication scheme, which does not appear to be very practicable under present grazing conditions, the regular occurrence of a few cases of the disease on a farm tends to keep infection alive, thus lessening the incidence of actual abortions. It is only when a blood test is applied to a herd that the real extent of the infection in the herd is revealed. Probably one of the most serious features of the disease is its bearing on subsequent breeding in the herd. There can be no doubt that a higher breeding efficiency would be obtained in abortion-free herds. On the other hand, when a storm of the disease occurs in a herd there is a serious dislocation of production in the loss of calves, loss of milk, and subsequent breeding difficulties.

The adoption of hygienic measures to prevent gross contamination of pastures will do much to prevent violent acute outbreaks of abortion. The principle of having self-maintained and self-contained herds has much to commend it in the control of this disease. Trafficking in breeding-stock, unless such stock is guaranteed free from the disease, must be looked upon as a pontential source of spread of infection.

Temporary Sterility.—Investigations into the problem of delayed conception in dairy herds are being continued by the research officers. In the Waikato district this work is centred at the Ruakura Farm, where attention is being directed into various aspects of the problem. Particular attention is being paid to the male and female reproductive organs of animals in herds where the disease is serious, and it is hoped that the preliminary work on artificial insemination will prove useful in bringing forward new information. Such work must be continued over a period of years, as there is evidence that the condition is more serious in some seasons than in others. Field reports go to show that a herd affected one season may be free the following season, and *vice versa*. There is also some evidence to show that the general feeding of the herd during one season has a distinct bearing on the breeding efficiency of the herd the following season. More farms are affected after a very dry summer season or after a severe winter, when the cows are subjected to a period of feed scarcity. Owners of high-producing herds should feed accordingly, and should see to it that the dairy herd does not suffer from a mineral deficiency during drought or winter periods of green feed scarcity.

Grass Staggers in Cows (Grass Tetany).—This disease was again rather prevalent in the Waikato last spring. This was not unexpected, as owing to the severe outbreak of facial eczema in this district a few months previously many farmers had used up their winter supplies of hay and ensilage in an endeavour to combat the eczema. Consequently a supply of supplementary feed was not available to carry the cows over the critical period of a few weeks after calving. In addition, many cows were in very poor condition at the time of calving, and some losses were attributed to grass staggers when in reality the cows died from debility and difficulties in calving, owing to their weakened and emaciated condition.

It was, however, fortunate that a rather cold spring prevented a sudden flush of growth, otherwise the mortality from true grass staggers, in the absence of hay, would have been much more serious.

Although the treatment of affected animals has given some measure of success, permanent results can only be expected to follow rational lines of supplementary feeding of stock so as to prevent the mineral unbalance which appears to be the acute factor in the disease. Whether hay or ensilage will do this, or whether mineral supplements require to be added to the diet, and the nature of such mineral supplements, is being investigated. Further experimental work is being carried out from season to season as opportunity offers. Here, again, seasonal conditions influence results and delay the formation of definite conclusions.

Milk-fever.—The incidence of this disease would appear to have been lower in all districts affected with a feed shortage. Late-calving cows are more susceptible, owing to the spring feed and the better nutrition. An increased number of cases occurred in the Wairarapa district, where winter feed conditions were good and where practically no eczema had been reported during the previous autumn months. Hay-feeding up to the time of calving, and for a few weeks afterwards, would appear to be necessary and of value in the prevention of both milk-fever and grass staggers. A sudden flush of grass-feeding in the early spring is dangerous in regard to both diseases.

Trichomoniasis.—This protozoan parasite of the genital tract of dairy cows is rather difficult to demonstrate even in animals where it is suspected as being a cause of breeding-troubles. There is reason to believe, in view of investigations in other countries, that the parasite is not likely to prove a menace under our conditions of dairying. At the same time, too much reliance on overseas reports might place a false interpretation on the position, and it is therefore necessary that further investigation on infected farms be carried out. The breeding history on these farms should form a useful guide as to the necessity of further inquiry.

Parasitic Disease in Young Cattle.—Owing to the dry season, parasitic gastro-enteritis of calves does not appear to have been so serious as in previous years. Judicious drenching combined with a reasonable standard of feeding is being recognized as the main line of prevention. Probably the most popular drench is the nicotine-bluestone mixture in appropriate dosage.

Photosensitization.—As already stated, one of the most serious outbreaks of photosensitization affected the herds and flocks in the months of April, May, and June, 1938. Although previous outbreaks had been mainly confined to sheep, this outbreak seriously affected dairy herds in many parts of the North Island, particularly the Waikato district.

The disease was not unexpected, owing to the nature of the season and the sudden autumnal flush of green feed following the advent of rain. It was not, however, anticipated that cattle, particularly dairy cows, would be affected to the extent that they were.

The dairy herds were so acutely affected in certain areas that the owners were faced with a major problem of treatment and feeding in order to save the affected animals. As it was, the serious shortage of milk, the serious amount of udder trouble, the loss and dislocation of dairy production, and the loss of animals were acutely felt. At the height of the disease much of the feed saved for winter use had to be used in an endeavour to overcome the trouble and this resulted in a serious scarcity in later months. In the Waikato district entire herds were affected with the disease ; in other districts the animals were less seriously affected, and in some herds only a small percentage of animals were affected. Where owners had had some previous experience of the disease and where prompt measures were taken on the appearance of symptoms, very good results were obtained from the measures recommended. In the Wellington Province many owners had some experience of the previous outbreak in 1935 and were in a position to adopt promptly the measures recommended by departmental officers through the press, through contact, and through lectures.

A thorough investigation into the disease was decided upon by the Government, funds were provided for research purposes, and an organization was set up to prosecute research into the many phases of the disease. This organization comprises workers in all fields likely to be of assistance in elucidating the true picture of the disease. The work will cover a long term, and include much fundamental research, covering the chemical analysis of soils and pastures and the biochemical and pathological examination of specimens. Much experimental work will require to be carried out in such an investigation. This work is proceeding.

SHEEP.

The comparatively dry season was a favourable one for fat-lamb production, and better results were obtained than in the early part of the previous season. The works returns show a small decrease in the killing of lambs and an increase in the killing of mutton. A decrease in lamb killing was to be expected in the North Island works following the severe outbreak of photosensitization in sheep the previous autumn.

Photosensitization.—As already referred to in the section dealing with cattle diseases, in the months of April, May, and June, 1938, there was a very severe outbreak of this disease affecting the sheep flocks and dairy herds in many parts of the North Island. The disease was most acutely felt by farmers in the Waikato District, and this applied to both sheep-farmers and dairy-farmers.

Many sheep died or were killed in the later stages of the disease. Many recovered, but owing to various causes were not of much value for breeding-purposes. Owing to the outbreak it was generally anticipated that a lower lambing percentage would be experienced in the spring. The lambing percentage was low, and varied greatly from farm to farm. Many surviving ewes continued to die for some time after the disease had disappeared, showing the very serious nature of the internal lesions produced when the disease was at its height. Although the Waikato District had the disease in a most acute form, other districts in the North Island did not escape. In the Gisborne, Hawke's Bay, Manawatu, and in the Wanganui-Taranaki districts some flocks were very seriously affected. The Wairarapa District practically escaped without loss.

It is pleasing to record that, owing to the strict method of check inspection at the export works, no complaints were received from overseas in regard to the carcasses passed for export. Owing to yellowness of varying degree in many carcasses, either directly or indirectly due to the disease, a very careful examination of each line of sheep had to be carried out.

Fortunately, the period up to the 31st March, 1939, has remained comparatively free from the disease, although minor outbreaks in sheep have been under investigation by the research officers. Further work remains to be done, and this is being steadily pursued with a view to elucidating many baffling aspects of the underlying causes.

Lamb-mortality Survey in Canterbury.—Much useful work has been carried out during the year by Messrs. Knott and Ewer, Veterinarians, who have been investigating the cause of losses in lambs, hoggets, and sheep in the Canterbury District. For a number of years the losses in this essentially sheep-raising area have been marked, and it is hoped that the survey which has been undertaken will enable a programme of advice to be outlined which will do much to prevent and reduce losses. The information obtained and the personal contact established between the officers and the farmers by visits, lectures, demonstrations, and radio broadcasts is an indication of the extent of the diseases of sheep in this area.

Although the parasitic problem appears to cloud all other issues as a prime factor in the cause of losses, many other diseases have been known to exist in the area. Such items as enterotoxæmia (pulpy kidney), foot-rot, contagious ecthyma, contagious ophthalmia, ante-partum paralysis of ewes, milk-fever of ewes, and mastitis have themselves either accounted for losses or indirectly have lowered the animal's resistance to parasitic attack.

The parasitological investigation has included the collection of much data from lambs dying in the field and from lambs sent forward for slaughter at the works.

Field observations as to pasture-management, rainfall, drenching, supplementary feeding on rape and other crops, and other relevant inquiries have been carried out. There appears to be no doubt that seasonal climatic conditions play a big part in increasing or decreasing the parasitic invasion of the animals, and consequently increasing or decreasing the mortality from such an invasion. In these circumstances too much emphasis cannot be laid upon the fundamentals of sound sheep-management (feeding, drenching, avoiding overstocking, supplementary feeding, pasture-control) and sound sheep-nutrition at all seasons of the year.

The weekly radio lecturettes have repeatedly stressed these points, and much of a preventive nature has already been achieved. Several seasons of an intensive fight against the parasitic problem would undoubtedly do much to improve the position and cut down losses to a reasonable minimum.

Infectious Entero-toxaemia (Pulpy Kidney).—The losses from this disease were below the average in most districts. In Otago a considerable measure of control of the losses in lambs is now effected by means of vaccination of the pregnant ewes. From the figures contained in a special report it is observed that the percentage mortality in lambs from unvaccinated ewes was about double that in lambs from the vaccinated ewes. Vaccination of the ewes is justified in all districts where losses of lambs warrant precautions.

The losses occurring in older sheep from this disease are not so easily dealt with. Apparently the immunity conferred on the lamb through the colostrum of the ewe is not of a lasting nature. Although it appears to protect the lamb over the period of lamb-mortality—*i.e.*, from three to eight weeks of age—further vaccination of the lamb itself has been considered with a view to a longer protection to cover losses in older lambs and hoggets. So far the results obtained have not been satisfactory, and further trials will require to be carried out.

As a result of the extent of the losses in young lambs in Canterbury from this disease, it is anticipated that a considerable increase in the vaccination of the ewe flocks in this area will take place during the next winter.

Lymphadenitis.—Although the incidence of this disease in North Island flocks is generally low, lines of aged ewes sent forward for slaughter are frequently seriously affected. In such cases the owners are advised as to the proper methods and precautions to be taken to reduce the infection on the farm. The incision of the carcass glands at all works is necessary in mutton being exported, and a higher incidence is shown in certain South Island works. It is essential for owners to take the precautions recommended so as to keep the disease in check.

Pregnancy Toxaemia (Ante-partum Paralysis) in Ewes.—Among the diseases of sheep in Canterbury, it is reported that this disease had a widespread occurrence. In Otago the incidence was comparatively low last season, the failure of the turnip crops necessitating the feeding of more hay and chaff, with apparently beneficial results. In the absence of the usual prolonged feeding on turnips, the ewes were healthier and more active.

In the North Island the mortality from pregnancy toxæmia was not high. There were a few exceptional cases.

As curative treatment is not satisfactory, this is a disease which it appears necessary to control by prevention. Sound management and winter feeding of the ewe flock in the later stages of pregnancy are effective measures which repay owners for the extra labour and expense involved.

Contagious Ecthyma (Sore Mouth).—The use of the vaccine as a protection against this disease continues to give good results. Numerous outbreaks were seen in unvaccinated flocks during the past year in Canterbury and other districts. It is anticipated that there will be an increase in the number of flocks to be vaccinated next year. Owners are strongly recommended to adopt this course.

Contagious Ophthalmia (Pink Eye).—The dry season experienced revealed quite a number of flocks affected with this eye-disease. Information in regard to it was the subject of radio broadcast lecturettes from 3YA, Christchurch. The disease is not serious if prompt measures in regard to isolation and treatment are put into operation.

Hydatid Disease.—Much publicity has been given to the subject of hydatid disease in man and animals and the prevention of same. During the year the Dogs Registration (Prevention of Hydatid Disease) Regulations 1938 were gazetted, and as from 1st January, 1939, have been in force.

Under the regulations all owners of dogs have been supplied with the effective tapeworm medicine known as arecoline hydro-bromide. It now remains with owners to carry out the suggested dosing of their dogs at regular three-monthly intervals, and to prevent the reinfestation of dogs by prohibiting the use of raw offal in the feeding of dogs. Acting conscientiously along these lines, the incidence of the disease in the human subject should be eliminated and the incidence in animals greatly reduced if not eliminated.

It is on record that the owner of one property reduced the incidence of the disease in his sheep from 15 per cent. to ½ per cent. in a period of three years through feeding no offal (livers and lungs) to his dogs. Only four livers were found affected with hydatid cysts out of seven hundred examined. This should be an incentive to other owners to adopt the same practice and achieve such equally good and encouraging results.

Liver-fluke and Black Disease.—The losses from black disease in the liver-fluke district of Hawke's Bay is now controlled by the regular use of black-disease vaccine. Fluke itself does not cause losses of sheep in New Zealand, but indirectly is responsible for the occurrence of black disease.

Two lines of sheep sent forward for slaughter from the Otago Central District were found infested with flukes in the liver. The increase in irrigation in this area will require to be carefully watched from a stock parasitic point of view. Irrigation and heavier carrying-capacity will tend to intensify the parasitic problem.

Cutaneous Myiasis (Sheep Blow-fly).—This was less troublesome in the Nelson and Marlborough districts during the year. In Hawke's Bay and parts of the Auckland District—*i.e.*, Te Kuiti—the fly menace was more prevalent than in previous years. In the Canterbury District outbreaks commenced in December and have continued in confined areas. Back strike is undoubtedly the most serious form and the main cause of death. It is the most difficult type to treat. Research is being continued on this problem.

Foot-rot.—This disease continues to give a good deal of trouble to sheep-farmers, particularly in Canterbury and Southland. Wet seasons are blamed as being responsible for the greater number of sheep affected. It has, however, been found that thoroughness in the eradication of the disease during a spell of dry weather is not sufficiently exercised, that chronic carriers are left in the flock, and that the disease then spreads rapidly in wet weather.

During the year an amendment to the Stock Act was passed which it is hoped will have the effect of preventing the exposure and sale of badly infected sheep, and thus afford a measure of protection in regard to the spread of the disease.

Lice and Ticks.—A careful inspection of sheep at saleyards was carried out by the stock-inspection staff. Although it was necessary to prosecute in some cases, the sheep were found to be in good condition in regard to these parasites.

PIGS.

The number of pigs slaughtered for the season 1937–38 at registered premises was 1,012,836. Those slaughtered on holdings and examined at butchers' shops numbered 18,951, making a total of 1,031,787, a decrease of 76,401 on last year's figures.

Of 984,502 coming under inspection, 191,642 carcasses were found to be affected in varying degree with tuberculosis, the percentage of infection being 19·46, an increase of 1·05 per cent. as compared with last year. Meat-export works, 805,006; abattoirs, 179,496; ordinary slaughterhouses, 28,334; shops, 18,951: total, 1,031,787.

Suipestifer Infection.—This disease is responsible for considerable mortality in young pigs. Improved sanitation, drainage, shelter, and general conditions of cleanliness in housing and feeding are being constantly advised, and there is evidence that good results are being obtained.

Mr. W. T. Collins, District Superintendent, Auckland, reports:—

> "For the six months ended 31st March last the percentage of total condemnations was 0·4 lower than over the same period the previous year. For the year ended June, 1937, the percentage of pigs rejected for export was 12·3; for the following year the percentage was 8·1; for the nine months ended 31st March last the figure stands at 6·5 per cent. This is very gratifying, as it clearly shows that more care and attention is being paid to a very important industry."

Although this shows a big improvement in regard to a reduction in preventible pig diseases, there is still room for further care.

Pleurisy.—The number of rejections under this cause is still too high, and there is room for more improvement in the housing and feeding of very young pigs.

Wounds and Bruises.—This is a cause of rejection which is still too high, and calls for more careful handling of the pigs on the farm, on trucks, on rail, and at the works.

Sarcoptic Mange.—Outbreaks of mange occurred in the Auckland and Otago districts during the year. The outbreaks were successfully cleared up and the disease eradicated on each farm.

Swine Erysipelas.—No cases of this disease were recorded during the year.

Necrotic Ulceration of the Skin.—This continues to be a cause of the rejection of pigs for export. The amendment to the Stock Act intended to include this disease in pigs when exposed for sale will assist in preventing the spread of the disease.

Swine Husbandry.

The report of Mr. M. J. Scott, Superintendent of the Swine Industry, is submitted herewith:—

"The season just ended marks the completion by the Department of most of the projects recommended during the last few years by those interested in the development of pigs. A service that embraces most of the problems associated with pig-production is now in operation, and can be of value in assisting the industry just in proportion to the use that is made of it by individual farmers.

"Pedigree-sow recording was introduced in October, 1936, pig census in May, 1937, national instruction service in August, 1937, grading of baconers in February, 1938, carcass-quality scheme for baconers in October, 1938, and a performance-record scheme for pedigree pigs is now ready. In addition, a bulletin on "Modern Methods of Pig-production" has been printed and sold to dairy companies at cost for distribution to their suppliers. Approximately twenty-seven thousand copies have been distributed to date; and a bulletin on the housing of pigs—designs of houses and lay-outs, running into about thirty pages—is in course of preparation.

"Departmental films on different aspects of breeding, sanitation, and disease have been shown by Mr. Peirson, Extension Officer in Pig Husbandry, in eighty centres to highly appreciative audiences. Mr. Peirson has also given approximately seventy demonstrations at field-days all over the North Island.

"*Progress of the Industry.*—During the year ended September, 1938, there has been a decrease of approximately 2·2 per cent. in the number of pigs slaughtered, and a further estimated decrease of 4 per cent. for the year ending September, 1939. The corresponding decrease in cow-production of approximately 5 per cent. for the year ended 1938, and a still greater one for 1939, indicates that the level of pig-management and the efficiency with which the dairy by-products are used for pig-feeding are still improving.

"The present status and past development of the industry are set out in the following table :—

Year.	Number of Sows at 31st January.	Total Pigs killed, Year ended 30th September.	As Baconers.	As Porkers.
1934	98,299	827,315	313,135	727,315
1935	111,793	936,700	346,948	589,752
1936	116,058	1,091,845	427,178	664,667
1937	112,921	1,117,856	494,315	623,541
1938	104,803	1,091,933	478,642	613,291
1939 (estimated)	..	1,050,000	..	..

"The estimate of the number of killings for 1939 is based on the killings to the end of March and the percentage these have been of the total for past years. A variation of 1 per cent. to 2 per cent. from this figure is to be expected.

"In view of the excellent export market available, the consistently good prices that have been offering for pig-meats, and the known worth of pigs when handled with modern conveniences and up-to-date methods of feeding and management, this falling off in production is to be regretted. Pork-production particularly has failed, probably because pork can be produced with a minimum of equipment and a maximum amount of inconvenience, whereas bacon, entailing better accommodation on account of the longer feeding-period, is usually produced on places with better conveniences, and has not fallen off so seriously.

"*Pedigree-sow Recording.*—This service continues to receive increasing support, chiefly from pig clubs. For the year ended 31st March, 612 sows have been entered for test, 412 have completed records, and 245 have been good enough to be included in one of the five grades. A quarterly report, giving performance of sows and the names and addresses of the owners, is published in the *Journal of Agriculture*. In view of the fact that only 60 per cent. of sows that complete the test produce litters that are heavier than 70 lb. and 210 lb. at three weeks and eight weeks respectively, some concern can be expressed for the quality of breeding-stock or for the attention given to them at this critical period. Many of the litters that have failed to reach the graded standard do so on account of being too light only at one or other of the three or eight weeks' weighings, indicating that it is the attention they receive rather than the quality of the pig that is at fault.

"*Pig Census.*—This was inaugurated in 1937. Returns of pig-production have been collected from approximately five hundred farmers all over New Zealand by field officers of the Department, summarized and tabulated at Head Office, and the results returned, through field officers, to those supplying information. From the information supplied it has been possible to arrive at the importance of using different amounts of meal, of producing big litters, of selling certain weights of meat for every sow kept, of using certain quantities of home-grown feed, and of other factors pertinent to profits in the industry. Analyses under these different headings have been published regularly in the *Journal of Agriculture*. A standard form of report has been adopted, and each farmer supplying information receives a sheet showing the production per sow, pigs born, bought, sold, and died, feed as skim-milk, meal and other crops required to produce 100 lb. of pig-meat, pounds of pig-meat produced per sow and per 100 lb. of butterfat, and the calculated earning-value of skim-milk per gallon. These figures can be compared with similar figures for all other farmers in his district who supply census information, and whose returns are similarly indicated by a reference number. This service, by providing standards with which a farmer can compare his own production, promises to be as useful to the pig-producer as herd-testing has been to the dairy-farmer. Steps are being taken to extend it. Its value in the future will be in keeping with the use that farmers wish to make of it.

"*National Instruction Service.*—Reports from District Councils, of which there are now nine, indicate a continued maintenance of interest in this movement. Approximately two hundred and fifty pig clubs are now formed and functioning. All distribute pedigree breeding-stock, and with few exceptions the clubs are giving satisfaction. A noticeable improvement in methods of pig-production is evident in all districts as a result of the instruction and advice given by District Council Supervisors.

"*Grading of Baconers.*—This has now been in operation for just over one year. The average turnout of baconers is approximately 64 per cent. No. 1 primes, 24 per cent. No. 2, 8 per cent. No. 3, and 4 per cent. of second quality. The lowest monthly percentage of No. 1 primes was sixty-two in January, and the highest sixty-nine in September. Where the grading is done after the pigs are backed down it is very reliable, but where the measurements are taken with a "trier" and the pigs are not backed down grading is not satisfactory. A number of parcels of graded pigs have been reported on from England, and with one exception the grading there has agreed closely with the grading done in New Zealand.

"*Carcass-quality Scheme for Baconers.*—This service was inaugurated in October, 1938. Any pig intended for bacon will be tattooed by the District Council Supervisor, on request by the owner, at any age between the porker and baconer stage. All tattooed pigs are reported on by the work's grader, and the owner receives a report on the carcass quality and maturity rate from the Department after the pigs are killed. The object of the scheme is to find out which breed, cross, or strain of pigs provides the best type of baconer, both from the viewpoints of quality of carcass and rate of growth.

"*General Activities of Field Officers.*—The services of field officers have been made use of in two specific directions, as previously indicated—viz., pedigree-sow recording and census collection. These services are definitely of an instructional and advisory nature, as distinct from a regulatory one, and tend to emphasize the importance of management and the prevention rather than the treatment of stock ailments, an aspect of departmental policy that has repeatedly been stressed and one that calls for the full support and confidence of the community in order to make it effective. A marked increase in requests for advice on housing, feeding, and general management has been noted during the current year.

"*Housing of Pigs.*—It is in this section that the most active interest has been shown. Mr. Peirson reports from every district in the North Island a striking increase in the number of improved houses and lay-outs. This is true for the South Island also.

"Under Mr Peirson's direction, a bulletin of plans and specifications for all the most satisfactory types of houses and lay-outs has been prepared and is now in the hands of the printer.

"*Feed-supply.*—As a result of the acute shortage of feed in July–August, 1938, and the consequent representations made to this Department for assistance in ensuring adequate supplies for the forthcoming season, the Internal Marketing Department has undertaken the importation of barley in quantity sufficient to meet the demand. This is available at main ports (North Island) to individuals or merchants, in ten-sack lots or more, at prices lower than pig-feed has been for a number of years. On a conservative basis, this importation should effect an increase in production equivalent to at least thirty thousand baconer carcasses. Immediate attention to the production of weaners in order to make use of this increased grain-supply is essential if appropriate returns are to be obtained from it.

"*Publications.*—During the year a bulletin entitled 'Modern Methods of Pig-production' was issued and distributed through dairy companies at cost. This method of distribution was adopted to meet the unexpected demand for the bulletin and to finance the production of a second edition of approximately one and a half times the number of the original issue. As previously mentioned, a further bulletin on houses and lay-outs is in course of publication and will be distributed as soon as possible."

Dairy Inspection.

This aspect of the Division's work has been given special attention during the year. The importance of the supervision of the public milk-supply does not need to be stressed. It is a phase of the field officer's duty which calls for continuous effort and a large amount of instructional service. It is, however, pleasing to record a general upward trend in the hygiene of dairies supplying milk for local consumption, this being more particularly noted in the case of the suppliers to the larger centres.

Owing to seasonal conditions, difficulty was experienced in many centres in maintaining the required quantities of milk, and arrangements to meet the position were necessary in several instances.

Live-stock Statistics.

The 1938 sheep returns (as at the 30th April) showed that sheep flocks in the Dominion had increased by 1,072,966 to a total of 32,378,774, an increase of over one million for the third year in succession. The number of breeding-ewes has increased by 325,575. The number of sheepowners has increased by 732 to 31,909. The number of cattle in the Dominion as at the 31st January, 1938, increased by 116,981 to a total of 4,506,082. The number of dairy cows (included in cattle totals) decreased by 62,727 to 1,872,797. The number of pigs in the Dominion was 756,466, a decrease of 45,953 on the previous year. Horses show an increase of 368, the 1938 total being 278,167.

Meat Inspection and Slaughter of Stock.

The work of the meat-inspection staff was satisfactorily performed throughout the year. Owing to the establishment of a "Supervising Meat Inspector" at all freezing-works, numerous changes in staff location took place. This was further designed with a view of strengthening the staff at certain works at which heavy pig slaughterings are carried out, and to bring about the greatest degree of efficiency in the inspection of export meat and meat products. Reports from London on condemnations of meat indicated the number to be few when a comparison is made with the large quantities exported.

The total numbers of stock slaughtered at registered premises were: Sheep, 4,153,927; lambs, 9,910,782; cattle, 588,772; calves, 1,013,968; swine, 1,012,836.

The following table shows the stock slaughtered during the past year at freezing-works only, the previous year's figures being shown for comparison:—

Stock.	Year ended 31st March, 1939.	Year ended 31st March, 1938.	Increase.	Decrease.
Cattle	331,135	322,992	8,143	..
Calves	932,333	996,436	..	64,103
Sheep	3,291,919	2,534,236	757,683	..
Lambs	9,780,736	9,839,269	..	58,533
Swine	805,006	883,080	..	78,074

For further purposes of comparison the following table, showing the killings of sheep and lambs at meat-export slaughterhouses over four periods, 1st October to 31st March, indicates the stock killed from the beginning of each season to the 31st March :—

Stock.	1935–36.	1936–37.	1937–38.	1938–39.
Sheep	1,287,331	1,276,234	1,748,035	2,362,223
Of which				
Ewes were	471,662	588,805	942,380	1,178,543
Lambs	6,269,694	6,536,408	7,040,149	7,454,031

The figures show an increase of 614,188 sheep (of which 236,163 were ewes) and an increase of 413,882 lambs compared with the same period last year.

The following are the numbers of each class of stock slaughtered under direct inspection during the year ended 31st March, 1939 : Cattle, 504,426 ; calves, 1,011,915 ; sheep, 3,933,364 ; lambs, 9,890,806 ; and swine, 984,502.

The table below shows the class of premises at which this stock was slaughtered :—

Stock.	Abattoirs.	Meat-export Slaughterhouses.
Cattle	173,291	331,135
Calves	79,582	932,333
Sheep	641,445	3,291,919
Lambs	110,070	9,780,736
Swine	179,496	805,006

Stock slaughtered at ordinary slaughterhouses during the year was as follows : Cattle, 84,346 ; calves, 2,053 ; sheep, 220,563 ; lambs, 19,976 ; swine, 28,334. Carcasses of pork killed and dressed by farmers, sent into butchers' shops and small factories, and examined by departmental officers numbered 18,951

In connection with the animals shown in the tables above as slaughtered at meat-export slaughterhouses, the following are returned as having gone into consumption within the Dominion : Cattle, 33,427 ; calves, 100,273 ; sheep, 244,881 ; lambs, 137,146 ; swine, 182,244.

Compensation paid for Stock and Meat condemned.

Compensation to the amount of £16,137 8s. 3d. was paid out during the year for animals condemned in the field under the provisions of the Stock Act, and £25,794 2s. 7d. for carcasses or parts of carcasses condemned for disease on slaughtering for human consumption at abattoirs, meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act.

Importation of Stock.

The following stock were imported during the year : Cattle, 33 ; sheep, 839 ; pigs, 24 ; horses, 18. Of the above animals, the following were placed in quarantine for the respective periods required : Cattle, 33 ; sheep 14 ; pigs, 24 ; horses, 12 (trotters from the United States of America).

Exportation of Stock.

During the year under review the following animals were exported : Sheep, 10,742 ; cattle, 97 ; pigs, 22 ; horses, 6.

There was the usual movement of thoroughbred horses to and from Australia.

Poultry.

Present-day practice of more or less intensive methods of poultry-keeping, combined with the ever-increasing demands required of the laying bird, accentuate the necessity for a greater degree of vigilance on the part of the poultry-keeper to maintain the health and constitution of his birds.

Disease follows in the train of weakened constitution, and, failing an enlightened outlook in the breeding, feeding, and general management, failure must be the ultimate result.

During the past few years the incidence of disease has shown a tendency to increase, and as it is realized that control must be directed to the management of the flocks, the instructional staff of the Department has been increased by the appointment of two additional Instructors, one of whom has been placed at Dunedin and the other at Auckland, in order that poultrymen may be assisted on the instructional side to prevent the onset of disease in their flocks.

I append hereunder the report of the Chief Poultry Instructor :—

" The industry kept the Dominion supplied with eggs and poultry-meats, and a greater number of eggs was shipped overseas than was the case during the previous season. However, it cannot be claimed that the industry has made a great deal of advancement during the past twelve months. This may have been due to the fact that the prices of poultry-foods have been high. Poultry-foods have at times been difficult to obtain.

"*Farm Poultry.*—It has been the policy of the Department to advocate farm poultry-keeping, as it is felt that the production of eggs and poultry-meats can be made a profitable side-line to farmers, especially dairy-farmers. It is true that some poultry are kept on practically every general farm, but few farmers are really interested in poultry. However, quite a few could augment their income if they realized that a flock of well-bred birds can be made to pay well if some suitable person—a son or a daughter—could be encouraged to study and practice efficient methods of management and give the birds a reasonable amount of regular attention.

"A curd-feeding test for egg-production being conducted at the Animal Research Station, Ruakura, is demonstrating the advantages of the proper utilization of dairy-farm by-products.

"*Egg-laying Tests.*—During the year egg-laying tests were conducted at Auckland, Taranaki, Massey Agricultural College, and Papanui. These tests were well supported, and altogether 983 pullets and 118 ducks were individually tested. Many very good birds were sent forward, and good laying was recorded.

"For some time past it has been realized that the conditions governing these tests should be such that only birds of certain quality should be allowed to compete, and more credit given to the breeding-value of the birds and the quality of eggs produced. In this connection it is pleasing to report that recently, at the request of the Department, those concerned in the conduct of egg-laying tests, the New Zealand Poultry Board, and a representative from the Department met in conference, and a set of uniform conditions to govern all tests was agreed upon.

"As long as egg-laying tests are governed by the conditions which were agreed upon, they will prove of great assistance to the industry and justify every support.

"*Egg-export.*—During the past season 7,759 cases of eggs—232,770 dozen—were shipped to the United Kingdom, as compared with 2,338 cases—70,140 dozen—shipped the previous season. An increase of 162,630 dozen is shown over the previous season's export. A guarantee of 1s. 2½d. per dozen was given by the Government on all first-grade eggs passed for export during the 1938 season.

"Last season a standard type of case and similar packing-material were used at all the exporting centres, and it is pleasing to report that all the shipments arrived in London in good condition.

"*Chilled Eggs (Marketing) Regulations.*—During the year the above regulations were amended in order to provide for the stamping of all eggs placed in cool store. Visits of inspection to the various cool stores showed that, generally speaking, the regulations were fully complied with. However, in one instance some eggs were found to be unstamped, and in some cases the stamping was not well done. These omissions were attended to, and those concerned advised to exercise more care in future.

