1932.

NEW ZEALAND.

DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT FOR 1931-32.

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

Wellington, 27th September, 1932.

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, 1932.

Perusal of the report reveals a great volume of effective work for the betterment of the various agricultural industries, although handicapped by rigid economies necessitated by the continued financial stringency. The policy of the Department in closely linking the advisory field services with its current scientific research work must be largely credited for the satisfactory results recorded.

The maintenance of primary production at a high level generally, in face of abnormally difficult weather conditions which prevailed over large parts of the country during the season, is worthy of special note, bespeaking as it does the qualities of hard work, skill, and tenacity among the great body of our farmers. These results were achieved, moreover, under the naturally depressing influence of low prices and declining returns. In too many cases the farmer's best efforts have been unable to bridge the gap between costs and receipts.

Those sections of our pastoral industry represented by meat and wool are bearing the brunt of the price fall, and this is largely responsible for a disquieting feature of the present position. I refer to the marked shrinkage in the country's sheep stocks during the past two years. The extremely low price of wool, in particular, has obviously led to heavy overselling of sheep and lambs for the meat trade by farmers compelled to realize in the effort to meet their financial commitments. The dairy industry, fortunately, has been hit less hard, and at present constitutes a particularly valuable factor in the export trade, which forms such an essential part of the Dominion's financial structure.

The fruitgrowing industry continues to steadily expand its commercial production, and the results generally, aided by the support accorded by the Government guarantee on exports of apples and pears, are most encouraging. Measures were taken this year to further safeguard the Government's liability under the guarantee, at the same time strengthening the self-dependence of the industry, and it is proposed to carry this policy a step further during the coming season.

The Government is fully alive to the vital necessity of maintaining primary production and keeping farmers effectively on the land, and is employing all available resources for this purpose. Among special measures taken may be mentioned subsidies on fertilizer manufacture and railage, and extended rural credit facilities, together with legislation for mortgagors' relief and rent and interest reduction. The recently launched Small-farm Plan is also largely designed for a similar end, and it is thus fitting that the Department of Agriculture should have been entrusted with the task of obtaining land and settling men under this scheme.

The outlook is not without encouraging features. The reactions of the Imperial Economic Conference at Ottawa may be expected to manifest themselves appreciably before long, and there is hope that further developments on wider lines towards price-level restoration may follow. The generally improved tone in the Mother-country is another favourable sign, and New Zealand agriculture will more than welcome any definite betterment in its great consuming market.

I have, &c.,

CHAS. E. MACMILLAN,
Minister of Agriculture.

His Excellency the Governor-General.

REPORT OF THE DIRECTOR-GENERAL.

Wellington, 31st July, 1932.

The Hon. the Minister of Agriculture,—

I beg to submit the following report on the work of the Department for the year ended 31st March last, including the usual Division reports and statement from the Phosphate Commissioner, also detailed reports on activities of the Chief Chemist, the Plant Research Station, and the Veterinary Laboratory.

The Agricultural Position.

Consequent upon unfavourable conditions in 1931, the continued increasing production which has been so noticeable during the past few years was checked to some extent. However, except in the case of arable crops, which showed a marked falling-off, the average yield per acre being much below normal, an increase has again to be recorded in our main products. In the case of dairy-produce yields can be best shown by taking the figures of each dairying year ending on the 31st July. In the period 1st August, 1929, to 31st July, 1930, the increase of butterfat production over the preceding year was 10·40 per cent.; from 1st August, 1930, to 31st July, 1931, the corresponding increase was 2·50 per cent., and for the year ending 31st July, 1932, the increase over the preceding year is 5·28 per cent. Considering the unfavourable season, this last-mentioned aggregate, which represents nearly 9,000 additional tons of butterfat, must be regarded as very satisfactory. A well-marked decreased average yield per cow occurred, and this would naturally have resulted in a decrease in the aggregate production of butterfat, but for the fact that it was more than counterbalanced by a greater number of cows being milked on dairy-farms, while a number of sheep-farmers started small dairy herds by way of assisting their finances in the face of low values for sheep-products.

The falling-off of the average milk-yield per cow was undoubtedly attributable in part to the cold dry spring weather, followed by a dry summer in large areas of the country, and the effect of this upon supply of feed. Another factor of importance was the decreased use of fertilizer top-dressing of pastures, due to the lowered purchasing-power of farmers. The provision of a subsidy on superphosphate improved the position, and it is evident that top-dressing on a more extensive and reasonably adequate scale is being brought about.

A feature of the year's operations lay in the heavy slaughtering of sheep and lambs at meat-freezing works, the figures for the twelve months ending 31st March showing an increase of 942,885 sheep and 491,707 lambs, the proportion of killings to total stocks being higher than usual. A larger proportion of old ewes than usual is included in the sheep figures, and this is bound to be reflected in the number of breeding-ewes returned in the next sheep returns. Owing to the seasonal conditions the wool-clip was somewhat lacking in style and character, while selling values reached a very low level. This, with markedly reduced prices for mutton and lamb, has seriously affected the finances of sheep-farmers. Additional trouble has been caused by low values for sheep and lamb by-products, and altogether sheep-farmers are having a very hard and anxious time. The heavy slaughtering already mentioned was doubtless the result of attempts to make as many realizations as possible. While the anticipated large reductions in sheep stocks cannot be regarded with equanimity it may have some compensating effect in reducing the bulk of wool to be marketed and thereby helping to harden prices.

The fruit crop of 1931 was a good one, and the quantity exported was some twenty thousand cases of apples and pears in excess of the previous season's shipments. The returns were good so far as sales in Great Britain were concerned, but losses were experienced on continental sales, owing to the serious financial collapse in Germany and its reflection elsewhere. This is unfortunate, as the previous season's continental sales gave good results. A call upon the Government guarantee ensued, the amount involved being £19,171. So far as the 1932 season is concerned the prospects are at present better from the guarantee standpoint.

The poultry industry is still making progress, but is hampered by a lack of proper organization. A strong effort is now being made to get the industry organized on a good basis, and, if successful, it should result in it being placed in the position so useful an industry deserves. A relatively small quantity of eggs were exported, but the realizations were considered satisfactory in the circumstances. The leaders of the industry exhibit commendable enterprise, and, if assisted in their efforts to obtain better organization, the endeavour to develop an increasing export trade should give good results.

In the case of honey, production fell heavily, the seasonal conditions being entirely responsible. The hemp industry is still languishing, the serious drop in manufacture recorded last year having been accentuated. Efforts are being made to find fresh avenues of utilization of the products. Good work is being done at Massey College in the selection and breeding of plants from strains of proved high quality, and it may be hoped that better times are in prospect for this industry.

The production of grass and clover seeds for export has become a useful adjunct to farming practice in areas where soil and climatic conditions are suitable, and the returns therefrom for the calendar year 1931, as shown by the Customs export figures, amounted to £155,410. The practice of Government testing and certification has proved a valuable factor in building up this branch of rural industry on a good basis.

Taking the year as a whole, the Dominion has come through very well in the matter of production, considering the adverse weather conditions and the severe financial depression existing. Notwithstanding the increased bulk of lamb, mutton, and dairy-produce shipped, the policy of the Meat and Dairy Boards in regulating shipments has prevented any periods of badly glutted markets occurring, activity in getting our butter sold to a greater extent in the Midlands and North of England being of material aid in this. There is still ample room for an increased distribution of our produce in portions of Great Britain where hitherto it has not gone much into consumption, and greater activity is now being shown in seeking markets in other countries, a line of action which is most desirable.

Fuller details regarding the various classes of produce will be found in the Divisional Directors' reports appended.

Advisory and Instructional Work.

The year has been a busy one for all Divisions through the widespread requests for advisory and instructional work. It is realized by the farming community that the essential response to low prices must be a reduction in costs of production, and the majority are rightly holding the view that improved farming practice not only will bring this about, but is also a matter within the power of the individual farmer through better knowledge and its application. It is therefore not surprising that farmers are more and more tending to lean on the Department and the agricultural colleges for guidance in those practices, both in crop and stock management, that will enable production to expand side by side with a reduced unit cost of production.

The Department, by means of its field staffs throughout New Zealand, possesses the necessary machinery whereby farmers can be kept in the closest touch with progressive development, and the close connection between the Department and the agricultural colleges enables it to function as a potent and important factor in the stimulation of primary production.

Animal Diseases.

The Dominion has been free from any new outbreak of disease during the year, and the efforts of the Department's staff to combat those existing have been actively continued. The most costly of these existing troubles are abortion, sterility, and mammitis of dairy-cows, and with regard to these a further advance has been made in knowledge regarding, and in methods of dealing with, them. This applies particularly to sterility and mammitis, and the staff at the Veterinary Laboratory with their associated field-research workers, Mr. Webster in Taranaki and Mr. Blake in the Waikato, deserve credit for the energetic and effective work which has been done. The extent to which bulls rendered incompetent through natural impotence, or by temporary or permanent local affections of their genital organs, are responsible for failure of conception in cows is understood to a much greater extent than heretofore, and a method under which, by the aid of the microscope, the relative fitness of a bull for efficient service can be determined has been further practised, with very promising results. Also, a method of treating cows unable to conceive through a frequently-met-with affection of the neck of the womb has been elaborated and is giving good results. Its successful application, however, demands skilful manipulation, and it is consequently beyond the ability of the dairy-farmer to carry out with exactness.

A method of controlling and gradually eliminating mammitis from a herd has been elaborated by Mr. Hopkirk, Officer in Charge at Wallaceville, and put into operation on a number of farms. It involves a preliminary microscopical examination of the milk of each cow, the milking of the cows in a set order always, and further milk examinations at intervals. The system is yet on its trial, and it is too early to state anything regarding its effectiveness. It

is sound in principle and should prove valuable. As regards vaccine treatment, our own observations do not show any improvement in the position, and the recorded experiences of research workers in Great Britain and elsewhere abroad cannot be regarded as satisfactory. With a large proportion of more or less heavy-milking cows a certain percentage of cases of mammitis may always be expected, especially when milking-machines are in use, and rendering the earliest manifestations of trouble likely to pass unnoticed. Still, everything possible must be done to reduce the number of cases to a minimum.

The research into pulpy kidney in lambs has, in the hands of Mr. Gill, made further progress, and a notable advance in knowledge has been made.

Further work in connection with ante-partum paralysis in ewes indicates concurrence with the view of Mr. Leslie of Lincoln College that the exciting cause is over-fatness followed by the effects of food shortage.

The campaign against lymphadenitis in sheep has been energetically carried on. Its success is dependent upon the co-operation of sheepowners, and this is being secured to an increasing extent. The British health authorities have still further relaxed their restrictions in the matter of the examination of imported carcasses, and their later reports indicate that the measures taken here are giving good results. This disease does not affect the general health of sheep, but it is necessary to still continue the special examination of all mutton and lamb carcasses in order to ensure as far as is possible that no carcasses containing the characteristic lesions of the disease are exported.

The appended reports of the Director of the Live-stock Division and of the Veterinary Laboratory staff give details of the conditions existing and the work done in connection with animal disease generally. The field-work of the Veterinary staff and the Stock Inspectors has been a valuable factor not only in direct disease control, but also in the dissemination of advice to stockowners in management methods aimed at the maintenance of health and productivity and the prevention of disease.

Investigations into Nutritional Disorders in Stock.

A considerable amount of work has been done during the year in connection with stock troubles arising from nutritional causes. These may be broadly differentiated as those resulting from unsuitable feeding and those resulting from soil deficiencies. The first-mentioned have not been evident to any great extent (apart from the ever-present and too-often-seen failure on the part of farmers to feed and fatten pigs to the best advantage) except in drought areas, where no investigation was needed. In one Southland district, however, where serious trouble in sheep and lambs occurs shortly after midsummer, a thorough investigation is being carried on, as the conditions are quite unusual. Soil and plant chemistry play an important part in this, and details will be found in the appended report of Mr. Aston, Chief Chemist.

As regards trouble arising from soil deficiency, bush sickness is now largely amenable to preventive and curative treatment under more easily carried out methods than heretofore. This is the result of using limonite (a hydrated oxide of iron) in licks or otherwise. It is cheap and effective, being much more freely taken in licks by both sheep and cattle than were the iron compounds previously in use. The very full knowledge we now possess of bush sickness and its treatment warrants a great reduction in strictly investigational work connected with it, and a concentration on the effort to bring preventive measures into more general operation in all affected areas.

With the extension of settlement on previously unoccupied or lightly stocked land, coupled with the geological survey work carried out by the Research Department, other areas, not previously recognized as such have been found to be bush-sick in varying degrees, but the knowledge now possessed enables advisory officers to put farmers in the way of satisfactorily combating the trouble by the adoption of suitable management and treatment methods. Work in connection with other manifestations of soil deficiencies has been actively pursued. It is dealt with in the Chief Chemist's report.

Live-stock Remedies.

Of late years a number of proprietary remedies for various live-stock ailments, particularly those affecting dairy cows, have been on the market, and their sale has been energetically pushed through the medium of advertising and direct canvassing. Some of these are in the form of licks, the remainder being preparations for either internal administration or outward application. Taking the dairying community alone, the annual outlay of farmers in the purchase of these preparations must amount to a very large sum, and while some are good and others useful in varying degrees,

it cannot be said that farmers get anything like good value for the money expended upon many of them. In certain cases which have been specially noted the price charged is out of all proportion to the intrinsic value of the ingredients present, even when it is recognized that the price is loaded with the costs of advertising, canvassing, &c.

Then as regards licks, these are invariably composed of comparatively inexpensive material and often sold at a high price. Moreover, they are usually sold indiscriminately without regard to particular conditions of soil deficiencies or the need for medicinal materials for the maintenance of health and production in different districts, and in many cases the money spent on them may not be recouped by any beneficial results. If farm animals are healthy and getting good nourishing food in sufficient quantity they do not need licks or anything else of a medicinal nature. It is evident that legislative action is necessary in order to prevent farmers being unduly and unreasonably exploited. Undue interference with the sale of all proprietary remedies is not suggested, but it is submitted that some effective form of regulation is badly needed. This could be brought about by the enactment of legislation requiring (1) all stock remedies to be officially registered, (2) a true description of the ingredients of each remedy and the price at which it is to be sold to be supplied with the application for registration, (3) evidence as to the efficacy of the remedy to be supplied with the application for registration, (4) the appointment of a competent authority to approve or disapprove registration, (5) the receptacle containing the remedy to have imprinted on a label affixed to it the weight or volume of the contained product and a description of its ingredients, this to constitute a warranty.

It is recommended that steps be taken to introduce legislation on these lines. The Department has done a good deal in discouraging the use of certain of the more blatantly objectionable remedies (one of these, for external application for mammits, contained a good proportion of cow-dung) but without statutory authority the required reform cannot be brought about.

Use of Artificial Fertilizers.

The falling-away in the use of artificial fertilizers in the autumn and winter of 1931 became so serious as to necessitate national action in an endeavour to restore the practice to an adequate level. The Government, therefore, in October subsidized the manufacture of superphosphate to the extent of 11s. per ton until the end of June, 1932, and the subsidy has been now renewed for a further twelve months. On the subsidy becoming operative superphosphate was reduced by 17s. 6d. per ton, making the cash price f.o.r. at works £3 17s. 6d. After some months, owing to the increased cost of sulphur brought about by the rise in dollar exchange, the price had to be advanced 5s. per ton, but has now been reduced to £4.

The lowering of price resultant on the operation of the subsidy has had a marked effect in stimulating the use of artificial fertilizers, as shown by the amount used in the January-June period of the past four years:—

	Tons.	Decrease from 1929. Tons.
1929	228,000	..
1930	212,000	16,000
1931	152,000	76,000
1932	222,000	6,000

From the above figures it can be seen that virtually the 1929 position has been recovered so far as actual tonnage used is concerned. The fact, however, that in the past three years cows have increased by over four hundred thousand would seem to show that there is considerable leeway yet to make up. This, however, is not as great, so far as dairying is concerned, as the figures indicate, inasmuch as top-dressing has steadily declined during the past two years on purely sheep-country, and almost the whole of the increase can be credited to dairying grassland.

Crop Certification.

Crop certification whereby superiority of type or strain is guaranteed has been considerably extended during the year. In its commencement the service was a free one, but the great increase in crops certified has necessitated the levying of a small fee, varying in accordance with the crop, to cover the expenditure involved.

Certified seed of all the crops under certification—perennial rye-grass, white clover, red clover, cocksfoot, brown-top, potatoes, beans, and wheat—commands a premium price, and both growers and buyers are keenly alive to the advantages of certification. It is interesting to note that so far as certified grass and clover seeds are concerned there is a growing inquiry from overseas, and it is hoped that within a very few years a lucrative export trade will be developed.

Demonstrational work carried out throughout New Zealand has definitely shown the great superiority of the special strains of rye-grass, white clover, and cocksfoot that are now eligible for certification so far as permanence and herbage production are concerned, and there is little doubt that special strain certified grasses and clovers will finally be alone used in the establishment of New Zealand pastures. It has long been recognized that pedigree in grasses and clovers is just as important as in live-stock and in ordinary crops, and the certification methods now adopted, which are based on the research work of the Plant Research Station, are enabling the New Zealand grassland farmer to improve the yield and permanency of his grassland to an astonishing extent.

The Pig Industry.

While our sheep and dairying industries have progressed steadily for years past and the volume of exports derived from them has shown a marked increase, the pig industry has made little or no real progress, and to-day, as was the case ten years ago, pigs are regarded mainly as a means of using up dairying by-products and nothing more. Yet New Zealand is eminently adapted for pig-production on a large scale, our pork has a good reputation in British markets, and a much greater quantity could have been exported without any fear of oversupply. It has always been difficult to understand why New Zealand farmers, who in most respects are quick in adopting improved and progressive methods in production and marketing, have failed to make use of their opportunities for building up a large export trade in pork, in spite of the efforts made by advice and general propaganda to induce them to do so.

The food question has no doubt been a factor in this, but the cost involved by the purchase of foodstuffs could be largely avoided if more pig provender were produced on the farm itself. A further point is that in meat-meal, now a well-prepared article, a large supply of highly concentrated food is available in the Dominion at a very reasonable cost, considering its high feeding-value. In combination with roots, it makes a well-balanced food on which pigs do well. Certainly, of late years, the type of pig produced has shown some improvement and a greater interest in pig-production is noticeable. The establishment of a Pig Recording Club in the Waikato (assisted by a grant from the Meat Board) was a progressive move, and it is hoped that similar organizations may be established in other dairying districts.

With a view to organizing a definite forward step in pork-production, arrangements are in hand for setting up a special Pig Industry Committee to go fully into all aspects of the industry and assist in bringing about a large expansion of it on sound lines. This body is composed of representatives of the Meat and Dairy Board, Massey and Lincoln Colleges, bacon companies, pig-breeders, the Farmers' Union, the Waikato Pig Recording Club, and the Research and Agriculture Departments. Its deliberations and recommendations should prove of great value, and it may be noted that its members give their services free of any cost whatever to the Government.

One important matter for discussion by the Committee is the establishment of a properly organized system of grading of pigs, whether intended for export or for local consumption through the medium of bacon factories, and recommendations regarding this will be submitted in due course. Such a system would go far towards establishing improvement both in type and quality, for which there is plenty of scope. The co-operation of freezing companies and others concerned is confidently anticipated, as, though for the time being the overseas market for bacon pigs is unprofitable, there is so good an opportunity for considerably expanding our export of pigs of the porker type that it should be taken advantage of to the fullest extent attainable.

The Noxious Weeds Act.

The administration of this Act entails considerable expenditure in the endeavour to bring about observance of its requirements, and a review of the position to-day and of the results of the efforts of past years raises the question whether this expenditure is worth while. In closely settled areas farmers, in their own interests, should keep weeds under proper control, and most of them do so, especially as by the use of sodium chlorate ragwort can now be effectively and economically dealt with. On larger properties, especially in broken country, this weed is still a nuisance, but on the whole, it is no longer the serious menace it was a few years since. As regards other noxious weeds, blackberry is the worst.

Having regard to all the circumstances it is believed that no serious results would accrue if the Act, as at present constituted, were repealed and replaced by a measure so framed as to enable adequate measures to be taken to deal with any unforeseen development of serious spread of any existing or newly introduced noxious weed, and to give authority to County Councils and urban authorities to take such measures in the event of necessity arising. Local authorities

might be unwilling to accept this responsibility on the score of expense, but the amount involved should be small under ordinary circumstances, and it would be reasonable to make provision for financial assistance from the Government in the unlikely event of trouble arising to a sufficient extent to involve active measures and considerable expenditure.

As a matter of fact, County Councils already possess powers enabling them to deal with noxious weeds. They also have powers to declare any plant, other than blackberry, not to be regarded as noxious weeds within their district, and this has been exercised to a sufficient extent in Otago and Southland to render the Noxious Weeds Act practically a dead letter in those provinces.

Experimental Farms.

During the year three farms established and operated by the Department for demonstration purposes have been handed over to the Lands Department for settlement purposes. These were the Puwera Farm near Whangarei, the Galloway Farm in Central Otago, and the Waimaunga Farm near Reefton. The Puwera Farm was made on an area of the poorest type of gum land, and it demonstrated how, by suitable methods, this land can, at reasonable cost, be converted into good dairying land. The Galloway Farm, on arid and apparently barren country, proved that by properly applied irrigation practice luxuriant feed for dairy cattle could be produced and maintained; it became, in fact, of higher carrying-capacity than any other known South Island dairy-farm. The Waimaunga Farm helped to stimulate dairy-farming on the West Coast, where there are great possibilities for the further development of dairying. The Ashburton Farm, used largely for experimental and seed-certification purposes, has been vacated, and the work transferred to an area on the Lincoln College property, thus establishing a close association with the college.

This leaves only the Ruakura Farm existing as a State farm in the true sense, and the time has arrived when consideration should be given to utilizing a portion of this for settlement purposes. Some of the land, adjacent to the town of Hamilton, has a high potential value for other than farm purposes. This farm, like all others, felt the effects of the unfavourable season and the low prices ruling for produce in the past year, but nevertheless, gave a gross return of £9,213 from the year's operations, including fees paid by students. The Mamaku Farm which has been operated as an aid towards the elucidation of bush-sickness problems, is no longer needed for this purpose, and a commencement has been made towards opening it up for settlement.

Two other definite experimental areas are still being conducted, these being at Marton, where the work is confined to pastures and carried out in direct association with the Plant Research Station, and at Gore, where fertilizing and cropping demonstration work is conducted. Both are serving a useful purpose. The area in occupation at Marton has, however, been reduced. Apart from these, the Department is associated with useful subsidized farms at Dargaville, Winton, Stratford, and Waimate West, the subsidies in the case of the two last named having been met from the Moumahaki Endowment Fund.

Land Development.

The development of hitherto unoccupied pumice land in the Rotorua district on behalf of the Lands Department has been continued. Some 4,000 acres have now been grassed, with every indication of permanent success. One area has been reserved as a demonstration farm to illustrate practices best suited to the farming of this comparatively high-level pumice country where winter conditions are moderately severe. In the first season, following clearing and ploughing, dairying has been carried on with a return of butterfat of approximately 70 lb. to the acre. In the second season it is considered quite possible that the return will reach 100 lb. per acre, a figure considerably in excess of the average obtained from the land devoted to dairying in New Zealand. As the cost of bringing the land into dairying production, including buildings and stock, need not exceed £20 per acre, an average production of over 100 lb. of butterfat to the acre would represent a capitalized interest charge of 2½d. per pound, clearly indicating the scope for profitable utilization of such land.

The main lesson that has been learnt in the development of this country is the necessity for the adoption of modern methods of grassland management in their entirety, both in establishment and maintenance. The use of certified seed, rational top-dressing, rotational grazing, shelter, adequate winter-feed provision, and surface cultivation after establishment, are the essential grassland practices that must be followed. With their full adoption the future in front of suitable high-altitude pumice country can be regarded as satisfactory, but there must be no slacking in management in the early years of development, otherwise the position could well become reversed.

Publications and Publicity.

Publication activities have been well maintained during the year, with the *Journal of Agriculture* as the Department's chief medium for information and record, supplemented by a steady output of matter in pamphlet form. A full amount of miscellaneous printing connected with the Department's varied services has also been handled.

Radio broadcast lecturettes "for the man on the land" have continued to be delivered weekly from Station 2 YA, Wellington, by the Live-stock, Fields, and Horticulture Divisions in rotation. Topical or seasonal subjects are usually selected, and the service appears to be well appreciated by the farming community. A considerable amount of agricultural matter has also been broadcast from other radio stations in the Dominion.

The usual number of ordinary instructional lectures, many with lantern illustrations, were given by field or specialist officers at the request of various farmers' organizations and others.

Staff.

Since the 31st March, 1931, the personnel of the Department has been further reduced in number by twenty-five permanent and seventeen temporary officers (a reduction of twelve permanent and thirty-six temporary had been made in the preceding year). During the year the Department sustained a severe loss through the death of Mr. H. Munro, Manager of the Ruakura Farm. He was an exceedingly able officer, with a record of thirty-four years' good work in the Service. Another loss occurred through the resignation of Mr. G. F. V. Morgan, Dairy Bacteriologist, who decided to return to England. During his engagement here he did excellent work, which was of material assistance to the Dairy Division.

I must express my appreciation of the really good service rendered by the Divisional Directors and all members of the departmental staff, all of whom have co-operated heartily in carrying on the activities of the Department to the best possible advantage, while at the same time exercising every care in keeping down expenditure.

C. J. Reakes, D.V.S., M.R.C.V.S. Director-General.

NAURU AND OCEAN ISLANDS PHOSPHATE.

Report of A. F. Ellis, C.M.G., New Zealand Commissioner, British Phosphate Commission.

The twelfth year of operations at Nauru and Ocean Islands since the industry came under Government ownership terminated on the 30th June, 1932, with the following shipping results, as compared with the two previous years:—

	1929–30. Tons.	1930–31. Tons.	1931–32. Tons.
Nauru	296,310	240,855	289,340
Ocean	207,863	145,122	142,200
	504,173	385,977	431,540

It will be noted that there is an increase of 45,563 tons in shipments compared with 1930–31. Of the quantity in 1931–32, 273,365 tons were shipped to Australia, 146,270 to New Zealand, and 11,905 to other countries. The proportion of output coming to New Zealand, as compared with the previous two years, is as follows: 1929–30, 25·21 per cent.; 1930–31, 31·85 per cent.; 1931–32, 33·89 per cent.

Importations of phosphate to the Dominion, as compared with the two previous years, were as follows:—

	1929–30. Tons.	1930–31. Tons.	1931–32. Tons.
Nauru – Ocean	117,826	112,873	148,530
Outside	49,983	22,935	20,437
	167,809	135,808	168,967

During the year under review generally fine weather and satisfactory health and labour conditions were experienced at the two islands. Similarly to the previous year, the output of phosphate was materially restricted owing to the trade depression existing in the countries taking the phosphate. There has, however, been a very material improvement in demand during the last six months, and the islands are now working up to their present capacity.

For the current year a larger output than hitherto reached is aimed at, and towards this end some important constructional developments in the plant, now approaching completion, are expected to help materially. The Nauru cantilever for mechanical loading during fine weather conditions continues to give very effective service. All the phosphate shipped from that island during the year under review was loaded by means of this plant, thus effecting a material saving in labour and in steamers' time, besides other advantages, as compared with the previous system of lightering.

The Commission's steamer "Triona" is proving quite up to expectations in regard to phosphate carrying, facilities for laying and lifting deep-sea moorings, labour recruiting, &c. Since her arrival at the islands in May, 1931, she has carried eleven phosphate cargoes, totalling over 62,000 tons, besides being occupied at other duties in connection with the moorings and labour recruiting.

LIVE-STOCK DIVISION.

REPORT OF J. LYONS, M.R.C.V.S., DIRECTOR.

General Conditions.

The past season has been a disappointing one for farmers in several districts throughout the Dominion. After a fairly mild winter a cold dry spring set in, which retarded the growth of young grass, while during the summer, drought conditions worse than have been experienced for many years, prevailed in a number of districts, especially in Hawke's Bay, Wairarapa, South Canterbury, and North Otago.

Health of Live-stock.

HORSES.

General health and condition among horses have been good, and there have been no ailments amongst them calling for special mention. The breeding of horses throughout the Dominion, with the exception of thoroughbreds, can be said to be at a standstill. There is still a limited demand for draught horses of the right type, and it is to be regretted that more of this type are not being bred, especially as just recently inquiries have been made from Australia for sires of the heavy type, and a number of Clydesdales have been exported to that country.

CATTLE.

Tuberculosis.—The total of cattle condemned in the field as the result of clinical examination and the tuberculin test amounted to 5,831. The total number of cattle examined at the various abattoirs and meat-export slaughterhouses was 266,848, an increase of 7,008 over last year's figures. Of these, 15,493, or 5·8 per cent. were found affected in varying degrees, a large percentage being only slightly affected. The total number of swine subjected to examination was 438,101. Of this number, 48,621, or 11·09 per cent., was found affected with tuberculosis, the great majority showing only slight lesions.

Actinomycosis.—The animals condemned for actinomycosis for which compensation was paid was 639, a decrease of 21 over last year's figures. Only advanced dangerous cases with open lesions were condemned and slaughtered, others met with being placed under treatment.

Malignant Growths.—The number of animals condemned for which compensation was paid was 423, a decrease of 35 from last year's figures.

Mammitis.—Reports from all districts show that there are still too many cases of this complaint in evidence, and consequently many cows have necessarily to be culled on account of faulty udders at the end of each milking season. As scientific workers here and elsewhere have not been able to further our knowledge with regard to this disease, and also seeing that any preventive or curative treatment applied so far has not given entire satisfaction, it was considered that with more accurate diagnosis of the disease in its earlier stages, more care in milking and the handling of the machines, and better sanitation generally, the disease could in a great measure be prevented. With this end in view measures were inaugurated by the officers of the Veterinary Laboratory, Wallaceville, whereby the milk of each cow in herds was examined microscopically, and in accordance with the results shown the herd was divided into three groups and milked accordingly. At monthly periods the milk from all cows was again examined so that it could be noted how individual cows were progressing. At the commencement of the milking season a number of dairy-farmers in various parts of the Dominion agreed to have the milk from their cows examined, and carry out their milking arrangements under this system. Unfortunately, a considerable number of those who entered into the arrangement were unable or unwilling to carry it through. It was their opinion that the grouping of the cows and milking them in rotation within such groups involved labour that could not be afforded, and also knocked the herd about to some extent. However, a number conscientiously carried out the arrangement, and some of these speak highly of it. They are well satisfied with the results obtained and intend to carry it further. It is yet too early to give a definite opinion in this matter, and further trials will have to be made before doing so. From the experience gained so far I feel assured that it is well worthy of a wider trial, and I trust that many more of our dairy-farmers will see their way clear to milk their herds under the arrangements made.

Contagious Abortion.—Although this disease is still in evidence in all districts where dairying is carried on, it has ceased to be the menace it once was. While anything from 1 to 3 per cent. of abortions can still be seen on a number of farms, it is only on a very rare occasion that the disease is noticed to the extent which prevailed formerly, when one could see anything from 30 to 50 per cent. of the herd abort. This is no doubt due to the fact, as the District Superintendent, Dunedin, remarks, that as a result of dissemination a high degree of immunity has resulted. In parts of the North Island the disease was fairly prevalent, more particularly in heifers carrying their first calf, and the disease was quite possibly contracted from paddocks where aborted cows had been depastured. If dairy-farmers would pay more attention to the segregation of their affected animals less would be heard of the disease among animals carrying their first calf. With reference to the prevention of abortion by segregation, I would refer to my remarks on the subject in the last annual report.