"*Chick-sexing Examinations.*—Three chick-sexing examinations were conducted by the Department during the past year. Six candidates undertook the examination, three sitting for first-class certificates and three for second-class certificates. Two qualified for a first-class certificate, one for a second-class certificate, and one for the renewal of his second-class certificate.

"At the present time there are five chick-sexers holding New Zealand certificates—three holding first-class and two holding second-class certificates.

"*Health of Stock.*—Reports from the district Poultry Instructors show that increased requests for their services have been due to ailments or disease amongst flocks.

"The South Island Poultry Instructor reports that coccidia troubles are on the increase in the South Island, and owing to the absence of concrete floors on many older-established plants this trouble is difficult to eradicate. He advises that the use of flame throwers, whereby floors and equipment are subject to intense heat, has been beneficial.

"It may be mentioned that a few years ago some heavy losses were experienced from coccidiosis, especially in the Wellington, Foxton, and Manawatu districts, but by a good clean-up on these plants, heavy culling of stock, the introduction of fresh blood, and extra care in the selection of breeding-stock these plants were practically freed of the trouble, and it is felt that if those poultry-keepers who are now experiencing trouble will only adopt similar methods and practise a regular system of sanitation they will soon rid their plants of this trouble.

"Since the introduction of the large mammoth incubators there has been a tendency on some plants to aim for quantity rather than quality.

"Investigations have indicated that many outbreaks of coccidiosis have been mainly due to weakened breeding-stock, and for this reason poultry-keepers cannot be too careful in the selection of their breeding-birds.

"*Pullorum Disease.*—As the result of post-mortem examination of chicks forwarded to the Animal Research Station, Wallaceville, revealing pullorum disease the Department decided to blood-test a certain number of flocks where infection had been indicated.

"The result of the testing of these flocks revealed a larger percentage of reactors than was anticipated. However, it is interesting to note that the mortality rate in chicks on these plants has not been unduly heavy; in fact, in almost every case where losses have been experienced, investigation has shown that the chickens have been exposed to some weakening condition regarding management.

"Apart from some rather severe losses from coccidiosis, occasional colds, and odd cases of leukæmia and tuberculosis, there has not been any serious outbreak of disease. Nevertheless, the position is such that poultry-keepers cannot be too careful in regard to cleanliness, culling of flocks, and selection of breeding-birds, especially those keeping stock on the intensive system and on old plants.

"*Sale of Unfit Stock.*—Wherever possible, Poultry Instructors have visited auction-marts and inspected birds offered for sale. Through the activities of the Department and the co-operation of

those in charge of the poultry-markets, the position in regard to the offering of ailing stock for sale has improved, but there are still some poultry-keepers who do not seem to realize their responsibility in this matter.

"A matter that seems to call for attention is the state of some crates used for the carriage of market poultry. When poultry-keepers wish to sell a number of birds they usually send to the auction-mart proprietors for the loan of crates. The same crates are in almost constant use, and at times become insanitary, and can be responsible for a certain amount of infection being spread.

"*Wallaceville Poultry Station.*—The Wallaceville Poultry Breeding and Experimental Station continues to render a very useful service to the industry.

"Five interesting feeding-tests were conducted during the past year, and the results of these tests will be published in the *Journal of Agriculture*.

"A good number of breeding-birds, hatching-eggs, and day-old chicks were supplied at reasonable rates to those poultry-keepers requiring fresh blood.

"During the year two Australorp (Utility Black Orpington) cockerels and six hens were imported from the New South Wales Department of Agriculture. Two White Leghorn cockerels, three pullets, and one Langshan cockerel were also imported from England. Eggs and stock from these birds will be available at reasonable rates to those requiring a change of blood.

"All young stock have been trap-nested for the past two seasons. Therefore, during the coming season all hens in the special pens will have produced over two hundred eggs of good quality during their first year's production.

"*Instructional Staff.*—The three district Poultry Instructors have had a busy year. They have done good work, and their services have been in keen demand. Some 1,697 visits of instruction were made during the year.

"In conclusion, I desire to express my appreciation to those who co-operated with me in the work of this section during the past year."

Wool.

The instructional service in connection with the production and preparation of wool for marketing has been carried out during the year by Mr. J. E. Duncan, assisted by Mr. H. R. Lusk, who was added to the staff during the year.

I append hereunder Mr. Duncan's report:—

"Contrary to the general opinion held a year ago, wool-values have remained remarkably firm in spite of the very uncertain international situation, and fluctuation of prices over the whole of the selling season just closed has been unusually small. The range of prices has also been abnormally restricted, with no great difference in value between fine wools and crossbreds. The following table shows at a glance the position over the last five years:—

Wool sold at Public Auction.	1938–39.	1937–38.	1936–37.	1935–36.	1934–35.
Offered (bales)	727,997	687,718	668,397	768,933	527,283
Sold (bales) ..	706,776	614,609	663,798	737,454	471,512
Sold (lb.) ..	240,813,735	210,151,212	226,089,994	258,270,784	162,538,056
Total proceeds	£9,220,741	£8,793,873	£14,903,257	£9,840,427	£4,401,010
Average price—					
Per bale ..	£13 0s. 11d.	£14 6s. 2d.	£22 9s. 0d.	£13 6s. 10d.	£9 6s. 8d.
Per pound	9·189d.	10·043d.	15·82d.	9·144d.	6·498d.

"As will be noted, the price received by the sheep-farmer for his wool is not much different this year as compared with last season.

"Acknowledged world authorities on wool matters admit that long-range predictions of the trend likely to be followed by the wool-market are so untrustworthy as to be virtually useless, for, as any one who takes the trouble to study wool-prices over the last twenty years can see, the fluctuations have been at times both violent and sudden. In spite of this, however, there seems to be a growing body of opinion that artificial substitutes have already appreciably reduced the upper limit to which wool-prices are likely to rise in the future. On this account, the man who is depending on any big rise in prices to extricate him from his difficulties is clinging to a very slender shred of hope.

"With regard to the question of artificial wool substitutes just mentioned, new and improved synthetic fibres continue to be announced at more or less frequent intervals, and the total production of the various types has now reached a staggering total; in fact, in 1938 the total world production of synthetic fibres was actually slightly in excess of world wool-production, reckoned on a clean-scoured basis. Of course, it is true that all of this vast quantity of man-made fibre does not enter into direct competition with wool, but a large proportion of it does, and the sheep-farmers of the world can no longer afford to ignore it and merely rest on their laurels with a false sense of security in the knowledge that 'wool is best.' That slogan still remains true, but by an ever-diminishing margin. The best scientists available in the totalitarian countries are continually striving after a fibre which will be the perfect substitute for wool, and that their efforts are not altogether unavailing is shown by the fact that one by one they have imitated the valuable attributes of wool. First they improve the tensile strength of their products, then their elasticity, next even imitating the crimp in wool, and now, to quote a recent report from the International Wool Secretariat on the Leipzig Fair, 'particularly striking was

a photomicrograph of a Floxalan fibre alongside a wool fibre, which showed a surface scale structure almost identically the same.' Fortunately for the world's sheep-farmers, the scientists have not yet been able to imitate the fundamental and very complex internal structure of the wool fibre or its precise chemical make-up; yet, although these may seem tasks of insuperable difficulty, who is to say that they will not one day be accomplished.

"In the light of the above facts, it behoves us in New Zealand to do with our wool what we have done with our other primary products—to build up a reputation for quality and uniformity, for, after all, apart from cheapness, it is mainly on the score of being uniform standardized article that the synthetic fibre is sought after by the manufacturer. In this respect wool lags a long way behind our other products and there is still plenty of scope for improvement in the get-up and preparation of our national clip for market. Admittedly much may yet be done in the way of improving our wool by the use of better rams and more intelligent mating and culling, and also by a further research work, but, leaving all this out of account for a moment, there could still be wrought a great improvement by the application of present knowledge and by putting into general practice the methods now employed by the most efficient farmers only. Year after year educational work and propaganda have been undertaken by this Department and by other bodies such as the agricultural colleges, and there has doubtless been some response, but a visit to any wool-store will show that the goal has not yet been reached. There is still too much evidence of clips, carelessly or inadequately prepared, sent to the store unskirted and often poorly classed, sometimes with no attempt at proper classing at any stage. The owners of these clips will tell you that classing does not pay and that they can get just as much for their unclassed wool as can their neighbours after classing. With few exceptions this is a fallacy, and the men making the statement are making direct comparisons where no direct comparisons are justifiable, on account of variations in yield, length, soundness, and other factors vitally concerning the buyer and the manufacturer, but blissfully ignored by the farmer in question. There is no need here to go to any great lengths to prove that proper classing does pay, except to point out two salient facts—viz., the excellent returns always secured on binned wool properly prepared by any reputable wool-broker, and also the existence of speculators who year after year make a living by buying up unclassed clips, preparing them properly for market, and then reselling at a profit, a profit which should rightly have gone into the grower's pocket.

"A word might also be mentioned here about the practice of 'false packing.' Although genuine cases are fortunately comparatively rare, there are still quite a number of instances each year where bales might be said to be irregularly packed. The grower may not have included a few inferior fleeces in an otherwise good bale with any intent to deceive, but the fact nevertheless remains that should a buyer find one of these inferior fleeces his suspicions are immediately aroused, and he either does not buy or else adjusts his price accordingly to safeguard himself. As far as the grower is concerned, it is much easier to maintain a good reputation than to live down even one instance of this sort, which is likely to be noted by not one buyer but many.

"Small clips do not lend themselves to proper classing, but these and also oddments from larger clips can be adequately dealt with either by binning or by sorting, this latter process being one which, although comparatively new to New Zealand, is steadily on the increase. Generally speaking, interlotting—the fate of small lines of wool sent to the broker without definite instructions—is very much of a gamble, and is not a practice to be encouraged. It means the grouping together of *bales* of wool of a similar type (as against *fleeces* in the case of binning) from different owners for disposal as a single lot. It is obvious that some will profit at the expense of others, and although this service costs the grower nothing, he usually finds it better in the long-run to pay the extra charge to have his wool properly binned by a firm of repute. It is gratifying to note that binning is still on the increase, and in one particular wool store in a district where there are many small mixed clips to be handled the proportion of binned wool has reached almost 75 per cent. of all the wool handled by the store. In other stores and other districts, however—particularly in such districts as the Waikato, where wool is often a secondary consideration to lamb—there is still plenty of room for a big increase in this desirable practice. Actually binning or pooling, or grouping as it is sometimes called, could be used profitably on a much larger scale than it is to-day, and it is safe to say that it is virtually the only satisfactory method (apart from sorting) of dealing with many small and mixed clips. In the post-war period we had an excellent illustration of the very successful operation of this process on a gigantic scale under the B.A.W.R.A. scheme for the disposal of some 2,600,000 bales of wool left over from the 'commandeer' period.

"It is usually pretty well impossible to give any statement of general application to the whole of the New Zealand wool-clip, because conditions vary so much from one district to another. However, it is safe to say that, with the exception of some of the Auckland wools, length was generally much better this season, and there were far more shafty well-grown "preparing" types offering. The exception in the case of Auckland was due to the disastrous facial-eczema outbreak which affected so many sheep in the autumn of 1938. The check received by these sheep was plainly shown in the wool as a bad break, and although the wool grown prior to their illness was sound and attractive that grown afterwards was thin and tender. In the cases of hill-country flocks unaffected by the trouble the wool was well up to usual standards. In most other districts, with the exception of some of the hogget wool and some of the Otago wools (due to the severe winter), the bulk of the clip was very satisfactory as regards soundness.

"Condition varied from generally about the average to a little more than usual in the Wellington district, and somewhat lighter than usual in the back country of Canterbury. Colour was good practically throughout, and definitely better than last year. Some of the late-shorn clips showed a fair amount of dust, such as those from Marlborough and Canterbury, due to the dry summer, but

most of the wool shorn at the normal time was free from dust. Very little seedy wool has been in evidence this past season again, with the exception of some of the late-shorn clips from parts of the Wellington District.

"Taking it all round, the clip this year has been definitely better than the preceding one, and the improvement has been particularly marked in the case of Hawke's Bay and the Wairarapa.

"A method of disposal for certain portions of their clips frequently overlooked by farmers is that of scouring. On investigation they will frequently find that it would pay them to scour such oddments as pieces, bellies, locks, crutchings, dingy fleece wool, dead wool, and sometimes lambs' wool. To obtain full market value for these lines after scouring, it is wise to ship them to London for sale, as much better competition exists there for these scoured lines than at the local auction sales.

"Nowadays wool requires all the publicity we can possibly give it, and the International Wool Secretariat continues to do good work in this direction on an income (from the levy of 6d. per bale) which is almost negligible compared with the vast sums spent on advertising by the makers of the synthetic fibres. There is room for more publicity on behalf of wool even in a small country like New Zealand, and if every one interested in the growing of this product would co-operate much might be done to increase our home consumption.

"During the year I have dealt with the usual variety of correspondence pertaining to sheep and wool, and have written a number of illustrated articles for the *New Zealand Journal of Agriculture*. I have attended some seven or eight agricultural and pastoral shows, and arranged, through my assistant, for the staging of wool exhibits at another half-dozen. I have also given some fifteen or sixteen lantern lectures and about two dozen demonstrations on wool to farmers' organizations, young farmers' clubs, &c. I was one of the team of three members of the Department who recently conducted a Farm School on the Chatham Islands, and while there delivered a number of lectures and demonstrations, besides interviews with individual farmers on their own properties.

"The results of the experiments which I have been conducting on sheep-rugging in collaboration with Mr. Grant of this Department and several farmers in Canterbury have proved so promising that I am continuing a further series this season. A full review of the results to date, which have been a marked success from the wool point of view, will be found in the *New Zealand Journal of Agriculture*.

"This year I have also dealt with a number of requests for reports on wool samples sent in by farmers, and have supplied a large number of plans of wool-sheds, sheep-yards, and dips. As opportunity permitted during my ordinary travelling, I visited a number of wool-scouring works, so that now I have made personal contact with nearly every works in New Zealand, and this has been of great assistance to me in preparing reports on wool-scouring. I have also prepared and sent out a number of complete sets of wool-sample cards, prepared exhibits for shows, and attended a number of committee meetings.

"As my ordinary duties entail a considerable amount of travelling (approximately twenty thousand miles being covered during the course of the year), the appointment of an Assistant Wool Instructor (Mr. H. R. Lusk) last November has helped me a great deal in coping with my duties, and it has been possible in many cases to arrange for one of us to be in Wellington while the other is away. This has meant that we have been able to deal more promptly with correspondence and other matters than was formerly the case, and as Mr. Lusk has been able to assist me in nearly all phases of my work we have been able to undertake very much more in the way of exhibits at agricultural and pastoral shows, &c., than would otherwise have been possible."

Rabbit Nuisance.

Over the whole of the North Island and the greater proportion of the South Island rabbits are well under control, and this satisfactory position is largely attributable to the work of Rabbit Boards, whose areas now cover a good deal of the farming-lands of the Dominion. The season has been a favourable one for rabbit-breeding in most districts, but in spite of this the improved position of last year has been maintained, and in many instances improved upon. The result is that some pastoral areas have improved their carrying-capacity and show a greater wool-clip owing to reduction of the pest. Vigilance is necessary to maintain this position, and in this connection landowners must realize that spring and early summer poisoning is essential, as it is by this means that the pest can be effectively checked.

In many parts of Otago and Southland the rabbit pest is in a different category, for there the commercial aspect has mitigated against rabbit-destruction to a marked degree. The work appears to be spasmodic rather than continuous, and the amount of killing is determined by the price of skins. Under such conditions it would seem to be impossible to exterminate or even control the rabbit pest. It would thus appear that the Department, as the responsible authority for the administration of the Rabbit Nuisance Act, must adopt more coercive measures in southern provinces.

As already indicated, the various Rabbit Boards, constituted for the purpose of suppressing rabbits, have achieved considerable success, and as a result of their operations rabbits are now practically non-existent in many places where they were once numerous.

Noxious Weeds.

In co-operation with County Councils, concentrated efforts on ragwort control were carried out in continuance of the previous two years' control measures. The scheme of operations was on somewhat similar lines to previous years, which was inaugurated in conjunction with the Labour Department (Employment Division) and known as Scheme 13A, with the twofold object (1) of

providing employment, and (2) of making an effort on a much bigger scale than had previously been attempted to deal with the large areas of ragwort-infested country that was menacing the continued occupation of such lands on a payable productive basis.

During this year thirty-nine County Councils and two River Boards operated under the scheme at a cost of approximately £65,000, most of this expenditure being on ragwort, and the reports received on the work indicate a very considerably improved condition of the areas generally. In addition to this, many individual farmers took advantage of the opportunity afforded by Scheme 13B of the Labour Department by getting subsidized labour for noxious-weed control. As a sequence to the improved condition of lands following on the extended work of the past three years, consideration should now be given to maintaining control, without the recurring expenditure on labour and material, by stocking up under proper methods of control with sheep, and it is hoped that this means of dealing with the weed will now be adopted by farmers who have benefitted by the assistance given under the scheme. Large grants of money for the purpose of dealing with ragwort or other noxious-weed infested lands cannot be expected to be continued indefinitely, and every effort should be taken to see that any improvement gained is maintained, and the land not allowed to slip back to its former position.

The subsidy of 1d. per pound on sales of sodium chlorate and Atlacide was continued, and in all £10,326 6s. 6d. was paid out by way of subsidy.

Other classes of noxious weeds have been dealt with as circumstances permitted, but many lands still carry far too heavy an infestation of noxious weeds, which under good farm-management should not pertain. It would be of advantage in many cases if the areas held were smaller.

STAFF.

I desire to express a word of appreciation to the members of the staff for their share in the past year's work. All have loyally and willingly carried out their respective duties, and have thus contributed to the value of the work carried out for the benefit of the stockowner and the Dominion as a whole.

VETERINARY LABORATORY, WALLACEVILLE.

REPORT OF C. S. M. HOPKIRK, D.V.Sc., OFFICER IN CHARGE.

During the year the Laboratory has been extremely busy and taxed to the limit of its resources in the effort made by the Department of Agriculture to co-operate all services of the country in the study of the disease facial eczema. This work was placed in the very capable hands of Dr. J. F. Filmer, and all sections of the Laboratory have given the maximum assistance. The fact that a definite and important line of work became necessary showed the weak points in the staffing, and efforts have since been made to strengthen them.

Subsequently, three definite sections have been formed, the first diagnostic, the second nutritional, and the third a section combining pathology, specific disease, parasitology, &c., and in which work of an investigational nature will be carried out.

Staff.

The Officer in Charge spent nine months of the year abroad attending conferences in London, Switzerland, and Holland and visiting laboratories in South Africa, Great Britain, the Continent, and America. The time was well spent, for contacts so made will prove invaluable. During his absence the control of the Laboratory was placed in the hands of Mr. L. W. N. Fitch who ably piloted the Laboratory through a difficult season.

At the end of the year Dr. J. F. Filmer was appointed Director of the new Animal Research Division in which this Laboratory now functions.

Dr. I. J. Cunningham returned from Sydney with the degree of B.V.Sc., so qualifying him for leadership of the Nutrition Section of this station. Dr. Marion M. Cunningham then relinquished her temporary appointment.

Dr. W. G. Fischel joined the staff and is working on poultry diseases.

Mr. J. P. James, M.R.C.V.S., B.Sc., who had recently qualified in London, was placed on mastitis work and has been giving considerable attention to the brom-thymol-blue project of the herd-testing association.

Mr. A. L. Thompson, M.R.C.V.S., rejoined the Department and has undertaken sterility work in the Waikato area, also giving attention to the bull experiment at Ruakura.

Mr. N. T. Clare, M.Sc., and Miss A. S. Donne, M.Sc., have been added to the Nutrition Section.

Building.

The new Laboratory building is beginning to dominate the old Laboratory, but it will not be finished during 1939.

A Poultry Overseer's house is also in course of construction.

Cattle Diseases.

Diagnosis.—Three hundred and fifteen specimens were received for examination, representative of the full list of cattle diseases of the country. There were none, however, requiring particular comment except that one case of tuberculosis was found in eighty-two composite milk-samples taken from carts where milk was exposed for sale.

Mastitis of Dairy Cows.—Diagnostic examination of milk-samples has been carried on as usual at Hamilton and at Wallaceville. The numbers of samples received at Wallaceville have dropped off considerably, only 1,735 being examined for the mammitis-control scheme. Groupings were as follow: A group, 576; B group, 742; C group, 417. In addition, there were 355 samples received for examination from farmers, 194 of these being actual cases of the disease.

At Hamilton, for the mammitis-control scheme, groupings were as follow: A group, 13,949; B group, 7,577; C group, 4,991—a total of 26,517 samples. In addition, 7,485 miscellaneous samples were received, 3,323 being from definite quarters of suspected cows. Check-testing, comparing brom thymol blue with the leucocyte assessment, was carried out on 11,439 samples.

Mr. Kidd, in his report, has given a table showing the percentage of cows grouped in each examination during the season over a period of years:—

	A.	B.	C.
1931–32	66	15	15
1932–33	62	15	19
1933–34	67	20	10
1934–35	72	17	5
1935–36	69	22	7
1936–37	62	26	8
1937–38	61	28	10
1938–39	53	29	16

It will be noted that in 1934–35 the percentage of C group had reduced considerably, but that the B and C groups increased up to the 1938–39 season. The table is one of interest, but so many factors come into play that the table gives no true indication of the benefits or otherwise accruing from the mammitis-control scheme. The increase may be due to the fact that several satisfied farmers dropped out and no new herds were accepted for test. A further explanation exists in that many farmers are retaining the C group cows, a provision which has always been considered desirable for practical purposes.

During the season Mr. Kidd was given travelling facilities in order to visit herds utilizing the Department's scheme of control of mastitis. It was hoped that by giving encouragement and advice on the farm the control would show a marked improvement.

Treatment for Mastitis.—Treatment with 5 per cent. prontosil intravenously, with 1 per cent. prontosil by quarter infusion, with entozon by infusion and with three types of alleged cures have given varied results. In none of the experiments carried out by Mr. T. A. Blake, M.R.C.V.S., can we claim any special benefit. A few individual cows seem to have recovered, but the percentage is small.

Low-vacuum machines which do not require the stripping of cows are being used in two sheds under observation. Both owners have commenced with heifer herds which will remain under observation for a period of years. At the end of the first season each owner has one case of mastitis in his herd.

In last year's report mention was made of brom-thymol-blue testing being introduced on a large scale by the herd-testing association.

The staff of the Wallaceville Laboratory engaged in mastitis work, Mr. J. P. James, M.R.C.V.S., B.Sc., and Mr. T. Palmer-Jones, B.Sc., has been employed very largely in gaining some knowledge of the reason for the anomalies shown in the use of the brom-thymol-blue test. Frequently the test does not pick up an obviously infected animal. This matter was the subject of report in conjunction with Dr. McDowall, of the Dairy Research Institute, and with Mr. A. H. Ward, of the New Zealand Dairy Board staff, in which the authors found that the brom-thymol-blue test was only about 50 per cent. correct when the leucocyte assessment was used in the diagnosis of mastitis. Check-testing carried out in three laboratories other than Wallaceville gave even poorer correlation figures.

The factors which made any form of colour testing inaccurate were :—

(*a*) The fact that many cases of mastitis do not give an alkaline reaction.
(*b*) The reading is upset by quantity of cream, by the interval of time between taking samples and reading, by quantity of milk used in the tubes when taken by the farmer, and in the same way quantity of brom thymol blue used in the test.
(*c*) By the personal factor, many officers not being able to distinguish colours or shades of one colour, even though an ingenious colour standard was prepared by Mr. James for their use.

A table prepared by Mr. James giving a comparison between leucocyte counts and brom-thymol-blue tests carried out weekly in three herds is given *in toto* :—

Herd and Length of Test.	Brom Thymol Blue.	Leucocyte Assessment.							Totals.			Percentage.	
		0.	1.	2.	3.	4.	5.	6.	0, 1, and 2.	3.	4, 5, and 6.	0, 1, and 2.	4, 5, and 6.
St. Patrick's College : 17th November, 1938, to 18th January, 1939	+	..	2	3	15	31	34	40	5	15	105	4·5	95·5
	%	..	0·4	1·2	6·0	19·0	46·0	83·0	0·5	6·0	36·8		
	—	131	534	254	240	132	40	8	919	240	180	83·6	16·4
	%	100·0	99·6	98·8	94·0	81·0	54·0	17·0	99·5	94·0	63·2		
Massey College : 5th December, 1938, to 9th March, 1939	+	4	27	50	157	192	134	83	81	157	409	16·5	83·5
	%	0·95	2·0	6·0	20·0	35·0	57·0	75·0	3·2	20·0	44·9		
	—	416	1,267	757	616	351	101	27	2,440	616	479	83·6	16·4
	%	99·05	98·0	94·0	80·0	65·0	43·0	25·0	96·8	80·0	55·1		
Veterinary Laboratory : 8th August, 1938, to 6th March, 1939	+	4	20	7	38	57	32	33	31	38	122	20·2	79·8
	%	1·0	3·0	3·0	20·0	39·0	44·0	69·0	2·5	20·0	45·7		
	—	356	650	222	150	90	40	15	1,228	150	145	89·4	10·6
	%	99·0	97·0	97·0	80·0	61·0	56·0	31·0	97·5	80·0	54·3		
Totals	+	8	67	60	210	280	200	156	117	210	636	15·5	84·5
	%	0·9	2·2	4·6	17·2	32·8	52·5	75·7	2·5	17·2	44·0		
	—	903	2,451	1,233	1,006	573	181	50	4,587	1,006	804	85·1	14·9
	%	99·1	97·8	95·4	82·8	67·2	47·5	24·3	97·5	82·8	56·0		

A very detailed interest has been taken in the Laboratory herd over the year. Owing to dryness and lack of feed the numbers had to be reduced, but since August, 1938, nineteen animals have been under constant observation. Cultural work has been carefully mapped against leucocyte assessment, and the results tally very well. Similar work has been carried out regularly in a clean herd owned by the Dairy Research Institute, and intermittently for some of the Ruakura cows and for St. Patrick's College animals.

In the Wallaceville herd Mr. Palmer-Jones reports a steady deterioration as regards quarters infected with staphylococci and streptococci.

	Staphylococci.	Streptococci.	Micrococci.
1938	Six quarters (7·9 %).	Six quarters (7·9 %).	..
1939	Eleven quarters (14·6 %).	Eleven quarters (14·6 %).	Two quarters (2·7 %).

Clinica mastitis is, however, not marked in the herd. The leucocyte assessment also is deteriorating from A to C.

Season.	Percentage, A Group Quarters: 0, 1, 2 Leucocyte Counts.	Percentage, B Group Quarters: 3 and 4 Leucocyte Counts.	Percentage, C Group Quarters: 5 and 6 Leucocyte Counts.
1938	43·4	34·2	22·4
1939	37·0	31·0	32·0

It is of interest to note the continuous history of infected quarters which, in the case of staphylococci infections, tend to change to streptococci:—

1938.	1939.
Six streptococci quarters	Four streptococci quarters.
	One dry quarter.
	One normal quarter.
Six staphylococci quarters	Three staphylococci quarters.
	Three streptococci quarters.

A tentative figure has been obtained by Mr. James to correlate the leucocyte assessment of gravity cream with the Breed count in milk. His average figures, which will be improved upon during the next year, are as follows:—

Assessment Figure.	Leucocytes per Cubic Centimetres Whole Milk (averaged).
0	90,000
1	170,000
2	370,000
3	1,450,000
4	3,500,000
5	8,870,000
6	19,730,000

Sterility.—Work in connection with the sterility problem in dairy herds has been undertaken by Messrs. T. A. Blake and A. L. Thompson, stationed in Hamilton.

Mr. Blake, as in past years, has taken particular interest in semen examination of bulls. During the year 103 samples of semen were taken and reported upon, 95 being from bulls, the remainder from horses and rams. Of the bulls, 27 were good, 27 fair, 26 poor, 8 bad, and 7 completely sterile.

The percentage of successful first services of fifty of these bulls is given:—

Fertility judged on Morphology and Motility.	Number of Bulls.	Percentage of First Service Successful.
Good	18	63
Fair	9	49
Poor	12	37
Bad	5	31
Sterile	6	0

An experience is recorded by Mr. Blake where a bull known to be good after being placed in a herd already returning in a serious manner, failed on each of eight cows.

A record has also been made of one good bull over a period of seven years. This is worth placing on permanent record.

Examined.	Class.	Successful First Services.	Number of Cows.
		Per cent.	
October, 1932	Good	91	21
October, 1933	Good	82	29
October, 1934	Good	78	28
September, 1935	Good	88	46
September, 1936	Good	74	42
1937 (not examined)	..	42*	52
October, 1938	Good	91	61

* 82 per cent. including second service.

This bull in 1937 went to a herd troubled with temporary sterility and appeared to give less satisfaction than usual, but in his second round the cows held to him, and last year on his first service in this same herd he put up an exceptional performance.

There is therefore evidence to support the contention that cows once served by a bull of inferior fertility are difficult to get into calf even with a bull of proven potency.

Artificial Insemination.—Six hundred and thirty-seven cows in seven herds became available for artificial insemination, and Mr. A. L. Thompson attempted the work. A proven sire was chosen by the herd-testing association. Unfortunately, this bull injured a foot and was therefore not available for much of the work. Three other bulls were used. The percentage of conception was 31·6 per cent., ranging from 21·6 per cent. to 43·75 per cent. Valuable experience was no doubt gained, but this second departmental trial of artificial insemination on a large scale has again demonstrated the difficulty of using bulls untrained for hand service, and the even greater difficulty of obtaining daily, over a period of three or four weeks, the required amount of semen for a round of herds. Under these conditions of bulk insemination one cannot hope to obtain the somewhat better results of insemination as practised in continental countries, where cows are not required to calve on a given day of the year and where bulls are trained to lead and serve on the halter.

Bull-feeding Experiment at Ruakura.—This experiment, in which twenty-four bulls have been split up into four groups, is continuing, but many difficulties are being encountered. The control of the animals for semen-examination is difficult, and the training of the bull in the use of a dummy has not been possible. Consequently, seminal fluid is got by the Cambridge method.

Temperatures have been taken daily, but no difference in body-temperature could be noted between the groups.

Body-weight has varied considerably because of the difference in breeds. The semen-samples have been taken and observed by Mr. Thompson, and tests were made for motility, colour, density, pH, and morphology. At the present time the bulls vary more within the group than between groups, probably because of breed differences. However, the bulls are still very young and no conclusion can be arrived at for at least another year.

Because of the many difficulties to be overcome in handling twenty-four full-grown bulls of varying temperament, and the cost of attendance and feeding, the whole experiment may require modification.

Survey of Sterility.—Mr. Thompson is attempting a survey of the position regarding sterility in dairy herds of the Waikato. In general, he finds on normal farms that the plane of nutrition of bulls is high, the numbers in use satisfactory, while abortion in herds is low.

Dietary protein and sterility work carried out by Dr. I. J. Cunningham has been reported upon by him as follows :—

"*Male Rats.*—Some anomalous results have been obtained in the production of sterility in male rats. It was previously the experience that maize rations always produced sterile rats, but, more recently, it has been found that this is not invariably the case. Different varieties of maize are being tested to determine whether there is any difference between varieties in respect to their capacity to produce sterility.

"*Pig-feeding Experiment.*—Male sterility, judged by breeding tests and by examination of semen, has been produced in pigs fed a ration containing biologically poor protein. The histological examination of testes taken from sterile pigs, showed similar degeneration to that observed in rats under similar feeding conditions. The interesting feature is that the work first performed on rats has been repeated in pigs.

"*Females.*—The investigation of the relation of dietary protein to ovulation in the female has been suspended temporarily owing to pressure of other work."

Trichomoniasis.—One further herd has been found affected with *Trichomoniasis.* This is a herd of seventy-five head served by one bull, and ten cows have so far been found affected.

Collection of material from various herds for examination for *Trichomonads* has not shown the presence of the parasite. Over a three-year observation in the Waikato four herds have shown infection, so that the position cannot be regarded as serious. Effective treatment to diseased cows and useful advice to owners has been given by Mr. Blake.

Grass Staggers.—It was hoped to perform an experiment on a susceptible farm in the Waikato district to determine more exactly the prophylactic action of dolomite against grass staggers. Such an experiment was performed, but it was commenced too late to give all the information desired. Two ounces of dolomite administered three times per week to cows did not sensibly increase the blood magnesium over that of controls. The experiment must be repeated before any evidence can be adduced as to prophylactic effect against grass staggers.

Work in conjunction with Massey College.—An opportunity was provided to examine the bloods of cows from two experiments run at Massey College.

Experiment 1 contrasted the performance of dairy cows grazed on perennial rye-grass alone with similar dairy cows grazed on a mixed sward of perennial rye-grass and white clover. Supplementary feeding was provided when necessary from hay and silage.

Calcium, magnesium, and phosphorus determinations were made regularly on the bloods from the experimental animals.

In the eight cows fed perennial rye-grass alone one case of grass staggers occurred and ended in death. The case was typical, showing hypomagnesæmia and the usual clinical symptoms. No other animals showed hypomagnesæmia.

No cases and no reduction in blood magnesium occurred in six animals fed perennial rye-grass and white clover.

Experiment 2 contrasted the performance of two groups of three cows fed respectively Italian rye-grass and perennial rye-grass. Unfortunately, the design of the experiment provided for alternation of feeding every twenty-eight days, so that a comparison between Italian rye-grass and perennial rye-grass was not obtained. This will be available in a new experiment to be performed in the next season.

Definite fleeting hypomagnesæmia occurred in two cows, while in a third the condition was more prolonged and accompanied by clinical symptoms of grass staggers.

The design of the experiment was such that definite conclusions as to etiology could not be drawn.

The occurrence of two cases of grass staggers in the two experiments was, however, interesting in view of the fact that the animals were well fed throughout the previous winter.

New experiments are under consideration, and older cows, more susceptible to grass staggers, will be employed.

Johne's Disease.—A small supply of P.P.D. has been obtained by courtesy of Dr. Watson, Director of the Veterinary Research Institute of Ottawa, Canada. This is being tried in the field.

Production of johnin at Wallaceville has not yet been put on a practical basis.

Experimental work in connection with Johne's disease is very desirable, and the purchase of a farm for definite observation over at least a five-year period would appear desirable.

Contagious Abortion.—No experimental work has been carried out on this disease. In the two laboratories of Hamilton and Wallaceville a total of 1,514 blood-samples have been examined, 469 of which were positive.

Arsenic Poisoning of Cattle.—In connection with the toxicity of arsenic in the Reporoa area, certain experiments were carried out at Wallaceville on cattle by Mr. L. W. N. Fitch.

A heifer was drenched with four grains of arsenic (As), as sodium arsenite, daily for three days. Examination of milk and urine by the Chief Agricultural Chemist showed no increase in the arsenic content of milk and urine, so, ten days later, a further 16 grains of arsenic was administered. This amount was repeated on the two following days. The beast appeared unwell on the day of the third dose. The following day she refused to eat, her gait became unsteady, and she died on the fifth day, after receiving her first dose of 16 grains. Post-mortem, she exhibited a most severe ulcerative gastritis, while the first part of the small intestine was acutely inflamed.

Following this drenching experiment, two steers were fed, over a prolonged period, arsenic containing mud from farms in the Reporoa district on which mortalities, supposedly due to arsenic poisoning had occurred.

No. 1 steer received mud containing 1·75 grains of As_2O_3 per ounce from the 23rd May, 1939, to 20th August, 1938, at the rate of 2 oz. per day in the initial part of the experiment. Later it was increased to 4 oz. daily.

No. 2 steer received mud of approximately twice the concentration of arsenic, part being present in the form of the sulphide. This steer was fed from 4th October, 1938, to 20th December, 1938, at the rate of 20 oz. daily.

At the termination of the above periods, as the animals were showing no serious symptoms, they were turned out.

Ragwort-feeding to Cattle and Sheep.—A cow mentioned in previous reports as having been kept, together with sheep, on a diet of 1 lb. of rosette-stage ragwort per day and later for three months having been given ragwort-infusion, has recently calved and appears to be quite normal.

The two sheep were kept on ragwort until the end of this year, a period of two years and a half. They were then slaughtered, and an examination made of the livers. One sheep was normal but the second showed some increase in fibrous connective tissue, together with a number of so-called Gaucher-like cells. Apparently the amount of toxin to be found in rosette-stage ragwort is very low and insufficient, unless fed in large quantities, to cause any serious damage to sheep and to cattle.

Sheep Diseases.

Diagnosis.—Five hundred and thirty-six specimens from sheep were received, but the outbreak of facial eczema accounted for two-fifths of the specimens. Of the others, entero-toxæmia accounted for eighty-seven and contagious ecthyma for sixteen. One case of tuberculosis was recorded.

Two cases of blackleg in sheep were recorded following inoculation of the flock against entero-toxæmia. This is not uncommon in Australia and is not alarming, but is reported as a matter of interest.

Enzootic icterus appears to have been a little more prevalent this year, while the dry autumn resulted in a considerable amount of rye-grass staggers following the first showers of rain. While considerable suspicion has always existed that ergot in some form is present causing staggers, the experience in hoggets at Wallaceville rather disproves the ergot theory.

Facial Eczema.—Owing to an extensive and acute outbreak of facial eczema in April of this year it became necessary to undertake a serious investigation of the disease, and all the facilities of the country were called into operation.

Dr. J. F. Filmer was called upon to co-ordinate the work, and he reports as follows :—

> "(1) In May, 1938, a Facial Eczema Management Committee was convened by the Minister, comprising Dr. J. F. Filmer, Chairman, Dr. Annett, Messrs. Hayward and Anderson, representing the stock-owners, Mr. E. Bruce Levy representing the Department of Scientific and Industrial Research, and Mr. O. W. Smallfield. The research work in connection with facial eczema has since that date been co-ordinated by this committee.
>
> "(2) During the 1938 outbreak a field survey was made in the Waikato District by five veterinarians and five agricultural instructors assisted by agrostologists from the Department of Scientific and Industrial Research. Based on the information collected by these officers, advice has been issued to the farmers with a view to enabling them to prevent recurrence

of the disease. It was suggested that the provisions of mature feed for grazing during the early weeks of the autumn flush could be ensured by shutting up paddocks during December. This advice has been followed by very few farmers, allegedly because it is not possible to carry out this practice in the type of dry season which appears to predispose to an outbreak of facial eczema. The practicability of the scheme, however, has been demonstrated at both Ruakura and the out-station at Karamu, at both of which stations it has been found possible to provide mature pasture for autumn feeding by shutting up in December. At Karamu a quarter of an area carrying more than six ewes to the acre was closed and the sheep were carried on the remaining three-quarters without suffering any harm. The effectiveness of this scheme in preventing facial eczema has yet to be demonstrated, but if this can be done it is considered that the proposals will prove both economic and practical.

"The field survey has been continued by one veterinarian and one agricultural instructor.

"(3) Meteorological stations have been instituted at the Karamu out-station and at twelve other farms which were badly affected during the last outbreak, and the station at Ruakura has been supplemented. Records are now being kept at one or other of these stations for rainfall, shade temperature, grass-minimum temperature, soil temperature, humidity, wind, and sunshine. These estimations are being supervised and recorded by Mr. Walker, who has been seconded to Ruakura by the Department of Scientific and Industrial Research.

"(4) Forty affected ewes were selected at Ruakura, and monthly examinations have been made of these for weight, hæmoglobin, bilirubin, and these are being continued with a view to discovering the after effects of the disease.

"(5) A comprehensive series of experiments have been set up at Ruakura and the Karamu out-station, designed:—

"(*a*) To produce the disease so as to lengthen the period during which the investigation can be conducted; and

"(*b*) To study means of preventing the disease.

"The methods used have included pasture control by varying intensity of stocking, rotational grazing, spelling, and irrigation; the effect of pasture species, forage crops, and supplementary feeding. All experimental ewes were brought from non-facial-eczema districts. They and their lambs have been weighed and the ewes tested for hæmoglobin and blood bilirubin at monthly intervals which are now being shortened to weekly intervals.

"(6) An extensive chemical investigation by the staff of the Chief Agricultural Chemist and the chemists of the Department of Scientific and Industrial Research based largely on the above experiments has been initiated in which variation in the following is checked at regular intervals: Soil moisture and nitrogen, pasture protein and non-protein nitrogen, sugars, cellulose, lignin, chlorophyl, carotene, and minerals. Concurrently, an estimation of pasture species has been made by agrostologists of the Department of Scientific and Industrial Research.

"(7) A small series of experiments was initiated at Massey Agricultural College when it seemed likely that conditions there would be more favourable than those in the Waikato. These duplicated some of the more important experiments conducted at Ruakura.

"(8) The possibility of using a glasshouse for simulating the conditions present during a facial eczema outbreak is being investigated by the Plant Research Bureau of the Department of Scientific and Industrial Research.

"(9) A series of small outbreaks at Gisborne during April of this year have been investigated.

"(10) Material from affected animals has been examined histologically and chemically at Wallaceville.

"(11) Livers collected at various abattoirs have been examined histologically at Wallaceville with a view to determining whether the liver-changes precede the outward manifestation.

"(12) Extracts of pasture collected from paddocks in which the disease has occurred and extracts of ingesta from affected animals are being prepared for feeding to sheep and laboratory animals at Wallaceville.

"(13) Injections into laboratory animals are being made with blood from affected animals to test for photosensitizing substances.

"(14) A series of experiments have been commenced at Wallaceville with laboratory animals and with sheep to study the phenomena of photosensitization and its connection with liver-function."

Advantage has been taken of small outbreaks of the disease in March, 1939, in the Gisborne and Wairoa districts to carry out further experimental work and to obtain pasture from known infective paddocks. Much material has also been taken from affected animals.

Shortly after rain in February livers showing an increase in bile-capillary tissues were observed in Kaiti Meat Works from many farms in the Gisborne District. Photosensitivity—*i.e.*, skin-lesions—were not at that time connected with the liver-lesions. There is now strong evidence to favour the supposition that there are two toxic principles bringing about the composite condition known as facial eczema, the one an icterogenic, liver-damaging factor, and the other a photosensitive agent which may or may not require prior liver damage.

Considerable material is in hand for further work, both analytical and pharmacological, and this aspect is reported upon by Dr. I. J. Cunningham as follows:—

"The aspects of facial eczema investigated by the nutrition section are three:—

"(1) The routine examination of bloods from bilirubin and the performance of liver-function tests to establish differential diagnosis of facial eczema and photosensitization.

"A very large number of samples have been examined at a few outbreaks in the field, at Gisborne, at Ruakura, and at Palmerston North, the last two in connection with attempted experimental production of facial eczema.

"(2) The examination of blood-samples for the presence of photosensitizing agents. The detection of phylloerythrin in quantities as small as 0·01 mgm. has been satisfactorily carried out. Only five of a total of fifty bloods examined have proved positive for phylloerythrin. Further search is to be made into various tissues of affected animals.

"A scheme of work is being elaborated to cover the investigation of the porphyrin metabolism of the sheep. At the present time the fæcal excretion of phylloerythrin is being determined and correlated with the chlorophyll intake.

"(3) Examination of extracts from pasture on areas on which facial eczema is occurring is being conducted. The extracts are made by the Chemistry Section and tests are conducted at Wallaceville. So far no results are available as material is only now coming in.

"The use of small animals for work on photosensitization, using artificial light sources, is also being examined along with the susceptibility of the same small animals to liver toxins."

One experiment with icterogenin kindly supplied by Dr. Rimington of the Medical Research Laboratory, London, has shown a liver-damage in a rabbit similar to that seen in sheep with facial eczema.

Vitamins.—Vitamin D determinations have been made in a few samples of New Zealand fish-liver oils, and also some samples were examined for Professor Davies, of Melbourne.

Mutton-bird oil shown to be low in vitamin A by Professor Davies has also been shown to be low in vitamin D by Dr. Marion M. Cunningham.

Cobalt.—A series of experiments designed to discover the minimum quantity of cobalt top-dressing and the intervals at which this should be applied to protect sheep on bush-sick country were initiated at Mamaku in June, 1938. Top-dressings of from 2½ oz. to 2½ lb. of cobalt sulphate per acre were applied in the autumn; an additional 5 oz. cobalt sulphate was given to one paddock in the spring, another paddock received 5 cwt. lime in the autumn to test the effect of this in depressing cobalt uptake by the pasture. One group of sheep have access to a cobalt lick in a paddock which has received no cobalt top-dressing in order to determine how far this procedure is practicable in districts where top-dressing is not practised. To measure the effects of the various treatments they are being compared with those produced by regular drenching of cobalt and by grazing on a paddock not top-dressed with cobalt in which no cobalt supplement is fed. The pastures in the various paddocks are sampled monthly and analysed for cobalt. To date there has been no evidence of bush sickness in any of the ewes, nor have any of the various treatments produced any noticeable effect on them. A proportion of the lambs in the control paddock are now showing signs of bush sickness.

Experiments are being continued with all of the lambs and some of the ewes during this year. An opportunity will be taken to study the hæmatology and pathology of the disease, as well as to investigate the possibility of using the cobalt content of the liver as a diagnostic measure. Experiments are being initiated to study the fundamental action of cobalt by comparing the therapeutic efficacy of liver from healthy and affected animals.

Entero-toxaemia.—Mr. M. Buddle reports that, in conjunction with the routine examination of small intestinal contents from suspected cases of entero-toxæmia in the field, the majority of toxic filtrates of the ileal contents have been typed by serum-neutralization tests to determine whether other strains of *Clostridium welchii*, in addition to type D, are operative in ovine mortalities in New Zealand. The bacterial flora of the ileum has been determined in the greater percentage of laboratory-confirmed cases of entero-toxæmia, and the welch-like organisms have been isolated and typed by serum neutralization tests. The m.l.d. has been determined on the majority of the isolated *C. welchii* type D cultures and those of high toxicity have been retained for use in the preparation of special vaccines (products artificially reinforced by ammonium sulphate and *Potassium alum* precipitations) for immunity trials. In view of the promising results following a vaccination trial with a reinforced vaccine in Tasmania conducted by the Council for Scientific and Industrial Research it is proposed to determine the effective immunity transmitted to the offspring of ewes which have been vaccinated prenatally with a product of this type prepared from local strains.

Work on the typing of strains of *C. welchii* isolated from cases of entero-toxæmia in both the North and South Islands has only incriminated type D as the pathogen, and to date *C. welchii* types B and C have not been recovered from cases of ovine entero-toxæmia in New Zealand.

With the publication of Roberts' work on the mechanism of entero-toxæmia, a deficiency in our knowledge of the behaviour of *C. welchii* in the alimentary tract and the conditions initiating its proliferation has at last been adjusted. Roberts suggests that the mechanism operative in young

lambs is that when infective material is present in the abomasum the casein from an abnormally large quantity of milk ingested renders the acidity of the abomasal secretion inert, thus favouring proliferation of *C. welchii* type D in this rich pabulum. Toxin is formed initially in this site, but is activated by the trypsin in the small intestine from which it is absorbed with rapidly fatal effects.

Roberts used for his *in vivo* experiments an artificially-prepared milk which simulated the composition of the ewe's product. It was decided to attempt to induce entero-toxæmia in lambs using Roberts' technique, but to substitute ewe's milk for "adjusted milk." In the first experiment, 1,450 millilitres of ewe's milk to which the centrifuged bacteria from a twenty-four-hour *C. welchii* type D culture (a strain recently isolated from Canterbury) were suspended, were administered by stomach tube to a twenty-three-day-old twin lamb weighing 21 lb. Apart from the general discomfort occasioned by the very large quantity of milk, the animal showed little ill effects until the next day, when a transient diarrhoea was observed. The lamb was kept under close observation for a week without any further ill effects being exhibited. As the milk had been aerated during the stripping process from the ewe and as the dissolved oxygen had not been expelled by boiling, it was thought that the failure to induce entero-toxæmia in this lamb may be attributed to the failure to provide sufficient anærobiosis for growth of the suspended bacteria, it being assumed that less oxygen would have been present if the lamb had suckled naturally.

In the next experiment it was decided to administer the "adjusted milk" of Roberts to one lamb and ewe's milk, from which the dissolved oxygen had been expelled, to another of similar age and weight. It was thought that possibly the "adjusted milk" may provide a suitable pabulum for bacterial growth or induce a digestive disturbance, thus initiating *C. welchii* proliferation, but that this condition may not be induced by ewe's milk.

A female twin thirty-six days old, weighing 22½ lb., was given two litres of "adjusted milk" plus suspended *C. welchii* type D bacteria per stomach tube. The animal was collapsed after five hours and then followed the familiar train of symptoms. Six and a half hours after the administration the animal was purging severely, and it died a quarter of an hour later. The autopsy findings were identical with a natural case of entero-toxæmia. It was established that proliferation of the welch organisms had occured in the forestomachs and the abomasum and *C. welchii* type D toxin was present in these sites.

The lamb which received the ewe's milk (which had been previously boiled and rapidly cooled to expel the dissolved oxygen) plus the suspended bacteria was a female twin thirty-seven days old and weighed 26 lb. This lamb died within six hours after receiving the milk, and the findings were identical with those of the previously recorded case. These cases confirmed Roberts' experiments and provide a reliable method of artificially inducing entero-toxæmia in a suckling lamb.

It was proposed to extend the work to attempt to induce entero-toxæmia in lambs under conditions simulating those which may pertain in the field. Owing to the lateness in the season, difficulties were encountered in obtaining lambs of suitable age. As a basis for future work it was decided to isolate a ten-weeks-old lamb from its mother for twenty-four hours and then return the lamb after drenching with a large quantity of *C. welchii* spores (obtained from the ileal contents of an experimentally induced case of entero-toxæmia) suspended in 100 millilitres of milk. It was thought that the large quantity of milk ingested by the hungry lamb would provide a suitable pabulum for proliferation of the organisms in the abomasum with consequent death from entero-toxæmia. The animal remained normal, and it is possible that the lamb was a little too old and the mother's milk secretion was on the decline.

It is proposed to extend the scope of the work next season, when more conclusive results may be obtained as to the conditions predisposing to entero-toxæmia in lambs, hoggets, and older sheep under conditions simulating those observed in the field.

Enzootic Icterus.—Mr. Buddle, who has been interested in the anærobic flora of the alimentary tract of sheep, reports as follows on *Enzootic icterus*:—

> "In view of the high percentages of copper which have been demonstrated in the livers of sheep dying from *Enzootic icterus* and the great similarity between the symptoms and lesions of this disease and chronic-copper poisoning it was decided to determine the effect of administering 100 millilitres of a 1-per-cent. solution of copper sulphate daily to four fully-grown crossbred sheep.
>
> "It was suggested at one time that the condition was a *C. welchii* type A entero-toxæmia, but, while it has been demonstrated at Wallaceville during the past season that in a number of cases a proliferation of *Clostridium-welchii*-like organisms in the alimentary tract has occurred, no appreciable toxin has been demonstrable in the ileal contents using mice as the test animals. It is possible that this proliferation of a hæmolytic *C. welchii* organism may occur in the terminal stages of chronic-copper poisoning when digestive processes are in abeyance and conditions have been induced in the alimentary tract which would favour its growth and would contribute in some degree to the rapidly fatal course once symptoms are exhibited. A case of *Enzootic icterus* has been examined at Wallaceville which was associated with severe hæmonchosis, the severe anæmia related to this condition most probably accentuating the effects of a possible chronic-copper poisoning, the doses of copper apparently being insufficient for a medicinal effect on the parasitic infestation.
>
> "It was decided, therefore, to determine the bacterial flora of the abomasum and small intestines of these four sheep at death and to test the ileal contents biologically for *C. welchii* toxin. After thirty days' administration two sheep were drenched with *C. welchii* type A culture (recently isolated from a natural case of *Enzootic icterus*), but the conditions in the bowel were not such as to favour their growth or toxin production to such a degree to precipitate the animals deaths.

"The sheep died on the thirty-third, fifty-seventh, sixtieth, and seventy-seventh days after commencing the experiment, thus indicating the variable susceptibility of sheep to chronic-copper poisoning. In no case was there a welch-proliferation in the alimentary tract nor was toxin demonstrable by biological tests. The liver analyses for copper were 2,940, 4,030, 3,500, and 1,950 p.p.m. dry weight respectively. There is a marked similarity between these figures and those from natural cases of *Enzootic icterus*."

Parasitology.—Mr. W. V. Macfarlane has carried out parasitological work during the year on blow-fly control, cyst formation in sheep killed for export, and the feeding of Nematode larvæ in pure culture. In this latter work the effect of parasites on the nutrition of sheep, particularly on the strength and composition of bone, is being worked upon by the Nutrition Section, for field observations show a very definite change in bones in hoggets dying from parasitic gastro-enteritis. Several lambs have been brought up in crates, so that they are practically free from parasites, and these are being utilized for the work.

Blow-fly Strike in Sheep in Marlborough Province: Crutch strike with no relation to weather conditions is reported by Macfarlane to be due to vulval malformation and not to the scouring of the animal.

Wrinkle strike is also to be noted, but the main trouble in New Zealand is back strike, which occurs under suitable weather conditions in the autumn. It is associated with skin-irritation due to bacterial decomposition of yolk and surface layers of skin. Suggested control of fly strike in Marlborough is the control of fly population by trapping, efficient crutching, shearing and dipping, jetting, Mules operation where wrinkles are excessive, and breeding out of vulval deformities.

Cyst Formation in Sheep: Many sheep are found in slaughterhouses infested with small immature cysts throughout the musculature. The numbers appear to be increasing annually.

Puppies have therefore been fed the cysts where there is some hope of the cysts being viable. It is believed that the cysts are not those of *C. ovis* but of *C. tenuicollis*—and the feeding has been designed to prove the point. In examination of fæces from dogs in New Zealand by different workers, no *T. ovis* has been noticed. This feeding trial is in progress.

Liver Fluke: This parasite has been found on several properties in Otago. Examination of snails has not yet shown the presence of the cercariæ, and there is some idea that snails other than Myxas are carrying fluke. The point will receive further investigation.

Swine Diseases.

Diagnosis.—One hundred and forty-four specimens were received for examination; 40 were infected with *S. suipestifer*, 8 with *Pasteurellosis*, 3 with erysipelas, 5 with sarcoptic mange, and 2 with *Stephanurus dentatus*. One case suspicious of *Br. abortus suis* was noted but not positively confirmed. Abscesses in glands and musculature also occurred in fifty-four specimens. It is of interest to note that fewer cases of sarcoptic mange are now coming to hand, but that Salmonella infections are causative of the greatest mortalities in pig-farming. Eleven abscesses were put through bacteriological examination.

Two types of specimens call for careful field observations to prevent spread, these being swine erysipelas and *Stephanurus dentatus* infestation. Erysipelas has been a rarity as a pig disease in New Zealand, and that three cases should occur in one year is disturbing. Similarly, some cognizance should be taken of the finding of *Stephanurus*. While this parasite may not spread far on account of its warmth-requirements, yet it may become serious in North Auckland and Waikato districts.

Experimental work on pigs has been confined to zinc feeding and to nutrition in relation to male fertility (see Nutrition Section report).

Zinc-feeding Experiment.—In previous work reported in the 1936-37 report, 1 gram of zinc lactate per gallon had caused pronounced lesions in pigs receiving 1·5 gallons of skim-milk daily—*i.e.*, a total of 1·5 grams of zinc lactate daily.

Two groups of two pigs received zinc lactate at the rate of 0·125 gram per gallon and 0·25 gram per gallon respectively. They received approximately 3 gallons of milk daily throughout. The pigs thrived and showed no ill effects following the receipt of zinc lactate as above from 22nd November, 1938, until 25th February, 1939, when they were killed and a post-mortem examination was made. Post-mortem, the pigs appeared normal and histologically no abnormality was observed.

Results of analysis of organs is not yet to hand.

Poultry Diseases.

Diagnosis.—Of 282 birds sent in for examination, 84 were diagnosed as being affected with coccidiosis, 45 with peritonitis following ruptured yolk-sac, 42 with leukæmia, 38 with B.W.D., 12 with intestinal parasites, 4 with tuberculosis, and 10 with pneumonia. Only two were diagnosed as affected with neurolymphomatosis.

It is pleasing to note the comparative freedom from tuberculosis of New Zealand poultry, which is reflected in a similar freedom from avian tuberculosis in cattle and pigs.

Pullorum Disease.—Mortality in chicks on several poultry-breeding plants revealed the presence of B.W.D. practically for the first time in New Zealand history. On two previous occasions at intervals of years small batches of chicks have shown B.W.D., and a test of a cross-section of hens from farms of origin of the eggs showed birds to be affected to the extent of about 2 per cent. The sudden occurrence this year of mortality in chicks was, therefore, surprising. Agglutination tests, using the whole-blood technique, of the flocks on farms where affected chicks were hatched has shown an agglutination reaction of from 10 per cent. to 50 per cent. of birds.

In the total number of birds on six such farms, the following percentages of infection were found :—

	Total Birds.	Percentage Infection.
Pullets	2,686	18·6
Hens	2,134	30·1
Cockerels	663	2·3
Cocks	92	6·5

These figures suggest that infection gains considerable ground as birds acquire age.

Mr. M. B. Buddle, the Veterinary Officer who carried out much of the field testing with the District Poultry Instructors, writes as follows concerning his observations during field testing :—

> " On practically every farm where losses from pullorum disease were experienced last year accessory causes were operative which apparently had either initiated or influenced the propagation or course of the disease. In many cases faulty brooding was incriminated as the responsible agent in rendering the chicks susceptible, and this, when rectified, substantially reduced the losses. Other accessory causes found to be responsible were failure in the electric power during incubation, prevalence of unhygienic conditions, overcrowding of both chicks and adult breeding-stock, and fatiguing transport of day-old chicks.
>
> " An attempt is being made to control the disease on the few farms where losses were experienced last season amongst chicks by the detection and removal of pullorum carriers, the whole flock being submitted to the rapid whole-blood agglutination test every three months for a period of a year.
>
> " The whole-blood rapid agglutination test has the advantage that it can be performed on the poultry-farm and the reactors immediately ringed and isolated, thus obviating the obvious practical disadvantages of the slow-serum method.
>
> " Laboratory tests, embracing bacteriological, pathological, and serological examination, have indicated a close agreement between the two methods, thus confirming the practical applicability, reliability, and economy of the whole-blood rapid agglutination testing for pullorum carriers."

Dr. Fischel, a Veterinary Officer engaged in diagnostic and investigational work in connection with diseases of poultry, undertook the bacteriological examination of material obtained from one of the affected farms. He reports that :—

> " Experimental work was carried out in connection with fifty-five fowls giving positive reactions to the rapid whole-blood agglutination test for pullorum disease. The tube-agglutination test gave a high degree of coincidence with the whole-blood method, as it proved positive in all cases at a dilution of 1 : 25, in 87·3 per cent. at a dilution of 1 : 50, and in 70·9 per cent. at a dilution of 1 : 100. Post-mortem examination of these birds revealed lesions of the ovary in 70 per cent. of cases. Bacteriological examination of the organs of affected birds resulted in the isolation of *S. pullorum* from all those with affected ovaries and from birds with apparently normal ovaries, four times from the fæces, three times from the liver and one each from the bile and spleen.
>
> " A bacteriological examination of 286 eggs from twenty laying-hens giving positive agglutination reactions proved negative in respect of *Salmonella pullorum*."

Some twelve poultry-farms are being systematically tested for a period of a year before a decision is arrived at relative to the possibility of putting an eradication plan into operation.

The position of mammoth incubators in spread of infection is also being observed.

Apparently there has been an accumulation of *Salmonella pullorum* in recent years in adult birds which has suddenly reached a saturation point in many flocks. Increase in numbers of birds on the plant and the incoming of mammoth incubators leading to custom hatching from customers' eggs, have been conducive to spread of disease.

Supplies of Vaccines.

Supplies of vaccines and biological preparations generally for official and farm use have been made as follows :—

Blackleg vaccine	43,300 doses.
Tetanus anti-toxin (Commonwealth Serum Laboratories)	106,000 units.
Black disease vaccine (Commonwealth Serum Laboratories)	33,500 doses.
Entero-toxæmia vaccine (Commonwealth Serum Laboratories)	Approximately 90,000 ewe doses ; approximately 8,000 lamb doses.
Canine anti-distemper serum (Commonwealth Serum Laboratories)	463 doses.
Distemper virus-serum treatment (Burroughs Wellcome and Company)	422 doses.
Contagious ecthyma vaccine	Sufficient to vaccinate 10,000 sheep, approximately.
Tuberculin (Pasteur)	2,065 c.c. bovine.
Johnin (Dunkin's)	853 c.c.

The Farm.

The farm is now found to be rather small for the increasing animal needs of the station, and it is hoped that the purchase of a further 80 acres will be made in the coming year. The transfer of about 10 acres at the back of the racecourse through adjustment of Government property and racecourse property will assist the stock position, but the area first required cropping and putting down in good grasses.

The dry season has made the sale of some of the young stock necessary, for the Wallaceville farm requires fairly heavy stocking in flush seasons and light stocking of winter and dry summer seasons.

Sheep have done very well, but the dairy cows have not kept up the supply expected. Cream from these cows is sent to the Featherston Dairy Factory, while skim-milk is used for pigs and small experimental animals on the place.

Another trial in growing of lucerne is being made, several patches of ground having been sown in different parts of the farm.

For the first time on record hoggets were affected with rye-grass staggers in a paddock in which ergot could not have been prevalent. Pink-eye also showed up in the flock sheep. Foot-rot has practically been eliminated by careful culling and treatment.

Mr. R. Matthews, of Wairongomai, Featherston, was good enough to donate six ewes from his flock for an inbreeding experiment. The ram to be used was donated by Mr. R. A. Donald, Papatahi, Featherston, the strain being the same as the ewes. Some of these ewes may be mated to a second ram of good family belonging to Mr. Matthews.

The work of the farm has been well conducted by Mr. G. L. Wickenden. Much formative work is in progress connected with the new buildings and layout of the farm, and the difficulty of getting satisfactory labour at the wage which may be offered has rendered the completion of such work difficult.

FIELDS DIVISION.

REPORT OF R. B. TENNENT, DIRECTOR.

The Season.

It is usual for the general weather conditions over a full year to vary considerably from district to district throughout New Zealand, and the year ended 31st March, 1939, was no exception. In brief, the outstanding features were as follows in the areas under the control of the four Fields Superintendents :—

Northern Half of North Island.—The winter of 1938 was wet and the following spring late in consequence. The late summer and autumn were dry. The rainfall in October was only 1.28 in., and this prevented a normal flush of grass for hay and silage making. Dry weather in February and March, 1939, caused pasture growth to dry up, with a consequent fall in dairy-produce production, Most farmers will enter the winter period of 1939 poorly supplied with supplementary feed.

Southern Half of North Island.—The year has been notable for a very wet autumn and winter with disastrous floods in Northern Hawke's Bay. High temperatures in April and May in the west-coast districts, combined with humid conditions, provided a satisfactory spring and early summer. The late summer and autumn have been very dry.

Northern Half of South Island.—The past year can be said to have been unsatisfactory from a farming point of view. Over a considerable part of the period there was excessive rainfall and the soil became much too wet. This period of high rainfall was followed by a long period of dry and windy weather during the late summer and autumn.

Southern Half of South Island.—The season from a production point of view proved to be better than the previous one in that, generally speaking, conditions favoured the farmer more. At the present time dairy stock are in better condition than is usual at this period of the year, and with the exceptionally good supplies of winter fodder available stock should winter in very good condition.

Flood Devastation.

Severe flood damage and extensive silting on pasture lands occurred in parts of Hawke's Bay and Poverty Bay in the autumn of 1938. The Esk Valley, north of Napier, and adjoining valleys were covered with several feet of sandy silt. Officers of the Division were responsible for the purchase and distribution of grass-seed and fencing-materials for the rehabilitation of the devastated farms.

Arable Crops.

The wheatgrower in Canterbury had a very trying time during the year. The high rainfall of April, 1938, made the soil so wet that cultivation for wheat-sowing could not be undertaken. The following two months were so changeable that the sowing of wheat was greatly interfered with, and it was not until August that sowing to any extent could be carried out. The final results of the wheat crop have been unsatisfactory, as yields have not nearly been up to expectations. "Take-all" was prevalent in Mid-Canterbury and North Canterbury, and in some instances the crops were not worth harvesting. In North Otago wet conditions interfered to a certain extent with sowing-operations of both autumn and spring sown crops, but despite this wheat crops in this area were, generally speaking, very good.