Sterility.—The problem of temporary sterility in dairy herds still continues to cause loss and concern to the farmer. During the past year the Department has continued its investigational work into the trouble from the viewpoints of infection, nutrition, and male impotence. Much work has been done to determine whether the trouble is due to an infective agent, and under this heading the bull has received prominent investigation. Further work, however, remains to be done along these lines. Looked at from a nutritional standpoint, it is believed that in some cases, at any rate, temporary sterility often follows a deficiency of phosphates, or a lack of balance between the phosphate and lime content of the pasture. Good results are claimed from the use of bone-meal fed to the cows, more particularly in the dry periods when the phosphatic content of the pasture is low. A large volume of work has been done in the examination, microscopically, of the seminal fluid of unsuccessful bulls, and the results so far indicate that this is of distinct value as a means of determining the potency or otherwise of bulls. Mr. Blake, Veterinarian, Hamilton, and Mr. Webster, Veterinarian, New Plymouth, have both done excellent work in sterility investigation. Apart from these specific points, it is again reiterated that improvement in the general care, feeding, and management of the herd during the winter months would go far to lessen breeding troubles later.

Blackleg.—I am pleased to report that the incidence of this disease is very much lessened, the outbreaks showing a reduction of 45 per cent. as compared with former seasons.

Cattle-tick.—The position during the year can be said to be satisfactory. In Area A, although ticks are fairly plentiful in certain parts, the position is not any worse than in previous seasons—in fact, some districts report that fewer ticks were seen than usual. In the Area B district, Auckland Province, the position is better than last year, with the exception that an outbreak occurred on an estate near Te Aroha which had recently been subdivided into smaller areas. In the Area B of Poverty Bay district the position remains about the same. It is to be regretted that an extension occurred during the year in the Wairoa district, six farms being affected. With a view to the suppression of the pest in those isolated holdings where ticks are found, the stock thereon is kept under close supervision. All stock on the affected and adjoining farms are thoroughly sprayed at stated intervals, and all undergrowth, rushes, &c., are cleaned up and burned. The destruction by fire of all scrub, rushes, and undergrowth on farms which are infested is one of the greatest factors in keeping this pest under control. Stockowners should be alive to this, and at the end of the season all undergrowth should be destroyed by fire, as it is here that the ticks pass their inactive stage during the winter, and in spring are ready to infest stock grazing thereon. The necessity for destroying all scrub, &c., on affected farms cannot be too strongly brought under the notice of the farmer. Where this growth is kept in check, and the areas suitably grazed, very little trouble is experienced from ticks.

Parasitic Diseases in Young Cattle.—There is still a considerable amount of this trouble in evidence in all dairying districts of the North Island, and although a number of deaths have been reported the losses have not been great on any one particular farm. In all cases prevention should be aimed at. Dairy-farmers should see that, as soon as the young animals are fit to be turned out, there is a good dry well-sheltered paddock of young grass on which to put them, and such a paddock should not be used more than two years in succession, otherwise it is liable to become contaminated. Also, some good food material, such as linseed or meat-meal, should be added to the skim-milk to compensate for the material that has been extracted. When weaned the calves should be removed from the calf paddock and placed on another dry part of the farm where feed is plentiful. Calves reared under these conditions seldom suffer from parasitic invasion.

Redwater.—A number of cases of so-called redwater were seen in the Auckland district at different periods. This trouble is the result of errors in feeding, such as feeding the stock too heavily on turnips or confining them to paddocks where the feed is rank or sour. When the dieting is improved recovery soon follows. Among young calves, however, the results are different, and when once such animals become affected the mortality is fairly heavy in spite of treatment. Probably this can be accounted for by the fact that the young animal's metabolism is unable to withstand the changed condition of the blood at this period.

Ragwort Poisoning.—A considerable number of cases of poisoning from stock eating ragwort is observed in all districts where this weed is in evidence. Now that a reliable destructive agent (sodium chlorate) has been discovered, there is no excuse for allowing pastures to become contaminated to the extent that they become a menace to stock. All pastures where the weed is in evidence should be treated, preferably in the early spring before the grass begins to come away.

SHEEP.

Lymphadenitis.—On account of the restrictions imposed on carcasses affected by this disease by the authorities in Britain, exceptionally careful inspection of all mutton and lamb carcasses passing through the meat-export works has to be exercised. When evidence of the disease is found the sheep are traced to the holding from which they came, and advice given with reference to the control of the disease. From investigations made we are in the position to state that the chief source of infection is through wounds becoming contaminated while the sheep are being shorn, and also when docking and marking are being carried on. Sheep-yards should be kept as free from contamination as possible, all instruments used in shearing, docking, &c., should be thoroughly disinfected, and all affected sheep, particularly those with open wounds, shorn last, and the pens disinfected afterwards. Further, all affected animals should be eliminated from the flock as soon as opportunity offers. Some fifteen months ago, the District Superintendent, Dunedin, and his assistants, in conjunction with the manager of a station in the Otago district, known to be extensively affected, carried out an experiment with the object of demonstrating that the disease could reasonably be controlled under

station conditions by eliminating and isolating from the main flock all sheep affected by the disease. In all some 11,196 ewes were examined, these comprising the whole ewe flock on the station, with the exception of the ewe lambs; 9·34 per cent. were found affected, and these were isolated, and kept away from the main flock. A second examination was made one year afterwards, when 3·72 per cent. were found affected. In addition to the segregation of affected animals every care was taken to see that thorough disinfection was carried out, and all affected sheep were shorn after the main flock had been put through. These results are most encouraging in showing that the incidence of the disease can be controlled.

Parasitic Gastritis.—Owing to the favourable climatic conditions, very few cases of this complaint were seen. A few scattered outbreaks in small flocks were seen, but these were easily controlled. The mortality observed from this cause was insignificant.

Renal Congestion in Lambs.—The incidence of this disease was again fairly well in evidence last season, although not quite so much as in the season of 1929. Since my last report an important discovery has been made with regard to this disease from an etiological point of view. Oxer, in Tasmania, discovered the cause to be a bacillus which elaborated a toxin in the small intestines, which organism he named *Bacillus ovitoxicus*. This announcement was unfortunate for the Assistant Officer in Charge at Wallaceville. For a number of years he has been making extensive inquiries into this complaint, and was on the eve of making an announcement with regard to it on similar lines when the announcement was made from Australia. There is no doubt but what this officer deserves full credit for his independent discovery. As far back as 1927, and before any investigation was made into the disease in Australia, he made the announcement that the disease was probably due to a toxin in the small intestines set up by an organism of the *Bacillus Welchii* type, and since then he has been carrying out investigations to verify the opinion arrived at. There is no doubt that his finding gave a lead to others carrying out similar investigations. The discovery is most interesting from an etiological point of view, but a practical and economic method of utilizing it for protective purposes under farm and station conditions has yet to be explored. This will mean that meanwhile in the majority of flocks where the disease is in evidence the owner should still resort to the previously established method of reducing the trouble. This can be carried out by yarding the lambs from twenty to twenty-four hours every seventh day, and where this practise has been conscientiously adhered to reports indicate that the results have been very satisfactory.

Ante-partum Paralysis in Ewes.—This trouble was in evidence in many districts throughout the Dominion. Although several flocks suffered rather severely the number of cases seen was much less than in former seasons.

Maggot Fly.—This pest is still causing loss among our flocks, although less in evidence than formerly. The insect parasites liberated in the various districts have not been an unqualified success. In some districts they do not seem to have done much good, while in others they are highly spoken of. As an aid towards the control of the pest the Meteor fly-trap is being extensively used, and millions of flies have been caught and destroyed by this means.

Liver-fluke.—This disease becomes less and less in evidence each season. The draining of wet areas and the use of carbon tetrachloride as a drench has proved valuable.

Lice and Tick.—The control of these parasites has been well maintained. Although a certain percentage of lousy sheep can be detected in the saleyards, the position has considerably improved within the last two seasons.

General.—A number of minor sheep ailments were observed in several districts, and these were dealt with by the field officers of the Division.

PIGS.

The number of pigs slaughtered for the season 1931–32 was 459,790, as compared with 479,500 for the previous season, a decrease of 19,710. The quantity of pork exported was 104,882 cwt., as compared with 150,024 cwt. for the previous season, showing a decrease of 45,142 cwt. This is a considerable falling-off both in the numbers killed and the amount exported, a condition no doubt brought about by the low prices ruling. In spite of the ruling prices, which do not leave a very great margin of profit, a greater amount of attention should be paid to this branch of farming. In this country we have a supply of raw material much of which would be wasted were it not for pigs. I refer to skim-milk, and were this material fed under conditions for the hog population to make the best of it, I feel sure our output of pork could be increased with very little cost to the producer. Again, if the farmer could only be brought to realize the extra margin of profit through rearing his own pigs, as against buying weaners and stores at high prices when the flush of milk is in evidence, it would be to his advantage. The carrying of breeding-sows and late weaners successfully through the winter so that they will be in a condition to make the most of the first new season's milk is a matter which is also worthy of further consideration. Experiments carried out by officers of the Department have proved that such animals if well fed on roots, plus ½ lb. per day of meat-meal, show a handsome profit for the outlay. As regards the type of pig kept and methods of feeding, much greater interest has been shown, and it is evident that pig-breeders and feeders are becoming more alive to the fact that if they are to hold and increase their position on the world's markets, more attention must be given to breeding and feeding.

Mange.—During the season an outbreak of sarcoptic mange in pigs was found in the Palmerston North district, and almost simultaneously further outbreaks were discovered in other districts in both Islands. The disease in all cases was successfully treated by using crude petroleum. Many owners, for their own convenience, erected dips in which to dip their pigs. The position at the present time is well under control.

Abscesses.—An analysis of the monthly returns of the Inspectors at the various freezing-works shows that a considerable number of pig carcasses are condemned either in part or as a whole for abscesses, particularly in the scrotal region. The loss sustained from this cause alone is considerable, and, seeing that it could be avoided, it is to the interest of every pig-breeder to do so. These abscesses are caused by organisms gaining entrance either at the time the operation is performed or subsequent thereto. The greatest care should be exercised to see that the hands of the operator and the instruments used are thoroughly cleansed and made sterile. After the operation is finished the wounds should be dressed with a suitable antiseptic and the animals kept under the cleanliest conditions possible until the wounds have healed completely. If care were exercised in this direction it would obviate the necessity for condemning many pig carcasses which in every other respect are capable of being made into a first-class article.

General.—A few other minor ailments were in evidence, but in no case did they assume serious propensities or call for special action. During the past season the health of pigs generally has been satisfactory.

Live-stock Statistics.

After many years of steady increases the sheep flocks of the Dominion dropped (in 1931) by 1,048,771 to a total of 29,792,516, which number, however, still constitutes the second highest total in the history of the sheep industry. In spite of this decrease in the total number, it is some satisfaction to note that a decrease did not take place in the number of breeding-ewes, and that actually an increase of 44,554 was recorded. A heavy slaughtering of sheep and lambs is taking place this season, as shown in the slaughtering figures recorded elsewhere in this report, and this will undoubtedly be reflected in the enumeration for 1932. The number of sheepowners is increased by 767 to 30,789.

The number of cattle increased in 1931 to 4,080,525, being an increase of 314,857. Of this increase, 161,312 are dairy cows, the number of such being 1,601,633.

The number of pigs in the 1931 enumeration was 476,194, a decrease of 11,599 on the previous year's figures.

Horses have continued to show a decline, the number in 1931 being 295,743, a reduction of 1,452.

Slaughter of Stock.

The numbers of sheep and lambs slaughtered during the year were again very heavy. The total numbers of stock slaughtered at registered premises were: Sheep, 4,464,894; lambs, 8,689,196; cattle, 322,942; calves, 593,029; swine, 430,914.

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 ending 31st March, 1932.	Year ending 31st March, 1931.	Increase.	Decrease.
Cattle	131,624	124,323	7,301	..
Calves	537,003	504,222	32,781	..
Sheep	3,430,176	2,636,820	793,356	..
Lambs	8,459,244	7,896,328	562,916	..
Swine	246,048	273,489	..	27,441

For further purposes of comparison the following table is given, showing the killings of sheep and lambs at meat-export slaughterhouses over four periods, 1st October to 31st March in each year, as indicative of the slaughterings from the beginning of each season to the 31st March:—

Stock.	1928–29.	1929–30.	1930–31.	1931–32.
Sheep	1,421,741	1,982,550	1,671,493	2,614,378
Lambs	4,093,750	4,431,424	5,331,021	5,822,728

These figures show an increase of 942,885 sheep, and 491,707 lambs compared with the same period last year.

Following are the numbers of each class of animal slaughtered under direct inspection during the year ended 31st March, 1932: Cattle, 266,848; calves, 591,464; sheep, 4,218,221; lambs, 8,658,621; swine, 409,225.

The following table indicates the respective classes of premises at which these animals were slaughtered :—

Stock.	Abattoirs.	Meat-export Slaughterhouses.	Bacon-factories.
Cattle	135,224	131,624	..
Calves	54,461	537,003	..
Sheep	788,045	3,430,176	..
Lambs	199,377	8,458,244	..
Swine	131,369	246,048	31,808

Stock slaughtered at ordinary slaughterhouses during the year ended 31st March, 1932, was as follows : Cattle, 56,094 ; calves, 1,565 ; sheep, 246,673 ; lambs, 30,575 ; swine, 21,689. Carcasses of pork killed and dressed by farmers and sent into butchers' shops and small factories and examined by departmental officers numbered 28,876.

In connection with the animals shown in the above tables as slaughtered at meat-export slaughterhouses, the following numbers are returned as having gone into consumption within the Dominion : Cattle, 10,918 ; calves, 1,823 ; sheep, 162,075 ; lambs, 88,313 ; swine, 9,376.

Compensation paid for Stock and Meat Condemned.

Compensation to the amount of £13,163 16s. was paid out during the year for animals condemned in the field for disease under the provisions of the Stock Act, and £10,806 9s. 4d. for carcasses, or parts of carcasses, condemned for disease on examination at the time of slaughter at abattoirs, meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act.

Importation of Stud Stock from Abroad.

The prohibition imposed on cattle, sheep, and swine from the United Kingdom as a precaution against the entry of foot-and-mouth disease still exists, and the only countries from which stock may be imported subject to the regulations are : Cattle from Tasmania, Canada, and the United States (with the exception of California) ; swine from Australia (with the exception of Queensland and Western Australia) and Canada ; and sheep from Australia (with the exception of Queensland and Western Australia). Importations of cattle from the United States and Tasmania are subject to the precedent consent of the Minister in each case. The following imported animals were placed in quarantine during the year for the respective periods required : Horses, 1 ; cattle, 1 ; swine, 18 ; dogs, 36.

Exportation of Stud Stock.

During the year under review the following stud stock was exported : Sheep, 1,434 ; cattle, 46 ; swine, 11 ; horses, 11 (draught). There was the usual movement of racehorses to and from Australia.

Dairy Inspection.

Owing to the reduction in the wholesale and retail prices received for milk, the season just past has been rather a difficult one for those farmers engaged in producing the raw material for city use, but the standard both as regards the health of the cows and the conditions of the sheds, appliances, and surroundings have been well maintained.

There are now about five thousand dairies registered for supplying our cities, boroughs, and towns throughout the Dominion, and of these 2,189 supply the four largest centres. During the year all these dairies were kept under close supervision, and where any sign of laxity was observed special attention was paid. The District Superintendent, Dunedin, aptly remarks : "It is necessary at all times to keep the majority of licensees up to the mark, otherwise a certain amount of carelessness is apt to creep in, to the detriment of the premises as well as the wholesomeness of the product."

The sediment tester has again proved its usefulness. In all districts a large number of milk-samples have been subjected to this test, and where it is found that the milk does not come up to standard the premises are visited and instruction given which brings about an improved condition of the article supplied.

A considerable number of composite samples of milk were collected from all districts and sent to Wallaceville for the biological test, and it is satisfactory to report that negative results were obtained with one exception. This sample came from a herd the milk of which was not being used for city supply. The herd has since been subjected to the tuberculin test and all reacting cows have been eliminated.

It is worthy of note that year by year dairymen are becoming more desirous of supplying a better article, and just lately we have had a number of inquiries with regard to supplying milk from certified herds free from tuberculosis. Rules have been drawn up so that dairymen may be able to sell milk under these conditions.

Tuberculin Test.—The tuberculin test was applied to a total of 5,475 cattle during the year, and 401 of these reacted, equal to 7·32 per cent. Considering that of the number tested 484 were tested on suspicion, giving reactions up to as high as 53 per cent. in some districts, this result must be considered as indicating a satisfactory position.

Poultry Industry.

Those interested in the welfare of the poultry industry have been giving serious consideration during the year to the question of better organization of the industry, in order that improvements might be effected in methods of marketing and to provide an equalization fund for export. This is a step in the right direction, as the want of organization in this industry has undoubtedly militated against it in the past, and, as advancement can only be brought about by increased export the creation of a fund to enable any loss to be equally met is necessary.

During last season 3,995 cases of eggs, each containing thirty dozen, were exported to London, and as these were without any Government guarantee any loss on export would fall entirely on those who participated in the export and who by this action helped to maintain local prices, thus assisting those who took no part in the export. The position would be quite all right if the export of eggs resulted in a profit to the exporter, but the last few years' experience has not indicated that export on a payable basis is very promising; the industry being such that during a few months of the year the eggs produced cannot be consumed, the disposal of this surplus and the maintaining of payable prices locally creates a difficulty. It is with the object of removing this inequitable position as well as strengthening the position of the industry generally that the organization of the poultry producers as mentioned aims.

Considerable interest has been evinced in the poultry industry, and the indications are that more people are giving attention to the production of eggs, both for their own use and for market, than formerly. The general depression has no doubt led to this, as the production of eggs is a means of relieving to some extent the difficulties facing many people. High prices of foodstuffs, however, have exercised a detrimental effect on increased production, and until production costs fall so as to allow eggs to be exported at a payable price, production beyond our own requirements is limited.

I append some extracts from the report of the Chief Poultry Instructor (Mr. F. C. Brown), as follows:—

As there has been no census of poultry taken since the year 1926, the question as to whether or not the flocks of the Dominion have increased or decreased cannot be gauged with any certainty. The fact, however, that the local market for eggs has been well met at a reasonable price to the consumer, and considering that 3,995 cases of eggs of thirty dozen each were exported to the London market during last spring, where none was exported during the previous year, indicates that the industry has at least held its own so far as numbers are concerned.

Regarding the eggs exported, when these were shipped the oversea market offered poor prospects of a payable price being returned. It is gratifiying, however, to report that the prices realized were considered to be satisfactory, being equal to the ruling rate on the local market when the eggs were shipped, during the then flush season of the year.

With dear food and cheap eggs, poultry-keepers are now realizing probably more than ever before that if poultry is to prove a really payable proposition nothing but high-class laying types must be kept, and that drastic annual culling-out of low producers is imperative. This being so, the services of the Poultry Instructors to assist in the work of weeding out unprofitable stock, and in selecting the best specimens for breeding purposes, have been keenly sought, and with this work, together with delivering lectures, giving demonstrations, and grading eggs for export, &c., the Instructors have experienced a particularly busy time during the year.

Wallaceville Poultry Station: The value of this establishment as a demonstration and educational centre is evidenced by the increased number of poultry-keepers who have visited it during the year, and by the inquiries received by letter for advice regarding poultry-management in general. The practical investigational work which is being carried out at this station has been of great assistance in widening the knowledge possessed by the instructional staff, and this is being passed on to producers during visits to plants, by lectures, and through the medium of printed matter.

Wool.

Little improvement has taken place in the market conditions in respect to wool, and the prospect before sheep-farmers is anything but bright. Work of an instructional nature has been continued and an endeavour made to encourage farmers to keep up improvement methods, which in times of falling markets become rather a difficult matter. It is, however, all the more necessary that we should not only maintain but improve our quality of wool in order that when the clouds lift we may be enabled to meet market requirements in respect to quality. I append hereto extracts from the report of Mr. J. G. Cook, Wool Instructor:—

Sheep throughout the Dominion commenced the winter of 1931 in good condition, but in some districts the winter was severe and was followed by very dry periods during the growing season. When shearing commenced it was apparant the the fleece wool was lacking in style, bloom, character, and growth, and that super wools would be in short supply.

A very large amount of our crossbred wool realized low prices, more especially the 46's count and under, no doubt due to the fact that there wools are not being used so extensively for making clothing as in past years, the wool having to be diverted to making other goods such as motor-car and furniture upholsteries, carpets, and floor-rugs, and also belting and other goods of similar nature, and it is these trades which are feeling very acutely the effects of the world's depression. Last year there was a better demand for coarser wools, and prices for 36's up to 48's quality were very close together, the coarser wool in some cases bringing higher prices than the finer wool. This year the finer wool again realized the higher prices.

During the month of November I was in the Auckland District, giving demonstrations in the shearing-sheds, and was afforded an opportunity of looking through some of the wool-stores before the first sale. There was a considerable amount of wool left over from the previous years, much of the fleece wool being discoloured owing to the wool having been shorn off the sheep while the wool was damp and pressed while in that condition; a very large amount of seedy wool, and also much wool grown on scrub-burnt country. The number of bales of pieces, stained pieces, belly-wool, locks, and crutchings was out of all proportion to the fleece wool present, indicating that the former class of wool had comprised a very large amount of the carrying-over from 1930–31. It would have been better in the interests of the owners of this wool, had it been sorted into its various qualities, and been scoured prior to being offered for sale.

The woollen-mills operating in the Dominion secured a large amount of wool suitable for their purposes, and Dominion woolscourers were also operating more freely in their purchase of wool than had been the case for some time past.

The number of sheep-farmers on the 30th April, 1931, was 30,789, an increase of 767 over the previous year.

During the past year practical demonstrations on live sheep have been given to sheep-farmers, indicating to them the good points to breed for and the bad points to avoid. In addition, practical demonstrations were given in various shearing-sheds as to the way in which to prepare the wool-clip in the most attractive manner for sale. Lantern lectures, with suitable slides, have been delivered, and all lectures and demonstrations were well attended.

Microscopic examination of fleeces and wool samples: A fair amount of this class of work has been carried out during the year, and reports thereon have been sent to the farmers concerned as a guide in avoiding the use of faulty rams in their ewe flocks.

Knitting-wool: There has always been a considerable amount of this imported into the Dominion, mainly because the Dominion woollen-mills were not manufacturing it, but the last few years have seen an improvement in this direction. At present much of this wool, in attractive colours, is being made, and is meeting with a good sale.

The following table shows the number of bales of wool and the value of same exported from the Dominion to other countries during the year ended 31st March, 1932:—

Destination.	Greasy.	Sliped.	Scoured.	Washed.	Total.	Value.
	Bales.	Bales.	Bales.	Bales.	Bales.	£
United Kingdom	409,364	93,359	44,912	1,280	548,915	5,009,131
France	49,758	..	30	..	49,788	454,379
Germany	34,218	22	140	..	34,380	322,096
Japan	24,725	..	..	..	24,725	240,242
Australia	14,271	2,006	628	..	16,905	190,511
Belgium	16,241	..	..	..	16,241	141,928
Italy	8,190	25	..	..	8,215	65,940
Canada	3,359	986	644	..	4,989	52,837
Netherlands	2,994	..	25	..	3,019	31,404
Sweden	1,409	..	268	..	1,677	16,497
United States of America	795	633	2	..	1,430	16,376
Denmark	742	..	348	..	1,090	8,757
India	799	1	82	..	882	8,532
Spain	445	..	..	..	445	3,764
South African Union	407	..	..	..	407	4,204
Danzig	208	..	..	..	208	1,504
China	..	116	..	..	116	2,062
Norway	91	..	..	..	91	824
Totals	568,016	97,148	47,079	1,280	713,523	6,570,987

The great fluctuation in the price of wool is shown by the following figures: Year 1927–28, 723,717 bales, value £16,691,386; year 1928–29, 635,689 bales, £15,580,701.

Rabbit Nuisance.

As indicated in my report for last year, the rabbit pest showed marked indications of a tendency to increase, and it must to-day be admitted that a fairly general increase has taken place in the pest over widely separated areas in both the North and South Islands. This position is to be regretted, as, with the low price of pelts and the financial position of settlers generally, the cost entailed in rabbiting operations is a burden which many farmers find themselves unable to meet. The severe drought suffered throughout the spring and summer and into early autumn in North Otago, South Canterbury, and to a lesser extent in other districts, had also an influence in creating an increase in the pest.

Every endeavour is being made by the Department's officers to cope with the position, but the difficulties of finance, both departmentally and privately, are such that the position threatening is one of grave concern, and measures whereby assistance can be rendered to overcome the situation facing us will have to be given serious consideration. The question of finance is also affecting some Rabbit Boards, the trustees, out of consideration to the settlers within their areas, being desirous of avoiding the striking of rates, and, having insufficient funds to carry on with, the matter of the administration of the Act being passed over to the Department is a possibility confronting us. If this eventuality takes place it will be most unfortunate, as in the past Rabbit Boards have done excellent work in the suppression of the pest, and have demonstrated in a marked degree that local control can achieve very much better results than could be brought about by departmental officers, who necessarily have varied duties and very much wider areas to cover.

As an indication of the success of the Board system of control, additional Boards have been constituted during the year, and the preliminary steps necessary being taken in some other districts where rabbits have greatly increased of late, to form Boards as a means of control and safety in the future.

Industrial Rabbits.

The fur and pelt rabbit industry (Angora and Chinchilla) has not made any very pronounced progress during the year, but with the permission granted to import additional breeds such as the Rex, Beverens, and Havanas, the promoters are looking for more favourable results.

Noxious Weeds.

During the year sodium chlorate applied by spray has again proved an effective agent in the eradication of ragwort and other soft-leaf weeds. In some localities a measure of success has been obtained with this spray on blackberry, the plants having been sprayed from two to four times with very fair results. In other cases settlers have sprayed once only, at flowering time, to destroy the fruit, this method being quicker than cutting and entailing considerably less labour. So far as mature gorse is concerned, the results of spraying with sodium chlorate have been disappointing, while with broom and lupin the results have been encouraging. In the future, no doubt, much better control of many weeds will be brought about by spraying with this chemical and other compounds. The claim that sodium chlorate will give 100 per cent. result when used on ragwort is now generally admitted to be correct, but, notwithstanding the fact that a comparatively cheap and reliable means of destruction is thus available, a number of occupiers in every district have made little or no effort to clear their lands.

The point is emphasized by the District Superintendents at both Auckland and Wellington that there are many complaints voiced by the better class of farmers, who are asking that more drastic measures be taken to deal with defaulters. The leniency extended to the more dilatory or indifferent occupiers is not in the best interests of primary producers generally, and as far as ragwort particularly is concerned it is felt that a more rigid enforcement of the Act will be necessary, more especially as eradications by means of sodium chlorate is now much less costly.

Sweetbrier is a weed that is unfortunately getting a fairly extensive hold in parts of the South Island, especially on some of the back-country runs, and owing to the nature of the country it is difficult and costly to control. The weed appears to be increasing, and some settlers contend that the increase is more pronounced on uncultivated country since the reduction of the rabbit pest. Other noxious weeds—Californian thistle, gorse, broom, &c.—are still troublesome in districts where these are noxious weeds, but every endeavour is now being made to get landowners to avail themselves of the offers of labour from the Unemployment Board.

Shearers' Accommodation.

A considerable number of inspections of shearers' accommodation were carried out by Inspectors of Stock during the year on behalf of the Labour Department, although on account of the need for economy, and the consequent cutting-down of travelling-expenses, the number of inspections was necessarily curtailed. From the inspections made, however, it was found that, on the whole, the accommodation provided was quite satisfactory. In some cases alterations and improvements were needed, particularly to some of the older buildings, but in view of the present financial depression, owners were not requested to incur expenditure in this direction except, of course, where the accommodation was distinctly unfit or insanitary.

Staff.

I desire to record my appreciation of the manner in which members of the staff of all grades have carried out their varied duties during the year under difficult conditions. All demands in respect to economy in travelling-expenses and other expenditure coincident with the work of the Division have been loyally met, and another year's valuable work has been accomplished.

FIELDS DIVISION.

REPORT OF J. W. DEEM, DIRECTOR.

General Conditions.

The season 1931–32 has not been a very satisfactory one from the point of view of weather conditions. In most districts unseasonable weather was experienced off and on during the year, and what with droughts in certain districts, mainly in the South Island and in Hawke's Bay, farmers generally had a most trying time.

Arable Crops.

The drought conditions which existed for the greater part of the year throughout Canterbury and North Otago resulted in the failure of many of the grain crops, and the yield of wheat threshed to date of writing is comparatively small as compared with last year. In all wheat-growing districts yields have been more or less adversely affected by dry weather, but South Canterbury suffered most of all. Actual figures are not yet available, but it is estimated that 276,000 acres of wheat were sown, as against an actual sowing of 252,547 acres in the previous season. The total yield of wheat for 1930–31 was 7,579,153 bushels, but, basing calculations on figures so far to hand, it is estimated that the 1931–32 season's crop will yield only 6,660,000 bushels. The Dominion yield per acre for 1930–31 season was 30·44 bushels per acre, while the estimated Dominion yield per acre for the 1931–32 season is 24·44 bushels. It is apparent that the total yield of wheat will be insufficient for Dominion requirements.

So far as the oat crop is concerned, it was estimated for 1931–32 that 329,000 acres were sown, as compared with 310,605 acres actually harvested in 1930–31. The estimated yields per acre from statistics gathered by the Government Statistician indicate that the yield for 1931–32 is approximately 6 bushels less per acre than for the previous season, the figures being 32·56 bushels per acre in 1931–32, against 38·74 bushels in 1930–31. The oats threshed for the five seasons ended 1930–31 averaged 26·57 per cent. of the total. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 2,850,000 bushels, as against an actual yield of 3,376,609 bushels for the season 1930–31. Notwithstanding this prospective decreased yield, it may be found that the position in respect of oats and oaten chaff in the Dominion is quite satisfactory.

With regard to barley, it is estimated that 24,000 acres were sown in the 1931–32 season, as against an actual area harvested the previous season of 24,860 acres. As in the case of both wheat and oats, the yield per acre in the barley crop for 1931–32 is estimated to be several bushels per acre less than for the season 1930–31. Assuming that the percentage of the barley area threshed remains the same as last year, the total yield of grain should be approximately 530,000 bushels, as against an actual yield of 837,696 bushels for the season 1930–31.

The area under potatoes in 1931–32 was estimated at 22,500 acres, as against an area in the previous season of 28,484 acres. It is very difficult at time of writing to estimate the yield that will be obtained from the potato crop, but one is inclined to think that the quantity of table potatoes available from the 1931–32 crop will be ample for Dominion requirements.

Artificial Fertilizers.

The top-dressing of pastures still continues to be viewed as one of the main features in pasture production. Unfortunately, the present financial difficulties of the farming community have stopped, at least temporarily, the expansion of top-dressing. Last year's figures showed a decided decrease in the quantity of fertilizer used as compared with the previous year. This year's figures, however, show an increase of between nine and ten thousand tons. This increase came about during the last two months of the financial year, a feeling apparently existing that there was no certainty of the Government subsidy being continued beyond 31st March. At the same time many dairy-farmers who failed to top-dress last year found that their returns during the season had fallen rapidly, and they realized that they must top-dress or go under. Benefits derived from this practice of top-dressing are of the greatest value, and the adequate carrying-out of it is a national necessity.

Second-growth Country.

As was indicated in my last annual report, the experimental work conducted on hill country, particularly in Whangamomona County, which has been reverting to secondary growth, has been considerably curtailed. Much information of a valuable nature has been gathered from the work performed, and the continuance of this experimental work on the same scale as hitherto is not now considered necessary. Quite excellent work has been done on the demonstration farm run by the Lands Department in Whangamomona County under the provisions of the Deteriorated Lands Act.

Instruction in Agriculture.

The requests from the farming community for advice on agricultural matters of all descriptions are exceedingly large, and are stimulated by the difficult financial conditions now existing. Undoubtedly the advice and instruction imparted by the instructional staff of the Division has been the means of

enabling many farmers to "weather the storm" up to the present, and it is unfortunate that curtailment of expenditure, particularly in travelling-expenses, is tending to break that connection between instructor and farmer which is most essential to efficient service.

Experimental Farms and Areas.

Puwera.—This farm has continued to be run as an ordinary dairy-farm, although experimental work has been conducted thereon. Financial considerations, however, have restricted this work, which has been confined almost entirely to investigations regarding the value of nitrogenous fertilizers, observational phosphatic top-dressing plots, and rotational grazing. It is doubtful whether any further useful work can be conducted on Puwera, and I think the proposal that this farm should be relinquished and handed back to the Lands Department is a good one.