Oat crops have done very well, being clean and relatively free from rust attack.

With respect to yields, that portion of the wheat crop threshed during the months January–February, 1939, according to returns received from threshing-mill operators up to 24th March, showed that 63,211 acres of wheat threshed returned a total yield of 1,849,546 bushels, the average yield per acre being 29·26 bushels. This actual per-acre yield is lower than the estimated yield of 32 bushels. This, combined with the fact that the area sown to wheat for 1938–39 was less than the previous year, must result in appreciably less wheat being available. For the season 1937–38 the actual total area of wheat threshed was 185,900 acres, and this, with an average per-acre yield of 32·50 bushels, gave a total yield of 6,043,000 bushels. For 1938–39 the estimated area of wheat for threshing is 184,700 acres, but, as indicated above, the per-acre yield from that portion of the crop already harvested is 29·26 bushels; thus not only have we a smaller total area, but the yield per acre is practically 3¼ bushels less.

Like the wheat crop, the oat crop is also smaller both in yield per acre and total area when compared with the previous year. For 1937–38 the total actual area in oats was 289,763 acres, while the estimated area for 1938–39 is 263,000 acres. The actual yield in 1937–38 was 45·60 bushels per acre, against a per-acre yield for 1938–39, as far as that part of the crop already threshed has disclosed, of 37·09 bushels per acre.

The barley crop, estimated at 40 bushels per acre, is expected to yield 2 bushels to 3 bushels per acre less than last season's harvest produced. If in 1938–39 a similar average proportion of the total barley area is threshed, as was the case in the previous five seasons, the total yield should be approximately 990,000 bushels, compared with an actual yield of 1,085,950 bushels for 1937–38. The total actual area in barley in 1937–38 was 31,604 acres, while for 1938–39 the total area is estimated at 33,700 acres.

Potatoes.

The area in potatoes in 1937–38 was actually 23,090 acres, but the estimated area for 1938–39 is 20,000 acres, a decrease of 3,090 acres. The planting of this crop was delayed on account of bad weather, and early spring conditions were not conducive to quick growth. However, considering the seasonal conditions, crops are relatively good and the yields should be satisfactory, although not as heavy as the previous season.

The Australian Government decided to relax the embargo against the admission of New Zealand potatoes as from the 20th March, and the prospects of export to Australia has resulted in very remunerative prices being quoted for forward delivery.

Onions.

The Onion Marketing Advisory Committee has continued to function most satisfactorily, this Committee replacing the former separate North Island and South Island Committees, and consisting of two growers' representatives from Pukekohe, two from Marshlands, one merchants' representative each from Auckland, Wellington, and Christchurch, and two Government representatives. Several meetings have been held in Wellington, one meeting at Pukekohe, and one meeting at Marshlands. The 1937–38 onion crops were somewhat below average in yield, but the quality was extremely good, and by a carefully controlled marketing policy growers received most remunerative prices right throughout the season. It became necessary to import Victorian onions rather earlier than usual, and the first consignment, which arrived in Auckland on the 19th July, 1938, was placed on a market apparently bare of locally grown supplies. The first consignment to Wellington arrived on the 3rd August, and no onions were imported to the South Island until the 17th August, by which time the markets there were also clear of Canterbury onions. Imports were rationed and the ex-wharf price controlled by this Division, and it can be fairly claimed that the trade were very well satisfied with the procedure.

Importation of Canadian onions was carried out by the ordinary importers under a system of limited permits, the total allotment being restricted to 1,800 tons. A great deal of work was necessary to arrange an equitable allotment for merchants throughout the Dominion, but it was generally agreed that the importation had proved beneficial to the trade, since merchants were in most centres able to clear the whole of their imports without deterioration or loss. The 1938–39 onion crops appeared on the market about early January, and under pressure of the strong demand from Australia keen competition has existed for both prompt and forward supplies. As a result growers are again securing extremely high prices, which it is anticipated will be maintained throughout the season.

Considerable attention has been given to the control of disease in onions, particularly to diseases recorded in the Marshlands district—onion-smut and yellow-dwarf diseases. In co-operation with the Plant Diseases Division of the Plant Research Bureau, methods for the control of each of these have been demonstrated, and in the case of the latter a restriction has been placed on the growing of onion crops for seed in Marshlands district.

Subterranean Clover.

Importation of subterranean-clover seed has continued under permits issued by the Customs Department on the recommendation of this Division and subject to the production of certificates of origin and of fumigation. Owing to unfavourable harvest conditions in South Australia high prices have been ruling for new season's seed, and the importation has therefore been much smaller than in the past two or three seasons. This is rather unfortunate, as it is felt that the extension of the growing of this clover would be of considerable value to the lighter lands practically throughout New Zealand.

Grass and Clover Seeds.

The imposition of control of imports has made it necessary to survey accurately the production of various grass and clover-seed varieties in New Zealand in order that importation may be restricted only to such seed as cannot be procured from New Zealand growers. At present consideration is being given to the collection of better records of seed-production both in relation to export and import trade requirements.

Malting Barley.

Several meetings of the Barley Advisory Committee have been held during the year, and satisfactory price arrangements for the various grades of malting barley were made with the principal producers of this grade. For 1938–39 harvest grain the scheduled prices were made applicable only to grain grown under contract, and the maltsters found no difficulty in arranging for their full requirements to be grown under this system. That barley is popular is demonstrated by the keen demand for contracts and by the returns obtained on much of the recognized barley-growing land. With the exception of Marlborough, where drought conditions set in in December, yields above the average have been secured, and the quality of the grain has, on the whole, been very satisfactory.

Feed Barley.

During 1938, control of imports of feed barley was maintained under a system of permits to importers, but for 1939 importation was placed under the control of the Director of Internal Marketing, who, acting upon the advice of this Division, purchased substantial quantities from South Australia for spread delivery during 1939 at a price which enables this grain to be sold to consumers at 3s. 8d. per bushel ex-wharf, this being lower than has prevailed for many years. No importation is being made to the South Island, in order to leave that market for the reject barley grown there.

Maize.

A measure of stability has been provided for maize-growers through the action of the Director of Internal Marketing in conjunction with officers of this Division. A minimum price of 5s. per bushel f.o.b. Gisborne has been maintained for the 1938 crop without the necessity actually for purchase of grain by the Government from growers. The crop was only sufficient to supply the market from July, 1938, until February, 1939, and towards the end of this period growers were able to obtain prices averaging 5s. 3d. per bushel. For the period March–July, 1939, importation has been arranged from Java of sufficient grain to satisfy the demand and at the same time to keep the market bare of supplies when new season's grain becomes available.

Agricultural Instruction and Extension.

The giving of advice and instruction to farmers is one of the major activities of the Division, and every endeavour is made to meet the position. Unfortunately, the position attained in this respect is not as satisfactory as one would wish, due largely to the extensive districts officers have to attend to and to the fact that they are called on to undertake new spheres of work and other urgent matters. During the year, however, a number of new Instructors were appointed, and steps are in train at the moment for the appointment of others. This gradual building up of the instructional staff allows of more intensive instruction, and cannot but help have a most beneficial effect on the production of the country.

Experimental Farms and Areas.

The experimental farms and demonstration areas scattered throughout the Dominion, and which are seven in number, continue useful work. Some of the work is demonstrational in character, but a considerable amount is of a highly technical nature and is performed in close co-operation with specialist officers engaged on grassland research.

The majority of the areas are not actually conducted by the Department, but in consideration of the Government making an annual grant the body responsible for the conduction of each place agrees to the Division having a representative on the Committee, and thus we are very closely in touch with all the work undertaken.

In my two previous reports I have stressed the need for an experimental farm in the South Island. The establishment of such a place has not yet eventuated, and, being satisfied as I am of the need for it, I trust the necessary finance can be made available during the incoming year.

Ruakura Farm of Instruction.

Ruakura Farm Training College.—The attendance at the Ruakura Farm Training College has been disappointing. For the first term of 1938 there were eleven students, for the second twelve students, and for the first term of 1939 thirteen students. This poor attendance is accounted for largely by the shortage of labour on farms and the demand for boys in city business. It is proposed to close the training college at the end of 1939 and devote the facilities of the farm to short courses.

Winter Farm Schools.—Three special winter farm schools were held at Ruakura during the year. The courses, which were attended by 109 students, comprised dairy-farming, fat-lamb production, and pork and bacon production. In November a party of boys from the Whangarei High School spent a week at Ruakura. It is hoped that during the coming year parties of boys from other high schools will be given short courses at Ruakura.

Farm Advisory Committee.—The Ruakura Farm Advisory Committee was set up in March, 1938, and consists of the following :—

Mr. P. W. Smallfield, Department of Agriculture, Hamilton.
Mr. W. T. Collins, Department of Agriculture, Auckland.
Mr. T. E. Rodda, Manager, Ruakura Farm.
Dr. H. E. Annett, Waikato District Pig Council, Matangi.
Mr. G. T. Crawley, New Zealand Farmers' Union, Hamilton.
Mr. W. L. Ranstead, New Zealand Co-operative Herd-testing Association, Hamilton.
Mr. H. J. Finlayson, Waikato Agricultural and Pastoral Association, Tuhikaramea.
Mr. M. B. Iggulden, New Zealand Loan and Mercantile Agency Co., Hamilton.
Mr. W. Marshall, New Zealand Co-operative Dairy Co., Ltd., Hamilton.
Mr. E. F. J. Peacocke, Waikato County Council, Hamilton.

The Committee meets quarterly in March, June, September, and December, inspects experimental areas, and considers a general report on the experimental work.

Pastures and Crops.—Pasture-production was not as great as usual and difficulty was experienced in closing the usual area for hay and silage. Eighty-two acres were harvested for hay and twenty-seven acres for silage. In the silage harvest, trials were made with molasses silage and the usefulness of covering silage stacks with earth. Eighteen acres were sown in new grass and 502 acres top-dressed.

Annual cropping is being reduced to a minimum ; roots and forage crops are grown for the milk-production herd and for pig-feeding and other experiments.

Milk-production Herd.—The milk-production herd was milked in three sheds—two large herds and a small herd at the feed-flavour farm. The cows in milk were as follows :—

——	1st April, 1938.	31st March, 1939.
No. 1 shed	73	85
No. 2 shed	31	25
No. 3 shed	12	12

All the cows were tested under the group herd-testing scheme during the year. Experimental work for the control of mastitis was continued. To enable this work to be carried on according to the programme laid down, the numbers of the animals in the herds at Nos. 1 and 3 sheds were varied from time to time according to the intensity of the infection.

Sheep.—Facial eczema was extremely bad on the farm at the commencement of the year and a heavy mortality occurred amongst the flocks. Many of the breeding-ewes, although apparently not badly affected during the height of the epidemic, gradually declined afterwards. Quite a large number died prior to lambing, a number a week or so after lambing, quite a number when their lambs were about two months old, and the balance, including those which did not prove in lamb, gradually wasted away. No animals that were badly affected have recovered sufficiently to be suitable for any purpose.

Southdown Flock: No rams were available for sale during the year. The year commenced with the following sheep on hand: 139 breeding-ewes, 3 stud rams, 47 flock rams, 53 ram lambs, 47 ewe lambs: total, 289.

One of the farm-bred stud lambs died from facial eczema during the year. A new stud ram, bred by J. H. U. Slack, was purchased. The year closed with the following sheep on hand: 104 breeding-ewes, 3 stud rams, 52 flock rams, 20 ram lambs, 36 ewe lambs: total, 215.

Crossbred Flock: During April, May, and June there was ample feed on the farm, but during July, August, and September, owing to the backward spring, grass was not too plentiful. Owing to the prevalence of facial eczema at mating-time the lambing percentage from all classes of breeding-ewes was extremely low. Feed-shortage and cold weather conditions in early spring retarded the development of the lambs, and the first draft was much later than usual in being sold. Average weights were also below the usual standard. Lambs sold for export numbered 1,152, realizing £1,160 14s. 7d., at the average price of approximately £1 0s. 2d. Fifty-one lambs were transferred from Mamaku. Two hundred and seventy-seven culled ewes were sold, realizing £120 5s. 1d. Breeding-ewes were not quite so dear as they were a year ago; 530 were purchased at an average price of 19s. 1·5d.

Beef Cattle.—The Polled Angus cattle were handled on similar lines to last year. The weighing of the selected steers was carried on regularly until the weighbridge was dismantled to arrange for the construction of new yards. Feed-shortage during the winter and spring prevented all animals from increasing in weight as was anticipated. Two animals were entered in the national chilled-beef competition at Morrinsville last February. Fifth place was awarded at the show, but neither of the animals was placed on the hooks at the killing-works. Twelve young steers, ten heifers, twenty-four cows, and one bull were transferred to Mamaku Farm at a transfer price of £4 2s. 6d. per head for the steers, £3 10s. per head for the heifers, £5 15s. per head for the cows, and twenty guineas for the bull. Four fat cows and sixteen store cows were sold. Altogether seventy-four animals were sold and transferred, realizing £405 17s. 8d. Thirty fairly well bred heifers and a pedigree bull were purchased from Flock House at a cost of £277 10s. One heifer accidentally injured herself and had to be destroyed. All heifers have been mated and are due to calve next August.

Annual Sale.—No annual sale was held on the farm. Three two-year-old bulls (one Jersey and two Ayrshires) were sold at the combined breeders' sale at Claudelands during September last. As all the yearling bulls were required for experimental work, there was nothing further to offer.

Pigs.—The experimental work as outlined in last year's report has been continued and considerably extended. A very large programme of experimental feeding to produce the correct type of export baconer carcass was undertaken, and the results have been remarkably good. As formerly, the animals as they reached 200 lb. live-weight were slaughtered at the works of Messrs. J. C. Hutton (N.Z.), Ltd., at Frankton Junction. The firm named assisted us in every way to secure the necessary details required from each carcass.

Poultry Section.—An experiment to demonstrate the value of curd feeding for egg-production was carried out in this section. As far as the work has gone the results are most encouraging. The trial will be repeated during the coming year. Quite a lively interest has been taken by poultry-keepers in the work. During the winter a well attended demonstration of the proper methods of handling and feeding poultry was given by Mr. E. C. Jarrett, Poultry Instructor, Auckland.

Electric Power.—To meet the ever-increasing demand for electric power it was found necessary to renew all the power-lines feeding all sections on the farm. For certain reasons the Public Works Department could not continue to supply power any longer from their substation at Claudelands, so arrangements were made with the Central Waikato Electric-power Board to erect a high-voltage line from one of their mains to a central position on the farm and supply current at bulk rates. The service has been wonderfully improved since the change over.

Experimental Work.—The experimental activities of the farm have been greatly extended during the past year. At the end of the year the administration of the farm passed from the Fields Division to the Division of Animal Research, and the institution is now known as the Animal Research Station, Ruakura. A commencement was made in the erection of new offices and laboratories, and these should be completed about June, 1939. New pig-pens have been completed, cattle-yards erected, and a very large amount of fencing done for facial-eczema experiments.

Feed-flavour Investigation.—The work done on feed-flavour in cream at Ruakura in the 1937–38 seasons was repeated in 1938–39 with similar results. Control of feed-flavour by herd-management was also carefully investigated and shown to be practicable. This was the subject of an article in the *Journal of Agriculture* for February, 1939. Reduction of feed-flavour can be brought about by adopting the following practices: (1) Save winter grass for the spring by the system of alternate spelling and lenient grazing described in the *Journal of Agriculture* for February, 1939, under the heading of "Winter Pasture-management on Dairy-farms," and ration off these mature and grassy pastures during periods of strong feed-flavour in the spring; (2) graze the most grassy pastures during the daytime; (3) mow clovery swards, and feed in a wilted condition; (4) feed good hay—molasses sprinkled on hay may help to get cows to eat hay when pasture growth is rapid; (5) when the cows have been grazing on ample pasturage in the morning, shifting them to a bare yard for *at least three hours* before the afternoon milking does not reduce their production but does greatly reduce feed-flavour; (6) above all, practice absolute cleanliness in the milking-shed, thoroughly cool the milk or cream, and stir it frequently.

Pasture-management Trials.—In general the results obtained in 1937–38 were confirmed during 1938–39. This work is to be repeated during 1939–40, but greatly extended, particularly in measuring as accurately as possible pasture-production and changes under different methods of management. This work is to be co-ordinated with dairy-cow-nutrition investigation. The most important findings from this work are (1) close and continuous grazing of a pasture in the winter and early spring gives increased clover-production in the late spring and early summer and consequently the greatest likelihood of feed-flavour and bloat; (2) alternate spelling and lenient grazing of a pasture during the winter and early spring as described in the *Journal of Agriculture* for May, 1938, gives increased grass-production in the spring and early summer and consequently the least likelihood of feed-flavour and bloat, and it also provides good grazing for early calving cows; (3) hay and silage crops should follow lenient winter grazing and not hard winter grazing (see *Journal of Agriculture*, December, 1938); and (4) alternate spelling and lenient grazing of some pastures during the winter and early spring, and the rationing-off of this saved grass to early calving cows, as well as minimizing some spring troubles and simplifying the production of milk and cream of good quality, is also a splendid means towards attaining high production per acre.

Live-stock-feeding Experiments.—The live-stock-feeding experiments at Ruakura were controlled by a Committee comprising members of Live-stock and Fields Divisions—viz., District Superintendent, Fields Superintendent, Farm-manager, Extension Officer in Pig Husbandry, Poultry Instructor, and Veterinarians and Fields Instructor, Hamilton, and Assistant Experimentalist, Ruakura. The animal-nutrition investigations at Ruakura have shown satisfactory progress over the past year, and with the better facilities now available the work will be greatly extended. A well-planned piggery has been erected, and cattle-yards are under construction.

Cattle-feeding.—The investigation into the production of chilled beef on fat-lamb farms has been enlarged, and thirty-nine steers are now on trial. Calving-dates have been varied and cows calved in January, when normally the greater number of fat lambs have been sold and surplus grass is present. Calves born in January and April have been run on the mother over the first winter, and the growth rates of steer calves from weaning onwards obtained by periodic weighing. The dry summer and autumn of 1938 retarded the progress of the groups, and the steers born in January, 1937, had to be carried through the second winter and have reached killing weights at about twenty-six months of age. It is hoped to show that, given a good season, steers run on the mother over the first winter can be fattened to chilled-beef weights by the following autumn. This will eliminate carrying the steers over the second winter, when provision of hay is necessary to hold the condition of the steers. Data on the chilled-beef carcasses is being obtained, and a series of measurements on the length and depth of side, eye of meat, &c., are taken. By this it is hoped to evolve a standard of measurements similar to that in use for judging the pig.

The investigation into the influence of nutrition on the fertility of bulls is in progress, and the animals have been on their respective rations for about twelve months. Periodic examinations of the semen from the bulls is being carried out, but the investigation has not been in progress sufficiently long for any differences to be noted, except that in general the group on a high-protein ration appear less thrifty than do the other groups.

Pig-feeding.—One of the main problems of New Zealand's pig industry is the production of bacon pigs which are not overfat, and the best methods of feeding to obtain such pigs is now one of the main lines of investigation at Ruakura.

The position with regard to New Zealand bacon on the British market is that if our market is to expand it will be for the first-grade pig only, and New Zealand bacon pigs definitely tend to be over-fat. The ultimate solution of the problem is, of course, the breeding of a leaner type of pig, but the immediate solution is by restricting the ration at some part of the fattening-period. The main points of the investigation are therefore what is the degree of restriction and at what weight should the restriction be imposed. Another important factor is the effect of a store period in the early stages of the pig's life. This factor is of considerable importance, since a large number of New Zealand bacon pigs are pigs born in the autumn, over-wintered in store condition, and fattened in the spring. Here the main points under investigation are the effect of the length of the store period and the rate of growth during that period.

The investigation was commenced in 1938, and had been extended this year by the imposition of new forms of restriction. The 1938 trials have been repeated, and confirmed the previous results. In general it appears that the longer the winter store period the more disposed is the pig to lay on excess fat when fattened. Further, the pig of 200 lb. at six months of age will be as long as one which is 200 lb. at ten months. The growth in length of the pig is most rapid in the young stages, and this was demonstrated by an investigation into the carcass yield of young pigs of 40 lb. to 70 lb. live-weight, when it was found that the pigs of 70 lb. had already attained 75 per cent. of the length they would have when they reached 200 lb.

The use of roots in the fattening ration of bacon pigs is a further line of investigation at Ruakura, and their use has been extended to autumn fattening. This is to give a solution to the position where a man has a line of unfinished baconers and his milk-supply is dwindling, the present practice being to send these pigs to the works in a half-finished condition or at undesirable weights. With a small area of roots the farmer can substitute his skim-milk with the roots, which are a cheaper feed-supply than purchased meals and does not necessitate the cash outlay of meals.

In all the pig-fattening trials samples of the back fat are obtained, and these are analysed for fat quality. This ensures that any methods of feeding which give good results in the reduction of excess fat are not at the expense of the quality of the carcass produced.

Sow Nutrition: This experiment was designed to examine the effect of nutrition on litter-production. Unfortunately, the spring farrowing of 1938 was upset by a number of sows aborting,

the cause of which has not yet been determined. The abortion of sows in all groups excludes any common nutritional factor; moreover, from information gathered, abortion in sows was common in many districts at the time. Examination of aborted fœtuses and blood samples of the sows and boar did not show positive proof of any bacterial infection.

The autumn litters from the same sows have been normal in all instances, and the investigation is progressing satisfactorily, but has not yet advanced sufficiently to give definite information. Even at this stage, however, the advantages of good feeding at and after weaning are plainly seen. The sows which are well fed regain condition lost in the suckling-period, but sows turned out to pasture remain comparatively poor and are sometimes difficult to mate if a heavy boar is in use.

Winter Feeding of Store Pigs: In order that pigs may be profitably wintered as stores for fattening in the spring, the winter ration must be inexpensive and must consist largely of farm-produced root crops, pumpkins, carrots, &c. These crops are definient in protein, and this is best supplied in the form of meat-meal. Maize is commonly used in the Auckland Province, but is also protein deficient and should be supplemented with a protein meal for the best results. Winter-feeding trials with pumpkins, swedes, and carrots, together with various quantities of meat-meal, meat, and bone-meal and maize, are being conducted each year. The winter-feeding trials of 1938 were chiefly with pumpkins as the farm-grown crop. The results showed clearly the advantages of feeding small quantities of meat-meal with the pumpkins. Pigs receiving pumpkins only ate approximately 1¼ tons apiece in three months and gained only 7 lb. in live-weight. Pigs receiving ½ lb. of meat-meal per head per day in addition to pumpkins ate about ¾ of a ton of pumpkins and gained about 32 lb. in live-weight in the same period.

Trials with maize in place of the meat-meal gave less satisfactory results. The pigs did not thrive and put on the live-weight that was obtained with similar quantities of meat-meal, and pigs fed 1½ lb. of maize per head did not grow as fast as those receiving ½ lb. of meat-meal.

The value of cod-liver oil in the winter ration of pigs is also under investigation, and last season's trial will be repeated this year to confirm the results already obtained. Trials on winter feeding of maize and maize and meat-meal were also carried out at the Northern Wairoa Demonstration Farm, Dargaville.

Litter-production: The factors involved in the production of heavy weaning weights are under investigation, and all litters of the Ruakura herd are weighted at birth and at weekly intervals until weaning at eight weeks. Excellent weaning weights have been obtained, and the first fifty-five weaners born in 1939 average 45·6 lb. at eight weeks, the heaviest weaner being 62½ lb. The data will be examined statistically, and while such factors as birth weight, litter numbers, milking qualities of the sow, &c., play an important part in good litter-production, the chief factor is supplementary feeding by means of the creep from about three weeks onwards. Here management is all-important in having skim-milk and meals in a fresh condition, particularly in the early stages.

Cobalt Deficiency.—An investigation into the possibility of cobalt deficiency in Ruakura pastures was commenced in the autumn of 1938. The experiment was designed to see if pasture which at present fattens lambs satisfactorily with the usual top-dressing of super and lime showed improved results with the use of cobaltized super. This experiment was, unfortunately, upset by dogs worrying a number of the lambs from both the experimental and control groups. The trial will be repeated again this year.

A trial was conducted last winter and spring to see if the feeding-concentrates was of a benefit to in-lamb ewes which had been previously affected with facial eczema. Difficulty was experienced in getting the ewes to eat the concentrates, and a number of them refused their ration. Periodic weighting of the ewes and weighting the lambs at birth was carried out. The mortality in both ewes and lambs was noted, and the final results did not show any difference in favour of the concentrate feeding.

Facial Eczema.—Following the outbreak of facial eczema in the autumn of 1938, experimental areas were laid out at Ruakura and Gore's farm at Karamu. The experiments have been designed to (*a*) induce eczema, (*b*) prevent eczema. The work has been done in co-operation with the Live-stock Division and Chemistry Section. The Fields Division has been responsible for the establishment and management of the experimental areas and for the collection of pasture samples for the Chemistry Section.

The facial-eczema work has been supervised by the Facial Eczema Management Committee, and the Fields Superintendent has acted as Secretary of the Committee.

In addition to the experimental areas, twelve farms have been regularly examined and reported on for pasture and stock management.

Facial-eczema work has occupied a considerable amount of the Instructors' time. Fields Instructor Shepard has supervised Gore's farm; Assistant Instructor in Agriculture Brown has collected pasture samples at Gore's; Temporary Fields Instructor Simpson has collected data on pasture-management on the twelve farms and collected pasture samples at Ruakura.

Flock House.

Trainees.—The general standard of trainees coming forward has not, with a few exceptions, been good as one would like to see. This applies both to physique and general intellect.

Training progress, with due regard to the "raw material," has, I think, been satisfactory.

The boys have been well catered for in regard to sport and amusement generally, though there is not the enthusiasm shown that one would like to see.

Sheep.—Sheep, generally, have been maintained in satisfactory condition throughout the year, and though the months of January, February, and March were exceptionally dry, only 1·77 in. of rain being recorded for the three months, no real inconvenience has been felt in regard to shortage of feed.

In common with most districts, lambing percentages were down by approximately 6 per cent. on the average, being as follows :—

Total ewes to Southdowns,	2,650 ;	Southdown lambs,	3,742 = 103 per cent.
Total ewes to Romneys,	3,539 ;	Romney lambs,	3,310 = 93 per cent.
Grand Total—ewes,	6,189	Lambs,	6,052 = 97 per cent.

Lambs did not do so well early in the season, no draft being got away in November as usual. Latterly these have been doing reasonably well, though schedule prices have not been as good as last year.

The first draft of fats was got away immediately prior to shearing in December, and at approximately six-weekly intervals since, all Blackfaces remaining after the January draft being shorn. To date 2,240 have been sold at an average of £1 0s. 1½d.

Wool.—Crutching was done during the latter part of May, twelve bales being pressed. Shearing of dry sheep was completed on 8th November, and the main shearing on 7th January. A total of 206 bales were pressed and forwarded to Wellington for disposal, mainly at the March sale.

Cattle.—Run cattle have been kept in good condition throughout the year, the wetter areas on the property supplying ample feed throughout the dry weather, and in addition a hay ration was fed to weaners and bullocks during the winter. Generally feed conditions have been particularly dry. Conditions in respect to water have been particularly difficult, owing to the absence of wind to operate the mills, and, in addition one stream which has never been known to go dry before ceased running towards the end of March.

Calving percentages are slightly below last year, being as follows :—

Calves marked (heifer, 147 ; steer, 127)	274
Cows (including first-calving heifers)	374
Percentage	80

Dairy Herd.—The dairy paddocks provided ample feed up to the middle of January, when the dry weather began to have a marked effect on pastures, which, with practically a total absence of rain since December, have become comparatively bare. A supplementary ration of turnips has been fed daily since early in February.

The heifers purchased last year as replacements to cows put out for T.B. have performed well considering the season. Only one proved to be not in calf.

In addition to the usual testing for butterfat, mastitis-testing has been carried out throughout the season.

Pigs.—The drastic measures taken last year in respect to the T.B. infection in pigs would appear to have had the desired effect only an occasional head having been condemned of pigs slaughtered during the year.

The Berkshire sows purchased from Mr. J. A. Russell, " Blythewood," Palmerston North, have proved very satisfactory in regard to litter average and ability to rear them. Four very nice purebred sows have been retained from the first litters, and, as with all other sows on the property, are being bred to the Tamworth boar.

On the foundation of the Bulls Pig Club we consented, on request, to act as custodians of the club's sows, of which there are now two, one purebred Berkshire and one purebred Tamworth. A working-bee of the members was held and a very good lay-out erected. Several very instructive field-days have been held.

Agriculture.—Teams have been engaged in the usual routine work in the growing and harvesting of oats, wheat, peas, potatoes, swedes, chou moellier, carrots, and lucerne and pasture hay.

Severe gales in late January did very considerable damage to 20 acres oats and 2 acres wheat which were still standing, and also to a 20 acre paddock of swedes on the run.

The white butterfly has not done damage to the same extent as last year, though the diamond-backed moth has taken considerable toll of chou moellier, though this will recover, being well advanced before being attacked.

Fifty-nine tons of fertilizer were applied in the top-dressing of pastures.

Horticultural and Forestry.—Hostel grounds have been kept in good order throughout the year, though suffering from the prolonged dry spell. The vegetable garden, in particular, has shown the lack of rain. An adequate water-supply is badly needed here.

The usual tree-planting programme was carried out during the winter months. A total of 48,500 trees were planted as follows :—

Pinus insignis (beach paddock)	43,565
Macrocarpa (home planting)	4,651
Macrocarpa (river-bank and Governor's)	460

Approximately 15,000 *pinus insignis* and 5,000 macrocarpa seedlings were planted out in the nursery, and approximately 40,000 seedlings raised from seed.

Field Experimental Work.

The carrying-out of field experiments on farms throughout the Dominion continues to be an important function of the Fields Division, and the total number of experiments now being conducted is 1,050, compared with 984 for the corresponding date in 1939. The investigations are mainly ecological ones in which the necessary information can only be obtained under the conditions peculiar

to the districts in which the problems arise. Moreover, extreme variations in soil and climate make it imperative that the findings of the research worker shall be investigated over a wide range of conditions. In carrying out such investigations the Fields Division services the Plant Research Bureau and the Wheat Research Institute, thereby acting as a connecting-link between fundamental research and farm practice. Many of the experiments detailed hereunder are carried out by Instructors in collaboration with specialist officers of the above organizations with this object in view.

DESCRIPTION AND PROGRESS OF EXPERIMENTS.

1. *Grassland.*

(*a*) *Mowing Trials.*—At Marton Experimental Area seven experiments are being conducted in which the yield of herbage throughout the season is measured by the alternate mowing and grassing technique. On the pasture-manuring section the long-term investigations relative to different kinds of phosphate, different methods of applying lime, and varying degrees of fineness of carbonate of lime are being continued. During the year a further experiment has been laid down to investigate the effect of Heskett slag on grass-production. On the herbage-strains section the trials with pedigree lines of rye-grass, red clover, and white clover are being continued. The experiment on pasture harrowing is being carried out until the end of the present season, when the results will be published.

At Ruakura Experimental Farm the three mowing and grazing trials on major soil types are being continued. A comprehensive experiment designed to test the validity of the mowing and grazing technique, with special reference to the " transference of fertility " from one plot to another, has been laid down. A further trial is designed to investigate the use of drastic harrowing on a paspalum sward.

Included among the many projects in connection with facial eczema at Ruakura is an experiment to measure growth of pasture at bi-weekly intervals. By the use of movable frames small plots on which grass has been allowed to grow for a fortnight can be mown and the rate of growth recorded. Data concerning the speed of growth at various seasons will be helpful not only in regard to facial eczema, but in connection with pasture-management problems generally. A similar series of frames for measuring rate of growth is located at Gore's farm in the Waikato.

On one of the irrigation demonstrations area at Levels pasture-production on irrigated and non-irrigated pasture respectively is being measured by means of movable frames similar to those referred to above.

(*b*) *Observational Top-dressing Experiments.*—About four hundred observational trials are being carried out on pasture to investigate the effects of phosphate, lime, and potash on various soil types, and a large number have recently been laid down in Hawke's Bay following the soil survey of that district. Most of these trials now also contain a comparison of different forms of phosphate, and some recently laid down include the new " Heskett " slag. The appearance of several new phosphatic fertilizers on the market necessitates further trials being established, particularly on hill country, for which some of these products are specifically designed. Attention is being paid to the problem of " fixation " of phosphate on certain soils, and preliminary investigations are planned to study phosphatic manuring on such soil types.

(*c*) *Demonstrations of Grass and Clover Strains.*—Plots are established to serve both as experiments and demonstrations of new herbage strains in nearly all districts. They include the desirable and undesirable strains of the main herbage species, and serve to introduce to farmers the new pedigree lines which are brought out periodically by the Grasslands Division of the Plant Research Bureau. The outstanding features of these demonstration areas are generally the white-clover plots. Plots sown without white clover or with inferior strains are often very conspicuous because of the harsh unthrifty nature of the grass. Two strain trials on high-country tussock land have been established in collaboration with the Grasslands Division, Plant Research Bureau, one being located in South Canterbury and the other in the Wellington Province.

(*d*) *Grazing Trials.*—Two grazing trials which investigated the use of potash in Taranaki have been finalized during the year and the results have been published in the *Journal of Agriculture*. Four others are still being continued, and these are in connection with strains of grasses and clovers. One of these, situated on the Winton Demonstration Farm, compares certified rye-grass with uncertified Southland rye-grass harvested from old pastures. Production of wool and lamb from the two areas is being evaluated as well as the stock carried. Two years' production figures have now been obtained, and in both seasons the certified paddocks have carried more stock. In 1937–38 the revenue from the latter was 33 per cent. more than that from the fields sown with Southland rye-grass. Final production figures for last season are not yet to hand.

(*e*) *Clover-inoculation Trials.*—A large number of experiments have been established in recent years in collaboration with the Plant Diseases Division, Plant Research Bureau, to investigate the value of inoculating white clover and to test out different strains of culture in various parts of the Dominion. These experiments have all been finalized. About 20 per cent. of them gave definite results in favour of inoculation, but, although in a few cases the improvement in clover establishment was outstanding, it is not possible to make general recommendations regarding the use of white-clover culture as is done with the lucerne crop.

(*f*) *Subterranean-clover Trials.*—The ecological trials with subterranean-clover strains are being continued, and many additional plots have been established to determine the role of subterranean clover on hill country. The establishment of this species appears to be so bound up with seasonal effects that it is difficult at this stage to make any definite statement regarding its use on existing pastures.

On cultivated land there seems to be a definite place for subterranean clover in light-rainfall districts or on poor soils where white clover is difficult to establish. An exception to this appears to occur in Central Otago, where extreme dry and cold conditions prevail in winter.

(*g*) *Feed-flavour Investigation.*—The work carried out previously in connection with the occurrence of feed-flavours in cream as a result of grazing clover-dominant pastures in spring has now resolved itself into studies of pasture-management. Experiments at Ruakura are designed to study the technique of pasture control and its effects on the sward, particularly from the point of view of preventing excessive clover dominance in spring.

It has been indicated, also, that herd management can reduce feed-flavours, and that when cows are shifted from clovery pastures to a bare yard for at least three hours before the afternoon milking feed-flavours are much reduced. An experiment with two herds at the Waimate West Demonstration Farm showed that no loss in production occurred when the above practice was adopted.

(*h*) *Hill-country-pasture Deterioration and Soil Erosion.*—Experiments are in hand to find out methods of establishing legumes on hill-country pastures. The maintenance of fertility is closely connected with the presence of legumes in the sward. It is considered that the disappearance of the latter has largely contributed to the deterioration which has taken place on hill country and to certain phases of soil erosion. The use of subterranean clover in this connection has been referred to previously. Trials have been laid down at various centres in North Auckland to introduce legumes, including subterranean clover, into danthonia pastures and to make top-dressing more profitable.

The problem of slip erosion is becoming more acute, especially on hill country, where the rock is near the surface. Information is required in connection with the development of slips, and several areas in which this type of erosion is taking place are being kept under observation.

A study is being made of the possibilities of pampas-grass as a winter fodder on hill country, and several experimental areas have been established on hill-country farms in both the North and the South Islands. Lack of sufficient winter feed for cattle is one cause of secondary-growth invasion, and pampas-grass may prove a valuable means of making up the deficiency.

The control of secondary growth is being investigated in the Taumarunui district, where various methods of dealing with hard fern are being tried out.

(*i*) *Grassing of Depleted or Intractable Areas.*—Following up the valuable work carried out by the late Dr. Cockayne on the grassing of depleted lands in Central Otago, an area has been established at Pisa Flats to study the behaviour of grasses and clovers obtained from arid regions in other parts of the world. The Botany Section of the Plant Research Bureau is collaborating in this work, and much material has now been collected and sown. In addition, some of the species which are growing freely in Dr. Cockayne's plots have been established in the new area in order to study their behaviour under controlled grazing.

Experiments on the ironstone soils of North Auckland were continued, and certain plots, particularly those which have received heavy dressings of basic slag and lime, have done well. The Lands and Survey Department are now breaking in an area of similar land, and the results of the experiments will be available as a guide to the development of these ironstone soils.

2. *Annual Crops.*

(*a*) *Wheat Manuring.*—Ten wheat-manuring experiments were laid down, but three of these could not be harvested. Most of the experiments were in connection with the effect of nitrogen applications on crops showing the stunted and yellow condition in spring usually associated with nitrogen starvation. Following the cold, wet conditions in the winter of 1928 many such crops were seen in Canterbury. In five experiments an application of 1 cwt. sulphate of ammonia in spring increased the average yield by 4·6 bushels per acre.

(*b*) *Wheat Varieties.*—Eleven experiments with wheat varieties were carried out in collaboration with the Wheat Research Institute. The work was mainly concentrated on certain new varieties evolved by the Institute, and several of these continue to show promise in various districts. Two lines of a cross which show agronomic features similar to Solid Straw Tuscan have consistently outyielded the latter, and they have almost reached the stage of distribution to farmers. A trial was established in North Otago to provide the Entomological Division, Plant Research Bureau, with material for studies on hessian-fly and stem-weevil infestation, and further experiments on these lines are contemplated for the coming year.

(*c*) *Oats.*—Four oat variety trials were carried out in collaboration with the Plant Research Bureau (Agronomy Division) in the South Island. These included the varieties Abundance, Markton, and Anthony. In two trials the new variety Huskless was also included. A selection of Algerian oat was tried out against the commercial seed, but the former was inferior to the commercial strain.

(*d*) *Barley.*—Further experiments on barley varieties or barley manuring were conducted in the main barley-growing districts of the South Island. The yields of grain from most of the centres have been received, but the quality as indicated by malting tests has not yet been determined. In the manuring trials superphosphate sown with the seed continued to prove very effective on yield.

(*e*) *Potatoes.*—Thirteen manuring experiments were laid down in the South Island to investigate the relative merits of superphosphate, potash, and nitrogen on the potato crop. Such experiments have now been conducted over a large number of seasons, and there is abundant evidence available that about 3 cwt. super plus 1 cwt. sulphate of ammonia is generally a profitable dressing to apply with the crop. In certain districts the addition of potash to the above can be recommended for higher production, but some of the current season's trials aim to determine the effect of potash on the cooking-quality of the produce.

At Ruakura Farm there is one potato manuring trial and one variety trial, while a comparison of different varieties is also being made at Ohakune.

(*f*) *Turnips and Swedes.*—The effect of soluble phosphates on the germination of the turnip crop has been studied for several years and has enabled definite recommendations to be made relative to the use of superphosphate and lime. The possibilities of using "reverted super" have not been overlooked, however, and one brand of this fertilizer was tried out during the previous two years but gave results inferior to the super and lime mixture. During the season under review two different brands of "reverted super" were compared, and whereas one was highly efficient in overcoming germination injury, the other, which was identical to the brand tried out in previous years, was relatively inferior. It is evident that until some standardization is adopted or until some improvement is made in the manufacture of the last-mentioned product no general recommendation to use "reverted super" on the turnip crop can be made.

Several variety trials with swedes are being conducted. Some of them investigate the merits of club-root-resistant varieties, while others include commercial varieties and aim to get information on palatability and keeping-quality as well as yield.

(*g*) *Sugar-beet.*—Investigations regarding the commercial production of sugar-beet have been confined to five experiments in Canterbury. These are being conducted on a field scale and aim to get information on yield and on the costs of production under New Zealand conditions. During the previous two seasons some very satisfactory yields were obtained from such trials, and the information secured has been pased over to the Bureau of Industries for inclusion in their report.

(*h*) *Linen Flax.*—Working in collaboration with the Agronomy Division of the Plant Research Bureau, over sixty ecological trials with linen flax were laid down in districts throughout the South Island. From the information secured it will be possible to determine the districts most suitable for cultivation of this crop. The material harvested has yielded data relative to the type of fibre likely to be obtained under different conditions.

(*i*) *Onions.*—Methods of controlling onion-smut in the Canterbury District have been investigated in co-operation with the Plant Diseases Division, Plant Research Bureau. A fair measure of success has been obtained by the use of formalin, and the results of this investigation are to be published shortly. Two manuring and two variety trials with onions were carried out.

(*j*) *Maize.*—A large number of varieties, both imported and local, are being compared at various centres in the North Island. The growing of maize for pig-feeding is receiving more attention, and efforts are being made to obtain fairly quick maturing varieties for districts outside the main maize-growing areas. One maize manuring trial is being carried out at Dargaville Demonstration Farm.

(*k*) *Peas.*—An experiment with late Partridge peas was carried out in Canterbury, but the yield secured was not superior to the commercial variety. Several varieties of peas suitable for lamb-feeding were included in two North Island trials.

3. *Miscellaneous.*

(*a*) *Pampas-grass.*—Observations were continued on many farmers' crops of pampas-grass on dairy-farms as well as the specially planted experimental areas on hill country. In certain localities this species shows promise as a supplementary winter feed.

(*b*) *Ragwort-eradication.*—Experiments to investigate the botany of the ragwort-plant were continued at Ruakura, where an officer of the Plant Research Bureau was stationed for the purpose. The main features of the work have been the study of life-history, the effect of pulling, distribution of seed by wind, effect of grazing by sheep, and the effect of burying the roots and plants by ploughing.

Other experiments carried out by an officer of the Chemistry Section investigated the chemical control of ragwort under various conditions.

The experiments have been supplemented by trials carried out by field officers in the South Auckland district. Interim results on both the botanical and chemical investigations have been published recently.

(*c*) *Pig-feeding Experiments.*—Pig-feeding trials have been continued at Ruakura Farm, where a very large programme of experimental feeding was undertaken during the year. The main object of these investigations was to adjust feeding to produce the correct type of export carcass. One trial on the winter feeding of pigs was carried out at Dargaville Demonstration Farm.

(*d*) *Other Trials.*—Experiments not classified above include several experiments on the eradication of various weeds and trials on grass-seed production.

4. *General.*

The experimental work of the Fields Division continues to expand, and in spite of a good deal of additional work in other directions many Instructors are still able to carry out a large programme of experiments.

Seed Certification.

The Fields Division has continued during the past year its activities in regard to the certification of superior strains of seeds.

It has not been found necessary to make any radical departures from the organization which has been in existence for some time, with the result that the complete scheme of seed certification functions in a smooth and efficient manner with the minimum amount of effort necessary to produce these results.

While there is exhibited no violent expansion in the quantities of seed certified, nevertheless farmers and merchants alike, in their desire to handle and sow only the highest-quality seeds, are giving the Department every encouragement, if such is needed, to continue the activities already commenced, and to extend operations, from time to time as may be though desirable, to include other seeds into certification.

As an indication, the period under review has seen the inclusion under certification of seed oats, subterranean clover, and broad red clover, while preliminary investigations into a scheme of onion-seed certification have now been completed. In addition, areas of such crops as *Phalaris tuberosa* and rape seed, recent additions to the list of certified seeds, are rapidly increasing.

Increased growing of Pedigree and Selected Strains.—Further areas have been established under contract in order to build up supplies of pedigree and selected strains of grass and clover seed. During the 1938–39 season the acreages coming under this category included—

	Acres.
Perennial rye-grass	44
Italian rye-grass	7
White clover	63
Red clover	19
	133

In view of the great demand for the seed harvested from these areas, arrangements are now in train to still further increase the acreage under contract to the Department. The supply continues to be much less than sufficient to meet all inquiries, while the results obtained by farmers who have already established pastures with these seeds are more than gratifying.

The Department is also interested in the production by the Canterbury Agricultural College, along similar lines, of supplies of cocksfoot of a selected strain.

The Agronomy Division of the Plant Research Bureau is continually reselecting established varieties of wheat and oats, and the distribution to farmers of these lines also comes under the ægis of this Division.

Parallel with the research work which is being undertaken into the linen-fibre industry, the Fields Division is multiplying, under contract on private farms, a supply of linen-flax seed. To this end contracts covering 60 acres were entered into during the 1938–39 season.

Perennial Rye-grass.—A considerable increase in the acreage of perennial rye-grass entered for certification in the 1938–39 season has been recorded. Whereas in each of the two previous seasons approximately 8,000 acres had been inspected, the figure for the present season is about 12,000 acres. A 25-per-cent. increase is also being shown in the quantity of seed submitted for certification in the commercial class. It is unfortunate, however, that seasonal conditions throughout all seed-harvesting districts were such that practically all lines of seed have been reduced in germinating-capacity—some to very serious extent. In this respect the season has been the worst since the introduction of certification ten years ago. Thus, while the increased acreages gave rise to the opinion that the depleted perennial rye-grass seed stocks of the country would be replenished, as a result of the low germination of a large quantity of the seed, combined with the unprecedented demand from Australia on account of conditions prevailing there, it is not now expected that the reserve supply of seed in this country will return to normal.

The acreage of perennial rye-grass entered for certification which has been sown out with selected strains of seed is rapidly increasing, and the demand for this seed is a good indication of the value placed upon it by farmers who have established areas on their farms. Further areas to produce certified Government stock seed are being established under contract between farmers and the Department.

Cocksfoot.—Cocksfoot areas under certification have shown an increase in the current season of about 1,000 acres, the produce of approximately 9,000 acres having come into the scheme during 1938–39.

As with perennial rye-grass, so with cocksfoot there is a considerable increase in the area sown with selected strains of seed.

White Clover.—The quantity of white-clover seed accepted into certification during the twelve months under review approximates 200 tons. The seed has been certified in either the mother or the permanent-pasture class. Additional to this there are areas totalling 50 acres, sown out with certified Government stock seed, which are eligible to produce certified pedigree seed. Such seed is the twice-grown product of specially selected strains, and as such may be considered as a nucleus to still further raise the standard of the product being certified. The production under contract to the Department of supplies of certified Government stock seed is being continued, and from this time on it may be expected that a fairly rapid increase will eventuate in the acreages sown out in these superior strains.

Red Clover.—Approximately 1,100 acres of the " Montgomery " type of red clover have been closed for seed-production under certification this season. With prospects for a heavier seed yield than has been experienced for a year or two, it is anticipated that the demand for this type of seed may be met to a greater degree, thus obviating the necessity of extensive importations.

The certification of the " Broad " type of red clover was introduced this season. As arrangements for the commencement of the scheme were of necessity made rather late in the season, it is impossible to forecast at this stage what acreage might be entered. At the present time, however, over 40 acres have been harvested under certification, and this should make an excellent foundation for more extensive operations next season.

Brown-top.—Applications for the certification of brown-top seed are not yet sufficiently numerous to permit of definite conclusions being drawn in regard to the acreage of this seed likely to be under certification in the current season. No great variation from last year's area of approximately 20,000 acres is anticipated, however.

Italian Rye-grass.—The returns for the certification of Italian rye-grass seed indicate that over 900 acres have been inspected. The number of rejections made during field inspection has been low, so that more seed should be available for sowing this year than has been the case in previous seasons.

Phalaris tuberosa.—The area of *Phalaris tuberosa* entered for certification has increased to over 100 acres, as compared with 40 acres in the 1937–38 season. Up to the present difficulty has been experienced in obtaining seed of high germinating-capacity, an experience which is not peculiar to New Zealand. A few really good seed yields have been obtained, but generally the combination of low yield and low germination of any seed harvested has not given encouragement to the growing of this pasture plant for seed purposes.

Subterranean Clover.—An area of 70 acres of subterranean clover was harvested for seed certification in the Marlborough District this season. While most of this clover-seed in the past has been imported from Australia, a certain quantity has been harvested from time to time in New Zealand. This is the first time, however, that certification has been applied to New-Zealand-grown subterranean-clover seed. The areas in question are producing seed of the mid-season (Mount Barker) type.

Seed Potatoes.—The acreage of the potato crop inspected for certification in the current season approximates 4,000 acres, of which it is estimated that three-quarters will receive the official endorsement of certification.

Varietal purity and freedom from the virus disease known as leaf-roll are being maintained in a very efficient manner through the agency of the seed-certification scheme. In regard to the group of virus diseases known generally as mosaics, while reasonably efficient work is being done, it has not been possible to attain the same high standard as in the case of leaf-roll. It is considered that this is due to the complicated nature and behaviour of this group of virus diseases, and one feels that more headway might be possible if time could be given to a closer study under controlled conditions of the diseases concerned. Nevertheless, the certification scheme is fulfilling a very useful function as evidenced by the figures of the Government Statistician, who estimates that in the average throughout New Zealand certified seed potatoes yield 25 per cent. better than uncertified.

Wheat.—Approximately 5,300 acres of wheat have been inspected for certification in the present season, of which 3,600 acres have been accepted subject to a satisfactory grain sample. While the area inspected closely approximates that inspected in the previous year, the area accepted shows an increase of over 500 acres, indicating generally a higher standard in the crops offered for inspection.

Oats.—The oat crop has been included in the certification scheme for the first time, 30 acres of crop sown out with selected material having been accepted for the production of certified seed. It is confidently anticipated that a rapid development in the certification of this seed will take place.

Rape.—Endeavours were made in the past season to increase considerably the acreage of rape sown for seed-production under certification. Adverse weather conditions caused several acres to be drowned out, and eventually only 60 acres (approximately half the acreage sown) were harvested for seed. In view of the demand for certified rape-seed, strenuous efforts are being made in the coming season to increase the quantity of seed produced, and to this end over 300 acres have already been established.

Seed-testing.

For the calendar year 1938 a total of 20,791 seed samples were worked for analysis and examination, this number representing an increase of 387 on the previous year's total.

As in previous years, the demands on the Seed-testing Station's services proved to be in excess of the Station's capacity, and as a result, in the early part of 1939, some delay and trade dislocation has occurred, and has been the subject of representation to the Department by both trade and farmer organizations. It is obvious that the Station no longer acts merely in an advisory capacity, but is, in fact, an essential unit in the Dominion's seed trade, and, as such, its services must synchronize with agricultural and trade activity, otherwise an almost complete hold-up of domestic wholesale and export business occurs at a time when free movement of stocks is essential. Recommendations aimed at rectifying the position are under consideration.

As is usual, the bulk of the routine work comprised purity analyses and germination tests, mainly of samples submitted by seed-merchants either on their own behalf or on behalf of seed-growers. The majority of retail farmer buyers appear to rely on the integrity of the seed-vendor in supplying seed of approved quality, and, in consequence, only a very small proportion of the samples received are submitted by farmer buyers. The following are the number of samples submitted to the standard tests:—

	Samples.
Purity analyses	10,840
Germination tests	17,540
Ultra-violet-light examination	1,990
Picric-acid tests	1,425
Total	31,795

Expressed as individual tests, the working of these samples required over 96,000 separate examinations and analyses.

Ultra-violet-light Tests.

Of the 1,990 examinations of perennial rye-grass seedlings, 512 were made as check tests of certified seed for the information of the Department, 765 on officially drawn samples for the purposes of commercial certification, and 509 on trade samples preliminary to entry for commercial certification.

Picric-acid Tests.

Of the 1,425 tests, 1,235 were made in connection with the certification of white clover and 190 on trade samples preliminary to certification entry.

Certified Seed: Purity Inspection.

A total of 2,353 samples were examined, and 107, or 4·5 per cent., rejected.

Canadian Seeds Act.

Approximately 500 samples were examined, and certificates endorsed as prescribed by the Act and by authority of the Canadian Department of Agriculture for importation into Canada.

Australian Seeds Acts.

During the year an increasingly large number of samples were examined, and the possibility of conformity of the lines to Australian Federal quarantine and the State Acts reported.

Seed Certification on Laboratory Test.

Perennial Rye-grass.—For the purposes of certification in the commercial class, officially drawn samples representing 639 machine-dressed lines entered for certification were examined under ultra-violet light. Of the total quantity of 110,052 bushels entered, 486 lines, comprising 83,389 bushels, conformed to the required standard and were accepted, and 153 lines, comprising 26,663 bushels, were rejected.

White Clover.—A total of 558 lines were entered and tested by the picric-acid method for certification entry.

Of the total of 583,150 lb. of seed, 351 lines, equalling 356,365 lb., conformed to the required standard of test and were passed as certified seed, and 204 lines, comprising 226,785 lb., were rejected. Of the quantity passed, 51,136 lb. were classified as mother seed and the balance of 305,229 lb. as permanent pasture.

Investigational.

Low Germination of Perennial Rye-grass Seed.—Work on this problem was continued during the year in collaboration with the Plant Diseases Division and the Grasslands Division of the Plant Research Bureau, and a report on the work has been published. The identity of the fungus causing the disease has not yet been definitely established, but it is tentatively placed in the genus *Helotium fries*. Specimens have been submitted to European mycologists for confirmation. The identity of the *Apothecia* discovered in 1937 has now been confirmed, and the main features of the life-history have thus been elucidated.

A brief survey was made of rye-grass-seed crops in the Hawke's Bay District. In very few of the crops visited was no trace of the disease observed. In two instances over 30 per cent. of the seeds in the samples taken were infected.

Examination of Green Sheaves ex growing Seed Crops, 1939.—A total of 621 samples of rye-grass seed were received in response to an invitation to seed-growers to submit samples prior to harvesting. These samples were examined and the rate of infection estimated. By this means the grower may be spared the expense of harvesting seed which shows a high rate of infection and which would, on this account, have so low a germinating-capacity as to be unremunerative.

The number of samples from different seed-growing districts was as follows:—

Manawatu	322
Hawke's Bay	19
Wairarapa	3
Canterbury	56
Otago	27
Southland	194

The rate of infection in some instances exceeded 90 per cent. A considerable number of growers, when informed that a crop was heavily infected, refrained from harvesting the seed, and promptly turned the crop into hay. This temporary service was very widely appreciated, and there is no doubt that as the possibility of control of the disease cannot so far be viewed at all optimistically the fact that seed-growers could be provided with a report as to potential germination capacity before harvesting will assist seed-growers materially.

Work on control in collaboration with the Plant Research Bureau is being conducted as follows:—

(1) The selection and breeding of resistant forms. During the past year a trial was made of an inoculation technique designed to facilitate this work.
(2) The elimination of sources of infection in the crop by seed-treatment and pasture-management.
(3) A survey of the experience of seed-growers in affected localities.

Germination of Peas.

Regulations controlling the importation of seed peas into Australia require that germination tests be carried out in soil. Such tests in the past have given very inconsistent results, and the matter has been given special attention during the past two seasons. It has been found that only by using sterilized soil or by treating the seed with a suitable fungicidal preparation can consistent results be obtained. In the course of this work the mercury dusts at present on the market were tested to ascertain their capacity for protecting peas germinating under adverse soil conditions. It was demonstrated that these products, although giving some measure of protection, were not fully effective, because of the fact that an insufficient quantity of the dust adheres to the seed. Further experiments are being carried out with other preparations.

Vernalization.

In collaboration with the Agronomy Division of the Plant Research Bureau, experiments were carried out to ascertain the practicability of vernalization in connection with the production of seed of *Brassica* varieties in New Zealand. Vernalization, if effective, would make it possible to sow crop in the spring and harvest seed the same year.

In the work during the past year marrow-stem kale and two vatieties of rape were used. Partial success was achieved, particularly with the Giant rape. It is proposed to make further trials employing a modified technique.

Other activities include—

(*a*) A survey of cheap seed mixtures on the New Zealand market.
(*b*) A study of the effects of "dry pickling" of wheat on the retention of vitality during storage.
(*c*) In collaboration with the Department of Scientific and Industrial Research, trials in the machine-drying of Chewings-fescue seed, following upon work carried out by this Station on the deterioration of the seed during shipment from New Zealand.
(*d*) Identification of seed specimens.

SEED TRADE, 1938.

Export.—For the year ending December, 1938, the Dominion exported 2,270 tons of grass and clover seed, valued at £234,287, which totals, compared with those for 1937, represent a decrease of 730 tons in quantity and an increase of £28,589 in value. Nearly half the export was purchased by Australia and approximately one-quarter by Great Britain. The reduction in quantity was due to a second unfavourable harvesting season, but increased values resulted in a considerable falling off in the demand from the Northern Hemisphere for all except turf grass-seeds.

Import.—A total of 750 tons of grass and clover seed valued at £56,000 was imported, which totals show a decrease of 16 tons only in quantity and a reduced value of £22,000. Reimportation of New-Zealand-grown seed accounted for 220 tons of the total importation, a reflection of market conditions within the Dominion.

Approximately 500 tons of swede, turnip, rape, and kale seed were also imported, at a total valuation of £42,600.

The third unfavourable harvesting season experienced in 1939 will result in a reduced export this year, although Australia, with very short supplies, has been forced into a high-priced market in New Zealand.

SEED-PURCHASING FOR GOVERNMENT DEPARTMENTS.

For the year ending March, 1939, record figures were reached in all phases of seed-purchasing. The following tabulation shows the extent of the purchases authorized compared with those of the previous year—also a record year:—

——	1938–39.	1937–38.
Number of requisitions	739	668
Number of lines considered	11,000	10,000
Number of lines accepted	3,800	3,200
Total quantity—		
Grass and clover (tons)	718	500
Cereals, &c. (bushels)	4,754	3,600
Root seeds (lb.)	10,507	8,710
Seed potatoes (tons)	63	74
Total value—	£	£
Grass, clover and roots	82,000	52,818
Cereals, &c.	1,841	2,078
Seed potatoes	424	625
	84,265	55,500

Land-utilization.

To a considerable extent the work of the year in respect to land-utilization has consisted of a continuation of the work in progress at the end of the previous year.

Land-utilization Survey in Hawke's Bay.—In Hawke's Bay the land-utilization survey has been marked by substantial progress. A report on the Heretaunga Plains section was completed and has been published, while the preparation of the report on the Mid Hawke's Bay section of the work is well advanced. The amount of field-work remaining to be done in other parts of the Province is small, and so the completion of the whole Hawke's Bay land-utilization survey is in sight. During the year top-dressing trials were laid down on the main soil types in the province to ascertain the response obtained from the use of phosphates, potash, and lime respectively, and already, although the trials are as yet too new to provide conclusive evidence, they have yielded instructive indications of top-dressing responses: benefit from phosphates is very general, while visible benefit from lime and potash has been restricted to only a few soil types.

In several sets of circumstances under which field experience with subterranean clover is lacking and in which success with it would be specially valuable in Hawke's Bay farming, trials involving the surface-sowing of subterranean clover have been initiated, and some of these already provide promise of success with subterranean clover as a pioneer factor in improvement of pastures of low productivity.

The land-utilization survey has shown conclusively that under the current relationship between farming costs and farming returns there is considerable scope for profitable expansion of farm-production in Hawke's Bay.

In general, some of the major means to such expansion are—

(1) The improvement of pastures by ploughing up inferior ones and resowing with the best available commercial lines of seed of pasture species.
(2) The extension of top-dressing with phosphates as a general measure, and on specific soils the greater use of lime. The potash position has not yet been clarified enough to allow any safe conclusions about the economic worth of potash to be reached.
(3) The better utilization, as distinct from the increased production, of stock feed: the main measures conducive to such better utilization are the greater provision of seasonal reserves of feed and better grazing-management.
(4) The lessening of the ravages of some of the stock disorders which are among the more serious in Hawke's Bay and which have been correlated closely with the feeding-management of the stock.

Milk-production Investigations.—During the year two special investigations in regard to the production of liquid milk in the Wellington-Palmerston North district and the Christchurch district were carried out. The investigation covering the latter district was made at the request of the Internal Marketing Department, and the two projects entailed visiting numerous dairy-farms in the districts mentioned in order to secure the required information. Many interesting features evolved from the investigations in question, and these have been the subject of special reports to the Government.

Investigation of Canterbury Foothill Farming.—For a considerable period the economic status of the farming of parts of the Canterbury foothill belt has been unsatisfactory. The crux of the position is the type of pasture dominance which is most economic. The main possibilities are—(1) being satisfied with brown-top dominance, in which case a ready and fairly substantial source of revenue becomes brown-top-seed production. This is a primitive type of husbandry, an outstanding weakness of which is the limitations and uncertainties of the market for brown-top seed. (2) Having as an objective the establishment of long-term, high-class pastures in which rye-grass, cocksfoot, and clovers are prominent. Means to such pastures may be (*a*) the sowing of high-grade strains of pasture species, (*b*) liming, (*c*) top-dressing with artificial fertilizers, (*d*) mole or other drainage.

An investigation of the position has been initiated, the aim of the preliminary work being to study all available experience, and particularly the experience of those whose results have been characterized by more than the usual amount of success.

Land-utilization Potentialities of the Flax (Phormium) Areas of the Moutoa District.—The Department of Agriculture co-operated with the Public Works Department and the Department of Scientific and Industrial Research in presenting a report to the Flax Plan Rehabilitation Committee on the land-utilization potentialities of 4,621 acres in the Moutoa district, with special reference to the use of this area for the production of flax (phormium) to supply the woolpack-factory at Foxton.

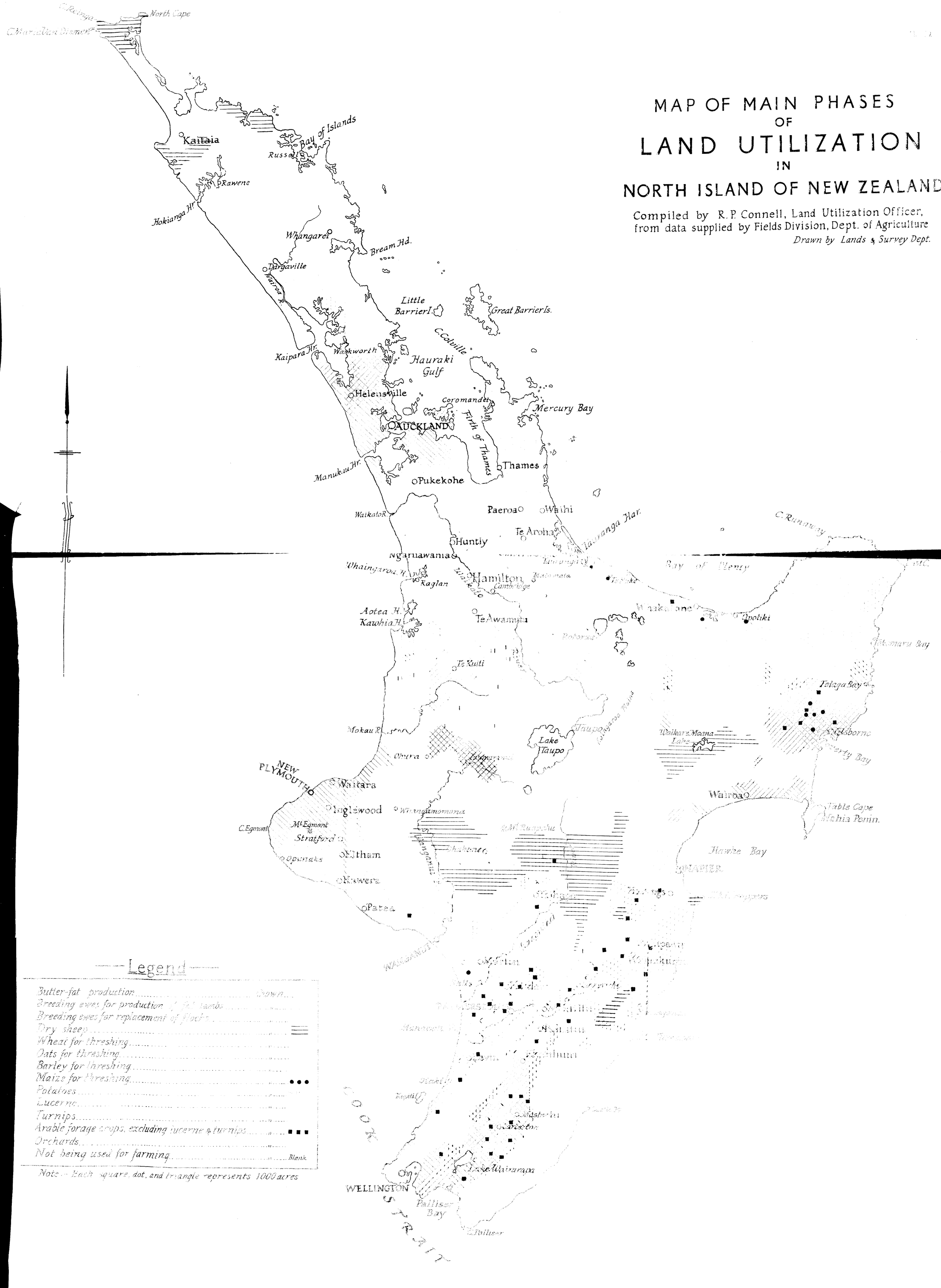
Land-deterioration.—During the year considerable attention has been given to major phases of the deterioration of farm land. The deterioration calling for consideration is mainly that of land devoted to sheep-farming. Because, during the last decade or so, sheep-farming has been marked by expansion in production, it seems well to point out that such expansion is due to improvements in parts of our sheep-farming land, while unfortunately, deterioration is rife in other parts of our sheep-farming country throughout both the North Island and the South Island. It is clear that the land-deterioration position calls for a comprehensive investigation, basic features of which should be—

(1) A survey of the present farming, with particular attention to its economics and to the operations of those farmers who are getting results better than the average.
(2) The establishment of selected trial areas on which to investigate the economics of practices which are considered promising but which have not been carried out widely enough to give an indication of their economic worth.