Marton.—This area, which was reduced during the year by some 30 acres handed back to the lessor, has been confined almost entirely to work of an intensive technical nature, and has been conducted by the specialist officers engaged in grassland research work. This work has consisted mainly of rye-grass strain trials, manurial trials, and the technique connected therewith.

Ashburton.—The experimental farm at Ashburton was closed down during the year, and in lieu thereof an area under the control of the Director of the Plant Research Station was established on a piece of ground leased from Canterbury Agricultural College, at Lincoln.

Gore.—Experimental and investigational work has been carried on on this area during the year. A separate report will be submitted later.

Galloway.—The farm at Galloway which was used to prove the feasibility of dairying on irrigated country, having fulfilled its usefulness, was closed down as an experimental area during the year and handed over to the Lands Department for settlement.

Waimaunga.—This farm, on which dairying was the main function, was, like Galloway and Ashburton, also disposed of to the Lands Department.

Subsidized Farms.—The four subsidized farms situated at Stratford, Manaia, Dargaville, and Winton respectively have continued as in the past to do much useful demonstration work in the districts in which they are situated.

Ruakura Farm of Instruction.

This farm experienced a change of Manager during the year due to the death of Mr. H. Munro, who had managed the place for some years past. Mr. Munro's death was greatly to be regretted. The gross income of the farm shows a decrease as compared with the previous year, due entirely to a decline in the values of farm-produce. On the other hand, the expenditure was kept as low as possible, and the saving in expenditure more than counterbalanced the decrease in receipts. The income from the dairy herd was practically the same as for the previous season. The milking of a few more cows than during the previous year offset the lower price received per pound of butterfat. The annual sale of pedigree stock was held in August, 1931. Competition was keen, and prices realized were above general ruling rates. This must be viewed as satisfactory.

Ruakura Farm Training College.—This college continues to be popular with farmers and others who have sons eligible for admittance. The accommodation has been fully occupied.

Boys' and Girls' Agricultural Clubs.

Owing to a reduced vote being available for expenditure in connection with boys' and girls' agricultural club work, it became necessary during the year to revise our views on this work and to limit the operations as much as possible rather than to encourage the movement. However, quite good work was done in those districts where the clubs have been in operation in the past. A certain amount of expenditure was saved this Department through a decision that no refund was to be made of the travelling-expenses of agricultural instructors attached to Education Boards when travelling on boys' and girls' club work. There is no doubt that the work performed by these clubs is of very great value from an agricultural-instruction viewpoint, and the curtailment of operations owing to financial stress is one which we would like to see overcome if possible.

Land-development Schemes.

As indicated in my report for the year ended 31st March, 1931, the land-settlement policy of the Government has created a considerable amount of extra work for this Division, particularly for the Fields Superintendent of the Auckland District. In addition to supervising the development work on Ngakuru Blocks 1 and 2 and Ngakuru No. 2 Extension, near Rotorua, the Superintendent mentioned has inspected and submitted special reports relative to quite a number of additional areas which the Lands Department had in view for development and settlement. The development wor on the Ngakuru Blocks mentioned has proceeded very satisfactorily, and has now arrived at the point where certain sections have been selected, and dairying will be commenced on them during the coming dairying season. During the past year dairying was carried out as a demonstration on one of the areas, and the results obtained under the circumstances are satisfactory.

In addition to the development work carried out on Ngakuru, as above mentioned, some work has also been done on pakihi land near Westport. Slightly over 60 acres have been sown to grass, and the ability of this land to stand up to grazing throughout the year can now be tested.

Farmers' Field Competitions.

These competitions were continued during the year in various parts of the Dominion, mainly in Taranaki and the Wellington - West Coast districts, on the same lines as in past years. They are inclined to become more varied as time goes on, and the benefits derived from them by way of instruction to the farming community in the centres in which they are conducted are of undoubted value.

Field Experiments.

The comprehensive programme of work in field experimentation conducted in the 1930–31 year has been continued, although it was found necessary through only a reduced vote being available to curtail the experiments to a slight degree. Nevertheless, 586 experiments were carried on. This is approximately 100 less than in the previous year, and the reduction is chiefly due to certain classes of experiments having served their purpose and consequently being abandoned. The record of the behaviour of crops under different manures and different systems of manuring and so forth which the Department has been able to obtain as a result of its careful recording of experimental work is most valuable. The summarizing of results and the dissemination thereof to farmers through the Department's *Journal* and the instructional staff cannot but have a beneficial effect on the farming practices as carried on in the Dominion.

Crop Certification.

The list of crops dealt with under the certification scheme of the Department was extended during the 1931–32 season to include cocksfoot, Montgomery red clover, and Kentish wild white clover, while the basis for certification of New Zealand white clover was altered from one of age to one of type. Other crops which were subject to certification prior to the past year were perennial rye-grass, brown-top, potatoes, wheat, and beans. Fees in connection with certification were enforced during the past year for the first time. By these fees, which are on a per-acre basis for the crops entered, with a per-bushel charge for the quantity of machine-dressed seed, it is hoped to make the certification work of the Division very largely self-supporting. As intimated above, charging for certification services only came into operation last spring, and for about the six months ended 31st March, 1932, a sum of approximately £1,098 has been collected. At the time charging was enforced it was anticipated that the result might be a reduction in the quantity of material handled, but such has not been the case. In respect of one or two crops reductions in quantity have occurred, but this has been caused by other factors than the enforcement of charges.

The major crop which comes into certification is perennial rye-grass, and with this crop a greatly increased area was dealt with in 1931–32, as compared with the previous season. Mother-seed areas show an increase for 1931–32 over 1930–31 of 110 per cent. Permanent pasture areas, which are eligible on reclassification for certification as mother seed, show an increase of 12 per cent., while areas eligible only for permanent pasture show an increase of 260 per cent. The other class of rye-grass under certification—namely, first harvest seed—shows an increase in area of 64 per cent. The total area of rye-grass passed for certification in 1931–32 was 8,800 acres, as against 5,642 acres during the previous season. It may be mentioned that up to the end of March 70,000 bushels of rye-grass seed have been machine-dressed, and finally sealed and tagged as certified seed. This amount will probably be exceeded when the work is finished, but even this 70,000 bushels is a big increase over last year's operations, when 46,000 bushels were machine-dressed during the whole season.

Ironstone-land in North Auckland.

The pasture-establishment experiments on the ironstone soils of the Kapiro Block, Bay of Islands district, were continued, but no new work was undertaken. The area sown in grass has been satisfactorily grazed with sheep and cattle, but the establishment and growth on the areas fall far short of a good pasture, and results generally are not satisfactory.

Ensilage.

The ensilage drive to which reference is made in my report for the year ended March, 1931, has caused ensilage to gain a definite and lasting popularity with farmers generally. Undoubtedly the use of labour-saving appliances, of which there are many on the market, has assisted towards popularizing the conserving of surplus herbage as silage. Notwithstanding an increase in the number of farmers feeding silage to sheep, this increase has not been as great as one would like to see, and the efforts of the officers of this Division will at the proper time be concentrated in making known more widely the benefits to be derived from the use of this valuable fodder. The drought experienced during the year in certain districts will without doubt bring home to many farmers the advisability of making silage when feed is plentiful, and being thus in a position to meet adverse conditions when they arise as they did on this occasion.

Purchase of Seeds and Manures for Government Departments.

During the year an arrangement was made by the Stores Control Board that my office was to be the purchasing office for all seeds and manures required for Government Departments throughout the Dominion. A system of purchasing was evolved, and it is claimed that in all instances, notwithstanding some particularly large orders, mainly on behalf of the Lands and Survey Department, all purchases made were to the benefit of the Government. Further, the system of testing for purity and germination samples drawn from the bulk supplies, where specific lines of seeds were authorized for purchase, disclosed that in not one instance was a delivery made showing a lesser purity and germination than that on which the supply was bought.

The Hemp Industry.

In my annual report for 1930–31, I made reference to the fact that the hemp industry of the Dominion had fallen on very bad times. As time progressed conditions became worse, until a point was reached during the year where very little hemp and its by-products were coming forward for grading. For 1930–31 the quantity of hemp graded showed a decrease of approximately 66 per cent. on the figures for the previous year. The amount graded for the year 1931–32 showed a further decrease. For the past three years the quantity of hemp graded has been: 1929–30, 65,813 bales; 1930–31, 23,478 bales; 1931–32, 13,561 bales. Naturally, with the fall in the quantity of hemp coming forward for grading, a similar fall has taken place in the by-products of hemp—tow, stripper slips, and stripper tow. This considerable drop in the output of hemp and its by-products has aggravated to a considerable extent the unemployment position in the Dominion. It is evident that to mill fibre at the present price obtainable for the finished product is not a paying proposition. The one bright point so far as this industry is concerned is the proposed establishment of a factory or factories for the making of wool-packs, sacks, and so forth.

Departmental Photography.

The departmental photographer attached to the Fields Division has performed excellent work not only for this Division and officers of the Plant Research Station, but also for other Divisions of the Department. Every endeavour has been made to keep expenditure relative to photography down as much as possible without impairing efficiency; but it must be recognized that, so far as investigation and research work is concerned particularly, photographic work is quite an essential adjunct.

Staff.

The staff of the Division, one and all, have rendered excellent service during a most difficult and trying year.

DAIRY DIVISION.

REPORT OF W. M. SINGLETON, DIRECTOR.

Production.

Notwithstanding the fact that climatic conditions during the year have not been altogether favourable to a high production of dairy-produce, the quantity of butter received for grading in any one year exceeded the 100,000-ton mark for the first time in the history of the industry in New Zealand. During the year ended 31st March, 1932, 102,087 tons butter and 85,258 tons cheese came forward for grading, as compared with 95,981 and 92,527 tons respectively for the previous year. This represents an increase of 6,106 tons butter, equal to 6·36 per cent., and a decrease of cheese of 7,279 tons, equal to 7·83 per cent. Reduced to butterfat equivalent there is an increase of 2,696 tons, or 2·34 per cent.

Creamery Butter.

Notwithstanding the record production, the high standard of quality attained by our butter has been well maintained, the average grade for the year being 93·068. Butters scoring finest totalled 77·508 per cent.; first grade, 21·3; and under first, 1·15 per cent.

Whey Butter.

Whey butter shows a slight increase of 97 tons, the quantity branded being 1,455 tons, as compared with 1,358 tons during the previous year. The quality, however, shows little improvement. More care and attention between the time of separation and churning, and a more frequent delivery of the whey cream from the cheese to butter factories, would facilitate the production of a butter of higher quality.

Cheese.

During the earlier months of the year—*i.e.*, April to July inclusive—cheese branded "Cheddar" as well as Full Cream, were being manufactured, the former being a standardized article providing for a minimum milk-fat content of 54 per cent. in the dry matter. This class of cheese, however, did not prove acceptable to the trade in Britain, and at the request of dairy companies a regulation was gazetted prohibiting the manufacture of other than full-cream cheese as from 1st August, 1931.

It is the general consensus of opinion that the quality of this season's make of full-cream cheese has shown considerable improvement. Of the full-cream cheese graded, 22·47 per cent. was Finest, and of the total "Cheddar" and Full Cream 21·57 per cent. were placed in this grade, as compared with 17·53 per cent. for the previous year. Percentages of First and Under First of all cheese graded were 76·28 and 2·14, as compared with 79·80 and 2·65 for the previous year. Openness of texture has been the most prominent defect, which has prevented a great quantity of the cheese being classed as Finest. Body of most cheese has shown improvement, being nice and meaty, and showing the right amount of acid. Some cases of discoloration came under notice, and this trouble is being actively investigated with a view to eliminating it.

The regulation providing that cheese manufactured in August and September should be held on curing-room shelves for not less than twenty-one days before being packed or coated with wax, and the raising of the curing-room temperature to not less than 55° F. has resulted in this cheese being marketed in a more mature condition. Reports from Britain indicate that the general quality has been more acceptable to the trade. During the year approximately 87 per cent. of the cheese graded was made from pasteurized milk and approximately 83 per cent. was wax-coated.

Quantities of Butter and Cheese forwarded to Grade Stores for Years ended 31st March, 1932, and 31st March, 1931.

Port.	1931–32.		1930–31.	
	Butter.	Cheese.	Butter.	Cheese.
	Cwt.	Cwt.	Cwt.	Cwt.
Auckland	1,372,589	304,081	1,298,483	354,252
Gisborne	32,532	1,296	29,506	260
Napier	46,564	2,002	34,781	3,597
New Plymouth	162,755	345,387	156,687	359,368
Patea	41,811	383,283	44,186	397,834
Wanganui	61,873	49,729	56,394	77,684
Wellington	240,122	295,037	229,760	327,280
Lyttelton	48,477	18,720	42,731	22,543
Timaru	5,346	15,220	8,249	19,275
Dunedin	18,061	44,708	13,521	48,374
Bluff	11,619	245,716	5,337	240,088
Totals	2,041,749	1,705,179	1,919,635	1,850,555

Value of Exports.

Prices for dairy-produce have during the year reached a very low level, and, despite the increased production of butterfat, aggregate values for the year were lower by £2,748,084. According to the Customs figures of export, values of butter, cheese, dried milk, casein, condensed milk and cream, and milk-sugar totalled £14,187,059, as compared with £16,935,143 for the previous year.

Casein.

Casein continues to be graded at Auckland, New Plymouth, and Wanganui. The quality during the year has been well up to standard, being of a nice bright colour, good solubility, and comparatively free from lactose. A total of 1,639 tons was graded, being 244 tons in excess of the preceding years' figures.

Testing Butter for Moisture and Salt Content.

The usual practice of testing a box from each churning of butter sent forward for grading was followed, and during the year 153,985 churnings were tested. A high degree of accuracy in the incorporation of water in the butter has been maintained by buttermakers, and only 0·4 per cent. of these churnings exceeded the legal limit of 16 per cent. The butter showing excess water was, of course, not exported. In addition, 99,015 samples were tested for salt content, the legal requirement of which ranges from 1·5 to 2 per cent. A tolerance of 0·25 per cent. below the legal minimum has been permitted, and a very small percentage of churnings was found to be outside this range; these were withdrawn from export.

Cream-grading.

The grading of cream in accordance with the regulations has proceeded on fairly sound and uniform lines. In isolated cases a slight divergence from the standard adopted has come under notice, more particularly with the grading up of borderline cream, but the Butter Instructors and Special Inspectors have been able to correct these irregularities. It is generally conceded that cream-grading has been of great assistance in maintaining the high quality of our creamery butter.

Milk-grading.

During the year under review there has been considerable discussion at conferences of dairy-producers on the subject of milk-grading. The South Island Dairy Association and the National Dairy Association at their annual conferences have carried resolutions in favour of grading.

A proposal to bring in milk-grading as a "try out" and without compulsory differentials in price for the different grades meantime, was supported by the Dairy Produce Board. On 10th March, 1931, regulations were gazetted giving effect to this proposal. It took a little time to get all companies in line with the requirements, but the system seems now to be working satisfactorily. From the beginning of the year a dozen cheese-producing companies were voluntarily grading their milk for cheesemaking and paying differential prices. These companies forwarded for grading during the year 1931–32 some 11,397 tons of cheese.

Farm Dairy Instruction.

Despite the generally low prices received for dairy-produce, and the tendency to reduce expenditure in consequence, it is pleasing to record that during the year none of the dairy companies associated with the Department in the employment of the Farm Dairy Instructors gave notice to discontinue this service. This, in itself, is a striking testimony to the value of the work carried out by these officers. In all, thirty-one Farm Dairy Instructors have been employed by seventy-seven dairy companies with 26,596 suppliers, and these companies have forwarded 59,071 tons of butter and 31,282 tons of cheese for grading. As there are approximately 64,000 suppliers to dairy companies, it will be seen that half this number receive little or no instruction in the care and handling of the raw material, which is so essential to the maintenance of the desired quality. As the present adverse economic conditions preclude the institution of farm dairy instruction on a national basis, factory-managers whose suppliers are not included in the voluntary farm dairy instruction service need to do what is possible to improve the milk-supply through careful examination of the milk at the receiving-stage, and by affording where possible the necessary assistance to their suppliers of faulty milk.

Inspection of Milking-machines.

The inspection of new and renovated milking-plants installed during the year has been given the usual special attention by Farm Dairy Instructors in the districts where these officers are operating, and elsewhere by the Butter and Cheese Instructors and check-testers as opportunity offered. During the year some two thousand notifications of new and renovated installations and alterations to existing plants were received, and of those already inspected the majority have been found to comply with the regulations. Where contraventions have occurred little difficulty is being experienced in having the irregularity rectified.

Check-testing Suppliers' Milk and Cream Samples at Dairy Factories.

During the year some 580 visits were made to dairy companies for the purpose of check-testing suppliers' samples of milk and cream for butterfat content, this work being undertaken by two special officers, assisted by the Dairy Instructors as far as their instructional work permitted. A general desire is evidenced by factory-managers to carry out this work accurately and efficiently, and a survey of the check-tests received from our officers indicates that companies are testing on approved lines. The testing-appliances at many factories have, since the inception of this check-testing, been much improved, and the general position from the standpoint of the milk and cream suppliers can be considered satisfactory.

Dairy Laboratory.

The work of the Dairy Division in connection with dairy bacteriology was continued throughout the seasonal year under the direction of Mr. G. F. V. Morgan, N.D.A., N.D.D., and that connected with dairy chemistry was undertaken by Dr. G. M. Moir as from 1st September, 1931. This work is directly associated with that of the officers of the Dairy Division who give instruction at butter and cheese factories, and those who do the grading.

In addition to routine work, these scientists gave considerable time and attention to the questions of discoloration in cheese, and the making of comparative tests of milks by various methods to determine the most satisfactory method by which the grading of milk for cheesemaking might be undertaken. Mr. Morgan gave much valued help in connection with the assessing of the merits of various tests for grading milk for cheese-manufacture. His practical experience in the manufacture of cheese enabled him to appreciate the factors required of such a test. His blending of the scientific aspect with the practical materially aided the attainment of the final determination to use a curd test or a reductase-curd test as the general test in connection with the grading of milk at cheese-factories.

Considerable work had been previously carried out by Mr. Morgan on discoloration in cheese, more particularly coloured cheese. This work was continued, and with the collaboration of Dr. Moir further light has been thrown on certain aspects of the trouble. As the result of this work the Division has been enabled to send to dairy companies circular letters containing useful suggestions for preventive measures.

Dr. Moir joined the staff during the year, his appointment dating from the 31st August, 1931.

Inspection of New Zealand Dairy-produce in Britain.

Owing to the increased volume of dairy-produce being exported to Britain, it was arranged that an additional officer should assist Messrs. Wright and Taylor, and Mr. E. C. Wood, Dairy-produce Grader-in-Charge at Auckland, was selected and took up his duties in London in October last. This extra assistance has enabled a greatly increased quantity of butter and cheese to be examined and reported on. Numerous detailed reports on the quality of dairy companies' produce are received by each mail, and these are in turn forwarded to the companies concerned. Many other matters of value to the industry have also been reported on, and have been passed on for the guidance of the industry generally.

Certificate-of-record Testing.

During 1931 the Dairy Division's Certificate-of-record testing system reached a peak in its progress. Practically all cows qualifying for certificate in that calendar year calved for commencement of test in 1930, when the effects of the gathering depression were as yet scarcely in evidence. The number of cows placed under test showed a decided increase, while average production was also higher than for 1930. In addition, 1931 was the first year of operation of the C.O.R. 305-day test. During the year 630 first-class certificates were issued to cows qualifying under the rules for the yearly test, and 107 under those for the 305-day division, a total of 737, or an increase of 94 certificates over the preceding twelvemonth. Thirty-five second-class certificates were issued, being one more than for 1930. The average butterfat yield represented by the 630 C.O.R. yearly certificates was 495·17 lb., as compared with 474·02 lb. for 1930. From the point of view of average yield, however, it should be stated that commencing with 1931 the minimum butterfat requirement for certificate was increased by 35 lb., which would eliminate some of the lower producers and react favourably on the average. The average production of the 107 cows which were granted certificates in the 305-day division was 421·29 lb. butterfat. The minimum butterfat requirements for this division are 25 lb. less than for the full-year class. The foregoing figures relate to the calendar year, which is the statistical period adopted for this method of testing.

Government Official Herd-testing.

The last Official Herd-testing year ended on 30th September, 1931, which was the fourth year of operation. During the twelve months ended on that date 175 C.O.R. breeders availed themselves of the Official Herd-test service to the extent of testing 2,236 cows. These are the highest figures yet reached, and represent an increase of thirty breeders and 770 cows over the preceding year. Classified on the basis of all cows in milk 180 days or more, the average yield of the cows under this test for 1930–31 works out at 298·17 lb. butterfat from 6,617·4 lb. milk, in an average lactation period of 278 days, some 2,008 cows qualifying for inclusion.

Ordinary Herd-testing.

The returns for 1930–31, on the basis of all cows tested twice or more, show a total of 271,404 cows tested in the Dominion, as compared with 283,731 for the preceding season. Of the last year's total 88·8 per cent., or 241,155, of the cows were tested under the Group system, while of the remainder 28,914 cows were tested under the Association system, and 1,335 cows tested by dairy companies on behalf of their suppliers. The Government again granted a subsidy to herd-testing, the amount for 1930–31 being £8,000. A portion of this was paid to organizations to meet establishment costs for new groups, a portion to established organizations to meet the cost of upkeep and of additional plant, while the balance permitted a payment to testing dairy-herd owners of 4d. per cow for group testing and 2d. per cow for association testing.

In carrying out this general herd-testing the Division has co-operated with the Herd-testing Federation. The actual allocation of the subsidy is directed by the Central Executive, upon which the Federation, the Dairy Board, Massey College, and the Department are all represented.

Appreciation.

The volume of dairy-produce now being manufactured has entailed increasing work on all members of the staff, and the good and loyal service given has been a very pleasing feature, and is much appreciated. The Division is also pleased to record its appreciation of the helpful assistance rendered during the year by the Chief Chemist, State Forest Service, Dairy Produce Board, the various freezing companies handling dairy-produce, the firms handling milking-machines, and the cattle breeders' associations.

HORTICULTURE DIVISION.

REPORT OF J. A. CAMPBELL, DIRECTOR.

The Fruitgrowing Industry.

From a cropping point of view the season under review was a very satisfactory one, the crop of pip-fruits in particular even exceeding that of the previous year, which was above the average. Conditions generally were very favourable for the carrying out of orchard operations—pruning, spraying, cultivation, &c. Although continued dry weather during the early part of the season was against the proper development of the fruit, the rains experienced in December benefited the crop considerably. Growers in a portion of the Central Otago district suffered severe losses as the result of a very heavy frost which occurred on 25th November, the whole of the apple and pear crop in a number of the large commercial orchards being completely destroyed. Stone fruits, being sufficiently advanced in growth, did not suffer to any appreciable extent. The apple crop in the Marlborough District was also seriously depleted by a late frost.

No serious damage was caused to orchards by fireblight, the disease being kept well under control in the previously infected areas. An outbreak occurred during the year in the Marlborough District, and steps were at once taken to deal with it effectively.

There was little or no extension in orchard-planting during the year, the total area in commercial orchards standing at approximately 27,000 acres.

The culture of citrus fruits (lemons and Poorman oranges) on a commercial basis has received considerable attention during recent years. It is considered, however, that the industry has now reached a stage when further planting should be undertaken with caution. The season's crop, generally speaking, was a satisfactory one. While it has been amply demonstrated that lemons can be produced in this country equal to the best-quality imported fruit, there is still room for improvement in the condition and keeping-qualities of the local article. More attention to the proper methods of curing would, without doubt, react in improving the value of the lemon-growing industry in New Zealand to a very considerable extent.

The large areas planted in passion-fruit at Kerikeri, North Auckland, have now reached a stage when heavy crops are being produced. The question of a suitable market at a remunerative price is giving some concern to growers at the present time. With a view of ascertaining the prospects on the British market for this fruit, an experimental shipment of twenty-two cases was forwarded to the High Commissioner for New Zealand, London, in March last. Each package contained approximately 12 lb. fruit, several different methods being adopted in the packing. Cabled advice has since been received to the effect that the consignment arrived at its destination in a satisfactory condition, but that it was considered the market was limited, as passion-fruit is treated more in the nature of a luxury line. Further detailed particulars are being awaited with interest.

The Imperial Fruit Show was held in London in June last. In the Overseas Section for apples, open to growers in Australia, South Africa, and New Zealand, the handsome silver challenge cup presented by His Excellency the Governor-General, Lord Bledisloe, was won by Mr. H. E. Stephens, of Stoke, Nelson. Mr. Stephens was also the winner of the Goodwin Challenge Cup in the same section.

Export of Fruit.

Another busy export season was experienced in 1931, the increased quantities of fruit coming forward necessitating the inspecting and grading officers attached to the Division working long hours in carrying out the necessary examinations and the detail work connected therewith. The work proceeded smoothly, the majority of growers showing a keen desire to comply with the requirements of the export regulations. The total quantity of pip-fruit exported during the 1931 season was 1,349,895 cases, being some 20,000 cases in excess of the previous year's record figures. Of this total 853,569 cases apples and 50,986 cases pears were shipped to Great Britain; 376,199 cases apples and 6,155 cases pears to the Continent; 45,993 cases apples to South America; and 16,993 cases apples to Canada.

The bulk of this fruit was exported under the Government guarantee of a gross market price of 11s. per case for Extra Fancy and Fancy grades, and 7s. for Good grade. While the returns received on the British markets were considered satisfactory, the shipments made to the Continent suffered a serious drop in prices, owing to the financial collapse in Germany which occurred in the middle of the season. As a result the claims on the guarantee were fairly considerable, amounting to £19,171.

The 1932 fruit-export season, which has now commenced, has every appearance of being a heavy one, and it is anticipated the total shipments will exceed one and a half million cases.

Local Markets for Fruit and Vegetables.

The local markets have been kept well supplied with fruit and vegetables during the year. While the bulk of the lines offered was clean and free from disease, there was an excess of mixed grades, especially in apples, which had a tendency to lower prices generally. Although considerable improvement is noticeable in the grading and packing of vegetables, it was found necessary to take legal proceedings against a few offenders who had not heeded previous warnings in regard to fraudulent packing.

Fruit Cool Storage.

Investigations in connection with fruit cool storage—a very important matter to the fruit-grower—have been continued during the year, and considerable work of an experimental nature carried out in co-operation with the Department of Scientific and Industrial Research, both in the local cool stores and on board ship. This includes fruit-scald control, maturity tests with apples and pears, wastage in export fruit, &c.

Further close attention has also been given to the loading and stowage of fruit shipments and the cool-storage conditions operating on the various vessels carrying fruit overseas. The rough-handling factor on the wharves, which has no doubt contributed largely to the wastage that occurs in export fruit, has been further looked into, and, although the practice is still more or less in evidence, an improvement has been brought about.

Numerous requests for advice and information on cool storage have been met, and visits of inspection made by the Cool Storage Officer attached to the Division to the majority of the fruit cool stores in the Dominion for the purpose of affording advice on the many related problems.

Instructional and Experimental Work.

Practical instruction in the many phases connected with fruitgrowing by means of lectures and public demonstrations has been carried out by the field officers, as far as the curtailed expenditure would permit. The usual classes in fruit grading and packing were held in a number of the main commercial centres, any expenses in connection therewith being defrayed by the respective fruit-growers' associations.

The comprehensive orchard research scheme put into operation last year in conjunction with the scientific officers attached to the Plant Research Station, Palmerston North, has been continued, and a very extensive programme carried out in the various districts throughout the Dominion, which entailed a considerable amount of work on the field officers concerned. The testing of a large number of spraying compounds relative to their efficacy and behaviour under varying climatic conditions, better control of certain orchard diseases, control of earwig and grass-grub, and fertilizer treatment in orchards, are some of the features of this work. Tests with various fruit-tree stocks are also being continued. Spraying experiments on a fairly large scale have been carried out at the Research Orchard at Redwood's Valley, Nelson, where a number of manurial tests are in progress. The investigations at this orchard are being conducted in co-operation with the Department of Scientific and Industrial Research.

Viticulture and Winemaking.

The crop of wine grapes varied according to the climatic conditions experienced in the various districts. A heavy crop which ripened later than usual was produced in the Auckland District. In Hawke's Bay and Poverty Bay considerable quantities of grapes were lost as the result of a very wet period towards the end of the ripening season. It is estimated the total output of wine for the Dominion will be in the vicinity of 100,000 gallons—an increase of some 25,000 gallons on last year's figures. Reports to hand indicate that the planting of wine grapes is steadily expanding.

The yield of outdoor table-grapes was well above the average, and a good season, as far as production is concerned, was experienced by growers of grapes under glass.

Towards the end of the year Mr. J. C. Woodfin, Vine and Wine Instructor, with headquarters at Wellington, was transferred to Te Kauwhata Horticultural Station as Acting Manager.

Cider-making.

There has been an increase in cider-production, the quantity manufactured during the year being estimated at 50,000 gallons, valued for commercial purposes at £12,500.

Te Kauwhata Horticultural Station (Lower Waikato).

A further portion of the Station property was handed over for development purposes during the year, leaving 94 acres for horticultural and viticultural work and general farming.

Favourable weather was experienced during the flowering season, and the grape crop was a fair average one. The new vines under trial have made good progress, and a number that have fruited give promise of being well suited for the district. Sales of wine amounted to 5,596 gallons, which realized £2,894. This represents a further decline in wine sales, and is no doubt due to the continued financial stringency. Owing to decreased sales and an increased grape crop, extra storage accommodation has had to be provided in the cellar. Notwithstanding the adverse conditions, the financial position of the Station is satisfactory, receipts exceeding the expenditure for the year by £1,180.

Tobacco-culture.

Much interest is still being manifested in the growing of tobacco in the Dominion, and the demands for advice and information on this subject have been considerable. An increase has taken place in the area planted in tobacco, and it is estimated the total acreage is now in the vicinity of 2,500 acres.

As the result of several years' experience, the industry in the Nelson and Motueka districts is in a satisfactory position, some fine crops being harvested this season. The bulk of the leaf is grown under contract to the manufacturing companies operating in New Zealand at remunerative prices to the grower. Considerable headway is also being made in the Auckland and Bay of Plenty districts, where some half-dozen tobacco-growing companies are operating.

While it has been amply demonstrated that high-grade leaf can be produced in the Dominion, it should again be stressed that only a limited amount can yet be absorbed locally, and the ultimate success of the industry largely depends on a satisfactory overseas market being found for the surplus not needed for New Zealand requirements. Such a market cannot yet be regarded as being assured. Regulations under the Products Export Act, 1908, relating to the grading and export of New Zealand tobacco were gazetted in September last.

Hop-culture.

There has been a considerable decrease in the area devoted to hop-growing during recent years. In view of the unstable market and the low prices ruling for hops, growers in the Nelson and Motueka districts are gradually going over to the cultivation of tobacco. Dry weather conditions resulted in the crop being on the light side. The quantity and value of hops exported from the Dominion during the year 1931 was 1,943 cwt., valued at £9,108.

New Zealand Institute of Horticulture.

The Institute of Horticulture established in 1923 continues to carry out valuable work in connection with the various branches of horticulture within the Dominion. Horticultural education forms one of the main objects of the activities of the Institute, which has full authority under the New Zealand Institute of Horticulture Act, 1927, to grant diplomas in horticulture to those qualified and passing examinations during the course of a special training.

The third Loder Cup competition for the best collection of New Zealand native plants took place in Christchurch in January last, and was won by Messrs. Henry Bennett and Sons, of North-east Valley, Dunedin, who were also the winners in the previous year.

Orchard Registration and Orchard-tax.

Registered orchards in the Dominion total 6,264, of which 2,954 are taxable and 3,310 non-taxable. Some £1,587 was collected in orchard-tax, and this amount, less cost of collection, was handed over on behalf of the growers to the New Zealand Fruitgrowers' Federation to be utilized in furthering the interests of the fruitgrowing industry generally.