Land-erosion.—An interdepartmental Committee on which the Department of Agriculture was represented surveyed the position in the Dominion in respect to land-erosion, which is a special phase of land-deterioration. The report of this Committee has been completed. The main feature of the report is that it stresses the problems that face us, the urgent need of tackling these problems, and the important extensive role that modifications in farm-management must have in reducing the grave national wastage due to soil erosion.

MAP OF MAIN PHASES OF LAND UTILIZATION IN NORTH ISLAND OF NEW ZEALAND

Compiled by R. P. Connell, Land Utilization Officer,
from data supplied by Fields Division, Dept. of Agriculture
Drawn by Lands & Survey Dept.



Legend

Butter-fat production	Brown
Breeding ewes for production of fat lambs	"
Breeding ewes for replacement of flocks	"
Dry sheep	═══
Wheat for threshing	"
Oats for threshing	"
Barley for threshing	"
Maize for threshing	●●●
Potatoes	"
Lucerne	"
Turnips	"
Arable forage crops, excluding lucerne & turnips	■■■
Orchards	"
Not being used for farming	Blank

Note — Each square, dot, and triangle represents 1000 acres

MAP OF MAIN PHASES OF LAND UTILIZATION IN SOUTH ISLAND OF NEW ZEALAND

Compiled by R.P. Connell, Land Utilization Officer,
from data supplied by Fields Division, Dept. of Agriculture
Drawn by Lands & Survey Dept.

C. Farewell
Golden Bay
C. Stephen
Takaka
Tasman Bay
Motueka
Queen Charlotte Sd
NELSON
Picton
Blenheim
Wairau R.
Glenhope
C. Campbell
Buller R.
C. Foulwind
Westport
Awatere R.
Reefton
Kaikoura
Greymouth
Hanmero
I. Brunner
Hokitika
Ross
Clarenden
Hurunui R.
Oxford
Rangiora
Pegasus Bay
L. Coleridge
Kaiapoi
Waimakariri R.
CHRISTCHURCH
Mt Cook
Bruce B.
Methven
Rangitata R.
Banks Peninsula
Akaroa
L. Ellesmere
Rakaia R.
Ashburton R.
L. Tekapo
Jackson B.
Cascade Pt.
L. Pukaki
L. Ohau
Temuka
Canterbury Bight
Timaru
L. Wanaka
L. Hawea
Milford Sound
Pembroke
Waimate
Waitaki R.
Cromwell
Nosebly
Oamaru
Queenstown
L. Wakatipu
Alexandra
L. Te Anau
Doubtful Sd
Middlemarch
Shag Pt
Roxburgh
L. Manapouri
Lumsden
Otago Peninsula
Lawrence
DUNEDIN
Dusky Sd
Gore
Winton
Balclutha
Chalky Inlet
Clutha R.
Riverton
INVERCARGILL
Bluff
FOVEAUX STR.
Stewart Is.
Paterson Inlet

Legend

Butter-fat production	shown
Breeding ewes for production of fat lambs	"
Breeding ewes for replacement of flocks	"
Dry sheep	" ≡
Wheat for threshing	"
Oats for threshing	"
Barley for threshing	"
Maize for threshing	" ● ● ●
Potatoes	"
Lucerne	"
Turnips	"
Arable forage crops, excluding lucerne & turnips	" ■ ■ ■
Orchards	"
Not being used for farming	" Blank

Note :- Each square, dot, and triangle represents 1000 acres

Map showing Land-utilization in New Zealand.—The accompanying map has been designed to show along broad lines the use being made of land in New Zealand farming. The map shows the types of farming and farm production prominent in the various districts. Because in some instances one type of farming merges into another, it has at times been necessary to adopt somewhat arbitrary boundaries, there being in fact no clear-cut boundaries to be used in the mapping. In other instances more than one type of farming is prominent and important in a district. This is especially so in respect to the production of butterfat and the production of fat lambs which at times are carried on side by side throughout a territory. When this is so then two sets of symbols appear over the district in the map to indicate the prominence of two types of production. Each of the symbols used in respect to crops necessarily represents a relatively large acreage: hence small areas of intensive culture of specific crops may not be depicted on the map. The map contains an explanation of the methods used in depicting the various types of farming and forms of farm-production.

Young Farmers' Clubs.

Very definite progress has been made in the young farmers' club movement during the past year. This is indicated not only by the additional clubs and increased membership, but also by the work and activities that have been carried out by clubs, District Committees, and the organization as a whole.

Organization.—The number of clubs has been increased by 37, and the total membership by approximately 1,000. At the commencement of the period under review there were 150 clubs affiliated to the Federation, with a total membership of approximately 4,000. The clubs were situated as follows: South Island, 67; North Island, 83. There are now 187 clubs in the Dominion, as follows: South Island, 71; North Island, 116. The total membership is now approximately 5,000 (active members), with an honorary membership of over 500. The average Club membership is about 27. Membership varies, some clubs having only from 12 to 20 members, while the greater majority have memberships of round about 30; a fair number of clubs have memberships of between 40 and 60, while one or two are particularly strong, notably Wairoa (Hawke's Bay) with 120 members, Masterton (Wairarapa) with 87, and Dannevirke (Hawke's Bay) with over 70.

A comparison of the number of clubs functioning to date with those in operation in August, 1936, when the present organization came into being, is interesting:—

	August, 1936.	At Present.
Number of clubs—		
South Island	59	71
North Island	27	116
Total number of clubs	86	187
Total membership	1,900	5,000

The above figures reveal an increase of nearly 118 per cent. in the number of clubs and an increase of over 163 per cent. in the total membership. These increases are mainly due to organization in the North Island, where the number of clubs has been more than quadrupled during the period.

During the past year actually 49 new clubs have been formed; 14 in the South Island and 35 in the North Island. Twelve Clubs, however, were disbanded, 10 being in the South Island and 2 in the North Island.

Club Work and Activities.—Club work generally throughout the Dominion has shown a marked improvement during the year. One very definite factor assisting this is the publication in the Y.F.C. section of the *Journal of Agriculture* of a detailed resumé of the work, &c., carried out at club meetings, and also fairly detailed accounts of the main activities undertaken at the various centres, illustrated, where possible, with photographs. Lectures still play an important part at club meetings, and the Department's officers of all Divisions have assisted in this respect, the Fields Division being particularly prominent. Impromptu speaking and debating have come very much to the fore during the year, the subjects being mainly of an agricultural nature, but varied by subjects of general interest. Interclub and district debates have been conducted freely throughout the Dominion, a number of trophies having been made available locally to stimulate this admirable work; and a start has been made with interdistrict contests, leading up to interprovincial debates and inter-Island contests. Club and district field-days and demonstrations have done much to instruct members in the many phases of agricultural and pastoral work, and have also assisted in giving publicity to the movement. Stock-judging competitions have been a regular feature in most districts, and a start has been made towards interprovincial competitions. Hay- and sheaf-stacking competitions have also been successfully carried out. The agricultural and pastoral associations throughout the Dominion have very definitely encouraged clubs and members by scheduling special classes for Y.F.C. members at the local shows, and also by allowing members to act as junior stewards and associate judges where practicable. Both the club and district activities have also included a number of social, recreational, and sporting events which have done quite a lot towards popularizing the movement and holding it together.

The main events of the year were two very outstanding activities carried out at Palmerston North. A Cavalcade of Agriculture was arranged by the Manawatu District Committee at the Palmerston North Winter Show, and proved a most successful undertaking, over one thousand Y.F.C. members taking part in a most brilliant and original display. At the Palmerston North Spring Show a Y.F.C. national shearing competition was held, the arrangements being carried out by the Manawatu Committee; over one hundred members from different parts of the Dominion competed, and the shearing was watched by an audience of over two thousand.

Educational Weeks.—A successful Educational Week was held in Wellington during July, being the first held in the capital city; it was attended by about one hundred members from the Wellington area, with the addition of a few members from Marlborough and Nelson. An Educational Week was held at Dunedin in August, attended by about one hundred and fifty Otago and Southland members; while another similar week was staged at the Waitaki High School, Oamaru, and attended by about seventy. A very successful Farm School was also held at Ruakura Farm of Instruction. Arrangements were in progress for the holding of an Agricultural Week at Wanganui, but the project had to be abandoned owing to the difficulties connected with accommodation. These difficulties have since been overcome, and it is intended to undertake this activity shortly.

Tours.—Doubtless inspired by the success of previous Y.F.C. tours, organized parties from a number of the districts undertook tours during the year. The main tours carried out were as follows: A South Taranaki party of fifty toured Canterbury, Otago, and Southland; a Bay of Plenty party of fifty toured Canterbury and Otago; a combined North and South Canterbury party of fifty toured Manawatu, Taranaki, Waikato, and Bay of Plenty, returning through the Wairarapa; a Wairarapa party of twenty-four toured the Waikato, Bay of Plenty, Auckland, and Taranaki districts; and a party of one hundred and thirty from the Manawatu undertook a camping tour of Taranaki, Waikato, and the Bay of Plenty. A number of minor more-localized tours were also successfully carried out by parties in the different parts of the Dominion. These tours promise to continue to be popular, a number being already arranged for this season.

Councils and District Committees.—The alterations to the Y.F.C. constitution, brought into effect just prior to the commencement of the year under review, have been justified. The general effect has been to give better proportionate representation by active club members on the various committees, &c.; and the four Councils, set up in place of the two Island Councils, have been doing very good work, acting as clearing-houses between the District Committees and the Dominion Executive Committee. District Committees are in most cases co-operating with the local Instructors (acting as District Y.F.C. Secretaries) and rendering valuable service to the organization. An endeavour is being made, particularly in districts where the clubs are well organized and the activities are becoming, if anything, embarrassing to the Instructor, to throw more responsibility on to these committees. The District Committees, in my opinion, form the key to the progress of the whole organization, and can act as the background to the work of the District Secretary, taking much of the work off his hands if they can only be persuaded to do so.

Age-limit.—A very far-reaching decision was made at the annual meeting in September last, when the age-limit was raised from twenty-five to thirty years. This has certainly had the effect of stimulating membership, but, as has been frequently pointed out to clubs and members, there is the danger of the clubs getting into the hands of the older members, to the discouragement of recruiting from the younger lads. However, this aspect is being given attention by most districts, and wherever possible competitive activities are being arranged in junior and senior sections. If care is exercised in this respect the raising of the age-limit will probably prove to be a wise move in the long run.

Journal of Agriculture.—Full advantage has been taken of the Department's service by way of the distribution of the *Journal* direct to individual members; at the annual meeting the club-membership fee was raised from 2s. 6d. to 3s. 6d., the extra 1s. to include the cost of the *Journal*, thus bringing in every member as a subscriber at the concession rate.

The Y.F.C. section in the *Journal* is being maintained, and consists principally of notes on club affairs and articles (illustrated, where possible) containing news of major activities.

Projected Activities for Current Year.—The programme for the current year includes many important events and major activities, among them being the following:—

Co-operation by Y.F.C. in Centennial tree-planting.
Co-operation by Y.F.C. in physical welfare and recreation campaign.
Co-operation by Y.F.C. in campaign against hydatid disease.
Y.F.C. camp at Wellington during the Centennial period.
Visit by overseas Y.F.C. delegates during the Centennial period.
Agricultural Weeks at Hastings, Wanganui, Dunedin, Gore, and possibly Christchurch, and a Farm School at Ruakura.

Value of the Y.F.C. Movement.—All who have come in contact with the Y.F.C. organization have been impressed by its value to the youth of the farming community and to the country as a whole. The work carried out through the movement is encouraging the young men associated with it to take a greater interest in their life-work, and is assisting them to improve their outlook and also their environment. It is seeking out the leaders from among them, and giving them confidence in their own ability, and generally exercising a wonderful influence on country life. A spirit of loyalty to their own organization is gradually becoming engendered, and this will, of a certainty, secure the successful carrying-on of the movement for many years to come.

Registration of Fertilizers.

Registration.—During the year 90 primary vendors and 650 secondary vendors were registered under the Fertilizers Act.

Inspection and Visits.—The Inspector of Fertilizers paid periodic visits to superphosphate-manufacturing plants, freezing-works, and manure-mixing stores, where official and unofficial samples of fertilizers were taken for analysis and the invoice certificates examined. Calls were made on manure vendors to discuss fertilizer matters, and meetings were held with vendors in a number of centres to discuss questions relating to fertilizer mixtures and their possible improvement.

Information on Fertilizers.—Considerable correspondence was received from vendors and users of fertilizers and from State officials on various aspects of fertilizer used, and the statistical position of fertilizer-consumption in New Zealand over a period of years was prepared for advisory purposes. Consultation was held with some fertilizer-manufacturers in connection with the making of new types of fertilizers designed to suit special soil and farm management conditions in the Dominion.

Fertilizer Development.—In association with the Chemistry Section and other State Departments, the Inspector of Fertilizers carried out preliminary inquiries and made arrangements with superphosphate-manufacturers to carry out experimental mixings of certain natural rock material found in New Zealand which, when incorporated with superphosphate, may assist in minimizing phosphate fixation on certain soil types. Close contact was maintained with fertilizer developments overseas, to the end that any improvements there will be tried out for the benefit of the New Zealand farming community.

Revision of Fertilizer Act.—Further progress was made along the lines of effecting improvements in the present Fertilizer Act, as outlined in last year's report. It is hoped that a new act will be passed this year. It is interesting to record that the Dominion led the Empire in regard to fertilizer-control legislation with the Manure Adulteration Act of 1892, which was the first of its kind in the British Empire. Whilst the Act gives protection to farmer users of fertilizers, and last year the value of the tonnage bought was £2,500,000, there are a few improvements in the direction of bettering the fertilizer mixtures in standardization of mixtures, and in ensuring that statements made to the public on fertilizers conform more strictly to known facts of their use, which it is considered can be brought about by an amendment to the present Fertilizer Act.

Exhibits at Shows.

The policy of staging exhibits at agricultural and pastoral shows and the like was continued during the year. Requests for an exhibit are received from centres scattered throughout the Dominion, and in all cases where it can reasonably be done the requests are complied with. All exhibits are made as instructive as possible by incorporating the many phases of the Department's work as lend themselves to such procedure. The appreciative messages, both written and oral, received bear testimony of the universal approval merited by the Department's action in the matter of exhibiting at shows.

The Phormium Industry.

The production of phormium fibre and its by-products continues to decline, and in the year under review reached a very low level. The amount of hemp fibre produced was 25,297 bales, a decrease of 15,295 on the quantity produced the previous year. Likewise, the amounts of tow and stripper slips also showed decreases—the former by 5,264 bales and the latter by 225 bales.

Further leaf-deterioration has been in evidence, and although faulty milling has accounted for a certain quantity of the high percentage of low-grade material produced, the general quality of the green leaf prevents the production of really high-quality fibre.

It is clear that the growing of phormium on suitable lands, selection of plants, and general supervision is the only hope of maintaining a supply for local consumption.

During the year a stripper, incorporating some of the principles of both the "Cormorant" and "Greig" strippers, has been constructed and installed in a mill at Foxton, and although in operation is not yet doing a thorough job, but when defects are overcome this machine will greatly reduce production costs, especially raw material for sacking-cloth.

Departmental Photography.

The photographic section of the Division is supplying a really excellent service, which is being availed of not only by the various sections of the Department, but also by the several research institutions, particularly those located at Palmerston North. The very high standard of work being put out is a valuable aid to the Department's *Journal* and to the exhibits being staged at shows.

Staff.

The staff under my control has been very fully occupied during the year, which has been a particularly arduous one. Every member of the staff has worked excellently, and I wish to place on record my appreciation of their loyal and whole-hearted support.

DAIRY DIVISION.

REPORT OF W. M. SINGLETON, DIRECTOR.

The Season.

Taken as a whole, the year ending on the 31st of March has been a very disappointing one for dairymen in the Dominion, owing to the very dry weather conditions which have prevailed in those districts in which the greater bulk of our export dairy-produce is made. Following a dry period in the summer of 1938, there was a great growth of grass in several districts, which, in the Auckland Province, was followed by an outbreak of facial eczema which caused a rapid drying off of the cows affected. This was followed by a cold winter and spring, which resulted in a serious shortage of feed in practically the whole Dominion. As a consequence, paddocks could not be shut up for hay until several weeks later than usual, with very serious results, as later events showed.

From December until the date of writing, what may be termed drought conditions have prevailed in the greater portion of the North Island and in Marlborough and Nelson. Other parts of the South Island have been more fortunate, and the dairying season in Southland has been the best recorded for many years.

Production.

In addition to the reduction due to climatic conditions, there has been an inclination to reduce the number of cows milked on individual farms, and this also has tended to reduce the output of dairy-produce generally.

While in some districts there has been a certain amount of change over from cheese to butter which has resulted in the closing of a number of the smaller cheese-factories, chiefly in Southland, there has been in others a change in the reverse direction, and one large new cheese-factory has been erected in the Auckland Province.

A minor factor which has caused a reduction of the output, principally of cheese, has been the increased demand for liquid milk for the milk-in-schools scheme. On the other hand, owing to the low price offering for casein, six comparatively large dairy companies decided to cease the manufacture of butter and casein and revert to the manufacture of cheese.

The net position as shown by the returns for the twelve months ending 31st March, 1939, is that 129,277 tons creamery butter and 84,236 tons cheese were received for grading, as compared with 145,596 tons butter and 86,012 tons cheese for the previous year, a decrease of 16,319 tons butter (11·20 per cent.) and 1,776 tons cheese (2·06 per cent.). In terms of butterfat the decrease represents 14,282 tons, equal to 9·25 per cent. Of the total amount of butter received for grading 92,501 tons were produced in the Auckland Province, as against 104,307 tons during the previous year, a decrease of 11,806 tons, which gives a clear indication of the unfavourable dairying weather experienced in that area.

Export Values.

Basing export values on Customs figures and including all dairy-produce—butter, cheese, casein, dried milk, sugar of milk, and cream—there was a decrease of £1,782,010 in the value of this year's dairy-produce, the total values for the two financial years 1938–39 and 1937–38 being £22,455,952 and £24,237,922 respectively. Customs values are based on realization values.

While the price levels for butter during the year were rather higher than during the previous one, the price of cheese was lower, so that the reduction in value is obviously due to the substantial reduction in output.

Zoning.

The work of zoning the supplies to dairy factories has been continued by the Executive Commission of Agriculture and has now been practically completed in Central and North Taranaki, Bay of Plenty, and Poverty Bay. Adjustments have been made in a number of instances where these have been shown to be necessary in the light of changing circumstances, and attention is at present being given to a number of cases which were not finalized when larger schemes were being dealt with.

As a result of this work, combined with causes such as decreasing supply to some of the smaller cheese-factories already referred to, the number of dairy factories registered has shown a reduction from 412 on 31st March, 1938, to 402 on the same date this year.

As a result of the zoning of supplies there has been very little difficulty through illegal transfers of supplies from one factory to another during the year, and reports indicate that a better understanding between dairy companies has developed, while very definite savings in the cost of cream cartage have been shown in many instances.

Creamery Butter.

It is pleasing to be able to report that, in spite of a number of factors all tending to reduce the quality, there has been a slight improvement when compared with the previous year as indicated by the average grade, which was 93·373 points, against 93·371 for 1937–38. Of the 129,277 tons of butter received for grading, 106,561 tons, or 82·42 per cent., was classed as finest, 22,056 tons, or 17·06 per cent. as first, and 660 tons, or 0·51 per cent., under first grade.

The low average temperatures, especially night temperatures, recorded during the summer helped considerably in the prevention of the development of acidity and undesirable flavours, but by checking the growth of grass forced the cows to consume the weeds which were available. This was the cause of an increase in the weed flavours in the cream, and in the butter made from it which have been reflected in the reports received from Great Britain. These have frequently referred to feed-flavours in butter which was made from cream which had been subject to the most stringent treatment in an endeavour to remove them.

With the advent of the dry weather a serious shortage of water was experienced on many farms, and as a consequence the cleaning of the milking plants was not as thorough as it should have been, with the result that the quality of the cream suffered.

Under these circumstances there was a rapid fall in production, and once-a-day milking was resorted to at an early stage, with a consequent drop in the quality of the cream.

Reports from Instructors and Graders refer to a lack of character in both cream and butter which was noticed more or less during the whole season.

It is also reported that there in an inclination on the part of dairy companies to exercise less care in the segregation of cream which is not of the highest quality, and this probably accounts for the slight increase in the percentage of first-grade butter produced compared with the previous year.

It has also been noted that a number of dairy companies seem to be reserving their best butter for sale on the local market, with a consequent reduction in their average grade.

Reports on the quality of unsalted butter as seen at the London end lead to the belief that less care is being exercised in segregating the best of the cream for that purpose, and the experience of the previous year pointed to the danger of carrying on its manufacture after the flush of the season had passed. The quantity made for the year under review amounted to 3·16 per cent. of the total graded, compared with 4·91 per cent. for the previous year.

pH Testing of Butter.

The testing of butter samples for alkalinity by the pH method has been continued, and these total 3,048 at Auckland, 887 at New Plymouth, 123 at Castlecliff, and 1,048 at Wellington, a total of 5,107, compared with 7,547 for the previous year. The decreased number is accounted for by the fact that as the result of this work the neutralization of cream has been placed on a much better footing, and it is now almost rare to find a sample which has been over-neutralized.

The reduction in the pH work has made it possible to devote more time to the bacteriological and chemical examinations, and in Auckland these amounted to 2,526 samples, compared with 816 carried out at that port during the previous year. Samples from other ports were examined at Wallaceville.

Phosphatase Test.

In addition to this work, the Division has co-operated with Mr. K. W. Griffin, Government Analyst at Auckland, and has furnished him with a very large number of samples of butter from most of the grading-ports for examination by the phosphatase test for efficient pasteurization of the cream used in its manufacture. The results of this work have not yet been finalized.

Testing Butter for Moisture and Salt.

Following the established practice, all churnings of butter forwarded for grading have been tested for moisture and salt. The total of the former was 143,350 churnings, of which 0·34 per cent. were found to exceed the legal limit of 16 per cent. and were returned to the owners for reworking. The average moisture content of the churnings below 16 per cent. was 15·606 per cent.

Salt tests carried out during the year totalled 134,831 samples, and of these 0·44 per cent. which were outside the legal limit and had not been manufactured under special permit were withdrawn from shipment by the owners.

Butter-boxes.

During the year the task of consolidating the regulations published in 1926 and the numerous amendments subsequently made was completed. These were gazetted on 20th July, 1938.

One of the most important is No. 28, which provides for the use of only one type of box for packing export butter "except with the prior written consent of the Minister and subject to such conditions as may be prescribed in such consent."

As stated in last year's report, it was the general opinion of those concerned in the manufacture and sale of our butter that it was necessary to adopt one style of package, and as the one which had given general satisfaction was the substandard box bound with two wires this one was chosen. It is now referred to in the regulations as the standard box, and should not be confused with the heavier type without binding which was formerly known by the same name.

It will be realized that it was necessary to give a certain amount of latitude in order to allow for using up the boxes which were already in hand on the date when this regulation came into force, and had the season been a normal one the position would have been reached where the only box in use during the coming year would have been the standard box made of white-pine. Due to the causes mentioned, there will be a small carry-over of Swedish-pine boxes of the same type which were imported by the Dairy Board during an anticipated shortage of New Zealand timber in the 1937–38 season.

Apart from these, the only package for which a permit has been issued is the Whitford box. This box has been used experimentally for several seasons, and consists of a fibreboard lining encased in a saranac type of container which need not necessarily be made of white-pine, and which would therefore result in conserving the supplies of this timber. The experimental results were such that it was considered to be worth a trial in larger quantities, and permission has been given for the shipment of fifty thousand of these containers during the coming year.

The procedure outlined on page 36 of the report for 1937, under which supplies of timber are allocated to box-manufacturers by the State Forest Service and the boxes distributed to the dairy companies by the Dairy Board, has been extended to include delivery charges, and the pool price is now charged to every user delivered at the nearest railway-station or port, or in some cases to the factory door.

Butter-box Wrappings.

During the season the practice of wrapping all unsalted butter for export in parchfoil has been continued, and with a view to obtaining the reaction of the trade in London to its general use those dairy companies which chose to use it for wrapping salted butter also have been paid the extra allowance for this purpose by the Primary Products Marketing Department.

It has been established that the use of parchfoil prevents the development of "primrose" colour and "toppy" flavour on the block of butter. It also reduces the danger of timber taint, and for that reason all imported boxes used during the past year were required to be lined with it. It will also prevent the access of mould to the surface of the butter it if should develop on the timber of the box.

On the other hand, there has been a certain amount of criticism from users at the London end on account of the adhesive used in its manufacture being unsatisfactory, resulting in the severance of the parchment from the foil, which causes difficulty in stripping the block of butter. The opinion is also held by some that two thicknesses of 28 lb. to 30 lb. parchment of good quality when used in the standard box made of thoroughly seasoned white-pine gives satisfactory protection to the butter.

Whey Butter.

A further increase in the quantity of whey butter exported is recorded, the weight having risen from 1,820 tons to 1,904 tons. A high standard of quality for this class of butter has been reached at some ports, but there is evidence of neglect of the cream in other districts. There is an inclination in some areas for cheese-manufacturing companies to discontinue the manufacture of whey butter and to sell the cream to one central organization. These companies in many instances follow the same practice with the creamery cream obtained by separating the milk received during that part of the season when no cheesemaking is carried on.

Cheese.

Cheese received for grading totalled 84,236 tons (86,236), of which 14,672 tons (9,327), or 17·41 per cent. (10·84), were graded as finest; 67,080 tons (72,755), or 79·64 per cent. (84·61), as first; and 2,484 tons (3,910), or 2·94 per cent. (4·54), below first. The average of all cheese graded was 92·133 points, as compared with 91·934 points for the year ending 31st March, 1938. (The figures in parentheses represent those for the previous year.)

It will be noted that there is a reduction in the amount of cheese graded, the reasons for this having been dealt with in the introduction to this report. Further, that in spite of the difficulties difficulties encountered in connection with cheesemaking in the closing months of the previous dairying season which are included in this report, there is an appreciable increase in the percentage of finest-grade cheese and also an increase in the average grade for the year. Contributing factors to these results were, first, the comparatively cold temperatures with cold nights prevailing during practically the whole of the year which prevented the development of undesirable flavours, and, second, the inauguration of the farm-dairy-instruction service on a Dominion basis. The periods during which high percentages of second-grade milk were received at the factories were of very short duration, and instances in which no milk of this quality was received at a factory for many days in succession were quite common.

Under these circumstances, it is not surprising that less cheesemaking difficulties were experienced during the year, and the higher grading has been justified by the reports from the London officers of the Division. Except in those cases where starter difficulties had caused a drop in the quality of the cheese made, the one defect which has been pronounced has been slit openness. Body and flavour have seldom been criticized.

Starter failures have been less frequent during the past year, but this may be due to the fairly general practice of carrying on more than one strain. The use of one single strain culture has been less general than for some years past, and where these are used a second single culture or a commercial culture is also carried as a rule.

A noticeable feature of cheesemaking during the very dry weather was the general reduction in the drying and salting acidities in those districts affected. In some areas this has been down as low as 0·145 per cent. at drying and 0·70 per cent. at salting without showing any lack of acid in the finished cheese, pointing to an abnormal condition of the milk produced under these conditions.

The position regarding the pasteurization of milk for cheesemaking seems to have become stabilized, the comparative quantities for the last two years having been, 1937–38, 90·107 per cent., and for 1938–39, 88·21 per cent.

The heat-exchanger type of pasteurizer has replaced those of the vertical-dome type in quite a number of instances, and it is some considerable time since one of the latter has been installed.

Cheese which was withheld from shipment during the autumn has been the cause of some criticism in the London reports on account of mould penetration, and, while a certain amount of this is inevitable when cheese is held over long periods in cold store, it cannot be lightly regarded, as it is not only a source of monetary loss to the seller, but is also the cause of a loss of good will, which is perhaps an even more serious matter.

In all cases the reports received have been sent on to the dairy companies concerned, and steps have been taken to draw their attention to the necessity for improvements in the conditions obtaining in the curing-rooms. As a result, more attention is being given to this matter, and in a number of Southland factories installations of air-circulating plants have been installed, while artificial cooling has been provided at one more curing-room in the Wellington Province, and a second is to be provided in one at present in the course of erection.

The attention of employees has also been drawn to the necessity for the more careful handling of cheese in the factories, and in those instances where cracked rinds have been in evidence on receipt of the cheese at the grading-stores the defective ones have been returned to the owners.

The position in connection with the waxing of cheese remains practically stationary, as the quantity so treated during 1937–38 was 59·43 per cent. while in 1938–39 it was 59·63 per cent.

New kinds of wax for which certain advantages have been claimed are at present under trial, and shipments of cheese coated with them have been sent to London, but no reports have so far been received.

Hours of Labour.

The effect of the reduced hours for cheese-factory employees has, largely owing to the short season, not yet been fully felt, as at the time of writing quite a number of factories have closed down or are on the point of doing so. During the closing months of last season there was an inclination for some companies to try to make the cheese within the hours stipulated in the award, but a better understanding of the provisions of the award has shown that many of the anticipated difficulties can be overcome, and less has been heard of in the way of complaint regarding them.

Casein.

As already stated, there was a considerable change over from butter and casein to cheesemaking during the past year, and preparations are at present in hand for further changes in the same direction for next season. This is due to the difficulty of making sales at a remunerative price, and neither the gradings nor the export figures give a true indication of the quantity made.

Gradings in the past have been almost wholly confined to Wanganui, but the business carried on there for many years past has now ceased operations. The quantity graded for the year was only 189 tons, as compared with 983 tons for 1938 and 1,326 tons for 1937. Customs returns give the quantities exported during the last three years as 1,626 tons, 3,203 tons, and 4,185 tons. Values were £71,651, £215,133, and £218,433.

Regrading of Butter and Cheese after Storage.

The practice of regrading selected samples of butter and cheese with a view to checking their keeping-qualities and the accuracy of the original grading has been continued at Auckland and New Plymouth. At Auckland 187 boxes of butter and 82 crates of cheese, and at New Plymouth 30 boxes of butter, were so examined. These examinations have shown that the points awarded at the first examination have in most cases been maintained, but where any defect has developed advantage is taken of the presence of the managers concerned to draw attention to these. Unfortunately, a number of dairy companies have decided to discontinue these storage trials, a decision which may be an indication that under the present system of marketing their interest in their product ceases after it is graded.