The fireblight tax operated in six commercial fruitgrowing districts during the year. This tax was also collected by the Department, and the proceeds, less cost of collection, paid to the respective fireblight committees to be expended for purposes duly approved in connection with the control of fireblight disease.

Registration and Inspection of Nurseries.

During the year 659 nurseries were registered and duly inspected by the officers attached to the Division in the various districts; £659 was collected in registration fees. Nurseries generally are kept in good condition, and the stocks are well up to standard and clean and free from disease.

Imported Fruit, Plants, etc.

The Inspectors at the different ports of entry report an increase in the quantity of fruit imported as compared with last year's figures, increased consignments arriving from Australia and the Pacific islands. Larger shipments of bananas were received from Norfolk Island, due no doubt to the regular steamer service now operating.

The Beekeeping Industry.

The past season may be regarded as a disappointing one for the majority of beekeepers throughout the Dominion. Boisterous weather during the spring, followed later by extremely dry and unsettled conditions, resulted in very poor returns in most commercial areas, with the exception of the Waikato, Taranaki, and Wellington - West Coast districts, where medium crops were secured.

Although the honey market both locally and overseas is at the present time in a somewhat unsettled condition, the industry is continuing to attract persons with moderate capital who are desirous of making a partial or complete living by honey-production, and a considerable demand exists for suitable apiary sites.

The inspection of apiaries for disease and advisory services generally have been fairly satisfactorily maintained, and useful assistance has been rendered in the main commercial districts by a few experienced beekeepers who offered their services as honorary apiary inspectors at no expense to the Department.

Work of an experimental nature has been carried out in connection with the sterilizing of foul-brood combs and the forwarding of package bees from the North to the South Island. Final results are not yet available.

As the result of the poor season, only a small quantity of honey was submitted for export, the total number of cases passed at the various grading stores being 4,290. The quantity exported in 1931 was 1,958 cwt., valued at £7,845, a great falling-off compared with immediately preceding years.

It is considered that the great majority of beekeepers in the Dominion have complied with the regulations under the Apiaries Act, which provide that no person shall keep bees except in an apiary registered under the Act. The total number of apiaries registered is now 7,500, comprising 115,856 colonies of bees.

Staff.

Thanks are due to all officers attached to the Division for their loyal co-operation and assistance during the year.

CHEMISTRY SECTION.

REPORT OF B. C. ASTON, F.I.C., F.N.Z.INST., CHIEF CHEMIST.

Mineral Content of Pastures Investigation.

Now that so much information has been accumulated regarding the composition of improved and unimproved pastures of all types and at all seasons, in many parts of New Zealand, mainly through the investigations undertaken by the Chemistry Section, attention is being turned very largely to the remedying of the mineral deficiencies revealed, through the agency of compounds in lick form or other forms of supplementary mineral feeding.

Perhaps the most important feature of the year's work has been the remarkable demonstration of the efficacy of finely ground limonite (hydrated iron oxide) in preventing and curing bush sickness in sheep. With the knowledge that breeding-ewes can be maintained in perfect health and can produce a normal percentage of high-class lambs, which in turn can be fattened, or reared for flock purposes at trifling increased cost and trouble, the final bogey of bush sickness has been laid low. A powerful weapon is also placed at the disposal of settlers in the affected pumice areas where ragwort and other weeds controllable by sheep have hitherto proved a serious obstacle to dairying, which could otherwise be carried on with the methods recommended by the Department, of which the chief was periodical drenching of stock with a solution of iron and ammonium citrate.

It is not practicable to drench sheep as a farming practice to prevent or cure bush sickness; the adoption of a limonite lick should render it possible to run sheep in districts hitherto used solely for cattle, which cannot keep ragwort under control and which are more susceptible to the plant poison than are sheep.

Atiamuri Pumice Lands Experiment (Sandy Silts).

A large-scale and highly successful experiment has been carried out using limonite—obtained from a commercial firm who are mixing and grinding the soft ore which occurs near Whangarei—mixed in equal proportions with salt as a lick for breeding-ewes and lambs. Attention was diverted to limonite, as the native carbonate of iron which had previously given very promising results was becoming expensive, difficult to obtain, and irregular in quality. As the result of inquiries and experiments, three firms are now supplying limonite in very finely-ground form for use as a stock lick, Analyses of samples have been made both for fineness and hydrated iron oxide, with very satisfactory results.

From a flock of two thousand ewes, four groups of fifty were selected, of age between two and three years; all had been on the property for at least two years. On this property at Atiamuri the hill slopes are healthier than the pumice flats on which the experiment was conducted. The groups were treated as follows: No. 1, control, no lick; No. 2, lick containing iron and ammonium citrate and salt; No. 3, lick containing Whangarei hydrated iron oxide (limonite) and salt; No. 4, lick containing spathic iron ore and salt.

All groups grazed the same paddocks in rotation. Possibly owing to the taste, the iron-ammonium-citrate lick was only sparingly consumed, but the iron-oxide lick was taken freely. The spathic-iron lick was unsuccessful, probably on account of poor quality so that the effective supply of iron from this source may have been very small. In each group twelve ewes were selected for weighing at monthly periods.

On 20th February, a farmers' field day was held. All the lambs of the control and citrate groups were dead. Of the iron-oxide group forty-four lambs from forty-five ewes were well developed, robust, and with a healthy bloom on the wool, while the ewes were bright and healthy. The total cost of the treatment for nine months was about 5½d. per head. Only sixteen of the control ewes had survived, in poor condition, while twenty-four surviving citrate ewes were rather better than the controls. On *post mortem*, a lamb from the oxide group was reported by the Veterinarian to be healthy and free from parasites, while one from the main mob was poor and "full of worms" (parasitic infection). Apparently the iron oxide treatment of the ewes had enabled the lambs to resist parasitic invasion.

Results may be tabulated as follows:—

Group of Ewes.	Ewes' Weight.		Lambing.			Average Weight of Ewes' Fleece, 20th February, 1932.
	5th May, 1931.	8th February, 1932.	At Birth.	When marked.	Surviving at February, 1932.	
	lb.	lb.	Per Cent.	Per Cent.		lb.
Limonite	120	128	100	90	88	8½
Iron ammonium citrate ..	112	92	62	16	Nil.	7
Control	114	72	76	50	Nil.	6½

Experiments with the incorporation of limonite in ensilage have been continued. In one case several cows which had refused to take an iron lick and had consequently sickened were readily cured when fed the treated ensilage. Excellent results have been obtained from feeding limonite to dairy cows and calves, and it has been shown to be highly efficient when used as a drench for sick animals.

The collection of pasture and soil samples for analysis and the care and sampling of pure pasture species in the grass garden on Mr. E. H. Brain's property, at Kaharoa, have been continued. The experimentally green-manured paddocks have been stocked and some observations recorded. Cows milk better when on these paddocks than when on others similarly top-dressed, and also show

preference for them. Probably the best results are not obtained until the second and subsequent seasons after green-manuring and regrassing. The Analyst's Assistant (Mr. C. R. Taylor) at Rotorua reports as follows:—

Iron Treatment of Stock.—Apart from the very comprehensive trials with various iron compounds designed to overcome bush sickness in sheep at Atiamuri, the results of which have already been supplied in all detail (see *Journal* for March and June, 1932), a very large measure of useful work has also been accomplished at Tokoroa and other iron-deficient districts by way of feeding dairy cows with a limonite lick. The results, without exception, have been astounding and beyond all expectations, so much so, in fact, that settlers are looking forward to the coming season with the utmost confidence. The Tokoroa district alone has consumed well over twelve tons of limonite since January and not one single complaint has so far come to hand, but praise for the treatment is universal. To quote an extract from one settler's letter which may be taken as typical of the general feeling hereabouts, will no doubt be of interest: "I commenced feeding limonite about the end of January, 1932, and the stock are looking splendid. There are also twenty Jersey cross calves on the place, the first year I have succeeded in rearing a decent bunch. Looking fine. . . ." One could quote case after case similar to the above related by enthusiastic users of the limonite treatment.

The future of limonite is tremendous, and its importance in the economic life of the farmer on affected country is so great that no stone should be left unturned in making its usefulness known as widely as possible and without undue delay.

Waitomo County (Volcanic Loam).

Resulting from a spring season exceptionally conducive to mortality in sheep in the Mairoa district, a somewhat disastrous experience attended the sheep experiments in this locality. Even a good top-dressing with lime and super, although showing marked improvement in its effect in mitigating the malnutrition, was not sufficient to stop the mortality. The experiments were then taken over by the District Superintendent, Live-stock Division, Auckland, under the control of a committee consisting of the Director-General, Assistant Director-General, and the Chief Chemist, which had been set up on the 5th January, 1930, owing to the necessity of economizing in supervision expenses, but despite expert veterinary attention it was found necessary to terminate them. Lack of facilities in the way of cattle to control surplus feed probably contributed to the result, and it was thought advisable, especially as some of the paddocks top-dressed with mixtures (5–2 and 3–2) of lime and superphosphate, had only been stocked for a very short time, to commence a new series of experiments, using sheep from an outside district (Taihape), and arranging for adequate control of the growth with cattle. This has now been done. Sampling of the replicated plots was undertaken by a visiting officer subsequent to dispensing with the local assistant.

A large number of samples from the replicated enclosed pasture plots at Mairoa and Kopaki have been analysed, the results of the latter being reported in the fourteenth quarterly report to the Empire Marketing Board. The most striking features at Kopaki were the high contents of phosphoric acid and lime, the low iron content, the small seasonal variation, and the lack of marked response to top-dressing. The application of carbonate of lime depressed the manganese content slightly, but any effect on the already low iron content was masked by contamination due to soil particles which could not be entirely eliminated.

Estimation of sulphur in pasture samples from the experimental paddocks at Mairoa revealed no significant increase in sulphur content as a result of manuring with gypsum (sulphate of lime).

Bush sickness on soils of similar origin to those at Kopaki (Taupo pumice) has been reported in districts adjoining that locality, such as Mangapehi. Analysis of soils and pastures is being undertaken, and a limonite lick has been receommended.

Te Popo District, Taranaki (Sandstone).

On thin-volcanic-ash-covered hills of sandstone in the broken country of this district, a considerable mortality has been experienced in very young lambs, and difficulty in obtaining any fat lambs. After consultation, a lick of iodized salt, bone-meal, oxide of iron, and molasses was recommended and found to be very readily taken by all classes of stock. The result was the avoidance of deaths at birth and a much better growth in lambs.

Taihape District.

Analyses of soils and pastures from Rangiwahia district show a high lime-requirement and a deficiency of available phosphoric acid in the soil, and a lower lime and phosphorus content in the pasture from the unhealthy northern slopes than from the healthy southern slopes.

Morton Mains District, Southland (Alluvial Silty Loam).

Much attention has been devoted to this district owing to the increasing trouble in rearing lambs. Two visits were paid, during December and February respectively, the first just before and the second after the mortality had commenced. A large number of soil and pasture samples were collected for analysis, and a general survey made of the affected area. The collection of further samples is being arranged.

Briefly the history is as follows: The topography of the country is gently undulating, with many boggy depressions growing red tussock. The soil is alluvial, probably deposited in a shallow sea and then elevated, in texture a leached silty loam, overlying gravel of rounded quartz.

Till recently cattle were the stock chiefly grazed, and before phosphatic top-dressing became general were often affected by "Waihi disease" (aphosphorosis or phosphate deficiency). Heavy applications of lime, burnt or ground, were the rule, the pastures being frequently broken up for cropping. When phosphate was adequately applied to the pasture the "Waihi disease" disappeared. With the replacement of cattle by sheep, however, lambs, which previously were got away fat in small numbers, could no longer be reared. On dairy-farms, however, those lambs carried remained healthy, and sick lambs from neighbours' farms recovered. Sickness usually appears in December. Lambs which till

then have done well, while still on the mothers, but eating grass freely, become low-conditioned, constipated, anæmic, dull, and lustreless in the wool. Deaths occur rapidly and in large numbers. Ewes and even wethers sicken in some seasons.

Various licks have been tried, so far without result, but as this disease may be due in part to an inadequate supply of iron in the herbage, the limonite and salt lick is being given a careful trial. The pasture analyses so far completed have shown no deficiency of any of the usual mineral constituents, phosphate and lime in particular being present in adequate amount. Iron has been low in the uncontaminated samples. Analyses of ewes' milk and of bones from sick lambs have been made, but although the bones were apparently somewhat abnormal, interpretation of the results must be deferred until a sufficient number of bones of normal lambs of the same age have been analysed for comparison.

A somewhat similar trouble in calves on new, bush-burn, peaty soil, near Riverton is undoubtedly due to iron deficiency, and has been cured by the administration of iron ammonium citrate.

Mercury Island (Greywake Loam).

Some samples of pasture and soil were analysed from Mercury Island, as the owner reported poor response to top-dressing and mortality among his sheep. Pasture analysis showed low iron lime, and phosphorus, and high magnesium, while the shortage of rainfall on the island is probably the cause of the poor response to top-dressing. The use of a bone-meal, salt, and molasses lick was recommended, and the use of superphosphate in the drinking-water.

Bovine Eclampsia in the Waikato District (Volcanic Sediment Loam).

In the early spring a number of pasture-samples were collected from affected and unaffected farms in connection with the veterinary investigation of this trouble. As it was thought that excessive amounts of nitrates or nitrites in young pasture might be a predisposing factor, nitrates were estimated in a number of the samples. Although appreciable quantities of nitrates were present, there was little distinction in this respect between affected and unaffected pastures.

Miscellaneous.

A case of extensive bone-chewing and falling-off of milk-yield in a North Taranaki dairy herd was shown to be due to overstocking during a seasonal drought. Pasture and soil analyses undertaken later following heavy rain, when the bone-chewing had ceased, showed no deficiency of phosphate. Superphosphate in the drinking-water is indicated as the remedy in such cases.

A severe illness in a dairy herd near a superphosphate works was traced to the condensation of fumes containing fluorine, on the pasture. The symptoms were loss of condition, cessation of milk-supply and rumination, dull coat and eye, and rapid weakening. The cause of the liberation of so much fluorine was the substitution of North African rock-phosphate for Nauru Island phosphate, the former being much richer in this element.

Some flax strippings analysed to determine their value as supplementary stock-food, contained only 5·95 per cent. of protein in the dry matter, and this material is therefore unlikely to be of use in this direction.

Iodine Deficiency.

The main work during the year has been the mapping out of iodine-deficient areas in New Zealand, by the amounts of iodine found in the thyroid glands of sheep and lambs bred in definite districts, and the attempts to determine whether there is any correlation between the amounts of iodine found in the glands of animals bred on similar soil types in different districts. Veterinarians and Meat and Stock Inspectors have obtained glands from animals of known history, and from this source during 1931–32 about 350 samples have been received, many containing twenty or more glands. These have been dissected and digested and are in course of analysis.

Glands are sometimes received which are mutilated, or have small parts missing. About forty analyses were made from carefully dissected glands, cut into small pieces, to see whether there was a significant difference in the percentage of iodine occurring in various parts of the gland. On the whole, the percentage of iodine in the isthmus is smaller than that of the lobes through which the iodine is fairly evenly distributed, but the weight of the isthmus is so small compared with that of the whole gland that its rather lower iodine value makes no difference in the total percentage. Hence it was concluded that glands which had had the isthmus or a small portion of the lobe lost in dissection would still show a reliable percentage of iodine.

In *Chemistry and Industry*, Volume 51, No. 7, for the 12th February, 1932, reference is made to the discovery at Budapest of a method for administering iodine so as to avoid after-effects. Iodine is fed to poultry which lay eggs each of which contains 0·169 mg. of iodine. Apparently the fact has been overlooked that this method was investigated and reported on by Miss B. W. Simpson of the Rowett Institute, while on loan to this Department, in the *New Zealand Journal of Agriculture* for June, 1930 (Volume XL, No. 6, p. 403). Miss Simpson reported that eggs from hens fed with from 2 to 4 mg. potassium iodide per day contained from 0·213 mg. to 0·568 mg. iodine each.

Rabbit Experiments.—Experiments on rabbits are being carried out to find minerals which affect iodine metabolism in such a way as to produce goitre. About twenty glands from both young and mature animals have been analysed, and in many cases the iodine content was well below normal, although the glands were not enlarged. Results indicate that if the animal is not receiving sufficient iodine (due either to an iodine-deficient diet, or the presence of minerals exercising a possible depressing effect) in its daily intake, the total amount of iodine in the thyroid tends to be depleted. Further work is being carried out to see whether enlarged glands result after one or more generations.

Blood Experiment.—An experiment was carried out on cows at Wallaceville to find whether an indication as to the amount of iodine a cow was receiving through iodized licks would be given by a blood analysis. About 130 blood samples were analysed, and results clearly showed that the amount of iodine in the blood was dependent on the quantity fed, and the time which elapsed between dosing

and sampling. Graphs plotted with iodine content of blood against interval between dosing and sampling showed a very sudden rise to a maximum, with a more gradual fall to normal.

Rat Colony.—During 1931, five albino rats donated by the Glaxo Research Laboratories were imported from London. These animals are of the Wistar strain, a stock which has been selectively inbred for a very great number of years. As a result an exceptionally uniform product has been evolved, and this is of the greatest value in studying fundamental problems of nutrition. Among the advantages attending work with small animals are those of cheapness, exact control of conditions, rapidity of work, availability of a large number of uniform experimental subjects, &c. In some cases results cannot be directly interpreted in terms of larger animals, but the conditions surrounding a particular problem can be studied and many possibilities cheaply and rapidly eliminated. If necessary, experiments on larger animals can then be planned with a much greater degree of precision and with a saving of much laborious preliminary work. From the original rats a healthy and flourishing colony has been established and already experiments are in progress.

A study is being made of the conditions surrounding the absorption of iron—*e.g.*, the influence of plant acids, of elements such as magnesium, &c. Citric acid appears to have no effect on iron absorption, while magnesium as magnesium carbonate appears to exert a depressing effect. The importance of iron for hair growth is indicated by other experiments. In these experiments young growing rats fed for one to two months on rations containing very little iron, but adequate in other respects, became practically hairless. Remarkable response in hair growth follows the administration of iron, while the presence of iron in the ration from the commencement adequately protects the animals from hairlessness. The necessity of observations on iron feeding and wool growth in sheep is thus clearly indicated. Further experiments are concerned with the effect of feeding high levels of protein on growth and reproduction. So far, it has been found that growth is rather slower than normal when a diet containing 80 per cent. of protein is fed to animals weaned from the stock colony. After adult size is reached on this diet, reproduction also appears to be normal, but in all cases the suckling young have failed to reach the weaning stage. The effect appears to be inhibition of lactation in the mother, but this point is as yet undecided.

Bone Analyses.

Number of fresh bones from animals affected with various deficiency diseases have been analysed, the technique being improved. At the same time bones from normal sheep of various ages are being obtained and analysed to provide a basis for comparison.

Soils.

A certain amount of research has been carried out in conjunction with routine work. A modified method (Warren and Pugh) for the colorimetric estimation of phosphorus in soils has been adopted with success. The publications of the Imperial Bureau of Soil Science have been of great value.

The problem of the movement of phosphorus in field soils is a most important one, and preliminary work on the penetration and availability of phosphorus in certain New Zealand soils is nearing completion.

Research on methods of dispersion for mechanical analysis of certain New Zealand soils which are not amenable to ordinary methods of treatment has met with considerable success.

Rapid Soil Surveys for the Unemployment Board.

In connection with several projects of the Unemployment Board for developing new areas for settlement, rapid soil surveys to determine the prospective agricultural value of the land have been carried out in conjunction with the Lands and Public Works Departments.

Two extensive blocks of country in the vicinity of North Cape were visited, sampled, and reported on. The soils were very varied, comprising both light sands and heavy loams of varied geological origin. Practically all were, however, very acid and lacking in plant food, especially phosphate. A certain proportion, including the old consolidated dune sands and some volcanic soils would probably, with adequate liming, manuring, and shelter, be suitable for fruit-growing, but the majority would require considerable preliminary treatment before being utilized for agricultural purposes.

As regards the suitability of the old consolidated sand-dunes for passion-fruit culture, there is already a commercial passion-fruit orchard situated on soil of this type at Waipapakauri near the south end of the Ninety Mile Beach. An analysis of this soil showed it to be nearly identical with that from the north end of the dunes. There appears to be no reason why passion-fruit, and probably citrus and certain stone fruit, could not be grown in the latter locality under orchard conditions, but with the present transport facilities and remoteness and unreliability of markets, the cost of transport of fertilizers and products would have a determining influence on the success of such a project.

Some eighty samples of mud and silt from the bed of Lake Ellesmere, collected by Dr. P. Marshall of the Public Works Department, were analysed and reported on, in this case the report being highly favourable from the agricultural point of view, provided the engineering difficulties can be overcome. The soils were of good texture and very rich in plant-food, comparing in this respect with similar reclaimed mud flats in the Hauraki Gulf, but, on account of their much lower clay content, free from the danger experienced in the latter case of the development of sodium clay with its attendant evils of deflocculated or puddled soil, excessive alkalinity, and partial sterility. If reclaimed, it is considered that the Ellesmere soils will be especially suitable for market-gardening. On the rating adopted by Dyer for available plant-food these soils are three to four times as rich in phosphoric acid and potash as soils classified as "good" and five to six times those considered "normal." Some of the most productive soils in the world have been reclaimed from tidal mud-flats, and a vast development of this nature is at present being undertaken in Holland in the "poldering" of the Zuyder Zee.

In connection with a similar reclamation project for Blueskin Bay, a representative series of soils although rich in plant-food, were of such sandy texture as to make their utilization when drained subject to severe restrictions. In this case the water-supply would be the chief factor, and the effect of droughts would have to be contended with.

Samples of soil from some reclaimed land bordering Lake Ellesmere were analysed in 1908 and found to be very rich in available phosphoric acid. It was then advised that cruciferous crops would be likely to grow exceptionally well on these soils.

Limestones.

Probably owing to the need for utilizing all the resources existing on their farms during the depression, farmers have been very active in submitting samples of limestone for analysis. Two hundred and fifty-seven samples of lime have been analysed during the year. These include a number of samples of commercial crushed limestone submitted by the District Fields Superintendents for report as to whether their quality warranted the granting of the free railage privileges.

Fertilizers.

Two official and thirty unofficial samples have been received during the year. No important discrepancies were disclosed by any of the samples.

The following information relates to certain activities arising out of fertilizer control work covering the past registration year provided by the Fertilizers Act, 1927 :—

Registration Situation for 1931–32.

Number of superphosphate-manufacturers registered	8
Number of freezing and boiling-down works, &c., registered	57
Mercantile firms*, importing or selling fertilizers under their own brands, or selling overseas firms' fertilizers	236
Total number of primary vendors	301*
Number of merchants, storekeepers, &c., registered as secondary vendors	590
Number of firms registered solely as primary vendors	62
Total number of fertilizer vendors	652†
Number of brand registrations effected	2,016
Certificates of registration issued to primary vendors	353
Acknowledgments of registration to secondary vendors	660

Average fertilizing-strength of factory-mixed proprietary manures: Nitrogen, 1·3 per cent.; phosphoric acid, 18·5 per cent.; potash (K_2O), 2·0 per cent.

* Including 136 branches of various firms. † Including 160 branches of various firms.

Filler or Diluent employed.

Nature of Filler.	Number of Brands containing Filler.	Average Percentage.	Maximum Percentage.	Minimum Percentage.	Most Popular Proportions.
					Per Cent.
Carbonate of lime	189	16·6	62·5	4·0	10–25
Sand	9	17·8	18·0	16·0	18
Sulphur and sulphate of iron	2	2·5	..	..	..

Classification by Name of Typical Commercial Fertilizers registered for Sale in New Zealand.

Phosphatic.

Superphosphate.
Basic superphosphate.
Basic slag.
Bone-char dust.
Ground rock phosphates—
- Nauru Ocean Island.
- Makatea Island.
- North African—
  - Moroccan.
  - Tunisian ("Solfos," "Phosfull," "Hyfos," "Gafsa," &c.).
  - Egyptian ("Ephos").

Sulphurophosphate.
Phosphatic guanos—
- Seychelles Islands (Assumption Island and St. Pierre Island); and Juan de Nova Island.
- Walpole Island.

Phospho-nitrogenous.

Ammoniated superphosphate.
Basic ammoniated superphosphate.
Nitro-superphosphate.
Bone-meal or bonedust.
Blood and bone.
Whale bone-meal.
Meat and bone (tankage).
Bone tankage.
Fish fertilizer.
Leunaphos.
Diammonphos (di-ammonium phosphate).

Nitrogenous.

Sulphate of ammonia.
Nitrate of soda.
Calnitro.
Cyanamide.
Urea.
Dried blood.

Potassic.

Potash manure salts, 30 per cent.
Potash manure salts, 20 per cent.
Muriate (chloride) of potash.
Sulphate of potash.
Kainit.

Phospho-potassic.

Potassic superphosphate.
Potassic basic superphosphate.
Potassic mineral-(rock) phosphate ("Potassic Phosphate," "Potassic Phosfull," "Potassic Gafsa").

Phospho-nitro-potassic.

Nitrophoska.
Enpekay.
Dissolved guano.
Peruvian guano.
Nitro-potassic-phosphate.

DISTRIBUTION OF FERTILIZER SOURCES IN NEW ZEALAND.*

Province.	Number of Merchants.	Number of Boiling-down Works.	Number of Freezing-works.	Number of Superphosphate Works.	Total.
Auckland	52 (25)*	10	3	3	68 (25)
Taranaki	28 (17)	2	2	1	33 (17)
Hawke's Bay	7	6 (1)	1	..	14 (1)
Wellington	49 (27)	5	5	1	60 (27)
Nelson and Marlborough	8 (2)	2	2	..	12 (2)
Canterbury	42 (33)	5	5 (2)	1	53 (35)
Otago and Southland	50 (28)	4	5 (1)	2	61 (29)
Totals	236 (132)	34 (1)	23 (3)	8	301 (136)

* Does not include either co-operative dairy companies or agents not actually selling fertilizers.

Province.	(i) Number of Vendors registered per Form Ag. H/87.	(ii) Number of Vendors registered on Form Ag. H/222.	(iii) Number of Vendors registered on Form Ag. H/87 only.	Total (ii) and (iii).
Auckland	68 (25)	199 (37)	13	212 (37)
Taranaki	33 (17)	45 (14)	3	48 (14)
Hawke's Bay	14 (1)	51 (8)	5 (1)	56 (9)
Wellington	60 (27)	83 (25)	16 (2)	99 (27)
Nelson and Marlborough	12 (2)	27 (2)	3	30 (2)
Westland	..	13	..	13
Canterbury	53 (35)	84 (38)	8 (2)	92 (40)
Otago and Southland	61 (29)	88 (26)	14 (5)	102 (31)
Totals	301 (136)*	590 (150)	62 (10)	652 (160)

* The figures in parentheses indicate the number of branches of certain firms selling in various parts of the same province, and are *included* in the aggregates.

General.—Administratively, there has been an improvement in the registration situation during the year 1931–32, there being less occasion to refuse registrations or request amendments to registrations and invoice certificates. This also applies in the case of non-registration on the part of vendors and infringements of the fertilizer law generally.

Since the clauses of the Act relating to invoice certificates and registration have operated, there has been a distinct rise in quality of fertilizer goods sold, and careless methods of selling and advertising have been less obvious.

A thorough control has now been secured over registration, &c., which facilitates identification of numerous grades and kinds of plant-food carriers on the market by a system of recording, checking, certificating, and indexing of brands, and the filing of their analytical formulæ. In particular, from knowledge of the products of overseas firms, a careful supervision has been kept on imported brands.

In the past it has been customary for many vendors to leave fertilizer affairs in the hands of general salesmen having little knowledge of the analysis, composition, quality, correct branding, and terminology, &c., of fertilizers. Now, however, the tendency is for specialized officers in trading firms to look after sales and technical matters pertaining to fertilizers, and a keener desire to understand fertilizer affairs has become general. On the other hand, there is still scope for improvement in the education of farmers and salesmen, more particularly concerning the advertising of fertilizers, a matter which has been responsible for much correspondence and discussion during the year.

Connected with the registration of fertilizers is a great deal of advisory and inquiry work of a technical character. This includes the framing and correcting of analytical formulæ in invoice certificates, and the guiding of vendors in choosing suitable brands and describing the quality and composition and nature and percentages of diluents in fertilizers, especially of new or changed materials placed on the market. Correspondence on the nomenclature, valuation, quality, &c., of fertilizers is also involved to a lesser extent with fertilizer purchasers and departmental officers.

Quality of Proprietary Factory-mixed Fertilizers.—When registration was instituted under the 1927 Act a large number of imported and locally mixed fertilizers were being sold in misbranded or unbranded packages, and low-grade, diluted, and almost worthless substances were also much more numerous than they are to-day. But, apart from this improvement, the number of distinctive brands of the same or slightly different formulæ carrying, for instance, 1 per cent. of nitrogen and 2 per cent. of potash with a good measure of phosphoric acid, still continues to be unduly high in comparison with the grades of materials recommended by departmental officers and agronomists as being sufficient for soil and crop requirements in the Dominion.

In overseas countries of late there has been a movement in progress both toward materials with higher concentrations of plant-food and to a fewer number of brands. Very many brands in this country differing by only 1 or ½ per cent. of plant-food are sold for a variety of crops with widely divergent nutritional requirements. If manufacturers were to give more attention to fewer grades of high plant-food content, the farmer would be saved money on such items as freight, bags, handling charges, and manufacturing costs.

Suggestions regarding Amendments to the Fertilizers Act.—It is well recognized that the buying of fertilizer involves risk to the purchaser unless he can be quite sure of the analysis, for in no case can fertilizer be bought solely by weight, taste, colour, or smell. Therefore it is suggested that, as in other parts of the Empire, fertilizer sales of quantities under 5 cwt. be brought within the scope of the Act.

Further suggestions in regard to amending the Act are as follows: (1) Provision should be made for a statement in a fertilizer advertisement or circular to be in the form of a warranty to agree with the warranty in the invoice certificate. (2) Provision should be made for the incorporation of a schedule of fertilizer definitions in order to standardize fertilizer terminology. (3) A scale of licensing or brand registration fees should be charged vendors. Alternatively a fertilizer-tonnage tax could be levied. These recommended amendments are included in practically all recently amended fertilizer laws of other countries of the Empire. The foregoing do not exhaust all the amendments that are desirable under the present Act, but are only a few of the more urgently important ones.

Miscellaneous Work.

A sample of dried and ground seaweed, probably derived from the "bull kelp" *d'Urvillea Antarctica*, was submitted to determine its value as fertilizer. The analysis showed it to contain 26·8 per cent. of protein, 26·5 per cent. of crude carbo-hydrate, 19·3 per cent. of ash, of which only 1·7 was potassium chloride, 0·003 per cent. of iodine, and only 2·7 per cent. of crude fibre. If palatable and non-poisonous, it would therefore be much more valuable as a stock-food than as a fertilizer, and experiments are contemplated to elucidate this point.

Several samples of toetoe (*Arundo conspicua*) and pampas-grass (*Gynerium argenteum*) were analysed to determine their suitability as stock-fodder. They were found to compare favourably with oaten chaff in this respect, containing from 5 per cent. to over 7 per cent. of protein, and as they grow strongly in winter, being indicated as a substitute for oaten chaff in winter feeding. Toetoe is sometimes browsed by stock, but on account of its saw-toothed leaves, requires chaffing before it is readily consumed. Pampas-grass may be grazed directly. It is so grazed in the Hauraki Plains, one farmer growing no other winter feed and being so favourably impressed with the value of pampas-grass that he is planting fresh areas. The caution must, however, be made that the same grass varies largely in its appeal to stock in different types of soil, and that what is good food in the fertile Hauraki Plains may not necessarily be as suitable on drier soil containing less nitrogen.

An investigation was made of the processes of manufacture of meat-meals, together with analyses of several of the products on the market. The information was incorporated in a report in connection with suggestions which had been made for the standardizing of meat-meals for feeding to various classes of live-stock.

Other special reports were concerned with the analysis of whale-bone for conversion into manure, a suggested new process for the manufacture of superphosphate, the utilization of sewage as a fertilizer, of di-calcium phosphate as a stock lick, and of pipi-shells for fowl-grit.

Some samples of imported pineapple bran were analysed and found to be of good value for stock-food.

Several soils from the Solomon Islands were reported on for the Melanesian Mission.

Two samples of slag from the mercury works in North Auckland have been sent in for analysis, accompanied by favourable reports of its action as a top-dressing to pasture. Although the slag contains small quantities of alkali sulphates and sulphides, and carbon, owing to their being only traces present of those substances recognized as fertilizers under the Fertilizers Act, such as phosphate and potash, it cannot be registered or sold as a fertilizer. There is, however, nothing to prevent its being sold as a soil amendment, though its value in this direction would be limited to nearby farms owing to the cost of transport.

A series of experiments was carried out by Mr. C. R. Taylor at Rotorua during the spring of 1931 with the object of determining the best method of rendering sodium chlorate free from danger in causing combustion of clothing, &c., when used for spraying ragwort. It was found that the addition of small quantities of calcium chlorate to a solution of sodium chlorate did not affect its efficacy in exterminating ragwort, while materially reducing its inflammability. For general use when growth is not very far advanced a solution of 4 oz. sodium chlorate and 8 oz. calcium chlorate in 2 gallons of water is recommended, while for more advanced growth 6 oz. sodium chlorate and 8 oz. calcium chlorate in 2 gallons of water is preferable.

Work for the Departmental Divisions.

This has followed the same lines as in previous years and includes:—

For the Live-stock Division: Periodical analyses of public cattle-dips, analyses of licks, toxicological specimens, drinking-waters, &c.

For the Fields Division: Soils, limestones, spraying materials, &c. One sample of soil from Greys Hills Station, Mackenzie Country, was analysed to determine its suitability for an irrigation scheme. The results showed the soil to be a stony sandy silt very rich in available phosphoric acid and with high amounts of potash, lime, and magnesia. Chemically this soil should be well suited for irrigation purposes.

For the Dairy Division: Proprietary materials, discoloured cheese, parchment-papers, &c. One sample of discoloured parchment-paper was found to be contaminated with potassium permanganate. A rapid method for the estimation of salt in cheese was tested with satisfactory results.

For the Horticulture Division: Another case of suspected poisoning of bees by arsenical spray from fruit-trees was investigated. Arsenic was found to be present, but as a good deal of dirt had been scraped up with the dead bees, it was uncertain which contained the arsenic.

APPENDICES.

I. REPORT OF THE PLANT RESEARCH STATION, PALMERSTON NORTH.

THE activities of the Station have been well maintained during the year (1931–32), and a large amount of valuable work has been performed, as is indicated in the appended reports of the individual Sections.

The work has been carried out partly in co-operation with the Department of Scientific and Industrial Research.

A. H. COCKAYNE, Director.

AGRONOMY SECTION.

J. W. HADFIELD, Agronomist.

I. CROP CERTIFICATION.

The certification of seeds has been extended during the 1931–32 season to include (1) cocksfoot, (2) Montgomery red clover, and (3) Kentish wild white clover, while the basis for certification of New Zealand white clover has been altered from one of "age" to one of "type." Other crops subject to certification are (1) perennial rye-grass, (2) potatoes, (3) brown-top, (4) wheat, (5) beans.

RYE-GRASS.

There has been a considerable increase in the quantity of rye-grass handled during this season. The following table allows comparisons to be made of the acreages entered in the last three seasons:—

Class of Seed.	1929–30.	1930–31.	1931–32.	Percentage Increase of 1931–32 over 1930–31.
	Acres.	Acres.	Acres.	Per Cent.
Mother	..	1,074	2,300	110
Permanent pasture (eligible as mother)..	2,383	3,092	3,700	12
Permanent pasture only	..	279	1,000	260
First harvest	64	1,197	1,800	64
Total passed	2,447	5,642	8,800	55

The testing of rye-grass seed by screened ultra-violet ray, for determination of type, has been introduced by the Seed Analyst, and should to a large extent replace the method of plot-testing hitherto adopted. With the ultra-violet-ray test reports are available in a very short space of time, and a highly satisfactory standardized technique has been developed.

A standard of purity with regard to weed seeds has been adopted during the past season for lines of mother seed rye-grass. Only a few lines have failed to reach the required standard, and these have been regraded to the permanent-pasture class.

POTATOES.

A further increase in the quantity of potatoes finally inspected and tagged was experienced in the 1930–31 season. The figures, together with those for the two previous seasons, are given below:—

Variety.	1930–31.	1929–30.	1928–29.
	Tons.	Tons.	Tons.
Aucklander Short-top	390	176	85
Dakota	113	174	96
Aucklander Tall-top	73	50	14
King Edward	46	30	2
Epicure	37	13	..
Other varieties	99	68	51
Total	758	511	248

	1929–30.	1930–31.	1931–32.
Crops inspected	363	347	302
Crops rejected on account of rogues	84	23	11
Crops rejected on account of virus..	88	26	30
Crops passed field inspection	191	298	261
	=52 per cent.	=85 per cent.	=76 per cent.

BROWN-TOP.

Twenty-five thousand acres of brown-top was certified as free from red-top, and a large area was stripped, producing nearly 200,000 lb. of seed. The excellence of New Zealand certified brown-top is now well recognized overseas, and practically all this seed was exported. It is satisfactory to record that there is still a demand for certified brown-top, despite the introduction by the United States of America (our main purchasers) of a very high tariff on brown-top. On the other hand, there has been a decline in the quantity of uncertified seed exported during 1931.

Wheat.

The total quantity of wheat sealed and tagged fell from 16,000 bushels in 1929–30 to 4,060 bushels in 1930–31. This decrease may be attributed to two causes: first, the adoption of set standards for the 1930–31 field inspections, and the resultant rejection of 80 per cent. of the areas entered; and, secondly, to the fact that for the first time the Wheat Research Institute did not purchase and resell the wheat. This left merchants free to buy on the market, and many delayed purchasing their requirements till late in the season, by which time some of the certified wheat had been sold for milling purposes.

The effect of this high standard for field inspection is apparent in the results of the current season's field inspections, as may be seen in the accompanying figures:—

	1930–31.	1931–32.
Areas entered	136	62
Areas passed	27	46
	=20 per cent.	=74 per cent.

This improvement in the quality of areas entered in 1931–32 is a reflection of standards adopted during 1930–31.

White Clover.

A total of 30 tons of white clover seed was certified under the class "old pasture" in the 1930–31 season as compared with 35½ tons for 1929–30. There was a big decrease in the acreage entered for white clover certification alone, but this was partly counterbalanced by an increase in the amount of seed which was derived from the dressings of certified rye-grass from old pasture.

In the 1931–32 season a commencement has been made to certify white clover on a "type" basis. Samples from a number of areas have been tested by the Agrostologist, and those accepted have been grouped into "mother seed" areas and "permanent pasture" areas. Only a very few of these areas are being harvested this season, so that little certified white clover will be available.

Cocksfoot.

The certification of cocksfoot under the classes "mother seed" and "permanent pasture" has been introduced this season. In the meantime, practically all the areas are confined to the Akaroa Peninsula. The certification of the Peninsula seed is being undertaken by the Department in co-operation with the Banks Peninsula Cocksfoot Seed-growers' Association.

Beans.

As a result of the operations in Marlborough during the 1930–31 season, 1,000 bushels of machine-dressed seed beans were sealed and tagged as being the produce of crops in which no bean-wilt could be found.

Montgomery Red Clover and Kentish Wild White Clover.

A few areas throughout New Zealand have been sown down with imported lines of the above types of clovers. The system of certification adopted enables the genuineness of the seed to be maintained, a matter of great importance.

2. SEED PRODUCTION.

Government Pure Seed Station, Lincoln.

The special strains of seeds produced by the station have up to the present been grown at the Ashburton Experimental Farm. This farm was closed down in June, 1931, and arrangements were then made by the Department to lease from the Canterbury Agricultural College, Lincoln, an area of approximately 50 acres. This small farm has been designated the Government Pure Seed Station, Lincoln. It is established for the very definite purpose of producing productive seed for distribution. In this varietal or strain purity and freedom from disease are the main considerations.

The work of necessity entails a certain amount of plant selection, yield trials in connection therewith, and variety trials, the objective being the production of small nucleus lots of seed for distribution to approved growers or to merchants who are growing seeds on contract. Field crops at present being dealt with are potatoes, wheat, barley, linseed, and garden and field peas.

3. MISCELLANEOUS.

Rape.

It is generally stated by farmers that there is considerable variation in the yield and fattening-quality of lines of rape. No investigations have ever been carried out with the object of defining the various types, and the purpose of this investigation is to study these variations.

In 1930 samples were collected from merchants in all parts of New Zealand. All but two or three lines were imported. Samples were sown in the spring of 1930 and later the seedlings transplanted 30 in. apart each way to afford individual plant study.

Apart from a few lots that were mixed, it was found possible to place each line into one of the following classes:—

Type 1: A tall upright giant form. Leaves not numerous, leaf stalks thick, and crown open. As growth advances a central stem is produced from which arise a few lateral branches reaching a height of about 18 in. The type embraces a wide range of variation, more particularly in leaf character.

Type 2 is characterized by the production of numerous leaves, forming a dense crown. The plant is short, and forms a short stem upon which in due course are produced a large number of lateral shoots. The leaves are smaller and of a darker green than the average type 1. There appears to be very little variation within the type.

Type 3 is a flat spreading plant with dark bluish-green and much dissected leaves. Occasionally the crown is dense, but usually the leaves are few and the crown open.

The behaviour of these types in the trials may be summarized as follows:—

Type 1 gives the greatest initial bulk of fodder, but does not recover after cutting as readily as type 2.

Type 2 gives a smaller initial yield, but greater recovery than type 1 after cutting. In these trials it has continued to produce feed after repeated cuttings up to early spring without developing flower-stalks.

Type 3: Both initial yield and recovery are poor. After one or two cuttings the plants either die or develop flower-stalks.

Rape is sold in New Zealand under such trade names as "Giant," "Kangaroo," "Broad-leaf Essex," "Colonial," &c., but such names are no indication of type.

Kales, Rape Kales, and Chou Moellier.

Following the lines adopted with rape, samples were collected from all possible sources and grown during the past season in such a way as to make individual plant study possible. Palatability trials are being undertaken at Marton Experimental Farm, and chemical analyses by Mr. Doak. All lines of thousand-headed kale and chou moellier were true to name. There is no ambiguity in regard to the naming of these. There are two types of rape-kale, one of which gives no recovery after cutting. Moreover, there is field evidence which seems to indicate that one is very unpalatable. There are similarly two types of Buda kale. One is distinct from all other material grown in these trials, while the other is, so far as can be ascertained at present, identical in every way with rape type 2.

Turnips and Swedes.

In view of the interest at present evinced in turnip and swede seed production in New Zealand, it seemed desirable to study the varieties being imported into this country and compare their purity with locally produced seed. Duplicate plots were sown of all varieties from all available sources. Details are not yet available, but it is fairly evident that imported root seeds attain a very high standard of conformity to type. The few samples of Dominion-grown seed are of equally high standard, and no great deterioration could have been expected since they are but once removed from imported seed.

Lucerne.

The objective is—

(*a*) The production of a better hay type.

(*b*) The production of a dual-purpose type which will stand reasonable grazing and at the same time afford one or two cuts of hay.

Samples were collected from all sources, but mainly from old pasture in Marlborough. The seed was sown in the nursery, and in the spring of 1930 about 3,600 seedlings were planted out 30 in. by 30 in. for individual observation. Careful records have been kept of each plant. In 1931 sufficient evidence had been collected to discard all except 250 plants, and these represent what appear to be superior types and therefore worthy of further study.

Cuttings were then taken from each and grown in the nursery. Sufficient of these struck root to enable the transplanting of (*a*) five plants together to form a clump, (*b*) four replications of single plants. It is expected these clones will afford (*a*) evidence as to whether the parent plant was unduly favoured by environment; (*b*) a more accurate estimate of yield and general behaviour, (*c*) material from which to produce seed if required later.

After removing the cuttings, the original 250 plants were covered and allowed to seed. The covers afforded protection against insect pollination, but not against wind pollination. The flowers were not artificially tripped either by hand or by agitating the plants. A start was made to agitate vigorously the plant within the cover, but this was discontinued in view of the fact that pollen was by this means distributed over a wide area and might very easily have resulted in cross-pollination. In most cases sufficient seed was set on each plant for immediate requirements. This selfed seed has now been threshed and was sown at once. Germination is satisfactory and it is hoped to get the plants out in early spring, planting sufficiently wide apart for individual study. We have in view in this project two stages:—

(*a*) The discovery of several lots, containing one, two, or more lines of a similar type, reasonably homozygous in the more important characters and superior to the general average. Plants of a similar kind would then be seeded together and the lots put out under field trials.

(*b*) The second stage is one that will occupy many years, and will consist of the standard method of selfing for several generations the most vigorous and desirable plants in the most homozygous lines.

A few selfed lines have been under observation during the past few years. It would appear from these that even once selfing may be expected to result in marked progress toward uniformity, accompanied, however, by a certain loss in vigour. It is not unreasonable to hope that the fixing (within reasonable limits) of some of the superior types may not be unattainable.

AGROSTOLOGY SECTION.

E. Bruce Levy, Agrostologist.

STRAIN IN PASTURE PLANTS.

Strain in pasture plants has dominated the work of this section during the year under review. The application of the work and its extension by farmers and the seed trade is now limited by the smallness of the stocks of certified seeds available for distribution. The seed trade and the farming community as a whole are rapidly becoming convinced that the advocacy of "strain" is sound and are now prepared to accept "pedigree" in pastures on the same basis as pedigree in stock.

Slowness of breeding and high price of pedigree animals has limited the general acceptation and application of "pedigree" in stock throughout New Zealand: this must be avoided at all costs as far as pedigree in herbage plants is concerned. The pedigree strains in herbage plants are almost as prolific as the poor, and the project that should now be embarked upon as a national project is rapid reproduction on a commercial basis of lines that are by test up to pedigree standard. The rye-grass work is developing well, but last year too much mother seed found its way either into permanent pasture areas that will never be harvested for seed, or else was shipped overseas. The work of locating areas carrying good strains of white clover, cocksfoot, &c., should be rigorously pursued and every endeavour made to shut up these areas for seed-production. New Zealand has a splendid range of types of the main herbage plants, and up to date our field

trials show that these are unequalled by any other strain from any other part of the world. In short, it would appear that our inimitable grassland climate has evolved types in relation to its inherent high-producing capabilities both in the nature of total yield, persistency, and seasonal spread of their growth. Such are the more favourable permanent grassland areas of both Islands.

Where New Zealand fails in herbage seeds suited for permanent pastures is within the arable and short-rotation areas, particularly in the South Island. Our own trials and reports from trials of New Zealand herbage seeds at the Welsh Plant Breeding Station at Aberystwyth, Wales, makes it very clear that while the permanently grassed high-production areas have evolved splendid types, yet the arable areas have produced types, particularly rye-grass, poorer than anything yet tested at Aberystwyth. This position must be righted, and thanks again to the certification system inaugurated by the Department this is becoming rapidly effected. With the strains we possess and with the organization certification provides, virtually the whole rye-grass position at least should be righted in a few years. The possibilities of this have been demonstrated very clearly during the past year in our trials of the maiden seed crops produced from certified mother seed in arable areas of the South. This seed produced, say, in South Canterbury, when sown at Palmerston North alongside the original mother seed that was produced in Hawke's Bay, makes a sward for twelve months at least indistinguishable from that produced from the mother seed itself. The same lines put out as single plants confirm the impression that the once growing of certified permanent strains in arable areas under certification leads to no marked deterioration in type.

This opens up a wonderful opportunity to New Zealand, and makes possible the exploitation of our good strains that have become localized in permanent high-production habitats. Were it possible to reproduce those strains only in the habitat where they are found to exist, then it would be years before we had more than a mere handful of pedigree seeds and the price would always be so high as to be out of the reach of the average farmer. The position as I see it is to earmark those high-production habitats as mother-seed areas and to reproduce that seed not necessarily within those areas, but in any arable area where the soil and climate are suitable for seed-production.

Elite Pedigree Strains.—Every line of seed yet tested contains many types of plants and even the best lines contain little more than 50 per cent. of what one would call super-valuable strains. For practicable purposes a mixture of strains may be preferable to pure lines, however good these may be, in much the same way as a mixture of species in the seed mixture sown is generally advisable, but just as the farmer should be able to say what proportion of species he wants in a seed mixture so in the ultimate seed mixture it should be possible for him to stipulate what amount of any one strain of any one species he requires in the seed mixture. For the immediate future, however, the isolation of separate strains and the general improvement of the existing certified lines by culling and selection is being carried out.

Perennial Ryegrass.

(*a*) *Certification Trials.*—Approximately 1,000 lines of these were sown in the autumn and a further 400 lines in the spring.

(*b*) *Single-plant Study.*—Two thousand two hundred single plants put out last year were culled by approximately 90 per cent. The remaining 10 per cent. were lifted and replanted for further observational work prior to subjecting the most promising to critical mowing and grazing trials.

Sixty-four plants were selected from our first selections now two years old and which have been under a dual mowing and intercultivation treatment for the whole of this period. These sixty-four plants were split up into fifteen-tiller clones, five of which are being kept under close grazing, five under intermediate grazing, and five under intercultivation treatment. Owing to the extremely dry spring and summer experienced and the non-retentive-moisture nature of the soil, there has been a heavy death-rate in the tillers set out. A number of the plants are growing and producing well. The advantage of the fifteen-tillered clone as against the single plant is well manifest in this trial as a check against soil variation and injury by grub or root attack.

Four thousand single plants, representing eighteen "mother" seed lines and twenty-two "first harvest" seed lines from the eighteen mother seed lines were planted out for the dual purpose (1) of determining deterioration, if any, that takes place in once-grown mother seed from a permanent pasture area in a strictly arable district, and (2) for the purpose of securing additional material for selection work towards improved lines. In the first case careful notes on the single plants confirm the general results of the broadcast plot. There is no marked deterioration occurring under the Department's system of certification and field inspection. The 4,000 single plants as a whole amply demonstrate the possibilities of greater improvement by selection.

Growth-form Experiments.—Tests under mowing with intermittent grazing have confirmed results in former years—namely, that the light-coloured, lax, few-tillered type of plant is most undesirable from either the hay or grazing point of view. For grazing conditions the ideal plant appears to be dark-coloured, dense, stiff-leaf type. This type recovers rapidly, makes a good-sized plant, and produces well at all times.

Performance of Certified Rye-grass.—As a result of strain trials during the past three years throughout New Zealand and overseas it can be confidently asserted that the type of rye-grass being certified to is giving eminent satisfaction wherever it is being grown, and stands out markedly superior to the poorer types of rye-grass that dominated the markets before strain work, followed by certification, was initiated in New Zealand. Reports from Australia and Great Britain are particularly encouraging.

Non-germination of true Perennial Rye-grass.—For the past two seasons the germination of "first harvest" seed grown in high rainfall districts, especially Southland and South Otago, has been very low. Experiments have been laid down at Palmerston North and in Southland with the following objectives:—

(1) To determine susceptibility of rye-grass type to injury, and whether district of origin of the same type of seed when sown in Southland has any relation to degree of susceptibility. This will determine whether the trouble is a rye-grass type suspectibility rather than an acclimatization factor:

(2) To determine susceptibility of selected strains and single plants to see whether individual plants or strains vary in themselves as to degree of susceptibility or otherwise:

(3) To determine, by treating with hot-water treatment, whether the endophytic fungus held to be responsible is a major factor, and whether susceptibility is decreased by treatment.

In addition to seeding down with special types from different districts tillers of susceptible and non-susceptible plants growing at Palmerston North will be transferred to Gore for verification.

Elite-strain Work.—A selection put out at Flock House, Bulls, has been harvested, and the seed from this is now being field tested alongside ordinary certified lines and against once-grown British indigenous.

Tillers of three selected plants were planted out for seed and the seed from these is now undergoing broadcast plot trial at Palmerston North. A small area for increase growing of each line has also been sown. This seed has been treated with Neill's hot-water treatment.

A small crop of seed—approximately three bushels of dressed seed—was harvested from a line of British indigenous seed supplied by Aberystwyth. One-half of this has been returned to Aberystwyth for further trial at that Station in comparison with the original mother seed supplied. The strain has not done well in New Zealand, and at any period was behind the certified New Zealand rye-grass strain in yield and was more susceptible to rust. This strain, however, was markedly superior to any other line of rye-grass from overseas, but it is definitely not up to the standard of the New Zealand certified strain.

Cocksfoot.

Certification Trials.—One hundred and ninety lines of cocksfoot have been sown in connection with certification. The general uniformity of type within New Zealand lines is very marked, there being very few lines showing any marked superiority over the majority. A few lines contain traces of the Danish type of plant. No lines entered for certification have been rejected on account of being of the wrong type.

Broadcast Trials.—Danish cocksfoot is still markedly inferior to the New Zealand strain. Under field conditions the New Zealand type is more persistent and more productive than the Danish type. Four lines of cocksfoot, ranging from an extreme pasture type to a hay type, have been received from Aberystwyth. The extreme pasture type is making a good sward, but is low in production. The "dual-purpose" type, which is very similar to our New Zealand strain, appears to be the most suitable for New Zealand conditions. This "dual-purpose" type has been grown out at Flock House for seed, where it is doing very well under row and intercultivation conditions.

Single Plant Study.—More or less outstanding New Zealand lines, together with five selected lines from Aberystwyth, have been sown out in boxes for the purpose of putting out later as single plants for comparative study.

Elite-seed Production.—Two acres planted at Flock House, Bulls, from a pedigree line ex Aberystwyth were harvested and yielded a total crop of 325 lb. of machine-dressed seed. The crop was very uneven in ripening, and this, together with the comparative shy-seeding leafy nature of the strain, largely contributed to the low per-acre yield. One third of the crop, as per arrangement with the Director, Welsh Plant Breeding Station, will be shipped back to Averystwyth. Broadcast field trials of this once-grown Aberystwyth line are being arranged for to better compare the type with New Zealand certified strain.

Brown-top.

Certification.—Two hundred and fifty-one lines were sown in plots, the majority being in connection with certification. This year's certification trials have again demonstrated the purity of New Zealand brown-top, there being very few lines containing as much as a trace of red-top.

General.—Twenty-five lines of various *Agrostis* spp. have been received from abroad. These are being tested in plots for their lawn-forming properties. The dryland type of brown-top promises to be a useful lawn-grass in that it is more winter green than the true brown-top, and that it is making a close fine turf under mowing. The single-plant work indicates great possibilities of improvement by selection in New Zealand brown-top for the making of fine lawns.

Yorkshire Fog.

Single-plant Study.—Seasonal notes have been taken on these. Wide differences from plant to plant are still noticeable, but there are no marked differences from line to line. A fair percentage of the few-tillerd, short-lived type is now beginning to die out.

Timothy.

The trials of these on the light-soil type at the Station area continue to give unsatisfactory growth from timothy. No line or strain is outstanding.

White Clover.

Certification Trials.—A tota of 457 lines of white clover have been submitted for test, the majority of which are for certification purposes.

Single Plants.—Periodical notes have been taken on the original blocks of four thousand single plants which were put out in November, 1929. This year has seen the complete dying-out of most of the inferior types of plants. All the plants that now remain, and are yet of any economic importance, belong either to type 1 or else to type 2 group. Throughout the whole year the type 1 plants have shown marked superiority over all of the other types. A note taken at the end of the winter showed that there had been a relatively high percentage of deaths amongst the Kentish type of plants. Practically no type 1 plants had died, and the number of type 2 plants which had died was only half that of the Kentish. As a group the type 1 plants are outstanding both for persistency and for relatively high leaf-production at each period of the year.

During the year a new block of 2,640 single plants has been planted out. This is made up of fifty plants from each of forty-four lines (nineteen type 1 lines, nine type 2 lines, and sixteen lines for single-plant type test). The first-mentioned twenty-eight lines are to provide a greater number of good plants from which selection and breeding work can be carried out. These twenty-eight lines were chosen as being those which had performed the best in the broadcast trials sown in November, 1929.

Notes taken on these most recent plants tend to show that the amount of flowering in the seedling year is an indication of type, and it helps one to forecast the future performance as well as the persistency of individual plants. The plant that, at this stage, consists of nothing but flowering stems and is flowering profusely, after flowering is over, makes very little more leaf-growth and will probably die before the seedling year is complete, whereas the leafy persistent plant flowers very little in its first year.

Elite-strain Production.—A seed crop has been taken from the first selection planted out at Flock House during spring, 1930. Three separate selections have been made this year. One consisted of planting out blocks of 150 tillers from each of fourteen plants selected by eye from 4,400 single plants previously put out for this purpose. Two-thirds of each of these blocks has been sown with rye-grass and is being periodically mown, but the remaining third has been allowed to go to seed. The second of these selections consisted of 130 tillers of each of five different lots which were dug out of the five best plots in our broadcast trials. These tillers were planted out between spaced rye-grass plants and allowed to go to seed.

A third selection has been built up by planting out 100 tillers from each of the ten best type 1 plants in the single-plant trials which have now been in progress for two years and a half. A good seed crop has been harvested from each of these three selections and is available for plot and field trial next spring. A hand clover-huller has been constructed for the hulling of these selections.

Red Clovers.

Certification and Broadcast Trials.—Twenty-three lines have been sown for certification purposes. The majority of these are Montgomery type or else once-grown Montgomery lines which have been sent in for test.

Single Plants.—Seasonal growth notes have been recorded for all single plants. Although heavy mortality occurred last year amongst those plants which had reached their second autumn, the plants that remain now seem to have better persistency qualities, although many of them are not good producers. Some more recent plants, which have just passed through their second summer, are now dying off, so it would appear that this dying-off might well be regarded as a natural selection aid towards procuring a more persistent strain. Under our conditions the single plants from Aberystwyth selected material have made relatively low growth, although they are moderately leafy and dense. One thousand nine hundred and eighty seedlings of a particularly good extra-late-flowering line have been planted out so as to give more good plants for future selection work.

Elite Strain.—Seventy plants, selected by eye from a block of extra-late-flowering type single plants were isolated in a block and allowed to set seed under open pollinating conditions. The seed from these plants has now been harvested.

Subterranean Clovers.

The sowing of single rows of twenty different lines of subterranean clovers last spring has served to show that wide and important strain differences exist in this species. In order to study these differences further, fifty single plants of each of the above lines are being propagated.

Lotus Major.

Strain differences in this species have been apparent for some time. In order to study these further, fifty plants of each of thirty-two lines have been sown in boxes for autumn planting as spaced plants.

Odd Species.

Altogether nineteen lots have been included in the spring sowings. These represent samples of the lesser clovers and assorted species which have been sent mainly from overseas for trial under New Zealand conditions.

Genetical Work with White Clovers.

A small amount of elementary work has been carried out in order to gain experience which should prove useful for future work. This year's work has consisted of controlled hand-crossings with white clovers, and also some bee crosses with caged pairs of plants drawn from selected material.

Field Trials and Field Demonstrations relative to Strain in Herbage Plants.

In addition to field trials at Puwera, Dargaville, Ngakuru, Katere, Stratford, Manaia, Marton, Feilding, Oroua Downs, Irwell, Amberley, Dunsandel, Winchmore, Horarata, Waimate, Carterhope, Gore, Waikaka, Tapanui, Winton, and Wanaka, twelve new areas have been laid down spread throughout the Wairarapa, Manawatu, Taihape, Waikato, Westland, Nelson, Marlborough, and North Canterbury. 943 samples of grasses and clovers have been sent overseas for trial and report.

Suppression of Annuals in Hawke's Bay and Poverty Bay Pastures.

This work has been continued and detailed reports submitted by Instructors in Agriculture and my specialist staff. Owing to the abnormally dry season, full effect of manurial applications was not secured, and little, if any, reduction in annuals was obtained. The indication is that constant manuring with a mixture of phosphate and nitrogen will build a denser sward and control in large measure re-establishment of the annual. The present season should give much better results owing to the early autumn rains experienced.

REGRASSING SECONDARY-GROWTH COUNTRY, WHANGAMOMONA.

This work has been continued, and results to date have been written up during the year in the *Journal of Agriculture*. Apart now from work in regard to spraying of hard fern with arsenic pentoxide there is but little work necessary as far as grass-seed mixtures are concerned until such time has elapsed to more thoroughly test out the seed mixtures sown, and until improved strains of the hill country grass and clover species are available for field trial.

ECOLOGICAL WORK.

A certain amount of detailed analytical work in connection with field trials at Marton, in Poverty Bay and Hawke's Bay, and at the Research Station has been carried out.

GREEN-KEEPING RESEARCH.

A comprehensive scheme of green-keeping research has been instituted on behalf of the New Zealand Golf Association. An area of land, 1½ acres in extent, has been donated by the Manawatu Golf Club on their course at Hokowhitu, and the research is now in operation. All costs in connection with the scheme, apart from supervision, are borne by a grant from the New Zealand Golf Council. Commercial research in fine lawn-grasses is of the utmost importance in the definite bid that New Zealand is making to gain a world trade standing in the export of fine-lawn seeds. In 1930–31 the export value of New Zealand brown-top and New Zealand chewings was well over £100,000 sterling. Playing-greens, owing largely to the green-research activities of America and Great Britain, are improving rapidly, and each year the standard of excellence demanded by players the world over has become higher. Improved types of the standard fine-lawn seeds are being bred to cater for this demand.

DEMONSTRATIONS, LECTURES, AND CORRESPONDENCE.

Visitors to the Plant Research Station have increased greatly, and the actual time spent in conducting visitors around has been considerable. Correspondence from overseas as a result of the publicity given to the New Zealand work in plant-breeding, strain-selection, and the perpetuation and multiplication of these by certification, has greatly increased. No publicity campaign could have advertised New Zealand and its herbage-seed products as well as seed certification is doing at the moment.

FIELD EXPERIMENTS SECTION.

A. W. HUDSON, Crop Experimentalist.

CLASSIFICATION OF EXPERIMENTS.

A. Research into fundamental grassland problems being carried out at—
  (1) Experimental Farm, Marton.
  (2) Farm of Instruction, Ruakura.
B. Grassland investigations and demonstrations carried out by field officers of the Fields Division.
C. Experiments on annual crops carried out by field officers.

A. FUNDAMENTAL GRASSLAND PROBLEMS.

(1) MARTON EXPERIMENTAL FARM.

(*a*) MEASUREMENT OF PASTURE PRODUCTION THROUGHOUT THE YEAR BY MOWING WITH A LAWN-MOWER.

The six lines of investigation previously reported on have been continued.

The technique has been fully described in Part I of Bulletin No. 31 of the Department of Scientific and Industrial Research and in the *New Zealand Journal of Agriculture*, August, 1931.

(i) *Trial of Effect of applying Super and Slag as Winter, Spring, Summer, and Autumn Applications respectively.*—A full report on this investigation, covering a period of three years, has been published as Part II of Bulletin No. 31 of the Department of Scientific and Industrial Research, and a slightly abridged report appeared in the *Journal of Agriculture* for November, 1932. This experiment has been continued during 1931, but will be completed at the end of the fourth year.

(ii) *Trial to determine Effect of applying Superphosphate in Heavy Dressings at Infrequent Intervals against Lighter Dressings at Frequent Intervals.*—Biennial, annual, and twice-annual and thrice-annual dressings, each supplying 4 cwt. of super per acre per annum are being used.

A report covering the first two years has been published as Part III of Bulletin No. 31 of the Department of Scientific and Industrial Research.

(iii) *A Comparison of the Newer Concentrated Fertilizers with Equivalent Mixtures of Simple Fertilizers.*—Leunaphos is being compared with an equivalent mixture of superphosphate plus sulphate of ammonia. Nitrophoska is being compared with an equivalent mixture of super plus sulphate of ammonia plus potash. This trial has been in progress for over two years and a half, and a report will be published shortly as Part IV of Bulletin No. 31 of the Department of Scientific and Industrial Research. A brief summary appears in the *Journal of Agriculture* for July, 1932.