Cool-store Temperatures.

Owing to the cool temperatures prevailing there has been little difficulty experienced with the transport of butter and cheese from the place of manufacture to the cool stores. As the result of examinations of butter from the outside of the block and from the inside of the same block there is some evidence that this is a point which may require to be given closer attention in the future.

Daily readings of holding temperatures of all rooms in use at grading-stores continue to be taken, and these seldom give room for complaint. This is not always so in regard to temperatures reported by the Inspectors of the Marketing Department, which are taken at the ship's side. It would appear that there is at times a considerable lag between the time of despatch at the stores and loading on to the ship, and there is room for considerable improvement at this point.

In addition to temperatures, the records of humidity in the cheese-stores are regularly taken, and it is hoped by this means to gather information which will indicate the best method of reducing mould growth.

Grading of Milk and Cream.

As already stated, the cool weather has had a marked influence on the quality of the milk received at cheese-factories, and to a lesser extent of the cream received at creameries. This, and the falling away in quality in some areas during the dry months, gives strong support to the requirement that all supplying dairies should be provided with an ample supply of water at a suitable temperature for cooling-purposes.

Constant supervision over the grading is exercised by officers of the Division, but it would probably be correct to say that there is more difficulty in maintaining the correct standard at creameries than at cheese-factories. This is probably accounted for by the fact that, while the cream-grader depends entirely on the senses, the milk-grader has before him each day a sample of curd which shows the kind of cheese which each supplier's milk if manufactured separately would make.

Check-testing of Milk and Cream Samples.

Supervision of this work at dairy factories has been continued, but owing to a reduction in the number of officers engaged on it, and to the fact that those remaining were called upon to undertake a certain amount of supervision in connection with the extension of the farm-dairy-instruction work, the number of visits for this purpose was fewer than for the previous year. These totalled 1,044 for the past year, compared with 1,303 during 1937–38.

While check-testing has served a valuable purpose and has been the means of improving the accuracy of the work done at dairy factories, it has always been recognized that it was a comparatively easy matter for any person who wished to do so to show results which would give a good comparison with the check-testing figures and still be inaccurate. Whether from this cause or from some other unexplained reason, there has been a distinct increase during the past year in the number of instances where the yield of both butter and cheese cannot be justified by the fat in the manufactured product.

For many years past an analysis for fat content, which includes every churning of butter and every vat of cheese graded, has been carried out at all grading-ports. Based on the figures so obtained the fat recovered in both is calculated each month, and in too many instances this figure exceeds the amount credited to the suppliers after due allowance has been made for unavoidable losses. It would appear that the time has arrived when steps should be taken to deal with the position on a basis of the fat contained in the butter and cheese manufactured by each dairy company, and this question is at present receiving close attention.

Farm-dairy Instruction.

On 1st August 1938, the farm-dairy-instruction work was extended to cover the whole of the Dominion, and it can now be claimed that this service is available to every supplier to a manufacturing dairy in New Zealand. Although a large number of new appointments were required, it is pleasing to be able to report that the work has been carried out with practically no friction, and this is no doubt due to the fact that every man chosen for these positions had had practical experience in either butter-making or cheesemaking, and thus had a knowledge of milk and cream quality, was familiar with dairy plant, and had had experience of dealing with suppliers.

Reports received at this office indicate that the extension of this work to those areas not covered formerly was much needed, and there are indications that after a reasonable time has been allowed for urgent improvements to be made a firmer attitude will require to be adopted with a certain number of suppliers if the full benefit of the work is to be obtained.

Expressions of appreciation of the work being carried out have been numerous, both from individual suppliers and from dairy companies.

Inspection of Milking-machines.

During the year the notifications of milking-machine installations received at this office have totalled 3,095, compared with 3,006 during the previous twelve months. The prominence given to the incidence of mastitis during recent months, and the suggestion that the vacuum exerted on the cows had a bearing on it, has led to a large number of devices for reducing the vacuum at the teats being placed on the market. While it is not the function of this Division to pass judgment on the claims made for these units, it has been necessary to keep a close watch on them from the point of view of hygiene, and this has entailed a considerable amount of work.

For the same reason, the question of erecting the milk-pipe at a low level near the floor of the shed has received considerable attention, and here again the attitude adopted has been that, providing the quality of the milk produced is maintained, no exception will be taken to this system of erection of plants.

Dairy-factory Managers' Registration Board.

Since the making of the regulation requiring all applications for registration to be in the hands of the Registrar on 1st May in each year the work of the Board has been much simplified, and two or three meetings per year seem to be quite sufficient to deal with the business coming forward without inflicting any hardship on any one concerned.

There is, however, the need for the Board to be given authority to delegate some of its powers to an executive Committee, which could deal with minor matters which may arise during the year, as some inconvenience to dairy companies would thus be avoided in a few instances.

Inspection of New Zealand Dairy-produce in Britain.

The responsibilities of the officers engaged in this work seem to increase with the passing of time. This is probably due to a gradual transfer of complaints received by distributors from their own organizations to the Dairy Sales Division of the Primary Products Marketing Department. Many of these are referred to the officers of the Division for a report, and the time so taken up must necessarily reduce the number of routine examinations of shipments. These investigations, however, give personal contact with those concerned, and from that point of view are valuable, while they afford an opportunity of furnishing the manufacturer in New Zealand with a report on the actual condition of his produce. It will be recognized that the co-operation between the London representatives of these two Departments is invaluable to both and to the producers in the Dominion,

Again this year the London officers have been called upon to undertake duties connected with the industry which necessitated visits to the Continent. Three such visits have been paid, and contacts made which are of value from many points of view.

Further duties undertaken by Mr. Taylor in London have been representation of the Dominion on the Dairy Requisites Committee of the British Standards Institute and on the International Dairy Committee.

Dairy Laboratory, Wallaceville.

As in previous years, this Laboratory has maintained close contact with the Dairy Instructors and Graders to assist them with chemical and bacteriological analyses for the purpose of effecting improvements of the conditions under which dairy-produce is manufactured throughout the Dominion. The number of samples dealt with during the past year is just above three thousand, which is a slight increase on last year's total. This figure, however, does not include over eight hundred milks on which the Resazurin test was done for the purpose of comparing it with other tests being applied to detect mastitis.

The major portion of the bacteriological work continues to be the testing of butter samples received from the grading-stores. The number dealt with shows an appreciable increase over last year, but there is still scope for a good deal more of this work. In order to make fortnightly examinations of samples from Lyttelton, the samples usually procured from New Plymouth were obtained for a period at fortnightly instead of weekly intervals. Two small batches were also procured from the Dairy-produce Grader at Gisborne. Although this work has been in progress now for several years, it has not been possible to arrange for regular testing of butter samples from the smaller ports.

During the winter an investigation was carried out for the purpose of improving the method of making the mould and yeast counts upon these samples. The micro-plate procedure used in the past for this purpose yielded figures which were considered to be not sufficiently accurate. An improvement was effected by using the Esmarch roll-tube technique for this test, so that the counts can be obtained by the use of a factor of ten instead of fifty. In addition to the greater accuracy with which low counts can be thus estimated, the resulting roll-tubes are very convenient to forward to the Instructors for the purpose of showing them to the factory staffs. Thus visible evidence can be produced of the difference between good and bad sanitary conditions within the factory. During the past season an increased number of examinations have been made of scrapings of butter procured from the outer layer of butter in contact with the parchment or parchfoil wrapping. These tests have brought to light a few cases where the wrapping-material or the conditions of packing in the factory left room for improvement.

An increased number of tests have been made upon samples of unsalted butter. Notwithstanding special efforts on the part of some managers to manufacture unsalted butter under the most hygienic conditions, the bacterial counts obtained have often been excessive. It would seem that the temperature to which the butter is chilled after packing and the temperature conditions of transport may be responsible for the higher bacterial content of unsalted butter. By the introduction of improvements of these factors, the possibility of bacteriological deterioration of unsalted butter may be appreciably decreased.

Although very occasional cases have occurred where lower-grade butter has been found to be of high bacterial count, no attempt has been made to relate the bacterial condition of the butter to its quality or grading. The emphasis has been placed rather upon the improvement of the hygienic conditions within the factories. For this purpose several bacteriological surveys have been made of cream, butter, and buttermilk from factories where various types of contamination persistently occurred. This work has focused attention upon the need for better methods of cleaning certain equipment, particularly the churns and the refrigerated vats in which the cream is held overnight. The cleaning of the latter is particularly difficult as the metallic surface of the vat is always maintained at a low temperature during the cleaning-operations. To get over this difficulty, successful experiments where the hot cleansing solution was fed by means of a small pump through the brush as it was actually being used for cleaning the surface of the vat have been carried out. With this device, and the provision of better light to enable the workman to see what he is doing, these vats can be kept in better condition.

During the past season some three hundred and fifty samples of starter from butter and cheese factories were tested for bacterial contamination. This number is rather fewer than were tested during the previous season, but the proportion of butter starters was rather higher, amounting to one-fifth of the total.

The increased number of butter starters examined has appreciably diminished the number of cheese starters dealt with. The increasing attention given to the care of starters during the past few years has led to a higher proportion of them being kept so that they are quite free from bacterial contamination. As too many are still found to be contaminated, it is desirable to do more of these tests than there has been time for during the past year. It is very satisfactory that the latest investigations fully support the view which has been advocated here for many years—namely, that a starter culture should be looked after in the dairy factory with at least as much care as it would receive in a bacteriological laboratory.

The testing of water samples from butter-factories has been continued, although the number dealt with has been rather fewer than during the previous season. In supplying the results of these tests an endeavour is usually made to advise factories as to the best method of improving their

water-supplies. It has frequently been observed that the water drawn from the chilled-water tank for butter-washing purposes is inferior in quality to the source of supply to the factory, results which emphasize the necessity for frequent cleaning of these tanks.

Further efforts have been made to determine the value of the Resazurin test for milk and cream grading under New Zealand conditions, but the amount of progress to be recorded is comparatively small. A paper describing the results of last season's work was prepared. It is hoped that during the coming season the Resazurin test can be tried out upon a much wider scale than during the past year.

The examination of dairy-produce for metallic contamination has continued to be the principal chemical work carried out in the Laboratory, but instead of dealing with an increased number of butter samples more time has been devoted to the testing of cream samples. On account of the higher proportion of protein material in cream, these are more troublesome to deal with than butter, and the tests usually take longer to put through. The wet-ashing method used for butter has been suitably modified to deal with cream so that reliable results can be readily obtained. To provide a basis for comparison figures are now available to indicate the copper and iron content of cream produced under conditions of minimum contamination. The extension of this work should enable attention to be drawn to both factory and farm plants which are in need of renovation to eliminate metallic contamination. This work may also shed some light upon the suggestion that certain types of equipment are more prone than others to give rise to metallic contamination and associated flavour defects.

The introduction of a regulation requiring dairy utensils and machinery to be coated with pure tin has involved some analytical work, with the object of determining what limits of lead contamination are permissible in the tin used for this purpose. Preliminary inquiries have also been made with the view to determining the thickness of such tin coatings, but a considerable amount of work still remains to be done.

During the past season the testing of butter for pH has been continued at the principal grading-stores. The variation in results from excessive acidity to excessive alkalinity revealed by these tests emphasizes the desirability of continuing to use them. The simple colour test applied in the grading-store has been found also to be capable of application in the butter-factories to the buttermilk. This enables the results of the work done in the factory to be demonstrated to those responsible.

The waters procured for bacteriological testing have also been subjected to a limited number of chemical tests. The information thus obtained has been useful as a basis for suggesting chemical treatment to improve the water-supply, especially to eliminate corrosion and render the water more suitable for factory washing-purposes. If more adequate facilities were available it would certainly be worth while to supplement the chemical testing in order to provide evidence about certain insidious types of pollution which may not be revealed by the bacteriological testing.

A matter to which some attention has recently been given is the condition of the balances and weights in use in the Graders' testing-rooms. The checking of these weights is at present in progress. It seems possible that certain improvements may be introduced which will enable greater accuracy to be obtained without sacrifice of the necessary speed of testing.

One matter which received some attention last winter was the investigation of cleansers and detergents which are in use in dairy factories. It is hoped to be able to continue with this during the coming winter.

During the year consideration of the proceedings of the Dairy Standards Committee has taken up some time, and several meetings have been attended. In this connection one or two minor investigations have been initiated. One of these is the selection of an oil and dye which can be readily standardized for the preparation of the red reader regularly used for the Babcock test upon cream and cheese.

A paper dealing with the chemical control of export dairy-produce was prepared for a chemistry conference, and this paper is likely to be published shortly. Mention has already been made of the paper published dealing with the Resazurin test. During last winter a large amount of time was devoted to the writing-up for publication of two papers dealing with the methods devised and used in the Laboratory during the past few years. One paper deals with the bacteriological testing of butter, while the other deals with the testing of butter for copper and iron contamination. Both these papers have been submitted to English scientific journals, and it is hoped that they will shortly be published.

In addition to the matters referred to above, a number of miscellaneous matters have been dealt with both by Laboratory analyses and also in the course of discussions upon various subjects which have arisen from time to time. Evidence is available that the work carried out has proved to be of use to the officers of the Division and to the industry.

Legislation.

As already mentioned, the consolidation of the Dairy-produce Regulations was completed during the year and came into operation on the 20th July, 1938. As now arranged they will be found to be much simplified, as they follow the production, manufacture, and marketing of dairy-produce from the farm to delivery from the grading-store, where it passes under the control of the officers of the Marketing Department.

Prosecution.

Only one prosecution was taken under the Dairy Industry Act during the past year, this being a charge of placing wrong churning-marks on certain boxes of butter, some of which contained moisture in excess of the legal limit. The decision of the Magistrate was in favour of the Department

Certificate - of - record Testing.

Despite a not altogether favourable season, entries for certificate-of-record test showed a slight increase over the previous year, while only a small falling off in average production was recorded.

During the calendar year 1938 first-class certificates of record were issued for 570 cows, as compared with 554 cows in 1937, 497 cows being in the yearly test division and the remaining 73 in the 305-day division.

The average production represented by first-class certificates in the yearly division was 504·70 lb. fat, a decrease of 7·98 lb. over the 1937 figure of 512·68 lb. fat. A slight decrease in average production was also shown in the 305-day test division, the average production for the seventy-three first-class certificates issued in this division being 451·13 lb. butterfat, as compared with 452·90 lb. for sixty certificates issued during 1937, a decrease of 1·77 lb. fat.

Government Official Herd - testing.

This branch of the Division's cow-testing service, which has been in operation for eleven years, continues to receive the steady support of certificate-of-record testing breeders. The Government official herd-testing year closes at the 30th September, and for the year ended at that date in 1938 some 2,184 cows were tested, an increase of 82 cows over the previous season's total of 2,102. The number of testing breeders represented was 203, in comparison with 207 for the year ended 30th September, 1937. Average yield figures are taken out on the basis of cows which milked for 180 days or more, and on this basis 1,986 cows qualified with an average production of 329·13 lb. butterfat from 6,693·3 lb. milk.

Since the commencement of the system 20,978 statements of seasonal production have been issued for 14,410 cows, 6,568 of which have been tested more than once.

Ordinary Herd - testing.

The Division still carries out " association own-sample " testing for a few small associations and a number of odd herds. The cows represented number about three hundred all told. The herd-testing work for the Dominion as a whole is now under the supervision of the herd-recording department of the New Zealand Dairy Board.

Staff.

During the year three of the Division's senior officers reached the age-limit for the Public Service of sixty-five years, and consequently were retired. These were Mr. William Dempster, Mr. Nicholas Fulton, and Mr. J. S. Fleming.

Mr. Dempster was Supervising Butter Instructor, and had served twenty-nine years with the Division, having joined the staff on the 1st December, 1909.

Mr. Fulton at the time of his retirement was Dairy-produce Grader at Castlecliff. His service with the Division dated from the 1st November, 1905.

Mr. J. S. Fleming, Divisional Clerk in the Division's Head Office, was appointed on the 14th October, 1901.

The death, on the 17th July, 1938, of Mr. J. W. Smith, removed a fourth senior officer from our staff. Mr. Smith joined the Division on the 1st October, 1922, and prior to failing health was dairy-factory Superintendent at Massey College.

Two new Dairy-produce Graders—namely, Messrs. A. D. Littlejohn and A. E. Pain—were appointed during the year, the former at New Plymouth and the latter at Wellington.

The Division's staff was further increased by the appointment of thirty-five Farm Dairy Instructors, these officers being necessary on account of the extension of the farm-dairy-instruction Service to a Dominion-wide basis. Seventy-seven officers are now engaged on this work.

Thanks.

The past year has been a particularly busy one, and thanks are due to the staff for assistance rendered. Thanks are also extended to the various organizations whose functions bring them in contact with our work and who have so courteously co-operated with the Division.

DIVISION OF HORTICULTURE.

REPORT OF W. K. DALLAS, DIRECTOR.

The Fruitgrowing Industry.

Although orchard operations during the 1938–39 season were somewhat hampered by the changeable weather experienced during the spring months, growers as a whole were able to carry out the necessary spraying and general orchard routine work.

Early in the season good crops of both pip and stone fruits were indicated in most of the commercial growing areas. Unfortunately, in Hawke's Bay high winds, which reached gale force during November, December, and January, materially reduced the crop in that district. Drought conditions which have prevailed throughout the Dominion since the beginning of January also seriously affected what otherwise would have been a heavy crop of both apples and pears through the failure of the fruit to size up properly, thus rendering a considerable quantity unsuitable for export purposes.

A redeeming feature, however, is that the dry conditions have resulted in the fruit being of very firm texture, and it should hold well both in cool storage and under ordinary storage conditions.

The stone-fruit crop was a particularly good one, especially in Central Otago, where heavy yields were secured.

Small fruits were very disappointing, owing, chiefly, to unfavourable weather, and the supply of both raspberries and strawberries to the factories was greatly reduced.

There was a considerable increase in the area under tomatoes. The crop was, however, slow in reaching maturity, due to cold and windy conditions prevailing. The presence of virus disease caused fairly large losses in some of the commercial growing districts.

Reports to hand indicate that the major orchard diseases and pests were kept satisfactorily under control. The continued dry weather was favourable to the development of codling-moth, leaf-roller caterpillar, bronze beetle, and apple leaf-hopper, and necessitated extra precautions being taken on the part of the grower to keep these pests in check. Dicky-rice weevil has been causing some concern to citrus-growers in the Avondale district, Auckland. A survey of the affected area has been made, and steps taken with the view of keeping this pest within bounds.

Fireblight has not caused any commercial loss during the year, any infections having been promptly dealt with.

At Coal Creek, near Roxburgh, Central Otago, a serious amount of damage was caused to a number of stone-fruit orchards by a heavy cloudburst in November, the rush of water uprooting trees and leaving an accumulation of boulders and other debris. Government assistance was promptly made available to the growers affected, and men were engaged clearing away the rocks, &c., and otherwise restoring the damage as far at is was considered economical to do so.

Growers generally are maintaining their orchards in reasonably good order. Equipment used both outside and in packing-sheds is up to date, and very few growers now lack first-class equipment. The general trend in spraying-equipment is to provide pumps of greater capacity and to improve the reticulation of orchard areas by using large-capacity pipes. The gradual change is tending towards greater efficiency in every direction and improved disease-control.

In general orchard-management growers are efficient and up to date, but could with advantage, as a general rule, devote more attention to a detailed thinning of the fruit crop. The lack of detailed thinning is evidenced in misshapen fruit, the greater range in sizes, and much of the undersized fruit which is harvested.

The season just ended has been a record one for citrus production, especially lemons. The monetary return to many growers has, however, been disappointing, and at times even fell below the cost of production. In these circumstances there was a tendency to allow large quantities of fruit to remain too long on the trees, and, when ultimately harvested, the keeping-quality had been greatly impaired and considerable loss incurred through internal breakdown and fungal rots.

The marketing of citrus fruit has been receiving the serious consideration of the Government for some time past, and the Internal Marketing Division will, as from the 1st May, 1939, purchase all lemons intended for commercial sale throughout the Dominion at a price determined from time to time by the Department.

Figures compiled from the orchard-registration cards indicate that the total area under citrus fruits is approximately 2,000 acres, comprising 1,200 acres lemons, 450 acres sweet oranges, 320 acres New Zealand grapefruit, and 100 acres other citrus.

The estimated production for the past season from commercial orchards was 144,000 cases lemons, 10,000 cases sweet oranges, and 40,000 cases New Zealand grapefruit (Poorman orange).

An *ex gratia* payment has been made to those growers at Kerikeri who suffered loss through the outbreak of citrus canker in their orchards last year, and appreciation was expressed for the Government's action in this regard.

A slight outbreak of citrus canker also occurred in January last in the Tauranga district. Prompt steps were, however, taken for the control of the disease, and no further outbreak has been reported.

Investigations recently made show that in the last few years a considerable decrease has taken place in the area in commercial orchards. The principal contributory causes have been neglect, unprofitable orchards, unsuitable localities, and uneconomic varieties.

The total area of pip, stone, and citrus orchards for the whole of the Dominion now stands at approximately 21,000 acres.

There has been no further extension during the year of passion-fruit culture in the North Auckland district. It was anticipated that some 50 tons to 60 tons of fruit would be produced, but it is doubtful if this quantity will be realized owing to the absence of proper cultural methods and neglect in the control of disease.

The asparagus trial plot of 1 acre in extent which was laid down on the Napier Lagoon reclamation some two years ago looks very promising in spite of a record wet winter.

It is anticipated that a light cutting of asparagus will be made next spring. Arrangements have been made for a further area of approximately 1½ acres to be planted, and, should the experiment prove satisfactory, it will indicate that a considerable portion of the 6,000 acres of the reclamation will probably be suited to this and other crops requiring similar conditions.

In connection with the Government subsidy on fruit sold on the local markets during the 1937–38 fruit season, the total amount paid to growers was £89,000. The subsidy applied in cases where the average market return for fruit was below the assessed fair average return.

In August last a conference of Orchard Instructors attached to the Division was held at Auckland, and many important matters affecting the work of the Division were discussed.

The opportunity was also taken for the holding of a refresher course in conjunction with the officers attached to the Plant Diseases Division of the Department of Scientific and Industrial Research.

Export of Fruit.

As a result of particularly good crops of fruit in all the commercial growing districts, with the exception of Central Otago, where the apple crop was severely damaged by frost, the 1938 fruit exports compared favourably with past records, being only some 12,000 cases less than 1934 and 33,000 cases below 1932. A record export season was experienced in Hawke's Bay.

The distribution of the fruit crop (apples and pears) to overseas markets was carried out under the jurisdiction of the New Zealand Fruit-export Control Board, and the total quantity exported for the 1938 season was 1,562,720 cases (1,455,707 cases apples and 107,013 cases pears). Of these, 1,060,185 cases apples and 83,326 cases pears were consigned to Great Britain, 169,778 cases apples and 547 cases pears to the Continent, 98,176 cases apples to North America, 77,859 cases apples to South America, 40,552 cases apples and 23,140 cases pears to Sweden, and 9,157 cases apples to the East.

In connection with the 1938 shipments, the Government guaranteed to the grower a c.i.f. return of 11s. (New Zealand currency) per case in respect of approved varieties of apples and pears graded and packed in accordance with the requirements of the fruit-export regulations for shipment to duly approved markets.

The prices realized for the fruit on the Home markets were somewhat disappointing. While the first shipments arrived in reasonably sound condition and met a fairly good market, the favourable opportunity offering could not be fully taken advantage of in regard to the main bulk of the fruit shipments owing to the fact that the fruit failed to keep for any appreciable time after being taken out of cool storage.

In view of the large consignments arriving, it was necessary to dispose of this fruit as early as possible after landing at prices below what could have been secured for sound fruit in which some weeks of storage life still remained.

As a result of the lower prices realized the calls on the guarantee were fairly considerable.

The following are the quantities of fruit (apples and pears) exported from the Dominion during the last five years: 1934, 1,574,912 cases; 1935, 1,065,420 cases; 1936, 1,228,286 cases; 1937, 944,753 cases; 1938, 1,562,720 cases.

Owing to unfavourable weather conditions it is doubtful if the total number of cases exported during the coming season (1939) will exceed the 1,000,000 mark.

The first of the season's fruit for overseas was shipped per m.v. "Waipawa," which left New Zealand on the 13th February, and consisted of 10,816 cases of apples.

Local Markets for Fruit and Vegetables.

As a result of the heavy crops harvested in 1938, it was anticipated that the local markets were likely to be over-supplied with fruit during the season, and this prediction was fully realized.

Prices obtained for pip and citrus fruits were on the average very low, and resulted in the Government paying out a considerable sum in the way of subsidy to those growers who complied with the conditions under which the subsidy was payable.

Though it cannot be said with any certainty that compulsory standardization has effected all that was desired in the first year of its operations, it can justly be claimed that a considerable improvement has been effected in the manner in which fruit has been offered for sale on the markets.

It was to be expected that after so many years of haphazard marketing there would be a considerable number of growers who would need to be educated in grading and packing, especially those who had no previous experience in this work for export. To meet the position, additional Inspectors were appointed. Where grading and packing faults occurred, Instructors visited the orchardists to help them, by demonstration and advice, to improve their pack.

The improvement in the general get-up of the fruit marketed, in branding of cases, and in the segregating of the fruit into standard grades has been the subject of much favourable comment from fruit-merchants, auctioneers, and fruit-retailers, and a desire that compulsory standardization should be continued is generally expressed.

As compulsory standardization to be effective necessitated compulsory inspection, the industry was called upon to provide the necessary revenue to defray the cost of the work, and provision was made whereby this was collected by means of an inspection-fee stamp to be affixed to packages of fruit before sale—a 1d. inspection-fee stamp to be placed on all bushel cases of apples and lemons and standard cases of pears, and a ½d. stamp on packages of smaller dimensions. The revenue received from the sale of fruit-inspection-fee stamps as at the 31st March, 1939, since the regulations came into force in March, 1938, was £7,814 9s. 8d.

Unfavourable weather conditions seriously affected the supply of vegetables during the winter and early spring months, and as a result high prices ruled, especially for green vegetables.

Notwithstanding the warnings given in the past, several cases of fraudulent packing or "topping" came under notice during the year which necessitated proceedings being taken against the offenders for thus contravening the fair-packing regulations.

Organization of Market-gardeners.

The recent legislation which brought market-garden employees under the labour laws as regards hours and wages revealed the necessity of better organization amongst the employers, and the proceedings of the 1938 annual conference of market-gardeners held in Wellington were devoted chiefly to this object.

The market-garden industry is not as well organized as some of the other primary industries, due, mainly, to the lack of sufficient organization and co-operation amongst producers. To complete the organization throughout the country and assist the growers to bring about improvements in the marketing of their produce, the Department made available the services of an officer to assist the industry in these matters.

The request of the Market Gardeners' Association for the setting up of an Advisory Board was also arranged, and several meetings of the Board have already been held. At quarterly meetings representatives from the main producing centres report progress and deal with the more important problems that have arisen. As a result of the work being done it may be expected that ultimately the present association will be more fully representative of producers and will take a greater part in the building-up and organization of the market-gardening industry.

Imported Fruit, Plants, etc.

The Fruit Inspectors attached to the Division at the main ports of entry were kept fully engaged in the inspection of imported fruit, plants, &c., and also with exports of produce, which showed a substantial increase on the previous year's figures.

Imports of citrus fruits from Australia, Jamaica, and California were higher, as were oranges and bananas from the Cook Islands and pineapples from Queensland. The bulk of the consignments arrived in satisfactory condition, and were clean and free from disease.

The fumigation of fairly large lines of grass-seed from Australia was attended to in accordance with the requirements of the import regulations.

Export of Vegetables, etc.

Owing to the drought in Australia, a considerable quantity of market-garden produce was inspected and passed for shipment to Sydney and Melbourne, as well as several large consignments of onions and potatoes.

Fruit Cold Storage.

The cold storing of fruit—a very important factor in connection with the fruitgrowing industry—has received a considerable amount of attention, with a view to extending the cool-storage facilities and effecting further improvements in cool-storage methods for the purpose of eliminating as far as possible wastage in land cool stores and in transit on board ship.

Work of an experimental nature was continued during the year in conjunction with the Department of Scientific and Industrial Research, and interesting results were obtained in connection with tests made in the use of all-round pads in the staining of pears; the influence of copper-sulphate wraps in controlling the spread of grey mould on Winter Cole pears; the condition required for the successful cold storage of pears, different varieties being used in the test; the effect of oil wraps as against plain wraps in the control of superficial scald in Granny Smith apples.

Considerable attention was given to the loading and stowage of fruit on overseas vessels, for the purpose of minimizing as far as possible the bruising of fruit through careless handling. In the cooling-systems operating on the older types of vessels extra care is necessary in the dunnaging of the fruit cargo, in order that an even distribution of air may be maintained throughout the holds.

Arrangements have been made for the carrying-out of further experimental work during the coming year, which includes the pre-cooling of pears prior to export, cause of post cool-storage discoloration of Granny Smith apples and soft scald in the Jonathan variety, efficacy of direct-expansion cooling versus forced air-circulation in relation to bloom and wilt of certain varieties of apples.

Instructional and Experimental Work.

Every endeavour has been made to comply with the numerous requests for advice on the many phases connected with fruit and vegetable growing and horticulture generally. The instructional work carried out by the field officers covers a very wide field and forms an important part of their duties.

The interests of fruitgrowers and others have also been further considered by the giving of public lectures and demonstrations in the different fruitgrowing districts, and in the conducting of classes in fruit grading and packing. The majority of growers are anxious to adopt up-to-date methods of orchard-management, and the opportunities thus given to increase their knowledge are, as a rule, taken full advantage of.

Research work in connection with the various problems affecting fruitgrowing has been continued during the year. The manurial and root-stock experiments are now nearing a stage when the data obtained should provide some useful information. This work is carried out in co-operation with the Department of Scientific and Industrial Research.

Other experiments include fruit-tree pruning, control of leaf-roller caterpillar, use of tree-banding materials for earwig control on stone-fruits, tests with various spraying-compounds for the control of orchard diseases and pests, and orchard cover-crops.

The Division is also co-operating with the Cawthron Institute, Nelson, in the carrying-out of tests for the control of internal cork in stone-fruits in Central Otago.

Viticulture and Winemaking.

The total area of vineyards in the Dominion is approximately 655 acres. With temperatures above normal in the spring, vines made an early start and set their fruit under favourable conditions. The early ripening period was very dry and cooler than is usual at that time of year, which resulted in late ripening. The latter part of the season was, however, warm and dry, the grapes profiting in sugar content and colour.

Outdoor table grapes—of which Albany Surprise is the main variety grown—yielded good crops, and met with a good demand at payable prices to the grower.

The season has been an exceptionally good one in regard to quantity, quality, and freedom from disease in both table and wine grapes, especially when compared with the past two seasons.

It is estimated the production of wine will be in the vicinity of 223,500 gallons, an increase of more than a third on last year's figures. As a result of the very favourable conditions, the wine produced should be superior in quality to that of recent years.

The bulk of the vineyards are kept in good order and condition, and reasonable steps are taken to control disease. The Vine and Wine Instructor has visited many vineyards during the year and has given advice and instruction to the owners relative to management of their vines for the control of disease, winemaking, &c. It is expected that a considerable improvement in the general management will eventuate.

The growing of grapes under glass still attracts considerable attention, and a gradual increase is taking place in the number of vineries erected. A good season has been experienced by growers of indoor grapes, and the market prices received are considered satisfactory.

Cidermaking.

There has been an increase in the quantity of apples utilized for cidermaking, the output of cider for the year being estimated at 55,400 gallons, which indicates an increasing demand for this product.

Te Kauwhata Horticultural Station (Lower Waikato).

Routine farming operations were carried out during the year—buildings and fences kept in repair and drains attended to.

The usual number of live-stock was kept on the Station for grazing purposes, sales of live-stock, wool, &c., amounting to £188 17s. 10d.

The dry weather conditions experienced during the late spring and summer months were very favourable to the growth and development of the grape crop, grape-growing and winemaking being the main activities carried out at the station.