(iv) *A Determination of the Effect of applying Sulphate of Ammonia at Different Times of the Year.*—All treatments receive a complete dressing of minerals, and different plots receive an annual dressing of 2 cwt. of sulphate of ammonia at intervals of two months.

(v) *A Determination of the Effect on Production of utilizing Herbage at (a) the 2 in. to 3 in. Stage of Growth and (b) the 4 in. to 6 in. Stage of Growth.*—Dressings of phosphate plus potash are being compared with dressings of phosphate plus potash plus nitrogen under each of (*a*) and (*b*).

(vi) *A Determination of the Effect of using Sulphate of Ammonia mixed with Carbonate of Lime versus Sulphate of Ammonia alone.*—The object is to determine whether any loss of efficiency of sulphate of ammonia results when it is mixed with sufficient carbonate of lime to correct its acidifying effect.

Chemical Analysis of Herbage.—Dry-matter determinations are being made on all grass cut and soil-analyses are being carried out on some of the trials to determine the effect on the phosphate penetration of the soil of repeated applications of phosphate over a number of years. This work is being done by Mr. Doak, Analytical Chemist attached to this Station.

(*b*) SHEEP-GRAZING TRIAL.

This trial, which has been described in previous reports, has been continued.

(*c*) TRIALS TO OBSERVE THE EFFECTS OF DIFFERENT FORMS OF NITROGEN.

This trial is being maintained. The chief feature is the inferiority of sulphate of ammonia on unlimed ground.

(2) MEASUREMENT OF PASTURE PRODUCTION THROUGHOUT THE YEAR BY MOWING WITH A LAWN-MOWER, RUAKURA FARM OF INSTRUCTION (AUCKLAND).

This trial is an extension of (1) above. Its object is to determine the effect of winter, spring, summer, and autumn applications of superphosphate. Applications of nitrogen in autumn and winter are also included.

B. GRASSLAND INVESTIGATIONS AND DEMONSTRATIONS CARRIED OUT BY FIELD OFFICERS OF THE FIELDS DIVISION.

(1) GRAZING TRIALS ON DAIRY-FARMS TO DETERMINE THE EFFECTS OF NITROGEN.

During the 1931–32 season these trials have been reduced to fourteen. Of these, eleven are in the North Island and three are in the Southland District.

In the third season the results were in very close agreement with those of the first two seasons as regards increase per hundredweight of nitrogenous fertilizer applied. The previous indications that the use of nitrogen was most effective on the pastures of highest production were, however, not confirmed.

(2) GRAZING TRIALS TO DETERMINE THE RELATIVE MERITS OF HAWKE'S BAY PERENNIAL RYE-GRASS AND SO-CALLED PERENNIAL RYE-GRASS FROM CANTERBURY.

These trials are being maintained, and in the main the management has been satisfactory. All suffered to a great extent from the extremely dry conditions during the past summer, but in the majority of trials the Hawke's Bay recovered much more quickly than did the Canterbury rye-grass. Up to date the production from the Hawke's Bay rye-grass shows an average increase in six trials of 30 per cent. over that from Canterbury rye-grass.

Experiments containing different types of rye-grass were laid down alongside the above trials, and while they provide convincing evidence of the superiority of the good perennial types, it is apparent that the Canterbury rye-grass fields in the grazing trials contain strains infinitely better than the more common Canterbury types.

(3) Observational Top-dressing Experiments.

About two hundred and fifty experiments are in existence throughout New Zealand in pursuance of surveying grasslands from point of view of their response to lime, phosphate, potash, and nitrogen. The extension of this type of experiment has been limited on account of financial stringency. It is considered that something like two thousand of these experiments will be necessary before a reasonably efficient survey will be completed.

A survey of Canterbury was made in 1928–30 on these lines, and the importance of lime in conjunction with superphosphate on grasslands in Canterbury was clearly demonstrated.

In parts of Taranaki a number of these trials have indicated that potash is having a marked effect on production, and in order to define the limits of the potash-deficient area it is desirable to lay down a large number of trials in this district as rapidly as possible.

Other observational manuring experiments, numbering approximately one hundred and forty, are being carried out chiefly with the object of trying out various phosphatic, potassic, or nitrogenous manures under varying climatic conditions. Demonstrations of manuring with different types of phosphate and with lime, phosphate, potash, and nitrogen are laid down on nine areas adjacent to rye-grass and clover strain demonstrations referred to below.

(4) Demonstrations and Trials of Rye-grass and Clover Strains (in Collaboration with the Agrostologist).

A total of thirty-four trials to determine the relative merits of grass species and strains in various districts have been in existence over the past three years. The purposes of these trials have now been served, apart from their value as demonstrations to farmers, and many will shortly be abandoned. Further trials which combine demonstration with investigation are being laid down in districts other than those in which the above are situated. Nine of these have already been laid down.

C. EXPERIMENTS ON ANNUAL CROPS CARRIED OUT BY FIELD OFFICERS.

(1) Wheat.

(*a*) wheat manuring.

The programme of wheat-manuring experiments was maintained during the past year. Twenty-one trials were laid down in the Canterbury District and six in the Otago–Southland District.

The 1931–32 season was a disastrous one for the wheat-grower in many districts owing to the severe summer drought. Four of the trials could not be harvested on account of extremely poor crops.

The dry conditions were unfavourable to response from the use of nitrogen. The general average increase from 1 cwt. nitrate of soda was 0·8 bushel per acre. In the previous season this increase worked out at 2·6 bushels per acre, and even this represented the lowest seasonal average for some years.

The use of superphosphate at 1 cwt. per acre has again proved a sound proposition, the average increase from 1 cwt. super being 5·2 bushels per acre.

Up to the season under review the average increase from the use of 1 cwt. super in ninety-one experiments conducted over eight seasons was 4·1 bushels per acre, so that the increase due to super 1 cwt. in the 1931–32 season was above the general average. On the other hand, increasing the quantity of superphosphate to 2 cwt. gave no appreciable general increase over super 1 cwt., and it would appear as though 1 cwt. per acre just about meets the requirements of the crop, except on some of the heavier class of wheat land.

(*b*) trials of different forms of nitrogen at different times of application.

The results of three trials carried out in the 1930–31 season in which nitrate of soda and sulphate of ammonia were applied at different times were published in the *Journal of Agriculture*, July, 1931.

The trials were repeated in the 1931–32 season. The use of sulphate of ammonia with the seed, a treatment introduced as a modification of previous trials, gave good promise and should be further investigated. As previously stated, however, the use of nitrogen did not in general give good results, nor were the differences between times of application as marked as in the season 1929–30.

(*c*) rate of seeding trials with wheat.

This investigation has been continued and three trials were carried out with rates of seeding varying from 80 lb. to 120 lb. per acre with each of three varieties. The results confirm those of the previous years, and point to the conclusion that a sowing of 20 lb. or 30 lb. of seed in excess of the optimum will not affect the yield. If, however, the rate of seeding is 10 lb. or 20 lb. below the optimum a considerable reduction in yield may result.

(*d*) wheat variety trials.

Thirteen variety trials were laid down in collaboration with and on behalf of the Wheat Research Institute. Solid-straw Tuscan again proved to be the best-yielding variety under trial, except in one or two districts. Its popularity, in Canterbury at least, is based on its high-yielding and wind-resisting properties, and at the present time there is no incentive for farmers to grow quality wheats in favour of Solid-straw Tuscan.

As far as finances will permit the programme of variety trial work is being maintained, the main project for the ensuing year being the comparison of new crossbred wheats with Solid-straw Tuscan.

(2) Oats.

Manuring.—One trial to determine the effect of fertilizers on the yield of chaff was conducted at the Gore Experimental Farm.

(3) Barley.

Manuring.—One experiment was conducted in Canterbury: 1 cwt. of superphosphate increased the yield by 2·4 bushels per acre. Muriate of potash again depressed the yield. Nitrate of soda gave a slight increase, but this was not significant.

Malting tests of grain from the different treatments are being carried out by Mr. C. H. Hewlett of the Canterbury Seed Co.

(4) Potatoes.

(*a*) *Manuring:* (i) *Early Potatoes, Pukekohe District.*—The results of the 1930 experiments at Pukekohe were published in the *Journal of Agriculture* for April, 1931. The results in the main confirm previous season's work. The use of sulphate of ammonia up to 4 cwt. per acre has proved beneficial. Potash, on the other hand, does not seem to be a very important factor, and there are indications that the large quantities of phosphate applied to the early crop could be cut down to a certain extent without reducing yield significantly. These trials are to be continued with certain modifications.

(ii) *South Island Manuring Experiments on Main-crop Potatoes.*—Eight trials were sown in 1931. There has been a considerable reduction in the number of these over the past two years, chiefly through lack of finance.

(*b*) *Certified versus Commercial Seed-potato Trials.*—Three experiments have been laid down, using several varieties. These trials are, however, more in the nature of demonstrations, as facilities did not permit of large-scale experiments involving a number of replicated plots.

(*c*) *Source of Origin of Seed-potatoes Experiment.*—These trials are being continued. In 1930 and again in 1931 seed from eight different sources was put under trial at Rangiora. The yield from the 1930 sowings was very poor, and only small differences between the various lines of seed were recorded. One line was significantly lower than the control.

(*d*) *Potato Variety Trials.*—Results of trials conducted in the 1930–31 season were published in the September, 1931, *Journal*.

About thirty varieties of potatoes are being grown in the present season in ten different districts in simple single-plot trials to determine what varieties are most suited to particular districts. Yield, resistance to disease, and cooking-quality are being determined. This work is being done in collaboration with the Agronomist.

(5) Swedes and Turnips.

(*a*) *Manuring.*—A summary of the results of experimental work over seven seasons was published in the *Journal* for March, 1932. The advantages of using super plus carbonate of lime in equal parts, providing a safe means of overcoming serious germination injury and thereby increasing yields, have been amply demonstrated.

Eight trials were laid down in 1931 as compared with thirteen during the previous season. Present and future work aims at increasing the efficiency of superphosphate by trying out various super-slaked lime mixtures against super plus carbonate of lime. The work of the Mycological Section of the Plant Research Station indicates the desirability of this from point of view of combating club-root.

Investigations into various aspects of germination injury by manures are being carried out at the Plant Research Station's area.

(*b*) *Effect of Liming and Manuring on Club-root.*—Seven trials are being carried out in collaboration with the Mycologist to determine the effect of liming and manuring on club-root.

The marked effect of burnt lime in combination with basic slag on club-root control was demonstrated on two experiments in the 1930–31 season. The experiments in the present season are designed to investigate the best method of applying burnt lime and carbonate of lime in various quantities. In one trial, super, basic slag, super and carbonate of lime, and super and slaked lime are being sown on limed and unlimed ground on the same plots for a number of years.

(*c*) *Varieties in Relation to Club-root.*—At the Gore Experimental Area a number of varieties of swedes and turnips are under trial to determine their resistance to club-root.

MYCOLOGY SECTION.

G. H. Cunningham, Mycologist.

This report gives in condensed form, an account of the work performed by all sections of the Mycological Laboratory during the past twelve months. Despite the curtailment of finances and of travelling-expenses, an increased volume of work has been produced, consequent upon the greater demand made upon the services of the Laboratory by agricultural workers.

(1) Brassica Diseases.

(*a*) *Club-root* (Plasmodiophora brassicæ).—A considerable number of resistant strains of swedes, turnips, and rape, procured from Canada, Scotland, Denmark, and by selection at the Plant Research Station area, have been grown on heavily infected soil. From these, plants apparently immune to the disease were selected and seeded under controlled conditions. This seed has again been sown in infected soil for further immunity trials.

Further work with field control of club-root by liming has been undertaken, attention being paid in this work to the effects of time of application upon control secured. It has been demonstrated in the field that a satisfactory control may be secured, even on heavily infected land, if 30 cwt. per acre of burnt lime is applied three months in advance of sowing the seed, and if seed is sown with 2 cwt. of basic slag, or a 3 cwt. mixture of superphosphate plus hydrated lime.

Experiments conducted during the winter months under glass have led to the production of two satisfactory methods of combating club-root in small gardens or market gardens, where growers are faced with the problem of growing continuous crops on infected soils.

(*b*) *Dry-rot* (Phoma lingam).—Many experiments conducted during the year have led to the production of a modified seed-disinfection method which it is hoped, will give complete disinfection of lines infected with this disease. The process is a hot-water treatment, now modified so that seeds are immersed for fifty minutes in water held at 124° F. It would appear to be effective, since in the many hundreds of thousands of seeds tested (from a line averaging about 15 per cent. infection) no dry-rot fungus has appeared. Furthermore those field areas sown with seed treated in this manner have remained free from infection. Seed of six varieties of swedes and turnips have been grown to maturity from seed treated by this method. The plants, which have remained disease-free throughout, have been seeded, and the seed, when tested, was likewise found to be clean. A portion of this seed is being utilized for bulking purposes, the remainder has been forwarded to certain British seedsmen who intend utilizing these clean nucleus lines for production of seed for this market.

An improved method of testing seeds for the presence of dry-rot has been evolved, and has proved most useful against lines carrying only minute percentages of the disease. By this method, which is a modification of the cloche seed germinator, from eight thousand to ten thousand seeds may be tested at one time.

Certain British seedsmen have forwarded from time to time lines of swede and turnip seed which they claimed to have grown under conditions precluding dry-rot infection. Unfortunately, when tested under field conditions in New Zealand most of these lines have developed the disease.

(2) Potato Diseases.

(*a*) *Corticium Disease* (Corticium solani).—It has been found that this fungus spreads in the soil from one plant to another; that it remains in the soil for at least twelve months, and that crop rotation does not appear to affect this period of persistence. A series of investigations, extending over a period of four years, has demonstrated that it is economically unsound to treat potato-tubers for the control of this disease, since the fungus does not appear materially to reduce yields under New Zealand conditions.

(*b*) *Virus Diseases.*—During the year it was demonstrated that a condition known locally as "curly-top of Dakotas" was a graft-transmitted virus disease. Trials demonstrated that net necrosis decreased yields by upwards of 50 per cent. A masked virus, isolated from apparently healthy potatoes, has produced mosaic when inoculations were conducted with seedlings of tobacco and *Datura*.

A quantity of apparently virus-free tubers has been raised from eight varieties in several localities. Part is being used in the glasshouse for further studies of virus diseases, the remainder being reserved for bulking up preparatory to making them available for commercial purposes.

(*c*) *Wilt Diseases.*—Approximately 2,500 cultures have been secured from potato stems and tubers. From these numerous fungi have been secured, and tests are being made of their pathogenicity as the limited glasshouse accommodation permits. It would appear that many of the fungi isolated are unrecorded as pathogens of potatoes, and several would appear to be unnamed.

(*d*) *Internal Brown Fleck.*—Since all attempts to isolate a pathogen from tubers affected with fleck have failed, it is probable this condition is not due to any fungus or bacterium. It has not been possible to transmit the disease from tuber to tuber by inoculation, which further supports the belief that the disease is non-pathogenic.

(*e*) *Dry-rot.*—A long series of inoculation experiments extending over the past two years has shown dry-rot in New Zealand is due to three species of *Fusarium*, the most prevalent isolant being identical with overseas cultures of *F. coeruleum*.

(3) Legume Diseases.

(*a*) *Collar-rot of Peas* (Ascochyta *spp.*)—Experiments conducted during the past three years have demonstrated convincingly that it is not possible by known methods of treatment to free commercial lines of pea seed from this disease. Consequently, work has been concentrated upon the production of disease-free nucleus lines of several varieties. From certain of these a fair quantity of clean seed has been raised at Tangimoana, portion of which is being tested under glass preparatory to using the major portion for bulking prior to commercial distribution.

(*b*) *Bean Wilt* (Bacterium medicaginis, *forma* phascolicola).—Since this disease was introduced with seed imported from Australia last year, it has become widespread throughout the Dominion. As it is seed-carried, and as it is not possible to sterilize seed by known artificial means, we have concentrated upon the production of clean nucleus lines. A quantity of seed has been grown in this manner which is apparently free from wilt, and this will be bulked under isolated conditions in the spring.

(*c*) *Virus Diseases.*—Needle inoculations have shown that a mottling and dwarfing of garden peas is due to a virus. A second disease, known locally as streak, and suspected of being due to a virus, is under investigation. Attempts are being made to raise nucleus lines of garden peas free from both troubles. Cross inoculations from clovers have resulted in the appearance in garden peas of symptoms of both diseases, showing that the former hosts are carriers, and illustrating the difficulties facing the attempts at production of clean lines of seed.

(*d*) *Sore-shin* (cause unknown).—From this troublesome disease of lupins two fungi have been isolated. Experiments are now in hand to determine which is responsible for this disease, and field trials have been laid down in which various soil treatments are being tested with a view to working out practical control.

(*e*) *Legume nodule organism* (Bacillus radiciperda).—During the past twelve months 653 farmers have been supplied with cultures of the lucerne nodule organism, quantities being sent out sufficient to inoculate 46,185 lb. of seed.

(4) Cereal Diseases.

(*a*) *Barley Smuts* (Ustilago jensenii *and* U. tritici).—Several proprietary seed-disinfectants were tested against the hot-water treatment. Results convincingly demonstrated that hot water alone gave satisfactory control of either smut, showing that these proprietary compounds are of little value under New Zealand conditions.

(*b*) *Crown-rust of Oats* (Puccinia coronata).—Eight differential varieties of oats were grown and harvested from seed secured from abroad. These lines proved to be impure, so cannot be used for biotype work until pure lines have been produced from them.

(5) Tobacco Diseases.

(*a*) *Leaf-spot (cause unknown).*—Experiments with treated versus untreated seed failed to combat this disease. As we have failed to secure any specific pathogen in numerous cultures prepared from these lesions, it is highly probable the trouble is of physiological origin.

(*b*) *Tobacco Virus Diseases.*—Needle inoculations have shown that a diseased condition of plants prevalent in Nelson and Auckland is due to tobacco mosaic.

A crinkle-leaf condition which developed in a line of tobacco raised at the experimental area at Auckland, from seed imported from Turkestan is now under investigation, infected plants being seeded with a view to ascertaining whether the disease is carried with the seed.

(6) Strawberry Diseases.

Detailed surveys were made during the year of the strawberry areas at Auckland with a view to investigating those factors responsible for losses suffered by growers in that region. Seedling plants have been raised in quantity, and these are being used in attempts being made to determine the nature of these diseases. Attempts are being made to produce virus-free plants on a small scale, preparatory to bulking for commercial distribution.

(7) Fruit and Fruit-tree Investigations.

(a) Sprays.—A comprehensive series of field experiments is being conducted with a view to improving the spray control of our major orchard diseases. For the purpose 676 experiments concerning thirty-three district investigations were handled during the year. Analyses are being made of commercial sprays with a view to making operative the Fungicides and Insecticides Act of 1927. In this connection the sulphurs and lime-sulphurs have been dealt with, and completed accounts published in the *New Zealand Journal of Agriculture.*

(b) Fruit-rots in Store.—A second season's survey of all rots found in cool stores, has been completed. The fungi responsible have been isolated, identified, and are now being inoculated into fruits to determine their pathogenicity. A study has been made of the factors which enhance or inhibit fungous attack, with a view to working out methods of reducing losses.

The serious losses experienced in lemons in the curing-sheds at Tauranga led to an investigation being made into methods of handling and storing fruits. Recommendations made were adopted and losses materially reduced.

(8) Cheese-moulds.

An investigation into the possible role played by fungi in producing discoloration of cheese, has been in hand for the past twelve months. This has necessitated a critical investigation of species and strains of those fungi found in association with discoloured areas. So far it has been ascertained that one strain of *Penicillium* is more or less directly involved in one type of discoloration.

(9) Silage Investigation.

Experiments have been initiated to ascertain the effects of various organisms on the preparation of grass silage. Preliminary work has shown that it is possible to alter the quality of silage by means of artificial inoculation. Attempts are being made to work out a technique whereby this may be made use of in farm practice.

(10) Forest-tree Diseases.

(a) Die-back of Pines.—During the year investigations were made of a serious outbreak of disease in many of the afforested areas in the Dominion. It was found that the disease was due to two species of fungi (at present but tentatively named) attacking trees weakened by snow, frost, or as a result of growing in unsuitable soils or localities. It would appear that both are species of exotic fungi, probably introduced to nurseries with the seed, and from these to the field during the process of blanking.

(b) Seed-borne Diseases.—Investigations into the preceding disease, and into failure of certain seed lines to germinate satisfactorily, have shown that parasitic fungi may be carried with the seed. Preliminary work is being undertaken with a view to working out a method of sterilizing forest-tree seed without materially affecting vitality. Some method of disinfection becomes necessary in view of the discovery that pine die-back may be seed-carried.

(c) Timber-preservatives.—A process of testing wood-preservatives is being developed in the laboratory, so that their relative values may be brought to a common basis for comparison.

(d) Mycorrhiza.—The economic significance of mycorrhizal fungi has been experimentally demonstrated. In our experiments it was found that very material results were secured when *Pinus radiata* was grown in soil infected with certain fungi, as species of *Rhizopogon* and *Boletus*. Further experiments are in progress to determine the effects of four species of fungi on several different species of forest trees, and methods of propagating and introducing these beneficial fungi into nursery soils.

ENTOMOLOGY SECTION.

J. Muggeridge, Entomologist.

RESEARCH.

(1) Pieris Rapæ (The Cabbage White Butterfly).

Pieris rapæ is an Old-World species of butterfly well known in many parts of the world as a pest of cruciferous crops. It was first noticed in New Zealand at Napier, Hawke's Bay, in 1930. During the last season it has bred up in such large numbers as to constitute a menace to growers of cruciferous crops. Owing to the reports of the seriousness of this pest in Hawke's Bay it was deemed advisable to make a brief survey of the position.

From this survey it was found that *P. rapæ* was very common in the Hastings district. In all of the crops visited the adult butterfly was common, but very little of the other stages of the butterfly were present. The survey indicated, however, that most of the damage to the cruciferous crops in Hawke's Bay was due to the diamond-backed moth (*Plutella maculipennis*). It is not to be inferred from this, however, that *P. rapæ* will not be a serious pest to cruciferous crops, as it can only be within the next one or two years that the full effect of its presence will be felt.

CONTROL.

(a) Chemical Control.—The chemical-control method would be of value so far as home or market gardens are concerned, but this method would hardly be applicable on a field scale.

(b) Biological Control.—Well known parasites of the pest occur in Britain, and thanks to the promptitude of the Imperial Institute of Entomology we are now in possession of a number of these parasites which at present are being reared under insectary conditions. From the first consignment of two thousand parasites a complete generation has been reared. At the time of writing three thousand pupæ of *Apanteles glomeratus* have been reared in the insectary from the initial supply. This work is being carried on under glasshouse conditions during the winter months. The parasites reared are being held in cold storage for liberation in selected localities in the coming spring. Should these liberations under field conditions be successful, it is not anticipated that any great difficulty will arise in the further distribution of the natural enemy.

(2) Gnorimoschema (Phthorimæa) melanoplintha (the Tomato-stem Borer).

The tomato-stem borer at one time thought to be endemic is now known to be an introduced species apparently coming from Peru. A point of great interest at present is the fact that a similar if not identical tomato-stem borer occurs in Australia and has been described under the name of *Phthorimœa plœsiosema.*

Owing to the pressure of other work, we have been unable to carry on the life-history study of this insect as desired, but the control methods recommended for the Australian species should apply equally well under New Zealand conditions.

SPRAY EXPERIMENTS.

Under this heading a good deal of work has been carried out in the laboratory; through collaboration with the Horticulture Division through Mr. Dallas a considerable amount of extension work has also been carried out in the field.

(A) For clearness the subject-matter is dealt with under the headings—(*a*) Winter Oils; (*b*) Summer Oils.

(*a*) *Winter Oils.*—This included the testing of various oils as ovicides for red mite eggs under laboratory conditions. In this connection the following oils were used for dormant spraying at strengths of (1–15) and (1–20): Shell Red, Restar, Carbocraven, Avon Miscible, Sprayol, Avon Spray Emulsion, Winter Solol, Texide, Gargoyle.

(B) All of the laboratory experiments on these oils at the strength stated gave negative results—*i.e.*, none of the oils stated gave sufficiently high control to warrant their recommendation for use as ovicides against the red-mite winter eggs.

These preliminary laboratory experiments are being considerably extended during the coming year, as the work so far is proving a reliable index regarding the efficiency of the use of oils in the field. One of the great difficulties in the use of oils is to obtain reliable chemical and/or physical data by which they may be specified. The information gleaned from the experiments so far conducted, however, are helping one better to understand the relative values of the different physical properties of oils. Preliminary results indicate that within certain limits viscosity is one of the main determining factors regarding ovicidal value. An oil with a viscosity of 127, for instance, has far greater ovicidal properties than an oil with a viscosity of 59. The former giving a 60 per cent. control of mite-eggs and the latter only 25 per cent. control. Where the viscosity drops to 31 the control of eggs only amounts to 10 per cent. Heat of bromination* so far as winter oils are concerned appears to be of little consequence.

As the work so far conducted is merely preliminary, a considerable amount of further experimental work is necessary before any thoroughly reliable index can be obtained.

(b) Summer Oils.—With reference to the use of oils for summer spraying a good deal of useful information has been gleaned from laboratory work. In the past a considerable amount of uncertainty existed regarding the use of summer oils as opposed to lime-sulphur for the control of mites. The experiments indicate that the failure of lime-sulphur compared with oils as a control for mites is that the former, while it is a good acaracide, has no ovicidal properties, whereas the oils are both acaracides and ovicides. Lime-sulphur has been tested against summer mite-eggs at strengths from 1–40 to 1–120. At none of these strengths did it prove to have any ovicidal effect. Summer oils, on the contrary, at 1–80 gave up to 100 per cent. control. A winter oil at 1–150 gave up to 90 per cent. control. In general, however, it is not advisable to use a winter oil for summer spraying, as, apart from the acaricidal or ovicidal properties of the oil, a point of great importance is its effect on the tree or foliage. It appears to be well established that where the heat of bromination is high severe injury to foliage is likely to occur. It follows, therefore, that oils for summer use should have a very low heat of bromination.

Another point of great interest in the use of summer oils is their miscibility with other sprays that must be applied. One of the greatest difficulties is to obtain an oil suitable to apply with, or immediately following the use of lime-sulphur, as burning of the fruit or foliage may occur when these two sprays are mixed or applied within a short time of each other. Apparently the harmful property is not so much the oil as the emulsifier in the oil.

Study of Acid Lead Arsenate, Basic Lead Arsenate, and Calcium Arsenate.

This is an examination of the three types of commercial arsenates on the market in New Zealand. The work up to the present has been of a preliminary nature, and is directed towards discovering which is the most efficient and economical spray for chewing-insects. The materials are being tested for relative poisoning-effects and sticking and covering powers. Experiments have been conducted both in the laboratory and in the field. In the laboratory tests have been confined so far to relative poisoning-effects of several series of equal quantities of acid lead arsenate, basic lead arsenate, and calcium arsenate, the poisons being three commercial brands which are being used exclusively in this work. The amounts of spray used are being correlated with those commonly applied in the orchard, to discover what is the minimum effective dose for various chewing-pests, and whether they can be improved by the addition of spreaders and stickers. The insects being used are the bronze beetle, *Eucolaspis brunneus*, leaf-rolling caterpillars (family Toatricidæ), codlin-moth (*Laspeyresia pomonella*), the tomato and potato leaf-looping caterpillar (*Plusia chalcites*), and the white butterfly (*Pieris rapæ*).

Tests with the bronze beetle show that it should be quite possible to control this pest using the usual quantities of arsenate employed in common orchard practice, provided that the poison can be made to adhere evenly to the fruit. Apples dipped into a spray made by adding 2 lb. of acid lead arsenate plus 1 lb. of casein sticker and spreader to 100 gallons of water, for a minute or two until an even cover was obtained were uninjured by the beetles, whereas apples dipped for the same length of time into a spray made by adding 4 lb. of acid lead arsenate alone to 100 gallons were badly damaged. In the latter case the spray cover was very patchy and the insects had selected unpoisoned areas on the fruit for feeding. This shows clearly that in ordinary orchard practice plenty of arsenate is being sprayed on to the trees to kill the bronze beetle, but that owing to the bloom on the fruit the poison does not give an even cover. Ordinary emulsified mineral oils are natural spreaders and give a much better cover on fruit than do the arsenates alone. Experiments have also shown that oils repel the bronze beetle and the most hopeful line of attack on this pest is to find an oil which will combine satisfactorily with the arsenate and give an even cover on the fruit. Experiments on these lines will soon be continued.

The leaf-rolling caterpillars commonly found in the orchard are other pests which are difficult to control.

The supply of these caterpillars for laboratory experiments was very limited, and so the experiments conducted were on a small scale only. The tests have shown, however, that the action of the arsenates is much slower on these caterpillars than they are on the bronze beetle. Although these experiments were not very conclusive on account of the small numbers of caterpillars available, and on account of high mortality in the controls and a very large amount of parasitism in some of the series they indicate that enough poison is applied in ordinary orchard practice to kill leaf-rollers if they come in contact with it. Control would appear to be in applying the right numbers of spray at the right times. A study of the life and seasonal histories is thus important.

* Heat of bromination refers to the degree of refinement of an oil.

The potato and tomato leaf-looping caterpillars (*Plusia chalcites*) does a considerable amount of damage to potato and tomato crops and numbers of these were collected and used in the comparative poisoning tests between acid lead arsenate, basic lead arsenate, and calcium arsenate. These caterpillars can be bred very easily in the laboratory in large numbers and will be the main insects used during the winter in the arsenate tests.

The arsenates will be tested out in the laboratory in the early spring against larvæ of the codlin-moth. It was hoped to do this sooner, but the larvæ which have been collected show no signs of pupating yet.

The effects of the different arsenates on the white butterfly (*Pieris rapæ*) will also be closely studied in the winter months. Arrangements are in hand for breeding up sufficient numbers of these insects for the tests. One of the great difficulties in applying sprays to Brassicas is to get them to stick and spread evenly. A special study is to be made of this.

Up to the present time no outstanding differences can be detected in the effects of the three commercial arsenates, but the evidence is not yet sufficient to be conclusive.

Experiments have been carried out in the field on the effects spreading and sticking powers of the three types of arsenates on the fruit and foliage of orchard-trees. Calcium arsenate by itself appears to damage fruit and foliage severely and the effects of adding lime and ferrous sulphate to the spray have been studied. The great virtue of calcium arsenate is that it is cheaper than any of the other arsenates.

All the arsenate experiments are being carried out in conjunction with field tests conducted by the Orchard Instructor at the Plant Research Station and in conjunction with chemical work being conducted at the Dominion Laboratory in Wellington.

Red Mite.

The life-history of the red mite has been completed. A study of material from the orchard-growing areas of New Zealand has shown that there are two mites hitherto included in the category "red mite." These are *Paratetranychus pilosus* and *Bryobia prætiosa*. Of these the former is by far the more important, and causes most of the damage ascribed to red mite. The distribution and hosts of *Paratetranychus pilosus* have been studied. The life-cycle from the hatching of the egg to the adult occupies ten to fourteen days. Overwintering eggs are laid as early as February and the bulk of winter egg-laying is over in a comparatively short time.

The main points studied in this life-history have been: (1) Life-cycle of female; (2) life-cycle of male; (3) numbers of eggs laid by one individual; (4) length of life of adults; (5) summer and winter eggs; (6) incubation period of eggs; (7) habits of adults; (8) methods of spread; (9) Natural enemies; (10) distribution and hosts.

A detailed account of the red mite in New Zealand will be prepared as soon as the identification of the natural enemies is received from the Imperial Institute of Entomology in London.

Grass-grub.

The season's work with the "Orach" plant which was claimed to be very attractive to the grass-grub beetle has shown that it is useless from the control point of view. Further experiments are being conducted with the arsenate-of-lead treatment on turf against the larvæ of the grass-grub. It seems reasonable to suppose that ½ in. of arsenate-poisoned turf will be sufficient to kill the grass-grub instead of 2 in. to 3 in. as hitherto used in these experiments. This new set of experiments will mean the broadcasting by suitable means of about 5 lb. of acid arsenate of lead powder per 1,000 square feet of existing turf. Experiments on grass-grub control are also being conducted in conjunction with the greens research scheme of the Golfing Association.

Codlin Moth.

During the 1931–32 season a study of the seasonal history of the codlin moth mainly by the use of bait traps was made. It has been debated for a long time as to whether an arsenate spray is necessary at the calyx stage. The general impression is that in most seasons it is unnecessary, but that there are seasons in which it should be applied. Up to the present the orchardist has had no reliable means of deciding whether he should spray at the calyx stage. The use of an attractive bait, however, such as fermenting molasses makes it possible to do this. Sixteen bait traps containing molasses and yeast have been distributed over four fairly widely separated and previously neglected orchards in Palmerston North and records were made every four days of the insects caught. Counts of fruit sprayed at the calyz stage only, others unsprayed during the season, and others sprayed regularly except at the calyx stage, have shown that calyx-infection is very small. Unfortunately, the bait-pans were not put out until towards the end of November, so that there is no evidence from this source as to the prevalence of the moth at the calyx stage. By the end of February there was very little moth about, and this is in accordance with observations made in the field. It should be possible to rely on these baits to indicate the prevalence of the codlin moth, and if spraying is done within ten days of the appearance of the first moth then doubt as to whether the calyx spray should be applied or not would be dispelled. Information is also obtained as to how late in the season spraying should be continued. It is considered that the bait traps are useless from the point of view of lessening the number of moths, but, on the other hand, their use as indicators when to spray would be very useful to the orchardist.

BOTANY SECTION.

H. H. Allan, Systematic Botanist.

1. Routine Work.

(a) Identification of Specimens and Advice thereon.—In my previous report I mentioned that this work had steadily increased since I assumed office. This year also very full advantage has been taken of the facilities offered by the section. There has been a very pleasing improvement in the quality of the specimens sent in, favouring accurate and prompt identification. It is evident that field officers of the Department of Agriculture are taking a lively interest in the weed flora of their districts. Apart from these and officers of other Government Departments, many farmers and other private individuals have sent in specimens. A pleasing feature has been the increased advantage taken by commercial firms of this service. A considerable number of specimens of indigenous plants have been sent in, indicating an increasing interest in our flora.

Under the inspiration of its President, the New Zealand Junior Red Cross instituted a "Grassland knowledge" competition. Widespread interest was taken, and entries were received from all parts of the Dominion. The collections were named and judged and returned to the competitors. The considerable amount

of time involved in this work was well repaid by the knowledge that the competition resulted in a great deal of knowledge of our grasslands being gained by the youthful competitors. The Junior Red Cross is to be congratulated in the valuable work it is doing in interesting young New-Zealanders in the country's most important industry—grassland farming. A further competition is to be held and the Assistant Director-General and myself have prepared a pamphlet on grassland knowledge for the assistance of the entrants. A similar competition was instituted by the Friends' School, Wanganui, and was judged on similar lines. It is pleasing to note this activity in real useful nature-study.

(*b*) *The Herbarium.*—The herbarium is an indispensable adjunct both to routine and research work, and has been still further improved during the year. The New Zealand section (indigenous and introduced species) now contains over seven thousand five hundred specimens, while the section of foreign plants (selected with especial reference to their importance for research on the introduced flora) numbers well over four thousand specimens. This has been made possible by continuing the system of exchange of material with the leading herbaria abroad.

The whole of the collection has now been mounted and properly arranged for ease of reference. But the rapid expanse of the collection and the inadequate space available make conditions for working far from ideal.

(*c*) *Assistance and Advice to other Officers of the Station.*—As in previous years, this work has been done as occasion required. I wish to acknowledge the assistance given to this section by the various officers.

(*d*) *Plot Work.*—The area allotted to me on the Experimental Area has proved of great service for growing critical specimens to a stage fit for examination, and for the prosecution of various researches that we have in hand. It has proved of especial service for the investigations being carried out on grasses, piripiri, brassicas, and various weeds. Mr. Zotov has devoted a good deal of time to this work, with excellent results.

2. General Research Work.

Under this head I refer to the two main activities of the section—the study of the grasses of New Zealand (both indigenous and introduced) and that of the alien flora. Both of these are of considerable magnitude, and obviously cannot be completed within a short space of time. This needs noting, as we have found in both groups that the existing state of knowledge was in a very unsatisfactory condition. Hardly any critical work had been done on the grasses, and numerous errors of identification have been found in the received lists of alien species. Nor had any satisfactory attempt been made to assess the real economic importance of many of the species concerned. It is proposed to publish the results of each research in book-form, while dealing with certain problems by way of special papers. It would also appear that there is a need for a smaller illustrated book dealing with the chief grasses and clovers and their identification.

(*a*) *Grasses.*—The following large genera have been revised: *Agrostis*, *Deyeuxia*, *Poa*, *Danthonia*, *Festuca*. Work on the other groups, and on structure and economic ecology is well advanced. A number of keys for easy identification have been framed and tested out. A technical paper on *Festuca* is being sent for publication. Mr. Zotov has continued the preparation of illustrations. He has also made a special study of leaf-sections of all the grasses, made drawings of these, and is preparing a key based on leaf-characters. This work has already proved of great value in our own investigations, and breaks new ground in New Zealand botany.

(*b*) *Alien Flora.*—During the year over twenty new species have been added to the list of naturalized plants, largely as a result of the work on identification of specimens sent in. In addition, a number of others have been found tending to establish themselves. Of the new records some are of plants occupying considerable areas, and evidently established years ago, though they have not before been brought into notice. Among the new records may be mentioned as decidedly undesirable incomers, *Carthamus lanatus* (saffron thistle), *Calycotome spinosa* (a spiny shrub from the Mediterranean), *Eupatorium adenophorum* (Mexico; there are two other species established of this genus, which contains some poisonous plants), *Oxylobium ellipticum* (the genus is said to be one of the most poisonous in Australia), *Hordeum jubatum* (squirrel-tail; America). This last has recently been sent in from Central Otago, where it would find conditions very suitable for its multiplication. Although rather ornamental, it is regarded as one of the most injurious weeds, causing severe ulceration in animals that eat it. These examples are given not in any alarmist spirit, but as evidence of the good work that can be done by sending in prompt notice of any plant not before observed in the weed flora.

The names given in previous lists of alien species have proved in a number of cases erroneous. The necessity for having our alien flora correctly named hardly needs emphasizing, but I mention two cases as illustrations of its importance. When examining specimens hitherto called *Helenium quadridentatum* I found that the plant under consideration could not possibly be that species. It proved to be *H. puberulum*. The importance of a correct identification lay in the fact that several species of the genus are poisonous to stock. Acclimatization societies have often endeavoured to have Canadian wild rice (*Zizania aquatica*) introduced, as it is one of the best of the duck-feeds. The plant had, however, an extremely bad reputation, as it was supposed to be naturalized on the Northern Wairoa River. The plant there growing certainly has several very objectionable characters, but it is the Manchurian species (*Zizania latifolia*). In view of these facts, I have made a critical study of all the alien species, and prepared a preliminary account of them. This is being thoroughly revised before being offered as a handbook.

3. Special Researches.

(*a*) *Rushes.*—Mr. Zotov has completed a revision of the rushes and their hybrids occurring in New Zealand. This is a necessary preliminary to the study of their economic ecology.

(*b*) *Piripiri.*—An investigation into the distribution and systematics of the grassland species of *Acaena* is under way, in connection with the insect-control work being carried out at the Cawthron Institute. The botanical side of the work is being greatly assisted by the enthusiastic co-operation of the field staff of the Department of Agriculture.

(*c*) *Brassicas.*—A number of aberrant forms of *Brassica* have been sent in, and it seemed well to commence a detailed study. Work up to date suggests that hybridism is largely the explanation of these forms, especially in the swede-rape group.

(*d*) *Hybridism.*—The researches on hybridism in the New Zealand flora are being continued as opportunity offers. A complete list of the hybrid groups so far discovered is under preparation, in collaboration with Dr. L. Cockayne, C.M.G., F.R.S.

(*e*) *General Systematics of the New Zealand Flora.*—This is also being proceeded with as opportunity offers, with especial reference to the information gained during my period of work at the herbarium of the Royal Botanic Gardens, Kew. Several papers are now ready for publication.

4. Rootstock Investigations.

In connection with the general investigation on rootstocks under the scheme of fruit research, I was asked to take charge of the botanical side of the question. With the advent of Mr. C. Woodhead as special assistant for this work it has been possible to make good advance towards our objective.

Special attention has been paid to the Northern Spy Stock, the first aim being to see whether the stock was divisible into different classes. The first consignment of two hundred trees from a South Island nursery has been examined repeatedly during the season. As a result Mr. Woodhead has isolated eight types. The bulk of the collection belongs to one type, the others are represented by a few individuals each. It is possible that a few further types may emerge by the time the season's growth is finished. These types will be propagated and tested out. A preliminary propagation bed has already been established.

With a view to making a survey of Northern Spy stocks in orchards throughout the Dominion root-cuttings have been obtained from each of the fourteen horticultural instructional districts. The material was collected from representative orchards in three provisional classes: (*a*) From trees of outstanding development and growth, (*b*) from trees of normal growth, (*c*) from trees below normal development, where this appeared to be due to the inferiority of the stock. Unfortunately, these had to be planted out just before a long period of dry weather. Only about 33 per cent. (a little over five hundred sets) appear to have survived. Growth has been very irregular, and it has not been possible to make a complete botanical examination as yet. Our earlier work had shown that distinctive types cannot be isolated on studies of the younger growth. Thus only one hundred sets have reached a stage where they can be classed. Among these two of the more vigorous of the eight types previously isolated were recognized. The type mentioned as being the commonest in the first lot of plants is also the most vigorous and more rapidly growing one. This predominates also in the main collection so far as it has been possible to examine them. There does not, however, at present appear to be a correlation between this type and the three groups as selected by the horticultural instructors. The common type appears in all three of these groups. It is too early to make any decision, but it appears likely that within the morphological type isolated by us there may be differences of a physiological nature. It is to be noted, too, that certain of the cuttings sent in are not Northern Spy but seedling stocks.

A number of the chief types isolated at East Malling have also been grown. From the botanical point of view these are useful for comparative studies. Mr. Woodhead has also assisted Mr. Dallas in the general conduct of the fruit-research investigations.

SEED-TESTING SECTION.

N. R. Foy, Seed Analyst.

For the year ending December, 1931, 11,766 seed-samples were tested, this number representing an increase of 1,305 on the number recorded for the previous year. This total was made up as follows: Seed-merchants, 9,236; farmers and seed-growers, 238; Department of Agriculture, 2,068; other Government Departments, 224. A total of 16,129 tests were made, which represents an increase of 13 per cent. on the number for 1930 and 31 per cent. for 1929.

Certified Seed, 1931.

A total of 531 officially drawn samples were received and reported on. This total includes perennial rye-grass, 302; brown-top 78; white clover, 151.

Perennial Ryegrass.

With the exception of the samples representing seed grown in Southland and Otago (excluding Central and North Otago) all samples showed a very satisfactory germination and generally a high purity percentage. Several of the lines of mother seed from Hawke's Bay and Poverty Bay, however, contained up to 20 per cent. of goose-grass, which lines were unfortunately shipped to the South Island, where in certain districts the quality of North Island seed was unfavourably commented upon. As will be referred to later, necessary precautions have been taken to prevent a recurrence of these complaints. Later reference will also be made to the low germinating seed from Southern districts.

As from the 1st February, 1932, the International Testing Rules were adopted for the testing of the majority of the grass and clover samples received. General satisfaction has been expressed by the seed trade in regard to the change, and although in some cases there has been difficulty in interpretation of the test percentages it is freely stated that, through the removal of many of the anomalies which existed under the old testing system, there is a better and clearer understanding between buyer and seller not only in relation to the export trade, but also to domestic trade. Furthermore, contrary to general expectations, the farming community prefer this type of test, and throughout the Dominion farmers are taking a most ususual interest in test percentages and their interpretation, not only of certified but also of uncertified seed.

For the three months ending 31st March, 1932, 3,401 seed-samples have been received and reported upon for purity and germination, which total represents an increase of 1,992 on the number for the same period of the previous year, and includes certified samples as follows: Perennial rye-grass, 455; white clover, 6; cocksfoot, 8; total, 469.

The germination of all the seed from Hawke's Bay, Poverty Bay, Canterbury, North Otago, and Central Otago has this season been particularly good, the hot dry conditions obtaining in those districts during early summer being ideal for rye-grass-seed production. In other districts, notably in Manawatu and southern districts of the South Island, the germination of the greater part of the season's crop was below fair average. Much of the southern seed even at proportionately low prices could scarcely be regarded as being merchantable.

The quality of later harvested seeds—cocksfoot, Fescue, &c.—both certified and uncertified, appears to be excellent.

Additional Routine Activities.

(*a*) This season this Station has undertaken the urgent examination of samples of all lines of mother-seed and permanent-pasture lines eligible for reclassification as mother seed. In cases where the officer was uncertain as to the state of purity, sealing and tagging was delayed until telegraphic instructions were received—either pass or reject as mother seed. To date 304 purity examinations have been made and reported within twelve hours. Of this number 9, or 3 per cent., have resulted in the rejection of the line on account of goose-grass content.

(*b*) Test results have been examined and recommendations on a basis of relative value have been made in respect to practically the whole of Government seed purchases effected by the Stores Purchasing Officer

of the Fields Division. Over two hundred purity and germination tests on the bulk deliveries have been made and reported to the above officer, together with such commentary as might be deemed necessary in cases of deliveries below specification.

(*c*) The application of the examination under screened ultra-violet light of rye-grass seedlings to the official certification scheme was effected as from the start of this season's operations, thus replacing certain of the plot trials on certified lines hitherto carried out for every line by the Agrostologist. Up to the present, circumstances have permitted of the examination of only a portion of the samples representing seed classified as permanent pasture eligible for reclassification as mother seed, the reclassified lines relieving to some extent the active demand for mother seed which is in very short supply. The whole of the samples will be examined as opportunity permits, but it is unlikely that the whole will be completed for some months. Samples received for trial by the Agrostologist are also examined and reported on, the results being used in conjunction with the data obtained from plot trials carried out by that officer.

(*d*) The quartz lamp is also being used for an additional service to the seed trade and to farmers, and which must be considered unique in its application. Following the examination under ultra-violet light, the percentage reaction is interpreted in a formal certificate on which is set out seven retrogressivly inferior classes—*i.e.*, A 1, 2, and 3 of perennial representing "superior," good average, and fair average types, followed by B 1, 2, 3, 4 of false perennial rye-grass. This classification is based on certain fixed percentages of reaction the classification of the particular sample covered by the certificate being entered in the place provided thereon. Thus, provided with a report which indicates the value of the seed in terms of perenniality, the holder of the seed may buy or sell with confidence in the description of the seed. Some of the seed reported on is of course equal to certified seed, but care has been taken to present the information in such a form that no obvious comparison may be made between uncertified and certified lines.

Although the service was commenced only in February of this year, up to the 31st March, 75 samples had been received for classification.

Altogether in that period 480 samples have been examined comprising: Seed-merchants, 67; farmers, 8; Agrostologist, 27; Fields Division, 13; certification, 331; Station check tests, 34.

There are at present awaiting the ultra-violet-light test over one thousand trial and certified seed-samples.

Research.

(*a*) Diagnosis of type in rye-grass by the examination of ten-day seedlings under screened ultra-violet light:

Early in 1931 advice was received from England that a method of positive identification of Italian rye-grass seed had been demonstrated by Professor Gentner of the Seed-testing Station, Munich, and steps were taken by the Station to obtain the necessary equipment with a view to the observation of the results of the test on the various types of rye-grass present in New Zealand. Approximately ten days later published results of an investigation carried out in Ireland along the lines planned here, on thirty samples of New Zealand seed, were received. The results even on this small range of samples were sufficiently conclusive to warrant the purchase of the necessary equipment, which was obtained, set up, and in operation within a few days. During the following six months over four thousand separate examinations were made on samples which for the most part had previously been classified on plot trial by the Agrostologist. Ample confirmation was obtained of the theory tentatively suggested by the Irish workers—*i.e.*, that the plant type could be closely correlated with the percentage of fluorescent seedlings of any sample of perennial or false perennial rye-grass.

A paper covering the results of this work and discussions relative thereto was published early this year. As previously stated, ultra-violet-light examination has now become a integral part of the Station's routine functions, has replaced the greater part of the certification plot trials, and may ultimately find application to other phases of the certification system.

Some three thousand seedlings, representing positive and negative reacting individuals, were removed from the test pads during examination under the lamp, boxed, and finally planted out for study as mature plants. Some of these have suffered badly through the drought earlier in the year; the whole block, therefore, was not ready for critical examination as early as was anticipated. The majority of the plants have now recovered from cutting and will shortly be ready for observation. The purpose of this study is to obtain some idea as to the type of plant represented by positive and negative seedlings in the various types of rye-grass and to obtain confirmatory data in relation to the genetical aspect of the appearance or non-appearance of the reaction in certain types of plant. Certain of the plants have been selected for selfing purposes next season and if the selfing is successful, further data will be available on this aspect of the study.

(*b*) Low germination of rye-grass: Earlier reference has been made to the low germination of the certified rye-grass produced in certain districts during the 1930–31 and 1931–32 seasons.

For some years past, this trouble has been experienced in the Sandon district of the Manawatu, and latterly became so pronounced that many of the growers abandoned seed-production altogether. With the advent of seed certification, however, seed-production was revived on areas sown down in Hawke's Bay mother seed, and this season there has been seen the reappearance of low germination of apparently normal and healthy seed. Furthermore, most of the areas in Southland and portion of Otago sown with mother seed have produced seed very low in germination, some lines showing growth percentages as low as 10 per cent.

Obviously the problem has become a matter of concern to the growers of certified seed in the Southern districts and to a lesser degree in some of the other producing districts.

Observations made over a period of years have led to the belief that the trouble was associated with climatic conditions prevailing at about the time of flowering of the parent crop. Laboratory studies on Southern-grown seed have now demonstrated the presence on the non-germinable seeds of a fungus which is considered to be the primary cause of the death of the seed. The work has been carried sufficiently far to indicate that the degree of infection is always directly associated with a high relative humidity at the time of flowering and that the perennial strains are far more susceptible than false perennial types or Italian.

The co-operation of the Mycological Section has been sought, and that section is now carrying out pathogenicity studies.

At the moment it would appear that, unless strains showing a fair degree of resistance to the infection can be isolated, the growing of perennial rye-grass will necessarily have to be restricted to those areas where the possibilities of hot dry conditions at flowering and during seed formation. It should be stated that, given the conditions favourable to its development, the infection has appeared to a varying degree in all parts of New Zealand.

To ascertain the possibilities of strain resistance and seed hot-water treatment, the Agrostologist has provided certain material which is being grown in Southland preparatory to next season's harvest.

(*c*) Deterioration of Export Seed during Shipment: Results of the moisture determinations made at Cambridge on the dried and specially packed lots of Chewings fescue are to hand, but until the germination test results arrive it is impossible to draw definite conclusions as to the efficacy of drying prior to shipment. It would appear, however, that if the moisture content of the seed is to be kept down some form of sealed packing is essential. Further work on an extended scale based on the results of these trial lots is to be carried out this year.

Representations have been made by several Southern exporting houses during the last few months for further assistance in the matter of deterioration of fescue during shipment, and it now appears very likely that at least one firm will install drying equipment. The co-operation of this Station has been asked for, and it is our intention to carry out as much of the necessary laboratory-work as circumstances will permit. Fescue-seed production is of very considerable value to Southland and worth £80,000 to £100,000 per annum as an export commodity, and in view of the fact that serious attempts are being made to produce this seed in the United States of America, where most of the New Zealand seed is sold, every effort should be made to safeguard the local industry.

(*d*) White clover—possible correlation between the presence of a cyanogenetic glucocide in seedlings and plant type: Work has been commenced with a view to establishing a laboratory method of distinguishing between white clover seed samples representing superior and inferior plant-types. For the purposes of certification all white clovers are placed under plot trial, and, while this method is perfectly satisfactory from the point of view of classification, a considerable time has to elapse before observations can be made. Tests have been carried out using the picric acid method of detecting the presence of a cyanogenetic glucocide in eight-day seedlings. Approximately fifty samples previously classified on plot trial by the Agrostologist have been tested, with the result that all New Zealand Type 1 samples were definitely positive; of six Type 2, four were positive and two faintly positive; of the mixed Nos. 2 and 3 some were positive and some negative; of the Nos. 3, 4, and 6, all were negative; of two Kentish samples (No. 5), one was positive and the other faintly so. Within the No. 1 group there was a colour range indicating differences in the degree of the reaction, and it would appear possible that these chemical differences might be related to agronomic differences. The work is considered sufficiently promising to warrant its continuation and later association with special field trials.

(*e*) Various laboratory studies pertaining to purity- and germination-testing technique, have been carried out.

General.

The usual statistical matter has been compiled and issued to the seed trade and interested parties generally. An unusual amount of advisory correspondence, local and overseas, has been dealt with.

The transfer of this Station to more commodious accommodation was effected early this year and the convenience and ease of operations in the new premises has resulted in the handling of an increased volume of work and in an increased degree of efficiency.

CHEMICAL SECTION.

B. W. Doak, Chemist.

Marton Mowing Trials.

Analysis of herbage samples from these trials is being continued. The results of the work on experiment No. 16/2/74, which is a study of the effect of infrequent heavy applications against frequent light applications of super on the yield and chemical composition of the herbage, have been written up, and are at present in course of publication. The results show that, on this soil, the herbage from treatments receiving the more frequent light applications is superior in chemical composition to that from the infrequent applications, and the chemical composition shows less variation.

The analyses so far made on herbage of the effect of super and of slag applications in winter, spring, summer, and autumn show that the chemical composition of the herbage from the super plots is superior to that of the herbage from the slag plots—that from the super plots being higher in lime, phosphoric acid, and protein than the produce from the slag plots. This trial is at present in its fourth year. It has been contended that, because of the slower effect of slag than of super on the pasture, the herbage from slagged areas would be richer in essential elements than that from super areas. The results of this trial show that, for this soil at least, this contention is erroneous.

Soil Work.

During the year soil studies have been in progress on samples taken from where the effect of large infrequent applications of super is being compared with the effect of small frequent applications. Four sets of samples have been taken from this area, but the chemical work on these has not yet been completed.

The results so far indicate that the technique of sampling allows very accurate samples to be taken. There are strong indications that rapid leaching of added phosphate takes place on the Marton soil. These losses of phosphate appear to be reduced if the applications are small and frequent as opposed to large infrequent applications. It is very desirable that this work be continued with a view to finding out how these losses can be reduced to a minimum. These results, while agreeing in general with results obtained by Robinson in North Wales, are opposed to the well-known Rothamstead and other results. It is generally believed that phosphates are leached out of the soil very slowly, but the results obtained here indicate that in the case of an application of 8 cwt. of super over two years ago, about three-fourths have been removed from the surface 6 in. of soil. This is confirmed by the yield results. Since the falling-off of the yield is due to the lowered amount of available phosphoric acid in the soil, there are three alternatives: (1) Phosphoric acid must be removed in large amounts by stock. This cannot account for very much of the added phosphoric acid. (2) There must be an accumulation in an unavailable form of nearly all the added phosphate in the surface layers. Analysis of the soil-samples show that this is not the case. (3) Phosphoric acid must be leached out of the surface layers. This is supported by the results so far to hand.

pH determinations were made on soil-samples with a view to finding if increased soil-acidity was the cause of considerable yield depression following successive applications of sulphate of ammonia to the pasture. It was found that there was no important difference in the pH of the soils from the control and from the sulphate of ammonia plots. Where lime has been applied with the sulphate of ammonia (2 cwt. carbonate of lime to 1 cwt. sulphate of ammonia), the pH of the top 2 in. was slightly higher (less acid) than that of the other plots, though even on this treatment the yield of herbage was depressed. This shows that the depression in yield was not caused by increased acidity.

Determinations were also made in connection with the pH of brown-top soils.

Other Work.

During the year determinations of the oil content of nineteen samples of linseed grown by the Agronomist were made.

Samples were collected and analytical work is in progress in connection with rapes and kales which are being investigated by the Agronomist.

FARM ECONOMICS SECTION.

E. J. Fawcett, Farm Economist.

The following projects have been completed or undertaken during the year under review:—

1. Incidence of Disease and Replacement in Dairy Herds.

The records of some 2,500 herds have been analysed to determine the incidence of disease and replacement, and to establish the conditions surrounding variation in disease incidence. The herds under review were all tested, and therefore probably represent management above the average in efficiency. For the season to which records apply (1929–30) the replacement figure for the whole of the Dominion was lower than usual, and this affects the records to some extent.

Outstanding features of the analyses are—

(*a*) Total eliminations of milking-cows amounted to 10·7 per cent. of the total cows in herds.

(*b*) Of the total cows eliminated, old age accounted for 10·5 per cent., low production 49·0 per cent., accidents 5·7 per cent., mammitis 13·7 per cent., breeding troubles 11·5 per cent., tuberculosis 1·9 per cent., and 7·7 per cent. for other reasons of a disease nature.

(*c*) The provision for replacement amounted to 17 per cent., which covers elimination plus herd increase.

(*d*) Breeding troubles in dairy herds tend to increase as the size of the herd increases and as density of cows becomes more intense.

It is indicated that disease is more prevalent on highly phosphated farms, and that the ratio of lime to phosphate application may be associated with its incidence.

(*e*) It appears that intensification in management, no matter what form such intensification takes, has a decided effect on the incidence of breeding-difficulties.

(*f*) Breeding-difficulties are particularly prevalent amongst young heifers forming replacement stock.

This investigation is being continued, and the analyses of 1930–31 figures will shortly be available for corroborative evidence or otherwise.

2. The Organization of Apple Orchards.

A preliminary analysis of some 230 records has been made in an endeavour to devise methods of production forecasting. Before this can be done it is necessary to continue the study of crop records for several years to standardize methods. This initial survey shows—

(*a*) That there is a very wide range of average production per tree and per acre in different districts, Hawke's Bay giving the highest records and Waitemata the lowest for the season reviewed:

(*b*) That the same variety has a wide range of production within districts, and between different districts

(*c*) That different varieties have varying rates of maturity in production:

(*d*) Owing to the rate of maturing, the prevalance of young non-bearing trees, either new plantings or reworkings, and the prevalence of different varieties represented, must be taken into consideration when computing probable yields for future seasons.

Between seven hundred and eight hundred orchard records for the season 1930–31 are now under study.

3. The Relationship of Milk Test to the Standard of Per-acre Production of Butterfat.

In previous studies of the factors influencing per-acre production, direct agencies such as carrying-capacity and per-cow production have been taken as the basic features. It has been realized that, in determining the effect of pasture management and herd organization, there are underlying influences at work. In the present investigation one of these influences—namely, milk test—has been studied in some detail. The analysis of production data from 967 farms shows quite conclusively that test, and the conditions surrounding its variation, exert a direct influence on carrying-capacity, herd average, and per-acre production.

The features of outstanding importance as disclosed by the analysis are—

(*a*) When farms are reasonably comparable in every respect, test variation results in a per-acre production variation of from 88 lb. to 131 lb. of butterfat per acre.

(*b*) If the test for all the herds dealt with was moved from its present average of 4·57 per cent. to a uniform level of 5·2 per cent. the total butterfat produced would be increased by over 17 per cent.

(*c*) If the accepted average of 4·1 per cent. for all New Zealand herds is correct, total production for the Dominion could be increased by 35 per cent. simply by a breeding policy aiming at a general herd average of 5·2, without in any way improving the standard of management at present existing.

(*d*) High-test herds give a better per-acre return to the farmer, even under a materially lower differential payout on butterfat content of milk of different test standards.

The work done on test relationship has brought out the necessity for further research into cow types and the correlation of body weight with milk production and butterfat content, with the object of establishing simple standards which may be used in culling and in choosing cows from which replacement stock should be drawn.

4. Statistics of New Zealand Agriculture.

During the year a comprehensive compilation of all the statistics pertinent to New Zealand agriculture has been issued in mimeograph form. This set of tables covers a period of years on a comparable basis, and has been in considerable demand.

5. Values of Agricultural and Pastoral Products—Local, Export, and Total.

Comparative figures on the above lines for the seasons 1929–30 and 1930–31, and estimates for 1931–32 up to 30th September each year, have been prepared for the use of the various economic committees.

It is shown that local consumption accounts for 34, 37, and 33 per cent. for the respective seasons, and that if all wool is disposed of this season, the total value of exports will approximate that of 1930–31. This is due to carry-over of wool and additional killings of capital stock. It is calculated that the latter movement will result in a further decrease of sheep flocks this year, and a consequent lowering of the ewe flock also.

II. WALLACEVILLE VETERINARY LABORATORY.

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

The work for the year ended 31st March last shows a great increase, particularly in examination of milk-samples for diagnosis of mastitis. There has been no corresponding increase in staff, however, thus making the work of those engaged much more difficult. It has been the aim of all to keep up the investigational work in spite of the increase of diagnostic work, but it would appear that very shortly there will have to be a definite rearrangement of work. There are so many diseases which require some attention beyond that already given—notably mastitis, contagious abortion, and so-called eclampsia of cattle, parasitic gastro-enteritis, rye-grass staggers, enzootic icterus, and nutritional problems in sheep, and coccidiosis of poultry—that it seems a matter of urgency for an increase of staff or a rearrangement of staff in the Live-stock Division for investigational purposes.

Specimens received.

The specimens received during the year for examination at Wallaceville and the branch laboratories at Hamilton and New Plymouth respectively may be classified in the following way:—

	Wallaceville.	Hamilton.	New Plymouth.
Milk-samples for mastitis	9,070	20,093	4,038
Whey-samples for agglutination test for contagious abortion	..	774	..
Blood-samples for agglutination test for contagious abortion	2,884	385	363
Tumours, miscellaneous	91	..	..
Cattle specimens	378	165 (semen-samples)	234 (sterility)
Sheep	331	..	..
Swine, general	208	..	..
Swine, muscle for trichina	19,625	..	..
Horses	25	..	..
Poultry	63	..	..
Dogs	10	..	..
Miscellaneous (disinfectants, &c.)	38	..	11
Totals	32,953	20,417	4,666

The large numbers of milk-samples which have been put through the Hamilton Laboratory, together with the help given to the Field Research Officer, Mr. Blake, has more than justified the creation of that branch.

CATTLE DISEASES.

Mastitis of Dairy Cows.

A very great deal of work has been done by the three laboratories on mastitis in the effort to show that this disease can be controlled by microscopical examination of milk-samples from each cow, and by the grouping of cows into affected, slightly affected, and acutely infected cows, for milking purposes. All A group (clean cows) are milked first, B and C groups being milked afterwards. This control scheme is an extension of the field experimental work performed last year by Mr. Blake in the Waikato. In that district a number of herds are under Mr. Blake's personal supervision, while others in a number of districts throughout New Zealand have been placed under supervision of other field officers of the Live-stock Division. The monthly examination of all cows' milks in these herds has greatly increased each officer's work. For the first season the herds under supervision are considered to be in a process of culling of infected animals, and it has left many herds with only very few cows in the A group. By placing incoming heifers in the second season in A group it is hoped to protect them very markedly from inflammatory conditions of the udder.

An extension of the control scheme is contemplated by co-operation with the Herd-testing Federation, and it is probable that this will take effect experimentally in one district only for the first season. Although it is difficult to obtain figures of value from the scheme as far as it has gone, by taking a group of over 1,000 cows and watching the examination of these month by month, a certain fluctuation of the disease may be noted, as shown in the following table:—

Month.	Wallaceville.			New Plymouth.		
	A.	B.	C.	A.	B.	C.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
September	..	..	..	46·5	35·4	18·1
October	47·7	38·1	14·2	50·3	33·9	15·8
November	63·2	30·0	6·8	53·1	40·6	6·3
December	56·7	31·8	13·5	50·7	45·6	3·7
January	55·4	36·7	7·6	56·7	39·1	4·2
February	52·6	42·2	5·2	52·7	44·2	3·1
March	43·4	42·6	14·0	59·8	33·1	7·3

It will be seen that in the flush of milk in November there is inclined to be a great number of A group cows as compared with B plus C, while in the calving and drying-off periods there is an increase in mastitis of the acute type.