The grapes, although late in ripening, were harvested in good condition, being practically free from grey rot (*Botrytis cinerea*), which causes considerable loss in moist seasons. Although rather early to give exact figures as to the vintage, it is estimated that approximately 19,000 gallons of wine will be produced.

The wines produced at the Station are increasing in popularity with the general public, a total of 12,512 gallons having been sold during the year, which realized £9,029. This represents some 2,000 gallons in excess of the previous year's transactions.

Considerable quantities of rooted vines and vine cuttings were disposed of during July and August in response to numerous orders received.

The financial position of the Station is satisfactory, receipts exceeding the general working-expenses by some £2,450.

Tobacco-culture.

The total area planted in tobacco commercially during the 1938–39 season was approximately 2,130 acres, the bulk of the area being in the Nelson District (Motueka). Of this total, some 75 acres were planted at the Pongakawa tree-planting settlement, Bay of Plenty, which is under the control of the Forestry Department. The tobacco-plants in the Nelson and Bay of Plenty districts have been adversely affected by the weather conditions experienced during the growing period, and it is anticipated the harvested crop will be considerably below the average.

As a result of the previous year's crop (1938) being a good one, a larger quantity of Nelson-grown leaf was available for export overseas, and some 202 tierces, of a total net weight of 171,995 lb., were forwarded to London in three separate consignments. Included in this quantity were 31 tierces (26,280 lb.) of Pongakawa leaf.

The first shipment went forward per "Zealandia" on the 16th August, and consisted of 49 tierces, containing a total net weight of 39,715 lb. leaf. This consignment arrived in reasonably good condition, and the prices realized were considered fairly satisfactory.

The second shipment of 103 tierces (90,200 lb.), was forwarded per "Port Jackson" on the 28th October; and the third consignment, of 50 tierces (42,080 lb.), per "Fordsdale" on the 10th December (included 31 tierces = 26,280 lb. Pongakawa leaf).

Unfortunately, it was found on arrival in London that the leaf in these latter two shipments was more or less damaged by an excess of moisture, and its condition was such as to be unacceptable to buyers. As it was considered it would be detrimental to the good name already established for New Zealand leaf on the Home market to endeavour to find a sale for this leaf elsewhere, it has been decided to have these two consignments returned to the Dominion for reconditioning and ultimate sale.

The bulk of the leaf exported was treated through the Proctor machine at the newly established Government tobacco reconditioning store at Motueka, which was officially opened on the 25th July last.

Hop-culture.

The 1938–39 season has been a trying one for the hop-growers in the Nelson District where the bulk of the crop is grown. Unfavourable growing-conditions experienced up to the end of December, followed by a prolonged spell of dry weather, greatly retarded the vines, and has resulted in the crop being a very light one. It is doubtful if the total production will be much in excess of two thousand bales, as compared with some four thousand bales for the previous season.

The following shows the quantities and values of hops exported from the Dominion during the past five years ended 31st March :—

	Cwt.	Value. £	
1935	3,627	26,522	
1936	3,436	22,684	
1937	4,258	28,495	
1938	1,856	12,385	
1939	2,814	17,042	(1938 season crop).

Royal New Zealand Institute of Horticulture.

The New Zealand Institute of Horticulture, now known as the Royal New Zealand Institute of Horticulture, has been concerned with various matters of considerable importance to horticulture and fruitgrowing during the year.

A matter which created much interest was the holding of Horticultural Week and the National Horticultural Show at New Plymouth in January last. This included the annual conferences of the Horticultural Trades' Association, the Seedsmen's Association, the Association of Superintendents of Parks and Reserves, and of the Royal New Zealand Institute of Horticulture.

An outstanding remit at the Institute Conference was one advocating the production of more vegetable and flower seeds in the Dominion which received a very considerable amount of support, and a committee composed of seedsmen and growers was set up to consider ways and means of carrying out the proposal.

The annual examinations of the Institute attract a good type of student, and indicate that the efforts of the Institute in this connection cannot fail to be rewarded by a general raising of the standard of horticultural achievement in the Dominion.

The Loder Cup for 1938 was awarded to Mrs. Knox Gilmer, Wellington, whose outstanding interest in encouraging the protection and cultivation of the New Zealand flora is so well known.

Bledisloe Silver Challenge Cup.

The above-mentioned cup was originally presented by Lord Bledisloe, during his term of office as Governor-General of New Zealand, to the New Zealand fruit industry for competition at the Imperial Fruit Show, Southern Hemisphere, held in London. This section of the Imperial Fruit Show was discontinued some five years ago, and Lord Bledisloe agreed to allow the cup to be competed for at the autumn national shows of the Auckland, Wellington, Canterbury, and Dunedin Horticultural Societies.

The competition is for a special class of two cases of apples packed and finished as for export—the variety to be selected by the Society holding the competition and only that variety is allowed to be exhibited.

The last competition took place in connection with the Wellington Horticultural Society's Autumn Show held in Wellington on the 27th April, 1938, and the cup on that occasion was awarded to Mr. J. R. Laing, Riverside Orchard, Clyde, Otago.

Registration and Inspection of Nurseries.

A total of 534 nurseries were registered during the year and certificates of registration issued, the registration fees amounting to £534.

In the case of nursery stock, it is most important that it should be well grown and clean and free from disease. In this regard reports to hand indicate that a high standard is being maintained by the majority of nurserymen.

With the view of inculcating the importance of maintaining an up-to-date system of nursery-management generally, a closer inspection was made during the year by the field officers attached to the Division of all nurseries in their respective districts. This has resulted in an improvement being effected in those nurseries where a certain amount of slackness in disease-control, &c., was noticeable.

Orchard Registration and Orchard-tax.

The usual work connected with the registration of orchards and collection of orchard-tax has been attended to.

As is usual with orchard properties, a considerable number of changes of ownership took place during the year.

Registered orchards in the Dominion now stand at 4,653, made up of 2,481 taxable orchards and 2,172 non-taxable.

Orchard-tax payable for the year amounted to approximately £2,114, inclusive of penalty for late payment. This shows a slight decrease as compared with the previous year's figures, and is due to a reduction in area through the cutting-out of neglected or otherwise unprofitable trees.

The usual allocation of the tax collected, less cost of collection, was made to the New Zealand Fruitgrowers' Federation, Ltd., and the Department of Scientific and Industrial Research.

The collection of fireblight-tax, which operated in three of the commercial fruitgrowing districts, was also dealt with.

The Beekeeping Industry.

Beekeepers were unfortunate in experiencing another poor season. It was hoped that there would be a continuation of the conditions which existed in 1937–38, when the honey crop was the best for several seasons past. This, however, was not to be, the unfavourable weather experienced during the past season resulting in very poor crops being obtained in all the commercial beekeeping areas with the exception of Hawke's Bay and Canterbury, where the returns were slightly above the average.

As is usual in a poor season, the quality of the honey was below the usual standard, white honey being in very short supply.

The bringing into force of regulations bearing on orderly marketing and stabilization of prices has been well received by beekeepers throughout the Dominion, the majority of whom appear to be satisfied with the system of marketing through the Internal Marketing Division.

As a result of the placing of the industry on a sounder basis considerable extensions are being made to existing apiaries, and numerous inquiries have been received during the year from persons desirous of taking up beekeeping as a means of livelihood.

The affording of advice and information on up-to-date beekeeping methods and control of disease has been a feature of the work of the Apiary Instructors in their respective districts. Reports to hand indicate that the bulk of the apiaries are run on up-to-date lines, and satisfactory steps are being taken in the control of foul-brood disease.

The quantity of honey graded for export at the different grading-stores amounted to a total of some 10,350 cases (120 lb. each). This was more than double the quantity of the previous year (1937), and was due to the fact that the 1938 season was a particularly good one.

In October last arrangements were made for all honey for export to be graded at a central grading-store at Auckland.

The quantities and value of honey exported from the Dominion during the last five years ended 31st March are as follows :—

	Cwt.	Value. £	
1935	5,427	17,844	
1936	10,446	34,258	
1937	7,774	24,658	
1938	3,804	12,658	
1939	14,298	42,605	(good season 1938).

Registration of Apiaries.

The registration of all apiaries in the Dominion, which came into force in October, 1937, has enabled a purge to be made of the old registration cards, which has revealed that a considerable percentage of previous registrations do not now exist.

This has been brought about by the fact that a large number of persons who owned only a few hives had, for various reasons, discontinued keeping bees, and in other cases hives had been destroyed on account of disease or neglect.

The total number of beekeepers now registered is 4,751, representing a total of some 113,465 colonies of bees.

STAFF.

Thanks are due to all officers of the Division for their loyal and enthusiastic co-operation during another busy year.

With the decentralization of the control of the staff of the Division which took place in October last, the Dominion was divided into four separate districts, each being placed under the charge of an officer designated "District Supervisor, Horticulture Division," who is responsible, except in certain specified cases, for the direction and supervision of the duties and services undertaken by all officers in his particular district.

For the short period during which it has been operating the new arrangement is working quite smoothly, and should result in more immediate control and greater efficiency than can be exercised from one central office.

New appointments to the staff of the Division during the year included Mr. A. A. Powell, Cool Storage Officer (*vice* Mr. R. Sutherland, deceased); Mr. D. K. Pritchard, Assistant Horticulturist; Mr. B. W. Lindeman, Vine and Wine Instructor (*vice* Mr. J. C. Woodfin, shortly retiring).

Mr. W. T. Goodwin, who was seconded to the Cook Islands Department as Director of Agriculture, Rarotonga, for a period of three years, returned to the Dominion and resumed his duties as Assistant Director of the Division in August last.

It is with the deepest regret that I have to record the death during the year of Mr. J. A. Campbell, former Director of the Division. During his long association with the Department Mr. Campbell rendered invaluable assistance in the interests of the fruitgrowing, horticultural, and beekeeping industries in the Dominion, and his passing away was a very distinct loss to the general community.

CHEMISTRY SECTION.

REPORT OF R. E. R. GRIMMETT, M.Sc., F.N.Z.I.C., CHIEF AGRICULTURAL CHEMIST.

Staff.

The Staff at Ruakura concerned with facial-eczema investigations has been strengthened by the stationing there of Dr. R. J. McIlroy on his return from post-graduate studies in England and by the appointment of additional assistants.

Mr. R. J. Lancaster has been stationed at Lincoln College to undertake part of the chemical work on Canterbury pastures in connection with lamb-mortality research.

Towards the end of the year it was decided to transfer the majority of the Chemistry Section staff to the Animal Research Division at Ruakura. Plans for the new laboratory buildings are being drafted.

In this, the final report of the Section, I desire to express my appreciation of the notable spirit of co-operation and enthusiasm shown by all members of the staff. Long hours have voluntarily been worked and holidays sacrificed to secure continuity and success in the heavy programme of chemical investigations undertaken.

Animal Health and Nutrition.

Cobalt Deficiency.—Over 550 pasture samples, 135 animal organs, and various soils, limonites, limestones, and cobaltized superphosphates have been analysed.

Pastures.—A number of pastures submitted for analysis in cases of suspected cobalt deficiency gave low cobalt figures and were diagnosed as cobalt deficient (below 0·08 p.p.m. cobalt in the spring and summer months). Further extension of the cobalt survey of North Island pastures has been made, and special attention has been devoted to seasonal variation in the cobalt content of pastures. Pasture cobalt tends to be at a minimum in late spring and early summer and at a maximum in winter or after prolonged drought.

Analyses of pastures from cobaltized superphosphate topdressing experiments have shown a high initial uptake of cobalt but later a rapid fall, especially during the period of flush growth. The experiments themselves, however, have been outstandingly successful, and further demonstrate the efficacy and practicability of this method of treatment for the cure and prevention of bush sickness.

Soils, &c.—Analyses of several New Zealand ultrabasic magnesian rocks gave figures from 67 to 115 p.p.m. cobalt. Some North Auckland lateritic soils associated with cobalt-deficient pastures show figures as high as 10 p.p.m. for total cobalt, but the cobalt present appears to be relatively insoluble, even in strong acid. Owing to the occurrence of cobalt deficiency in the Wairarapa on a paddock built up of a fine limestone wash, analyses of typical limestones were carried out. Some low figures were obtained, the amounts ranging from 0·2 to 5·1 p.p.m. cobalt.

Animal Organs.—The average cobalt content of the livers of bush-sick sheep is about 0·04 p.p.m. cobalt or less, but for healthy animals more than 0·10 p.p.m. For cattle beasts a similar difference has been observed. There is no evidence of copper deficiency associated with bush sickness in the North Island.

Facial Eczema.—During the extensive outbreak of facial eczema in the Waikato in April arrangements were made for collecting large samples of pasture from fields believed to be still active in causing the disease. Unfortunately, it proved very difficult in practice to secure samples fulfilling this condition. The best of the material secured was treated according to Rimington's method for the separation of icterogenin, which it was suspected might be the active factor causing liver derangement. The results showed that icterogenin was not present in amounts capable of detection by the method employed. Among the conclusions that may be drawn, those of importance to the chemist include (1) the pasture may have passed its active phase when collected; (2) an icterogenic substance, but not icterogenin itself or necessarily related chemically to that compound, may be present; (3) toxin may be formed after the pasture has been eaten by the animal.

Progress could not be anticipated unless pasture, rumen contents, or other material of ascertained icterogenic activity were available. As, however, a number of large-scale carefully controlled animal-stocking experiments were being instituted at Ruakura Farm and at Gore's farm, it was decided to follow up resultant changes in animal health (if any), changes in botanical composition, and changes in growth stage, growth rate, succulence, &c., with chemical analyses of the pastures at frequent intervals. The objects were generally to provide as complete data as possible to assist in the interpretation of the results of the animal experiments, and particularly, should facial eczema occur in any of the groups, to help in furnishing a clue as to the most promising avenue for further specific chemical work.

About sixteen paddocks have now been sampled regularly each fortnight for over six months, variations being made from time to time to fit in with changes in the stocking or pasture-management. At the close of the first season's work the whole of the data will be assembled and considered in relation to planning further experiments. The routine chemical determinations include dry matter, phosphate, lime, non-protein and total nitrogen, sugars, cellulose, lignin, chlorophyll, and carotene.

Containers and supplies of alcohol have been distributed to Veterinarians in districts where an outbreak of facial eczema seemed possible this autumn. Some large samples of suspected toxic grass preserved in alcohol have already been received from the Gisborne district and are being subjected to fractionation preparatory to feeding experiments at Wallaceville. Rumen and abomasum and intestinal contents of affected sheep have also been received for resolution into alcohol-soluble and alcohol-insoluble fractions for toxicity experiments by the Veterinary Laboratory.

Several bulk samples of pasture from cocksfoot experimental plots at Marton have been received for lipid constituents, including glycerides, waxes, and phosphatides. The proportions of these constituents have been shown not to vary greatly over the period of observation, and study of their composition is at present in progress. Knowledge of the lipid (ether soluble) constituents of grasses is important for the recognition of abnormalities in the composition of pasture collected from facial-eczema paddocks.

Investigation has been commenced of the yellow pigment responsible for discoloration developing in certain sheep carcasses after the animals had been slaughtered and kept in cold storage.

Concurrently with the pasture analyses a programme of soil moisture, nitrate, and ammonia determinations has been carried out on certain of the experimental paddocks. A feature that has emerged and which greatly complicates the work is the extreme variation in soil nitrate found at intervals of a few hours throughout a single day. This may change from a level as low as 10 p.p.m. in early afternoon to one of 80 p.p.m. two hours later.

Lamb Mortality: Canterbury.—As part of a co-operative scheme, chemical analyses are being carried out at fortnightly intervals on pasture samples from several farms in Canterbury which are under close observations by veterinary and fields officers. The same analytical programme is adopted as for the facial-eczema pastures, some useful comparisons being thereby made possible. The soils have also been submitted to the usual conventional analysis. As many factors such as weather conditions, handling of stock, parasitic infestation, &c., affect the incidence of lamb mortality, the significance of chemical work cannot become apparent until much data from various aspects has been assembled over several seasons.

Reporoa.—The investigation into alleged poisoning of live-stock from arsenic naturally occurring in soils and waters (see annual report for 1937–38) has been continued and a comprehensive report submitted to the Lands Department. This includes a map and tables showing the distribution of arsenic in soils, muds, and waters; ante- and post-mortem notes and figures for arsenic in the organs of some thirty-one cases of live-stock mortality; the arsenic content of series of urine samples both from healthy and ailing animals; the arsenic content of pasture samples and accounts of experiments conducted with cattle at Reporoa and Wallaceville. Sixty-five samples of muds and soils were collected. Muds varied in arsenic content from 0·0068 per cent. to 1·9 per cent. of As. Representative samples of the whole soil to 9 in. depth in pasture lands varied from 0·0008 per cent. to 0·525 per cent. of As. Thirty-nine samples of water from springs, streams, and surface depressions showed amounts varying from a trace to 2·6 grains of As_2O_3 per gallon. Arsenic in the mud deposits was present in different places, either in combination with iron in impure limonite (the arsenic readily soluble in dilute acid) or as sulphide combined with sulphur (insoluble in dilute acid). In some places up to 5 per cent. of orpiment and realgar was found in orange-yellow siliceous deposits.

Farmers were advised as to likely sources of arsenic intake on their farms so that they might take measures to minimize danger to stock.

The evidence from the live-stock experiments and the analyses of organs of dead animals, and of urine and other samples from live animals both healthy and ailing, is too complex for brief summary, but is being published in a technical journal.

The general finding was that arsenic is of widespread occurrence in the spring and drainage waters and the soils of the lower-lying portions of the Reporoa Settlement but that it is only responsible for a small annual mortality, together probably with a further but undefined amount of unthriftiness in live-stock.

Clean-growing pasture on arsenical soil contains normally too little arsenic to have any toxic effect, and crops such as oats are also harmless.

Farmers are recommended to fence off areas where arsenical springs occur or where the mud along stream edges or in depressions is strongly arsenical, to provide safe water, and not to graze recently flooded areas while the pastures are still muddy. It is considered that they will then have little trouble from arsenic poisoning.

Carcass Quality of Bacon Pigs.—As part of a series of feeding experiments undertaken at Ruakura to determine the influence of restricted feeding and the use of various supplements on the quality of bacon-pig carcasses, a large number of analyses of carcass fats have been carried out. The work includes the determination of the iodine value of the fat as an index of degree of saturation of the fatty acids and therefore of hardness, and quantitative determinations of the constituent fatty acids by distillation at low pressure.

Standards for Trace Elements in Pastures.—In co-operation with the Cawthron Institute and the Dominion Laboratory, work has been commenced to obtain some quantitative data on the occurrence of a number of elements which are present in traces in many pastures and in animal tissues but of the function of which, if any, little is known. Naturally healthy and productive pastures have been selected in several localities, and by means of movable enclosures clean samples are being obtained several times a year.

Cobalt and some other determinations are being made by chemical methods, and the samples are then handed over to the Dominion Laboratory for spectrographic analysis of the ash.

Grass Staggers.—During the short period in the spring when grass staggers was reported as prevalent an attempt was made to discover if the chemical composition of the pastures was influencing the course of digestion in such a way as to diminish the assimilation of magnesium. Studies were made of the acidity-alkalinity (or pH), and the content of soluble magnesium of the fresh contents of the alimentary canal in several cases where animals suffering from grass staggers were killed. No conclusions can yet be drawn as the number of cases available was too limited. It is hoped to continue this work next spring.

Feeding-stuffs.—Further analyses have been carried out on various types of meat and other feeding meals, and in conjunction with the Standards Institute progress has been made towards the adoption of standards for pollard and for meat-and-bone meals. The standard for pollard is now under circulation in draft form. Meat-meals have also been analysed in connection with feeding trials at Ruakura.

Owing to the interest lately taken in America in the use of seaweeds (kelp-meal) for supplementing protein rations in the feeding of farm animals, and particularly as a shipment of kelp-meal had been imported to New Zealand and was being sold for pig and poultry feeding, it was considered desirable to ascertain something about the composition and feeding-value of some of the commoner New Zealand seaweeds. Through the co-operation of the Chief Inspector of Fisheries a dozen or so representative samples of different species of sea-weeds have been obtained from the beds, chiefly on the Kaikoura coast. As soon as the analyses are completed it is intended to secure and grind sufficient supplies of one or two of the most promising and hand them over to the Veterinary Laboratory for small-scale feeding trials.

A number of different imported lines of fish-liver oils have been sampled by officers of the Live-stock Division and determinations of the vitamin A content carried out. In one or two cases values below the B.P. standard for cod-liver oil were obtained, but generally the results were satisfactory.

Vitamin A Content of Butters.—Samples have now been received covering a complete year from a number of different districts. Analyses for carotene and vitamin A in the separated fats are proceeding.

Toxicological.—Zinc: Experiments on the toxicity of zinc lactate when fed to young pigs have been continued at Wallaceville and analyses of the organs performed as required. Further papers on this subject are awaiting publication.

Arsenic: Besides the extensive investigations at Reporoa, a number of more usual cases of arsenic poisoning have been reported on. Several of these have resulted from the use of arsenical weed-killers, and a warning should again be sounded as to the dangers attending this practice.

Tutu leaves have been found in quantity in the ingesta from two suspected cases of poisoning, and taxine was found in a case of yew poisoning.

Ranunculus rivularis, or "Waoriki," suspected as poisonous, was fed to a sheep at Ruakura. The animal died, and post-mortem examination showed evidence (ulceration) of an irritant poison.

Samples from Fields Division Experimental Areas.

Pasture samples from mowing and L.P.K. trial plots and irrigation areas have been analysed for dry matter, lime, phosphate, &c. A considerable volume of this work has been carried out at Ruakura. Swede varieties and sugar-beet trials have been responsible for numerous samples.

Soils.

A considerable amount of time has been taken up with the nitrate and other investigations in connection with facial eczema, already dealt with under that heading. This has also involved, however, some investigation of methods of sampling and storing soils to avoid changes in such labile constituents as nitrate and ammonia, which changes may be serious even in the short interval before the samples can be transported to the laboratory. Toluene has been found ineffective in stabilizing the nitrate. Even temperatures as low as −10° C. have not entirely prevented changes in nitrate, especially in samples from the surface inch of soil.

Mineral Deficiencies.—Newer methods of estimating the manurial requirements of soil have been studied—in particular, Egner's lactate method for estimating available phosphate. Modifications in the original technique have been found necessary. The indications of various chemical methods of examination and of field responses have been compared on a variety of soils, and this work is being continued. The effect of phosphate "fixation" on field response has been taken into account. Egner's method shows considerable promise.

Of the soils sent in for examination, the usual trouble was phosphate deficiency. Certain South Island soils show a very high phosphate content when extracted with 1 per cent. citric acid but a deficiency according to the lactate method. It has not been ascertained as yet which is the truer test.

Lime Requirement.—The assessing of lime requirement by means of buffer curves has been used in place of Hutcheson and MacLellan's method. Results from the two methods are in fair agreement. The buffer-curve method is superior, in that lime dressings can be prescribed for any desired pH. Also, the scope of the curve gives an idea of what effect can be expected from small dressings. The sensitiveness of the method to small differences in temperature is a disadvantage.

Other work during the year has been concerned with the reclamation of the Napier Lagoon and of estuarial areas in Hokianga Harbour and at Glorit, transference of fertility by stock, the effect of repeated top-dressing on the mowing and grazing trials at Ruakura, soil-moisture determinations in connection with barley trials, and the analysis of miscellaneous samples such as orchard soils, soils in connection with liver-fluke investigations, and muds from a survey of Lake Tuakitoto (with a view to reclamation). Samples of the deposits from this lake were decidedly acid (pH 4·7 to 5·9), well supplied with potash, but deficient in phosphate. Mechanically they varied from fine sandy loam to clay.

An article on the reclaimed soils of Ahuriri Lagoon was published in Bulletin No. 70 of the Department of Scientific and Industrial Research.

An investigation was commenced for the Fields Division into the relationship between field responses in L.P.K. manurial trials and the results of soil analysis and analysis of the herbage from the different treatments. The portion dealing with the soils has been published, but the pasture analyses are not yet complete.

Fertilizers and Limestones.

The usual routine testing of fertilizers and lime supplies and consultation with the respective administrative officers has been continued. Small-scale trials have been commenced of the manufacture of magnesium-silicate superphosphate, using ground serpentine as a reverting-agent with unmatured superphosphate, with a view to reducing phosphatic fixation on certain soil types such as ironstone soils.

Waters.

Water samples have been analysed in connection with irrigation supplies and reclamation projects, wool-scouring works, liver-fluke investigations, and for stock supplies.

Miscellaneous.

Special investigations include the identification and determination of phenol in honey for export rejected on account of taint (up to 3·8 p.p.m. of phenol was found), determination of the amounts of arsenic remaining after several weeks in fleeces from sheep treated with dips for blow-fly control, determination of manganese in citrus leaves from a suspected case of manganese-deficiency chlorosis, and the checking of moisture and methods for its determination in export tobacco.

The periodical checking of cattle-dips, meat-marking fluids, &c., has been continued. Supplies of cobalt sulphate and cobaltized salt have been prepared and distributed for sale to farmers. A number of stock-remedies have been analysed and reported on.

All meetings of the Standards Institute Chemical Committee were attended.

Chemical Control of Ragwort.

Mr. F. B. Thompson, Agricultural Chemist at Ruakura, reports as follows:—

"At the commencement of the year under review it was known that sodium chlorate and various proprietary chlorate compounds were the most efficient weedkillers for ragwort control, and that small applications would kill the foliage and crowns but only the tops of the roots, while large doses would kill all the roots, the incompletely killed roots being each capable of regenerating a new plant.

"The earlier experiments indicated that the Ruakura ragwort nursery was unsuitable owing to the abnormal root-development under cultivated conditions. In the absence of suitable ragwort growing naturally on Ruakura Farm, a comprehensive series of field trials were laid down on a farm near Putaruru. These trials were to determine the quantity of chlorate required to produce complete root kills, the best method of application, and optimum seasonal and weather conditions. Treatments were made through 1938 on plots each 16 square yards with a heavy infestation varying from fifteen to thirty ragwort plants per square yard.

"Sodium chlorate was applied, both as a spray and as the lime-chlorate dust, at the rate of 37, 75, 150, 300, and 600 lb. per acre, the material being applied evenly all over the plots. Practically all the existing plants were killed, and the efficiency of the treatments was judged by the absence of small plants growing from incompletely killed roots. The results were masked by numerous seedlings from seed already on the ground and not destroyed by the chlorate. Counts were made by going over portions of the plots inch by inch inspecting the roots of each plant to distinguish between seedlings and root regrowths.

"The results suggest that winter applications are the most effective. This is probably due to the combined effects of frost and sodium chlorate. In February, 1938, during several days of heavy rain, sodium chlorate was sprayed on a series of plots. A month later, during the middle of the drought in March, another series was treated. The counts of root regrowths were—

"Wet conditions: 2·2 per square yard (average of twenty-nine).

"Dry conditions: 5·3 per square yard (average of nineteen).

"Two similar series were treated with chlorate applied as the 5 per cent. lime-chlorate dust. The wet-weather application was made in May, and the dry in February at the beginning of a six weeks' dry spell:—

"Wet conditions: 0·6 regrowths per square yard (average of nine).

"Dry conditions: 4·6 regrowths per square yard.

"Plots were sprayed with sodium chlorate using various volumes so that the solution strength varied from 0·5 per cent. to 10 per cent. This was repeated using different quantities per acre. No significant variations were found in the results.

"Sodium chlorate was compared with three proprietary weedicides. All four materials gave substantially similar results, whether applied as a spray or the dry dust, under both wet and dry weather conditions.

"Applications of 300 lb. or more per acre cause a reduction in the clover and an increase in the Yorkshire fog on the plots.

"Seedling infestation after chlorate treatment was remarkably heavy. Some of the plots averaged over three hundred plants per square yard, but the usual figure was about thirty.

"The Putaruru experiments entailed the examination of the roots of 6,300 plants on a total area of 98 square yards.

"An experiment at Mamaku State Farm confirmed the superiority of chlorate compared with dichromate, thiocyanate, and bisulphite weedkillers. Another Mamaku experiment is designed to determine the effect of treatments on individual plants at various times throughout the year and the toxic dose per plant. Progress reports indicate that the amount will be about 3 grams or 4 grams. Plants in Ruakura pasture have been completely killed by 5-gram doses.

"Experiments in the Ruakura nursery indicate that injections of chlorate into the soil or applications on the soil surrounding the plants are not as effective as those applied to the foliage in the usual way, that dilution of the spray has little effect and that the seed from flowering plants sprayed with 2½ per cent. and 5 per cent. sodium chlorate has a germination of 10 per cent. to 20 per cent., compared with 50 per cent. to 80 per cent. in unsprayed seedheads."

Samples Received for Analysis, 1938–39.

Wellington Laboratory—			
Pastures for trace elements	448		
Animal organs for trace elements	137		
Pastures for mineral analysis, &c.	281		
Toxicological specimens	248		
Milks and urines (arsenic investigation)	121		
Stock-foods	32		
Pig-fats	56		
Butters	141		
Fertilizers	53		
Soils	491		
Limestones	150		
Field crops	49		
Sugar-beets	111		
Waters	84		
Stock-remedies	10		
Seaweeds	13		
Canterbury sheep survey pasture extracts	60		
Thyroids	8		
Dips	5		
Limonites	2		
Miscellaneous	109		
		—	2,609
Ruakura Laboratory—			
Pastures—			
Fields Division plots	404		
Facial eczema—general	301		
Facial eczema—rate of growth	102		
Soils—			
Facial eczema—moisture	202		
Facial eczema—nitrate	162		
Ragwort	14		
Viscera	22		
Curds	15		
		—	1,222
Total			3,831

NAURU AND OCEAN ISLANDS PHOSPHATE.

REPORT OF SIR ALBERT ELLIS, Kt., C.M.G., NEW ZEALAND COMMISSIONER, BRITISH PHOSPHATE COMMISSION.

Details of operations at Nauru and Ocean Islands for the nineteenth year under Government ownership are supplied herewith.

Shipments compare with the two previous years as follows :—

	1936–37. Tons.	1937–38. Tons.	1938–39. Tons
Nauru	577,600	836,250	924,250
Ocean Island	429,000	329,850	300,267
Total	1,006,600	1,166,100	1,224,517

The totals for the two former years established successive records considerably above any previous year, and it is confidently expected that another record will be set up by the current year's work. Actually 1,077,300 tons had been shipped up to 6th June.

The distribution of shipments for the three years is as follows :—

	1936–37. Tons.	1937–38. Tons.	1938–39. Tons
United Kingdom	17,225	15,650	61,500
Australia	683,475	771,150	818,020
New Zealand	243,400	290,300	293,047
Other countries	62,500	89,000	51,590
	1,006,600	1,166,100	1,224,517

The proportion of output coming to New Zealand is 23·93 per cent. for the current year, as compared with 24·18 per cent. in 1936–37 and 24·9 per cent. in 1937–38. The Dominion's requirements throughout the year have been fully met, and the somewhat reduced shipments are owing to a falling off in demand through various causes, the principal one being seasonal conditions. It is anticipated that consumption will again be on the upgrade next season.

During the year under review very favourable weather for operations was experienced at the Islands, though an unusually prolonged drought caused exhaustion of fresh water supplies, necessitating a heavy call on the condensing-plants. A number of shipments of water from down south materially helped to tide over the emergency. There have recently been useful falls of rain, and the position as to fresh water has eased up. Throughout the year the health of the Island staffs and labourers has been good, and there have been few labour troubles.

The mining, transport, artificial-drying plants, &c., have rendered excellent service at both Islands, and the shipping arrangements have met all requirements. Loading an 8,000 ton vessel at Nauru cantilever in the daylight hours of one day is now quite a common occurrence. In view of the expanding demand for phosphate, further plant is being installed.

The Commission's m.v. "Triaster" and s.s. "Triona" continue to make fast trips between Australia and New Zealand and the Islands, the former having now delivered a total of forty-seven cargoes and the latter eighty-one in the two countries, besides doing any necessary mooring and labour-recruiting work at the Islands. The m.v. "Trienza" and "Triadic," sister ships owned by the Commission with a carrying-capacity of 9,300 tons, entered the trade in April and July, 1938, and, making fast trips, have already delivered fifteen and eleven cargoes respectively.

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