It may be noted that this report refrains from calling the disease streptococcic mastitis as in former years. Cultural work as far as it has gone tends to show that leucocyte numbers upon which the grouping is based are certainly correlated with organisms, but that those organisms in carefully collected samples are micrococci, occasionally staphylococci, but not frequently streptococci. Streptococci do appear more frequently in acute C group cases. This phase of the work is the one now being pushed forward.

Experimental work on mastitis may be summed up as follows:—

(1) Three cows received drops of acute streptococcic udder secretion directly on to the ends of their teats after milking, for a period of weeks but without deleterious effect.

(2) Drops of streptococcic milk instilled into the conjunctival sac of a cow did not harm the eye nor produce mastitis.

(3) Vaccine virus (cow-pox) was used on clean heifers to find its possible action in production of mastitis. In one heifer the end of a teat was scarified and vaccine rubbed into the area. The resultant pustule was infected with streptococcus mastitidis and an infection of the quarter occurred with the usual change in secretion. This later subsided and the cow became normal in some weeks time. Quarters of two heifers were injected as far as the milk sinus with vaccine virus in saline, and both developed acute streptococcic mastitis, which later subsided and the quarters became normal. Another cow was given an intravenous injection of vaccine virus, with the result that the four quarters showed a definite increase in cell count, which persisted until the animal dried off. No pustules developed. This cow came in after calving with streptococcic mastitis in one quarter.

(4) Two heifers were given injections, the one of washed streptococcus mastitidis, the other of streptococcic mastitis milk into the uterus after calving, without deleterious effect.

(5) As an aid to bacteriological work Mr. Gill carried out experiments with boric acid, and found an amount which kept the milk exactly as it was taken from the cow without increase or decrease of flora. This improvement in technique will enable a considerable amount of bacteriological work on milk-samples from a distance to be carried out at a minimum cost.

It may be stated that any work now performed on cows requires as a basis that no leucocytes be present at the commencement of the experiment, and that the full udder history of the cow be known to guard against latent streptococcic infection, &c.

The view which is now taken of mastitis by New Zealand workers is that there is considerable subacute mastitis present in herds where the organism present (possibly not causative) is a micrococcus. Streptococci are present in the minority of cases, but when streptococci are present the mastitis frequently is persistent and acute. Following these premises it seems fair to base mastitis on a leucocyte count rather than on the presence or absence of streptococci as formerly. The mode of entry of organisms is still undetermined, though the effect of vesicles of cow-pox on teats is a factor which is being given every attention.

Temporary Sterility in Dairy Cows.

Messrs. Webster and Blake are still busily engaged in field laboratory work on this condition. The results obtained last year in examination of bulls has been confirmed in the present year's experience, particularly by Mr. Blake in the Waikato, where at least one hundred and fifty bulls have been under observation with regard to their spermatozoan morphology and herd efficiency. As a result of large numbers of examinations, experience is being gained with a view to developing a system of diagnosis of soundness for bulls of dairy-farmers.

Mr. Webster in his report says:—

"Work was continued on similar lines to those of the past two seasons. Cultural work has amply confirmed the view that the causative agent is invariably some strain of alpha streptococcus. Forty-six cultures have been forwarded for typing at Wallaceville.

"Semen examinations have confirmed previous work, and there is no doubt that semen examination is a valuable diagnostic aid. Cultures from the semen of bulls in herds suffering from epidemic sterility consistently give a profuse streptococcic growth. Sound bulls do not give this organism on culture.

"Treatment was carried out on as extensive a scale as time and opportunity would allow. The method was a development of that given a preliminary trial during the previous season—*i.e.*, injecting a bland antiseptic in paste form into the cervix. Improved technique enabled the material to be placed in the deepest parts of the cervix. Various combinations of chinosol, bismuth subnitrate, boracic, and glycerine were used. From a bacteriological and clinical point of view the treatment appeared most successful and from a practical aspect the breeding results following treatment were most successful, especially when a dilute chinosol mixture was employed.

"A new line of attack on the sterility problem in first-calvers has been followed up in taking an extensive series of blood-samples for chemical analysis and correlating the results with clinical records. The evidence is at times somewhat contradictory, but taken as a whole there is a definite tendency for low phosphate to be associated with a normal clinical appearance and *vice versa*—*i.e.*, when blood phosphorus was normal there was frequently clinical evidence in the shape of cervicitis, slight endometritis, &c., to account for the failure to breed. Further work is required in this direction, however. Speaking generally, I feel hopeful that the sterility problem is largely solved in so far as its causes and effects are concerned, and that a definite line of treatment has been established. However, there is still room for much work regarding the most satisfactory agents to employ in rational treatment."

Mr. Blake in his report gives a table of the findings in his microscopical examinations of the semen of a large number of the bulls examined by him, as follows:—

23 good bulls used on an average of 40 cows each have 76 per cent. held to first service.
17 fair bulls used on an average of 29 cows each have 64 per cent. held to first service.
26 poor bulls used on an average of 34 cows each have 39 per cent. held to first service.
38 bad bulls used on an average of 29 cows each have 31 per cent. held to first service.
2 sterile bulls used on an average of 18 cows each have 0 per cent. held to first service.

The history of all bulls examined is not yet to hand. The words "good," "fair," "poor," and "bad" refer to the microscopical picture of morphology of sperm heads, and can be reduced to definite percentages of abnormality in sperm heads in a given sample. This is a phase of the work yet to be completed.

Mr. Blake also considers from his district observations that on occasions a really good bull used after a poor or bad animal is able to overcome the effects of infection in the cow, and may put many empty ones in calf to first service. The evidence is based on experience, without bacteriological examination of seminal fluid of the bull or cervices of cows.

At Wallaceville a small breeding experiment was carried out on maiden heifers to find (1) whether bulls became infected from recently served or returning cows; (2) whether cows returning to one bull would hold when put to a second bull; (3) how long infection remained present in the bull and in the cow. A bull which had a poor sperm morphology and had been giving considerable trouble in a Taranaki herd was brought to the Laboratory and served a maiden heifer. A young unused 15-months bull was at once placed on the same heifer to become infected. The heifer served by two bulls proved to be in calf. The Taranaki bull subsequently got another maiden heifer and a cow in calf at first service, suggesting that the primary infection had passed

off. This is believed to occur in the majority of bulls, so was not unexpected, but the sperm morphology of the bull was up to the time of death damaged. The young Jersey bull put to the first heifer subsequently served four heifers, only one of which held to him. None of these four heifers reacted to the agglutination test for contagious abortion. When the Taranaki and young Jersey bulls were killed no streptococci were obtained from their genital tracts on cooked blood agar—an excellent medium for the growth of the streptococcus—yet all the heifers have numerous streptococci (of the alpha type) lying in the cervix.

A second bull was procured in Taranaki with a particularly bad history, a very poor sperm morphology, and streptococci in culture from his seminal fluid. This bull served three heifers, all of which returned, two at three weeks and one at four weeks. Two were again served by him and six weeks later had not returned, and the third was served by an Ayrshire bull. All by palpation would appear to be in calf, but as it is believed that the return at fairly long intervals is due to abortion induced by streptococcic infection it is yet too early to be sure of the results. At *post mortem* the second Taranaki bull showed a streptococcic infection throughout his genital tract. It is yet too early to say whether the Ayrshire bull has been able to put the defaulting heifer in calf, but this bull is being tried on a further series of heifers to see whether he, in turn, has become infected.

The experiment up to the present suggests that the infection is temporary in both bull and cow, thus bearing out field observation and the view that one bull becomes infected from another through service. It is yet too early to reply to (2), but field experience suggests that it depends largely on how long the cows have been infected—that is, whether the infection is declining, whether cows regularly hold to a new bull or not. How long bulls carry infection is not yet known, but a bull used in an affected herd one season and transferred to a clean herd the following season frequently causes trouble, although if kept in the original herd he gives fair (not good) returns.

Contagious Abortion.

No great advance has been made for the year in this disease. 2,884 blood-samples were put through at Wallaceville, 898 of those being positive to the agglutination test; while 386 were tested at Hamilton, with 95 positive. As with mastitis, farmers are encouraged to send in samples from the whole herd rather than single samples. There have been several cases referred to us from the Health Department where undulant fever has occurred and milk has been obtained from definite herds. In such cases, the blood of all the cows is put through an agglutination test. The milk of positive reactors is then cultured to find the cows voiding Bacillus abortus in the milk. Further action is impossible under the existing legislation, the farmer merely being advised of the position. The result of such cultural examination is very variable.

The intradermal method of preventive vaccination of heifers carried out in December, 1930, in Taranaki has been quite unsuccessful. Where records have been obtainable the following are the results: Vaccinated heifers, 20 aborted, 88 calved normally; controls, 12 aborted, 52 calved normally.

A point of interest obtained from herd composite samples for examination for tubercle bacilli was the amount of abortion infection appearing in guinea-pigs at *post mortem* six weeks following inoculation. Of 217 milk-samples inoculated, 190 sera of guinea-pigs were examined. Number of positive sera, 77=40 per cent. of total; number of positive lesions, 63=33 per cent. of total; result of cultural tests on gentian violet media of 217 milks=2 positive. Since January, 1931, of 281 guinea-pigs examined, sera, negative, 176; sera, positive, 105. Abortus lesions in spleen, 86; abortus lesions in testicle, 4; abortus lesions in spleen and testicle, 1. Number of macroscopic lesions, 14.

Biological Test for Tubercle Bacilli in Composite Milk-samples from Town Supplies.

Two hundred and thirty such samples were inoculated into guinea-pigs during the year, and two guinea-pigs became tuberculous. The loss in guinea-pigs has been very greatly reduced during the year by having milk-samples collected into bottles containing boric acid, the final solution being 1 per cent. Such samples carry very well and give no dimunition in numbers of organisms, nor do they lose such organisms as B. abortus and the tubercle bacillus. Boric acid enables samples to be sent from either end of New Zealand without souring and without subsequently killing guinea-pigs with peritonitis, &c.

Grass Staggers or so-called Bovine Eclampsia.

This condition is exercising the minds of both laboratory and field workers. The etiology is apparently of dietetic origin. Curiously enough, grass staggers occurs mainly in the Waikato and Rangitaiki, though odd cases are found in the Manawatu and the Wairarapa. Taranaki is apparently free from trouble, or, if cases occur, they have not yet been definitely diagnosed. Analyses of pastures and of blood and urine samples have shown that the pasture grasses are exceedingly rich in protein and that the animals' blood is deficient in calcium and magnesium, and the urine shows a certain amount of albumen and sugar.

The blood calcium deficiency is not sufficient to cause coma as in milk-fever, but possibly the hyperæsthesia is due to the magnesium deficiency. Intravenous injection of magnesium salts has, so far, not proved beneficial, but further trials will be made.

In view of the calcium and magnesium deficiency associated with the consumption of young quickly growing protein-rich pastures forced by superphosphate, one is inclined to speculate as to the possibility that excess of protein degradation products may effect a removal of calcium and magnesium from the animals' system. We have no direct chemical evidence to support this suggestion, and while so little is known about the altered metabolism of the affected animals little more than speculation can be indulged in.

Work in New Zealand on grass staggers agrees with that of Sjollema in finding a calcium deficiency and decrease of magnesium, but we differ from him in his suggestion of excess intake of nitrate from the young grass tips, which would produce methæmoglobin bands in the spectroscopic picture of the blood, a condition which does not occur. As regards Sjollema's statement that calcium salts give beneficial results, this is not the case in our experience. Our only method of treatment as yet is by rectal chloral hydrate to control the hyperæsthesia.

Blackleg.

Since the change-over to formalinized fluid vaccine last year, there have been no known deaths of calves from blackleg after one week following vaccination. This is very satisfactory. 46,160 doses have been supplied to field officers.

Field officers sent in 69 portions of muscle for identification for blackleg. Of these, 48 were positive by guinea-pig and cultural tests, 7 negative, and 14 were proved to be malignant oedema.

Jöhne's Disease.

Of 15 samples received for diagnosis for Jöhne's disease, 7 were proved positive and 8 negative. One particular case is worth quoting, where a 5-year bull was found affected, and on inquiry it was found that the bull was bought from a farm where the disease was present four years previously. A further trial is being made, under difficult conditions, with Johnin kindly supplied by Mr. Dunkin from his laboratory at Mill Hill, England.

Actinomycosis.

A commencement has been made to classify all specimens of actinomycosis coming in for examination, and valuable results should be available for the next annual report.

SHEEP DISEASES.

Ante-partum Paralysis.

Further work has been carried out on this problem during the year.

(1) Biochemical work in samples received from field cases and in samples from experimental cases on the Laboratory farm. Results are given later in the Biochemical Section report.

(2) Trial of insulin, adrenalin, and glucose on the course of the disease. No curative results were obtained.

(3) *Experimental work at the Laboratory.*—(*a*) Three sheep, chosen for condition and the possibility of twin lamb pregnancy, were placed in a shed about two to three weeks before lambing was expected, and fed on a very small quantity of hay only. In ten days one sheep developed typical ante-partum paralysis with the usual chemistry of the blood and urine. A second sheep became paralysed but not comatose, and remained down until lambing one dead and one live lamb. No albuminuria was present in this case, and possibly the fact that the kidney did not become involved may have accounted for absence of further symptoms. The third ewe lambed normally. In all these cases there was an increase in acetone in the urine as soon as starving commenced, and on occasion a trace of diacetic acid. No sugar was ever seen, nor did albumen develop until ante-partum paralysis commenced. This experiment will be repeated.

(*b*) Two sheep on the farm developed ante-partum paralysis naturally. The flock was badly checked by shortage of feed and foot-rot, and that no doubt led to the onset of the disease in the one case. The other was a sheep which had been watched carefully and whose blood had been analysed over a long period. She was kept at first on good pasture to increase the blood T.N.P.N., and then on very poor paddocks to find how low the T.N.P.N. would fall normally. Ante-partum paralysis resulted.

It seems from observations that two different dietetic factors may set up the trouble, the one a check, the other overfeeding, both setting up a fatty infiltration of the liver and so curbing the action of that organ. By feeding correctly, ante-partum paralysis is prevented.

Caseous Lymph-adenitis.

Results of work performed in 1930–31 were published in the annual report for that year. In this report a continuation of the work is given.

(1) Those sheep which had been naturally infected and brought to Wallaceville for examination have been carefully watched over the year. Abscess rupture has occurred in one ewe only during that time, twice from the inguinal and twice from the right precrural glands. At the end of the year all the sheep of this group were killed with the following results: Two with large encapsulated abscesses palpated without change on each occasion for two years still showed pure growth of Preisz Nocard bacillus. Five with glands slightly fibrosed and showing very little damage except for a brown discolation near the periphery. These glands would have passed palpation in flocks and in the meat-works, and would scarcely have been recognized on incision. One with new abscesses which had developed in the mediastinal, bronchials, and right prescapular. This case is one of very great interest in that the right supramammary gland had shown an abscessed condition and was opened and evacuated on the 19th October, 1930. The suggestion now is that the bacillus of Preisz Nocard entered the blood-stream and infected the thoracic glands as described. Such being the case, an earlier suggestion of the possibility of opening glands and evacuating the contents by farmers themselves is not justified. The result of this experiment is to indicate that sheep whose abscesses have once discharged and thoroughly evacuated do not tend to produce further abscesses. Whether it would be feasible to return those where such rupture has occurred and which appear to be normal by palpation, to the flock, is a point which might be considered where large numbers of breeding-ewes are involved.

(2) The remaining two sheep, of six which had been fed with cultures of caseous lymph-adenitis, were killed after twelve and twenty months respectively, and were found to be infected only in the retropharyngea glands. In the latter sheep the pus was becoming calcareous.

(3) A wether which in last year's report was described as having a growing abscess in a gland following infection from shear cuts was killed at the end of the year. A bronchial gland, right precrural, left prescapular, and left inguinal were all infected with a pure growth of Preisz Nocard, evidently the result of the heavy infection from infected shears.

(4) Four lambs were fed from the 21st October to the 12th January weekly with 5 c.c. of culture from New Zealand strains, and it is proposed to keep these for two years, running with the flock. Four other lambs fed on three occasions with actual pus from affected sheep have not as yet shown any lesion. No post-mortem examinations have been made, as these lambs are being used in other work.

Lesions from lambs killed in meat-works were examined during the season, with a result that of those lesions actually seen 8 were positive, 3 indefinite, and 33 negative cases of Preisz Nocard infection, the negative cases being due to *Bacillus pyogenes ovis* or to mixtures of that and staphylococci, &c.

Pulpy Kidney Disease of Lambs.

Work was carried on by Mr. Gill this past year at Oamaru instead of Ranfurly, as better arrangements could be made there for bacteriological examination of the intestinal contents of affected lambs. A scarcity of material was again encountered, but enough was obtained to confirm last year's finding—namely, that there was a highly potent toxin in the small gut of affected lambs, the nature of which suggested a bacterial origin—and to extend it by showing that, as was anticipated, this toxin was still present after passing the material through a bacteriological filter. Cultural examination gave several strains of an organism closely allied to *B. welchii*. On further studying these strains at Wallaceville it has been found that, given suitable cultural conditions, they produce toxins that are not neutralized by *B. welchii* antitoxin.

It is considered that absorption of toxins produced by these organisms is the cause of the disease. Work is being pushed on as rapidly as possible, and it is hoped shortly to publish the details of this aspect of it, together with the mass of data that has been obtained regarding the epidemiology of the disease. This latter is considered of great importance, as the incidence of the disease appears to be negligible unless the lambs have been predisposed by some digestive disturbance—generally brought about by a too copious supply of milk combined with inadequate exercise.

Circling Disease of Sheep.

Specimens were received from several small outbreaks of this condition. The lesions previously noted—namely, foci (in the brain) of polymorphs and lymphocytes and perivascular cuffs—were consistently present. In several cases organisms were present in the foci, and where this occurred they were always of the same appearance—short gram-positive rods. One living affected sheep was forwarded, and from its brain pure cultures of an organism of this sort were obtained. Intracerebral inoculations of brain emulsions from this sheep, and of pure cultures of the organism, into hoggets induced typical circling disease and similar histological changes. Intravenous injections of the organism into sheep did not set up the disease, but similar injections in rabbits caused an acute meningitis, the organism being present in enormous numbers in the inflamed meninges.

It is hoped that further cases will be available during the coming season in order to discover whether this organism is constantly present; to settle the question as to whether there is a filter-passing virus infection to which the organism is secondary, and also to continue the search for the path by which the organism enters the brain of affected sheep. One attempt to discover whether a filtrable virus was present in affected brain was made during the past season, but was inconclusive.

Foot-rot in Sheep.

An opportunity arose in the autumn to observe an outbreak of foot-rot in a flock of sheep. The trouble appeared suddenly in a large percentage of the flock as an inflammation of the skin between the two digits. This skin appeared red, then appeared a little damp, then later white and dead; or in many cases an increase in growth of the epithelial layer had taken place, and there was bleeding, scab, and pus formation. In such cases the horn of the inner side of the digit became underrun with a highly noxious pus, and this pus progressed right underneath the sole of the digit. From the commencement the sheep were intensely lame, and consequently lost weight. The organisms found present were mixed cocci and large numbers of *B. necrophorus*. No spirochaetes were found at any time in the outbreak.

Treatment of the feet was attempted with a variety of pastes and fluids, but without much beneficial effect. The best agent apparently was strong copper sulphate solution. Where the sole was underrun no treatment was of any avail, but paring as far as possible, followed by soaking in the copper sulphate solution, might have helped to some extent. Where the scalded condition alone was seen, drying powders helped. The majority of sheep took ten to fourteen days to heal. Some six to eight weeks later a number of sheep which had had an underrun sole again became lame, this time with an abscess formation at the coronet, evidently through an upward movement of the organism *B. necrophorus*, which was almost pure. Many of the worst affected sheep were left with deformed feet and a cankerous condition of the toe of the digit, a condition which does not seem to heal completely afterwards.

The part of the outbreak which was of most interest was the striking way in which sheep in different paddocks, but particularly the flock, suddenly showed the scalded condition. It appeared to be dietetic, yet there was no flush of grass, and the sheep had been on fairly bare pastures. One week before the condition was noticeable the flock had been on a comparatively rich paddock, but then were depastured on a very poor paddock for three days, and finally put on a medium type of pasture, dry but green and not long, but top-dressed.

On three occasions material from a scalded or eroded area was placed between the claws of sheep and kept in position. Some cases were scarified, but no sheep became infected, and if *B. necrophorus* or any other organism was at the bottom of the condition—*i.e.*, if the disease were contagious—this method of infection should have been effective. The bacterial invasion, therefore, would appear to have been entirely secondary.

Rye-grass Staggers.

Rye-grass staggers in sheep (and cattle) showed up in several districts where the pasture had been particularly dry, and where rain had fallen a short while previously. Blood and spinal fluid analyses from cases and brain sections showed no abnormality. It seems possible that one is dealing with the Vitamin A deficiency plus ergotism complex which has been noticed in ergotism in human beings.

Tuberculosis in Sheep.

Two cases have come to hand during the year, arising in meat-works. One was preserved on receipt, and so was useless for inoculation purposes, but the second was inoculated into experimental animals and was proved to be actually a tubercle bacillus invasion of the sheep. Further cultural work is being attempted to type the organism. It is curious that two cases should crop up within a month of one another and be the first cases of tuberculosis in sheep ever recognized in this country.

Coccidiosis.

Two further cases of coccidiosis have occurred in lambs, but no losses suspicious of this disease in acute orm have occurred, the specimens having been received from meat-works only. The farms of origin were without suspicious mortality in lambs.

Dermatitis following Dipping.

A further case of thickening and hardening of the scrotum of rams, with atrophy of the testes, has been seen, with every suspicion that the dermatitis œdema was the result of dipping with an arsenical dip incorrectly mixed.

Mycotic Dermatitis.

Mycotic dermatitis has been recognized during the year in specimens sent from Lincoln College. Inspectors of Stock have been, following instruction, sending in specimens of wool, and two cases have been received, one from Otago and one from Marlborough. The condition cannot be considered prevalent, but it needs watching and, where possible, eradicating. Inspectors are alive to this.

Liver Nodules.

A condition where small white spots are seen on the surface of the liver of lambs was given attention. Histological work, and the examination of livers in meat-works suggests that the fibrous areas in question are the result of a cysticercus invasion of the liver early in life. Occasionally the cysticercus is able to pass through the liver and become an adult in the peritoneal cavity of the animal, on other occasions the cyst dies on the surface of the liver, and at other times beneath the surface of the liver. Usually it would appear that the cyst died and was reabsorbed, leaving as a mark of its former presence old burrowings and a small damaged area of the liver, which appears as a white spot on the surface but actually shows damage of the liver to some depth in section.

Enzootic Icterus.

Several cases have been seen during the year, and cases of anæmia in hoggets have occurred in which the liver lesion—*i.e.*, the supposed Gaucher cells, have been found.

SWINE.

Mange.

Early in the year *Sarcoptes scabiei* var-*suis* was found present in scrapings from white pigs from the Manawatu. Subsequently a number of pigs on widely separated farms were found affected. Inspectors of Stock have sent in since then 148 scrapings from pigs all over New Zealand, and in 81 the parasites or their eggs have been seen. Compulsory treatment with crude oil will no doubt keep the parasite in check.

Trichinosis.

Following a report on a case of trichinosis found in Wellington in a human being, 19,625 portions of diaphragm from different pigs were examined for the parasite, but with entirely negative results.

Pig-feeding Trials.

A number of weaners were fed in batches on whey-paste, meat-meal, and pollard, with a base of waste milk, the whole experiment being subjected to a costing process. Meat-meal was shown to give better weight and better bloom than other foods, and also was fed at a lower cost.

Miscellaneous.

The remaining swine specimens were mixed, including spirochaetal ulcers, pasteurellosis, suspect abortion, parasitic condition, and diphtheritic enteritis.

POULTRY DISEASES.

Bleeding Experiment.—In continuation of the experiment related in last year's report, it may be recorded that the only hen left of three original bleeders used in breeding, died from anæmia due to hæmorrhage. Even after hæmorrhage had ceased, iron and ammonium citrate failed to raise the vitality of the bird. Two pullets and one cockerel from those bred from bleeder hens have developed bleeding, one from a feather follicle of the wing, the other two from leg scales. The remainder of about two dozen of these birds have been killed or have died except three pullets and one cockerel, one of the pullets being a bleeder. Biochemical tests on blood give no outstanding peculiarities, except anæmia at the time of hæmorrhage.

An Osteitis, similar in appearance to Paget's disease of human beings, appeared in a flock of poultry in the Wanganui district. The thyroid glands were so small in these cases that they were difficult to find, but percentage of iodine was normal. No tumours of the parathyroid were present, but the lymph glands appeared to be enlarged. The condition is one worth recording, but etiology is unknown.

NEWLY OBSERVED PARASITES.

Parasites observed or reported in this report for the first time in New Zealand during the year comprised the following: *Ixodes neumanni*, found on a Kiwi; *Chorioptes communis*, from udder of a cow; *Oesophagostomum brumpti*, from intestine of a monkey at the Wellington Zoo; *Sarcoptes scabiei* var-*suis*, from pigs.

QUARANTINE STATION.

Eleven dogs and five bitches were passed through quarantine; one bitch whelped. A percentage of animals were infected at the time of receipt with a very irritant dermatitis. There is no apparent parasite of any description to be seen present, and it would appear to be of dietetic origin. Treatment with external ointments and Donovans' solution internally has been developed and has proved very beneficial, the dogs usually being normal by the time they leave quarantine.

BIOCHEMICAL WORK.

Following is a report on biochemical work performed by Mr. S. W. Josland, Assistant in Biochemistry:—

"Technical.

"*Inorganic Phosphorus.*—It has been the practice to determine inorganic phosphorus on the serum. In many instances, due to the difficulty of collecting and preparing serum-samples under field conditions, it has been felt that the results obtained for inorganic phosphorus have been higher than they should be, owing to the hydrolysis of organic acid soluble phosphorus. To overcome this difficulty an improved method of sampling has been introduced similar to that suggested by Dr. Malan, Biochemist, Onderstepoort (Union of South Africa, 10th Report, Director of Veterinary Services, 1930). By this method hydrolysis of organic acid soluble phosphorus is reduced to a minimum for a period of at least eight days, and the values obtained for inorganic phosphorus may be taken as fairly indicative of the degree of aphosporosis of the animals concerned.

"*Magnesium.*—The method in use for the determination of megnesium in serum is under investigation. Through the courtesy of the Chief Chemist a series of gravimetric determinations of megnesium have been made on samples on which micro-colorimetric determinations have been carried out. In all cases the determinations have yielded colorimetrically considerably lower results for magnesium. Experiments are being conducted with a view to improving the micro-technique.

"*Normal Values.*—More work has been undertaken in analysing blood-samples from healthy cattle and sheep for the purpose of establishing normal limits. There is no need to modify the values given in last year's annual report (1930–31, page 55), except in the following instances:—

	Sheep.	Cattle.
"Magnesium (serum)	1·5– 2·5	2– 3·5 mgm. per 100 c.c.
"Potassium (serum)	17 –30	20–30 mgm. per 100 c.c.
"Amino acid nitrogen	5 – 8	5– 8 mgm. per 100 c.c.
"Hæmoglobin	10 –15	10–15 grm. per 100 c.c.

"Normal limits for lambs (up to four weeks):—

"Serum calcium	11–13 mgm. per 100 c.c.	Urea nitrogen	10– 15
"Serum inorganic phosphorus	8– 9 mgm. per 100 c.c.	Amino acid nitrogen	8– 10
"Serum magnesium	circa 2 mgm. per 100 c.c.	Lipoidal phosphorus	12– 18
"Serum potassium	20–25 mgm. per 100 c.c.	Cholesterol	100–150
"Sugar	circa 0·100 per cent.	Creatinine	1– 2
"T.N.P.N.	25–35		

"Regular analyses have been made on four ewes and four lambs for a period of twelve months. This work is being continued.

Sugar.—An interesting fact was observed that blood-sugar values obtained from cattle previously stunned at the abattoir prior to slaughtering were always greatly increased and therefore unsuitable for standard values. This increase in blood sugar may be accounted for by the liberation of adrenalin following cerebral injury.

"Biochemical Findings in Diseases.

"*Morton Mains Hogget Mortality.*—Values for blood calcium, inorganic phosphate, potassium, and magnesium lie generally within normal limits. Values for blood sugar and T.N.P.N. are slightly low. The hæmoglobin content has, in most of the samples received been low. Erythrocyte and leucocyte counts are normal. There is a tendency for a relative polymorph increase in the differential leucocyte count.

"*Mairoa Sheep Mortality.*—Blood calcium values in several samples taken from affected animals in untreated paddocks are low, values from 8 mgm. to 8·6 mgm. per 100 c.c. being obtained. norganic phosphorus values have been low (1·9 mgm. to 3 mgm. per 100 c.c.). The low inorganic phosphate values may be partly accounted for by the fact that the erythrocytes, which contain most of the inorganic phosphorus, are usually diminished in numbers. Values for magnesium, potassium, T.N.P.N., and sugar have been normal. The hæmoglobin content is lowered, some values being as low as 6·9 grm. per 100 c.c. In a few cases where leucocyte counts were made there was a slight leucocytosis together with a slight increase in the relative number of polymorphs.

"*Eclampsia (Cattle).*—In serum from 19 cases diagnosed in the field as eclampsia calcium values varied from 5·2 to 9·0, with an average value of 7·3 mgm. per 100 c.c. In several cases the magnesium content was markedly diminished. Values for inorganic phosphate showed moderate fluctuation, but generally were normal. Potassium values were normal.

"*Temporary Sterility.*—Serum-samples from seventy-four heifers showed on analysis little variation from normal limits.

"*Pulpy Kidney.*—In several cases blood analysed for calcium, inorganic phosphorus, magnesium, potassium, T.N.P.N., amino acid nitrogen, and lipoidal phosphorus showed no deviation from the normal.

"*Ante-partum Paralysis (Ewes).*—Analyses of blood from seventeen naturally occurring cases gave the following results:—

	Calcium.	Inorganic Phosphorus.	Sugar. Per Cent.	T.N.P.N.
"Highest	11·2	8·0	0·090	150
"Lowest	7·7	5·3	0·040	29
"Average	9·4	7·4	0·061	61

"Urinalysis was performed on samples from ten naturally occurring cases. All samples showed the presence of albumen. Nine samples gave positive reactions for acetone; six samples gave positive reactions for diacetic acid. pH values varied from 5 to 7·5, averaging 5·5.

"For the purpose of comparison, urines from twelve healthy pregnant farm ewes near the drop were tested with the following results: All samples gave negative tests for albumen, sugar, and diacetic acid; four samples gave positive tests for acetone. pH values varied from 4 to 7, averaging 5·2.

"*Mammitis.*—Samples of milk from normal quarters and samples from affected quarters were examined chemically. At the same time leucocyte counts and cultural examinations were made. The chloride, albumen, and catalase contents were increased, and the lactose and casein contents decreased relatively in proportion to the degree of inflammation as disclosed by the leucocyte count. The calcium content of composite mammitis and composite normal-milk samples from several herds was compared. The calcium content of the mammitis samples was slightly lower than that of the normal samples. Further comparisons of the calcium content are to be made.

"*Soft-clotting Milk.*—The calcium content of soft-clotting-milk samples varied considerably, so that no definite conclusion could be made.

"*Numbers of Specimens Examined.*—Sheep-blood, 297; cattle-blood, 140; fowl-blood, 10; sheep-urine, 10; cattle, 4; milk quantitative analysis, 156; cerebro-spinal fluid, 6; miscellaneous, 40: total, 673."

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